
**BIOCHEMICAL CHANGES IN INDIVIDUALS OF
HIGH BMI WITH SPECIAL REFERENCE TO
MEDHO SARA (EXCELLENCE OF ADIPOSE
TISSUE) AND STHAULYA (OBESITY)**

Thesis submitted to

**THE KLE ACADEMY OF HIGHER EDUCATION AND
RESEARCH, BELAGAVI
(KLE DEEMED UNIVERSITY)**

[Declared as Deemed-to-be-University u/s 3 & 12 B of the UGC Act, 1956 vide
Govt. of India Notification No.F.9-19/2000-U.3 (A)]
(Accredited 'A+' Grade by NAAC) (3rd Cycle)
[Placed in Category 'A' by MoE (GoI)]

*For the award of the degree of
Doctor of Philosophy
In the Faculty of Ayurveda*

By

Dr. Sumith Kumar M MD(AY)

(Registration No: KLEU/Ph.D./17-18 / D01217006)



Under the Guidance of

Guide

Dr. Pradeep L. Grampurohit

MD (ayu), PhD

Professor

KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya Post Graduate
Studies and Research Centre Belagavi

Co-guide

Prof. (Dr.) Sunil S. Jalalpure

M.Pharm., Ph.D.

Professor and Principal,
KLE College Of Pharmacy,
Belagavi

December 2024

UNDERTAKING

I, **Dr. Sumith Kumar M**, hereby declare that the information and the data mentioned in my thesis entitled “**Biochemical changes in Individuals of High BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)**” belongs to me and is original.

I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author.
- A piece of writing or other work reflecting such unauthorized use or imitation.
- The deliberate or reckless representation of another's words, thoughts or ideas as one's own without attribution in connection with the submission of academic work, whether graded or otherwise.

I hereby declare that the thesis prepared by me is original-one and does not involve plagiarism anywhere. In case at a later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the Institution is at liberty to take any disciplinary action against me including cancellation of the dissertation or any other penalties imposed by the University.

Place: Belagavi

Date:

Dr. Sumith Kumar M MD(Ayu)

Full Time Ph.D. Research Scholar

Reg. No. D01217006

KAHER's Shri BM. Kankanawadi

Ayurveda Mahavidyalaya Post Graduate
Studies and Research Centre Belagavi.

PLAGIARISM CERTIFICATE



Ref. No. KAHER/AA/24-25/D-305

13th September 2024

Sir,

The soft copy of Ph.D. research thesis of **Dr. Sumith Kumar, Faculty of Ayurveda** of KAHER, Belagavi has been submitted for anti-plagiarism check at the office of the undersigned through "Turn-it-in" package. The scan has been carried out and the scanned output reveals a match percentage of 5% which is within the acceptable limit of 10%.

To obtain the comprehensive report of the plagiarism test, research scholar can send a mail to **diracademic@kledeemeduniversity.edu.in** along with the Registration Number, Name of the Scholar, Name of Guide/Co-guide and title of the thesis.



Dr.(Mrs.) Jyoti M. Nagamoti
Director, Academic Affairs

To,

Dr. Sumith Kumar
Full-Time Ph.D. Scholar, 2017-18 Batch
KLE Shri. BMK Ayurveda Mahavidyalaya,
Faculty of Ayurveda, KAHER
Belagavi.

Cc to :

1. The Principal, KLE Shri. BMK Ayurveda Mahavidyalaya, Belagavi
2. Dr. Pradeep Gramapurahit, Professor, KLE Shri. BMK Ayurveda Mahavidyalaya, Belagavi – **Guide.**
3. Dr. Sunil S. Jalalpure, Professor of Pharmacy, KLE College of Pharmacy, Belagavi-**Co-guide**

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH

(Deemed-to-be-University established u/s 3 & 12B of the UGC Act, 1956)
Accredited A⁺ Grade by NAAC (3rd Cycle) Placed in Category A by MoE (GoI)

📍 JNMC Campus, Nehru Nagar, Belagavi - 590 010, Karnataka, India 📞 0831-2444444 🌐 kledeemeduniversity.edu.in

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,
(KLE DEEMED UNIVERSITY)**

[Declared as Deemed-to-be-University u/s 3 & 12 B of the UGC Act, 1956 vide Govt. of India Notification
No.F.9-19/2000-U.3 (A)]

(Accredited 'A+' Grade by NAAC) (3rd Cycle)

[Placed in Category 'A' by MoE (GoI)]

BELAGAVI



COPYRIGHT DECLARATION

*We hereby declare that KLE ACADEMY OF HIGHER
EDUCATION AND RESEARCH, BELAGAVI, KARNATAKA, shall have the
rights to preserve, use and disseminate this thesis in print or
electronic format for academic/research purposes.*

Dr. Sumith Kumar M MD(Ayu)
Full Time Ph.D. Research Scholar
Reg. No. D01217006
KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya. Post Graduate
Studies and Research Centre Belagavi

Dr. Pradeep Grampurohit
MD (ayu), PhD
Professor
KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya. Post
Graduate Studies and Research Centre

Place: Belagavi

Date:

© KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH, BELAGAVI

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,
(KLE DEEMED UNIVERSITY)**

[Declared as Deemed-to-be-University u/s 3 & 12 B of the UGC Act, 1956 vide Govt. of India
Notification No.F.9-19/2000-U.3 (A)]

(Accredited 'A+' Grade by NAAC) (3rd Cycle)

[Placed in Category 'A' by MoE (GoI)]

BELAGAVI



DECLARATION

I hereby declare that the thesis entitled “Biochemical changes in Individuals of High BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)” is a bonafide and original research carried out by me under the guidance of Dr. Pradeep Grampurohit. MD(Ayu), Phd. Professor, KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi. The thesis or any part thereof has not formed the basis for the award of any degree/fellowship or similar title to any candidate of any University.

Place: Belagavi

Date:

Dr. Sumith Kumar M MD(Ayu)
Full Time Ph.D. Research Scholar
Reg. No. D01217006
KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya. Post Graduate
Studies and Research Centre Belagavi.

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,
(KLE DEEMED UNIVERSITY)**

[Declared as Deemed-to-be-University u/s 3 & 12 B of the UGC Act, 1956 vide Govt. of India
Notification No.F.9-19/2000-U.3 (A)]

(Accredited 'A+' Grade by NAAC) (3rd Cycle)

[Placed in Category 'A' by MoE (GoI)]

BELAGAVI



CERTIFICATE

*This is to certify that the thesis entitled “Biochemical changes in Individuals of High BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)” is a bonafide and genuine research carried out by **Dr Sumith Kumar M** ^{MD(ayu)}, under the guidance of Dr. Pradeep Grampurohit. ^{MD(ayu), PhD}, Professor KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi.*

Place: Belagavi
Date:

Dr. Basavaraj Tubaki
^{MD (ayu), PhD}
Dean, Faculty of Ayurveda
KAHER, Belagavi

© KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH, BELAGAVI

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,
(KLE DEEMED UNIVERSITY)**

**[Declared as Deemed-to-be-University u/s 3 & 12 B of the UGC Act, 1956 vide Govt. of India
Notification No.F.9-19/2000-U.3 (A)]**

(Accredited 'A+' Grade by NAAC) (3rd Cycle)

[Placed in Category 'A' by MoE (GoI)]

BELAGAVI



CERTIFICATE

*This is to certify that the thesis entitled “Biochemical changes in Individuals of High BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)” is a bonafide and genuine research carried out by **Dr Sumith Kumar M** MD(ayu), under the guidance of Dr. Pradeep Grampurohit. MD(ayu), PhD, Professor KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi*

Place: Belagavi
Date:

Dr. Suhaskumar Shetty

MD (ayu), PhD

Professor-Principal
KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya Post Graduate
Studies and Research Centre, Belagavi.

© KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH, BELAGAVI

**KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,
(KLE DEEMED UNIVERSITY)**

[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Govt. of India Notification
No.F.9-19/2000-U.3 (A)]

(Accredited 'A+' Grade by NAAC) (3rd Cycle)

[Placed in Category 'A' by MoE (GoI)]

BELAGAVI



CERTIFICATE

*This is to certify that the thesis entitled “Biochemical changes in Individuals of High BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)” is a bonafide record of original research carried out by **Dr. Sumith Kumar M**, for the award of the degree of DOCTOR OF PHILOSOPHY IN FACULTY OF AYURVEDA under my supervision and guidance*

Place: Belagavi

Date:

Dr. Pradeep Grampurohit.

Md(Ayu), Phd.

Professor

KAHER's Shri BM. Kankanawadi
Ayurveda Mahavidyalaya. Post
Graduate Studies and Research
Centre Belagavi

© KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH, BELAGAVI

ACKNOWLEDGMENT

I take this privilege and pleasure to acknowledge the contribution of multiple individuals who have been inspirational and supportive throughout the study period and endowed me with the most precious knowledge to see success in my endeavour. This Ph.D. work bears the imprint of all those people, I am grateful to.

I would like to express my deepest sense of gratitude, thankfulness and appreciation to my esteemed and beloved research guide **Dr. Pradeep L. Grampurohit**. MD (ayu), PhD, Professor KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi and my former Guide **Dr. B S Prasad** MD (ayu), PhD, President Board of Ayurveda, NCISM and former Principal KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi for their patience, constant inspiration, motivation, enthusiasm, immense knowledge, excellent guidance and cooperation during this study. I thank them for all their advice and for always guiding me in the right direction.

I express my special thanks to my Co-guide **Dr. Sunil S Jalalpure**.M.Pharm, PhD Principal, KLE College of Pharmacy, Belagavi for extending his help and kind cooperation and extend my heartfelt gratitude to **Dr. Suhas Kumar Shetty** MD (ayu), PhD, Principal, KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi and **Dr. Basavaraj R. Thubaki** MD (ayu), PhD, Dean Faculty of Ayurveda, KAHER, Belagavi for their kind support and help in providing all the necessary facilities in the college for the conducting my research work.

I am highly grateful Vice- Vice-Chancellor **Dr. Nitin M. Gangane** MD, DNM, FUICC, FICP, FAMS, PhD, and express my deep gratitude to Registrar **Dr. M. S. Ganachari** M.Pharm, PhD for their valuable guidance, constant inspiration, encouragement and persistent help throughout my dissertation work. I express my deep gratitude to former Director of

Academic Affairs **Dr. Daksha Dixit, Dr. Roopa M Bellad** and present Director **Dr.(Mrs.) Jyoti M. Nagamoti.**

I owe my special thanks and gratefully acknowledge **Dr. Ramesh S Paranjape.** MSc., Ph.D. Distinguished Professor and In-charge BSRC, Belagvai and **Masud Ahmed Taha** for their guidance and providing an invigorative and conductive environment to pursue this research work with great ease.

I sincerely thank **Dr. Giridhar Vedantam,** Principal, GGIMS, MGUG Gorakhpur and all the teaching and non-teaching staff of KAHER's Shri BM. Kankanawadi Ayurveda Mahavidyalaya. Post Graduate Studies and Research Centre Belagavi and GGIMS, MGUG Gorakhpur for their constant guidance and invaluable help

I express my immense gratitude and love to my greatest source of inspiration, my parents **Shri E. S. Mohanan** and **Smt. Santha Kumari K P.** and my wife **Smt. Sheetal D. K** and son **Siddharth S. Nair** for being an ever-loving family and for their endless encouragement, guidance and support through all these years.

Most importantly, I thank the Lord Dhanvantari for continually blessing me and giving me the strength and wisdom to fulfil all my endeavours.

Date:

Dr. Sumith Kumar M MD(Ayu)

Place:

TABLE OF CONTENTS

Sl. No.	Particulars	Page No.
1.	Introduction	1-4
1.1	Background	5-6
1.2	Aims and Objectives	7
1.3	Literature Review	8-104
1.4	Justification	105-106
2.	Material and Methods	107-117
3.	Data Analysis Plan	118
4.	Results	119-152
5.	Discussion	153-167
6.	Summary	168-170
7.	Conclusion	171
7.1	Limitation	172
7.2	Recommendation	173-174
8.	Bibliography	175-196
9.	Annexure	197-242
A.	Data Collection	197-200
B.	Informed Consent & Patient Information Sheet	201-218
C.	Ethical Clearance letter	219
D.	Publications	220-233
E.	Other	234-241

LIST OF ABBREVIATIONS

A.H.	:	Ashtanga Hridaya
A.S.	:	Ashtanga Samgraha
BMI	:	Body Mass Index
BIA	:	Bioelectrical Impedance Analysis
B.P.	:	Bhava Prakasha
B.R.	:	Bhaishajya Ratnavali
B.S	:	Brihad Samhita
Ca.	:	Charaka Samhita
Chi	:	Chikitsa sthana
HDL	:	High-Density Lipoprotine
hrs.	:	Hours
K.S.	:	Kashyapa Samhita
Kg.	:	Kilograms
LDL	:	Low-Density Lipoprotine
NIR	:	Near Infra-Red
M.N	:	Madhava Nidana
mg.	:	Milligrams
m-RNA	:	Messenger Ribonucleic acid
Ni.	:	Nidana Sthana
Sa	:	Sarira Sthana
Si	:	Siddhi Sthana

SU.	:	Sushruta Samhita
Su	:	Sutra sthana
Ut	:	Uttara Tantra
VLDL	:	Very Low Density Lipoproteins
Vi	:	Vimana Sthana
WHR	:	Waist Hip Ratio

LIST OF TABLES

Sl. No.	Particulars	Page No.
1.	Description of <i>Sara</i> in Different <i>Samhita</i>	14
2.	Skin complexion according to <i>Vagbhata</i>	16
3.	<i>Chaya Nirupana</i> - <i>Panchamahabhuta Sambandha</i>	17
4.	Relation of <i>Dhatu Sara Lakshana</i> and <i>Varna</i>	19
5.	<i>Panchabhoutika</i> Composition of Different <i>Varna</i>	23
6.	Characteristics Of <i>Kesha</i> in Different <i>Prakruti</i>	24
7.	Physical Characteristics of <i>Medho Sara</i> from Different <i>Samhita</i>	30
8.	Socio-Psychological Characteristics of <i>Medho Sara</i> in Different <i>Samhita</i>	31
9.	Norms of Body Fat Percentage	58
10.	Explains the <i>Pramana Pariksha</i> in Ayurvedic treatises	66
11.	<i>Aharatmaka Nidana</i> of <i>Sthaulya</i>	68
12.	<i>Viharatmaka Nidana</i> of <i>Sthaulya</i>	70
13.	<i>Manasika Nidana</i> of <i>Sthaulya</i>	70
14.	<i>Anyā Nidana</i> of <i>Sthaulya</i>	71
15.	<i>Rupa</i> of <i>Sthaulya</i>	83
16.	Seven layers of Skin	88
17.	<i>Upadrava</i> of <i>Sthaulya</i>	98
18.	Score assigned to <i>Medho Sara</i> and <i>Sthaulya</i>	115
19.	Questionnaire Development and Validation	119
20.	Age-wise distribution of the participants	120
21.	Gender-wise distribution of the participants	121
22.	The weight distribution of the participants	122
23.	Height-wise distribution of the participants	123
24.	BMI classification distribution of the participants	124
25.	<i>Sharira Pramana</i> distribution of the participants	125
26.	Distribution based on <i>Medho Sara</i> and <i>Sthaulya</i>	126
27.	Distribution based on the classification of <i>Medho Sara</i>	127

28.	Comparison of Age, Ht, Wt, BF% and BSA to <i>Medho Sara and Sthaulya</i>	128
29.	Pearson's Correlation of Score for <i>Sara</i> to Weight, Height, BF% and BSA	129
30.	Comparison of Complete Blood Count to <i>Medho Sara and Sthaulya</i>	130
31.	Pearson's Correlation of Score for <i>Medho Sara</i> to CBC	131
32.	Comparison of Lipid Profile to <i>Medho Sara and Sthaulya</i>	132
33.	Pearson's Correlation of Score for <i>Medho Sara</i> to Lipid Profile	133
34.	Comparison of Biochemical Variables to <i>Medho Sara and Sthaulya</i> group	135
35.	Pearson's Correlation of the Adiponectin and Leptin with Score for <i>Medho Sara</i>	136
36.	Comparison of Anthropometric measurements to <i>Medho Sara and Sthaulya</i>	137
37.	Pearson's Correlation of Score of <i>Medho Sara</i> to Anthropometry	139
38.	Comparison of Body Mass Index (BMI) distribution among <i>Medho Sara and Sthaulya</i>	141
39.	Distribution according to the Classification of BMI	141
40.	Distribution of subjects according to Age group	142
41.	Distribution of subjects according to <i>Sarira Pramana</i>	143
42.	Pearson's Correlation of Adiponectin with Anthropometric Parameters	144
43.	Pearson's Correlation of Adiponectin with Anthropometric	145
44.	Pearson's Correlation of Adiponectin with other Biochemical parameters	147
45.	Pearson's Correlation of the Leptin with Anthropometric Parameters	148
46.	Pearson's Correlation of the Adiponectin with Anthropometric Parameter	149
47.	Pearson's Correlation of Adiponectin with other Biochemical parameters	151

LIST OF FIGURES & CHARTS

Sl. No.	Particulars	Page No.
1.	Classification of <i>Sara</i>	11
2.	<i>Sthana</i> and <i>Swarupa</i> of <i>Meda dhatu</i>	36
3.	Transformation of Fat from food into stored fat(Tg)	75
4.	<i>Samprapti</i>	94
5.	Adiponectin sample concentration determination	114
6.	Study Design	117
7.	Age-wise distribution of the participants	121
8.	Gender-wise distribution of the participants	121
9.	Weight distribution of the participants	122
10.	Height-wise distribution of the participants	123
11.	BMI classification distribution of the participants	124
12.	<i>Sharira Pramana</i> distribution of the participants	125
13.	Distribution based on <i>Medho Sara and Sthaulya</i>	126
14.	Distribution based on the classification of <i>Medho Sara</i>	127
15.	Distribution according to the Classification of BMI	142
16.	Distribution of subjects according to Age group	143
17.	Distribution of subjects according to <i>Sarira Pramana</i>	144

ABSTRACT

Biochemical Changes in Individuals of High BMI with special reference to *Medho Sara* (Excellence of Adipose Tissue) and *Sthaulya* (Obesity)

Background: Obesity, or *Sthaulya*, is a major public health issue, especially in India, where the swift epidemiological change has increased obesity-related ailments. Traditional Ayurvedic principles, such as *Medho Sara* (the superiority of adipose tissue), offer a foundation for comprehending the physiological and pathological conditions of body fat. It is essential to differentiate between *Medho Sara* and *Sthaulya* for precise diagnosis and therapy; yet, prevailing therapeutic procedures frequently overlook these distinctions due to an absence of objective signs.

Objective: The objective of this study is to examine the biochemical alterations linked to *Medho Sara* and *Sthaulya* in persons with elevated Body Mass Index (BMI). The main objectives are evaluating indicators associated with *Medho Sara* and *Sthaulya*, investigating biochemical alterations, and analysing the correlation between body fat percentage, lipid profiles, blood glucose levels, and anthropometric measurements.

Method: A cross-sectional study approach was utilised, comprising participants classified by their BMI. Participants were tested for *Medho Sara* and *Sthaulya* characteristics through clinical examinations and biochemical assays. Biochemical indicators including adipokines (Adiponectin, Leptin), lipid profiles, and blood glucose levels were assessed. Statistical analyses were done to examine these parameters between people classed as *Medho Sara* and those identified as *Sthaulya*.

Results: Preliminary findings reveal significant variations in biochemical markers between the two groups. Individuals with *Medho Sara* demonstrated advantageous adipokine levels and lipid profiles in contrast to those with *Sthaulya*, who displayed elevated triglyceride and glucose levels. The study also found that body fat percentage correlated strongly with the classification of individuals as either *Medho Sara* or *Sthaulya*, suggesting that body fat percentage may serve as an effective clinical indicator for distinguishing between physiological and pathological states of adipose tissue.

Conclusion: The study emphasises the necessity of distinguishing between *Medho Sara* and *Sthaulya* by objective biochemical metrics. By creating unambiguous distinctions based on adipokine levels and other metabolic markers, this study adds vital insights into the prevention and management of obesity-related health concerns. The findings urge for merging Ayurvedic concepts with modern scientific approaches to increase clinical assessments of obesity in varied populations, notably among Indians. Future research should focus on longitudinal studies to further understand the metabolic consequences of these findings and develop tailored therapies for at-risk populations.

Keywords:

Obesity, Adipose Tissue, Body Mass Index (BMI), *Medho Sara*, *Sthaulya*, Biochemical Changes, Adipokines, Lipid Profile, Anthropometry, Metabolic Disorders.

1. INTRODUCTION

The fundamental instruments of knowledge acquisition in *Ayurveda* are described as *Pratyaksha* (sensory perception), *Anumana* (inference), and *Aptopadesha* (credible directions by Rishi).¹ One's limitations are surpassed by those of the other; for example, knowledge derived from *Pratyaksha's* foundation allows one to deduce the unperceivable, while *Aptopadesha* provides knowledge of the unknowable. These reliable instructions are the result of *Acharya's* knowledge acquired by their senses and intellect, which developed into the foundational ideas and logical deductions for all *Ayurvedic* teachings. For science to advance, this vast amount of information, preserved in *Ayurvedic* literature and compressed into codes, must be carefully examined and deciphered. *Dhatu Sara* is one of the various theories and concepts that are explained in classic *Ayurveda* literature. The significance of *Dhatu Sara's* resolve is seen in examining each *Dhatu's* unique *Bala*.² Because the collective *Bala* of *Sharira* is provided by the individual *Dhatu's Bala*.

Three essential elements—*Dosha*, *Dhatu*, and *Mala*—are needed for *Shareera* to survive, and *Dhatu* is one of them.³ Only after completing *Dhatu Parinama Kriya* does it carry out the duties of *Dharana* (structural framework) and *Poshana Karma* (nutritional pool)⁴. It divides *Sara* and *Kitta Bhaga* from the *Ahara Rasa*.⁵ When of exceptional quality, this *Sara Amsha* of the corresponding *Dhatu* encourages certain unique physical and sociopsychological distinctive traits in *Shareera*, which are together referred to as *Sara Purusha Lakshana*.⁶ Even while *Dosha*, *Dhatu*, and *Mala* are the three basic components that make up every human, there are still differences between individuals in both the structural and functional aspects, depending on several variables. The lack of objective indicators makes it practically difficult for a doctor to diagnose *Medho Sara*.

In *Ayurveda Sâra* is said to be the essence of *Dhatu*⁷ (Body tissue), It is a remarkable tool to assess *Bala* (physical and mental strength or power of resistance against diseases) and *Ayu* (Life) of the person. The person who has *Medho Sara* is known to have more resistance against the diseases related to the *Medho Dhatu* (Adipose tissue) and *Sarva Sara* (excellence of all tissues) individuals have relatively higher *Bala* (physical and mental strength or power of resistance against the diseases) in comparison with *Madhyama* and *Avara Sara* individuals.⁸⁻¹⁰

The *Vishuddha Meda Dhatu* (excellence of adipose tissue) expresses itself in the form of physical characteristics like *Snigdhata* (unctuous) in *Varna* (skin complexion), *Svara* (sound), *Netra* (eye), *Kesha* (scalp hair), *Loma* (body hair), *Nakha* (nail), *Danta* (teeth), *Oshta* (lips), *Mutra* (urine) and *Pureesha* (faeces) and the person will be endowed with *Aishwarya* (Prosperous), *Sukha* (Happy), *Upabhoga* (Enjoyment), *Sukumarata* (Delicate), *Upacharata* (Polite behaviour)¹¹ and have distinctive features of *Bruhat Shareera* (big body frame) and *Ayasa Asahishnuta* (exertion intolerance).¹² all these characters demonstrates *Medho Dhatu* in its highest physiological stature.

Ayurveda has explained *Medho dhatu* (fat tissue) in great detail with a description of its Qualitative and quantitative status viz. *sarata*, *vridhhi*, *kshaya*, *ayatha upachaya* and *Medovaha srotas dushti*.

Medho dhatu is also said to play a major role in the pathogenesis of *Sthaulya* (Obesity) and *Prameha* (Diabetes mellitus). The word '*Sthula*' stands for the stoutness of the body. Ayurveda has included *Atisthula* (obese or overweight) persons in *Ashta Nindita Purushas* (undesirable physiques).¹³ *Sthoulya* is *Meda* and *Mamsa vikara pradhana Santarpanajanya Vyadhi*.¹⁴

Sthaulya is a condition wherein there will be *ayatopachaya* of *shareera* and an abnormal increase in *Medho Dhatu*, this increase in *Medho Dhatu* will cause flabbiness and pendulous movement of abdomen, breast and buttocks, and will lead to *Utsahahani*.¹³ Such a presentation of *Medho Dhatu* represents its pathological state and can be considered Obese.

India with 1.2 billion people is the second most populous country in the world and is currently experiencing rapid epidemiological transition. Undernutrition due to poverty which dominated in the past is being rapidly replaced by obesity associated with affluence¹⁵.

According to the World Health Organisation (WHO), obesity is one of the most common yet among the most neglected health problems in both developed and developing countries¹⁶. WHO's World Health Statistics Report 2012, states globally one in six adults is obese and nearly 2.8 million individuals die each year due to overweight and obesity¹⁷. Obesity is strongly associated with metabolic disorders including diabetics, hypertension, dyslipidaemia, cardiovascular diseases and even some cancers¹⁸.

A subgroup of approximately 10-30% of obese individuals is metabolically healthy despite having excessive accumulation of body fat¹⁹⁻²¹. This phenomenon is referred to as metabolically healthy obesity (MHO)²². However, to date, little is known about the factors that delay the onset of or protect obese individuals from developing metabolic disturbances²³.

Snigdhatta is one such subjective parameter mentioned in *Medha Sara Lakshana* which can be used to assess the same. *Snigdhatta* refers to *Sneha* / *Aruksha* / *Chikkana* / *Masruna*²⁴ and oily²⁵ and is the contribution of *Jala Mahabhuta*.²⁶ It

promotes lustre to *Varna, Swara, Netra, Kesha, Loma, Nakha, Danta, Oshta, Mutra, Pureesha, and Sweda*.²⁷

An adequate amount of body fat is required to carry out certain physiological functions in the body,²⁸ like promoting lustre to hair, lips, nails etc. and an unparallel increase in the Body fat can become pathological and may lead to many Metabolic diseases.²⁹

A better understanding of the differentiation between the Physiological and Pathological state of *Medho dathu* may help in maintaining and developing appropriate preventive measures.

1.1 BACKGROUND

Given that *Sthulya* is pathological and *Medho Sara* is a physiological entity, both individuals can have large bodies (*Bruhat Shareera*). However, because it is difficult to distinguish between the two eccentrics, it is possible to mistakenly identify a healthy individual as *Sthaulya* (obese) and a pathological individual as *Medho Sara*.

Traditional thresholds that are employed to determine the risk at the asymptomatic stage fail to recognise the full significance of metabolic risk and pathological obesity in Indians³⁰. Under such circumstances, a substitute technique that can estimate the metabolic risk at a young age must be offered.

A critical analysis of *Medho Dhatu* (adipose tissue), *Medho Sara* and *Sthaulya* and their relationship to biochemical alterations may offer a straightforward method based on a clinical assessment to forecast the likelihood and severity of these issues in the future. It will also provide a particular perspective on the conditions' prevention and treatment.

To establish a more distinct border One such scientific quantitative technique for figuring out how much body fat there is concerning body weight is body fat percentage.

²⁸ So, the main theme of this work was to analyze the relation between *Medho Sara* norms (*Pravara*, *Madyama* and *Avara*) and % Body fat Percentage.

Similarly, many studies have established a close link between levels of different Adipokines like Adiponectin, Leptin etc with the pathological condition of Adiposity. Additionally, different Bio-chemical parameters like lipid profile, Blood Glucose and Anthropometric parameters like BMI etc, have also established virtuous linkage between physiological and pathological levels of Adiposity.

Hence, we assumed that a thorough study of these parameters in correspondence with *Medho Sara* and *Sthaulya* would help to achieve a distinct demarcation between the two eccentrics and establish an objective parameter for an easy clinical assessment of *Medho Sara* and *Sthaulya*.

1.2 AIM & OBJECTIVES

Aim of the Study:

The present study aims to understand the relationship between *Medho Dhatu* (adipose tissue), *Medho Sara* and *Sthaulya*, with special reference to biochemical changes and adipokine levels. The study intends to differentiate *Medho Sara* (physiological entity) and *Sthaulya* (pathological stage), parameters that have been examined in the context of body fat percentage, lipid profiles, blood glucose levels as well anthropometric measures like BMI. This will provide an evidence-based tool to objectively assess and differentiate visceral obesity from the simple large body in the treatment of Metabolic Healthy Obese individuals, especially among Indians. This will allow for a greater insight into metabolic risks and help prevent, as well as treat related conditions.

Objectives:

- I. Assessment of *Medho Sara* and *Sthaulya* parameters in individuals of high BMI.**
- II. Study the Biochemical changes in *Medho Sara* and *Sthaulya* individuals.**

Hypotheses:

Alternate Hypothesis: The Bio-chemical parameters will demonstrate a significant difference between *Medho Sara* and *Sthaulya* in individuals with high BMI

Null Hypothesis: There will be no significant difference in the Bio-chemical parameters between *Medho Sara* and *Sthaulya* in individuals with high BMI

1.3 LITERATURE REVIEW

1.3.1: Nirukti of Sara:

The word *Sara* is derived from the root word

सृ-घम्, सार्-अच् वा (V.S.Apte)

Which means Best, Highest, Essential or Most Excellent.³¹

सृ = सृ स्थिरे (शब्द कल्पद्रुम)

With suffix “*Ghana*”

The meaning of the word *Sara* is essential, most excellent, the best, real, true, strong, powerful, solid, and energy.³²

1.3.2: Etymology

सार शब्देन विशुद्धतरो धातुरुच्यते । च्. वि. ८/१०२

It is the excellence of body tissues.³³

सार देहन्तर्गते स्थिर पदार्थ । (वैद्यक शब्द सिन्धु)

The most stable part of the body.³⁴

सारे बले स्थिरांसे च । (अमरकोष)

The term *Sara* has two meanings: -

1. *Bala* (resistance to disease or strength).

2. *Sthiramsha* (Part of stability).³⁵

Sir Monier Williams has defined the meaning of *Sara* as essence, the best part or quittances or excellent part of anything.³⁶ In Ayurveda literature the word *Sara* is used for the *Vishuddhatara Dhatu*.

1.3.3: Synonyms

Vajraksharam, Bala, Pashaka, Sthiramsha, Majja, Vayu, Roga, Dadhi uttaram.³⁷

Sarata

धारणात् इति धारण प्रकर्षात् तेन दोषाणां साम्यावस्थितानाम्

देह धारकानामपि धारकत्वं प्रकर्षाभावात् न मुख्यं धातुत्वं ।

[च. वि. ८/१०२ (चक्र)]

Acharya *Chakrapani* thinks that the concept of *Sara* is related only to the *Dhatu* and not to *Doshas*, *Updhatu*, or *Mala*.³⁸

View of Recent Ayurveda Scholars Regarding the *Sara*:

A new Nomenclature for *Dhatu Sarata* had been discribed by a recent scholars of Ayurveda. It is said to be - “**A true of the system**” by S.P.Guppta, “**Tissue vitality**” by K.N.Uduppa, “**Tissue quality**” by R.H.Singh, “**Stamina**” by Vd. Ranjeet Rai Desai and “**Constitutional essence**” by P.V.Sharma

1.3.4: Classification

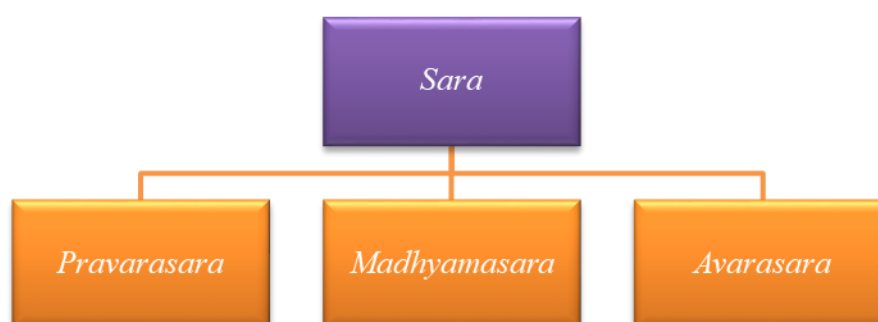
Although, the body of every human being is made up of seven *Dhatu*,³⁹ yet it is found that people differ substantially from each other at the level of *Dhatu*. It is because all the seven *Dhatu* of the human body undergo certain modifications during *Paka* (metabolic processes), from by which *Sara* and *Kitta* are generated.⁴⁰ The *Kitta* is flushed out of the body and the *Sara* portion is utilized in the development of *Dhatu*, which accomplishes all of the body's functions and supports it.⁴¹ The proportions of this *Paka* and its product i.e. *Sara* and *Kitta*, vary from individual to individual. Thus, the body, formed of seven *Dhatu* in varied quantum, differs from each other at the level of *Dhatu Sarata*.

Hence persons based on *Sara* have been divided into several types, depending upon the preponderance of certain *Dhatu* in the human body under its, quantity, quality, and endeavours.

It is to be emphasized that humans designated to particular *Sara* contain not only the essence of that *Dhatu* but may hold the essence of other *Dhatu* in some lesser proportion. Based on this conclusion *Acharya Charaka* and *Vagbhata* have classified the individuals into the following three groups.

- i. *Pravara Sara*: contains the essence of all the *Dhatu* and *Satva*.
- ii. *Madhyama Sara*: includes the essence of all the *Dhatu* in moderate proportion.
- iii. *Avara Sara*: holds the essence of all the *Dhatu* at the minimal level.⁴²

Chart No 1: Classification of Sara



Characteristics of *Sarva Sara Purusha*:

According to *Acharya Charaka*, individuals of *Sarva-Sara* are endowed with immense strength, happiness, endurance against challenges, self-confidence in all endeavours, a predisposition to humanitarian actions, a firm and balanced body; and a well-balanced gait. They have a resonant & melodic deep and high-pitched voice; supremacy; wealth; delight; honour; slower ageing process and pathogenesis; minimal disease and long life with progeny of their quality.⁴³

They are always involved in social welfare projects of the society. *Vagabhata* in *Astanga Sangraha* has mentioned the same traits as mentioned in *Charaka*.⁴⁴ According to *Astanga Hridaya*, such individuals are distinguished by strong self-respect, optimism for success in all activities, capacity to resist troubles, wisdom, and steadfastness.⁴⁵

Characteristics of *Madhyama Sara Purusha*:

These kinds of people have features of *Sarva-Sara* to a modest degree.^{46, 47}

Characteristics of Asara Purusha:

Persons missing classical qualities of *Sarva Sara*, are described to be “*Avara Sara* or *Asara*”.⁴⁸

Every *Dhatu* can be *Saravan* by following three dimensions: -

- 1) Quantitatively
- 2) Qualitatively
- 3) Functionally

Hence, a *Dhatu* can be designated as *Saravan* only when it is *Saravan* by all three aspects. A person who exhibits all the physical qualities of individual *Sara* but lacks Socio-psychological attributes will not be called as a *Sara* individual.

1.3.5: Description Of Sarata in Different Samhitas

Chronicle of *Sara* according to *Charaka* – 8.⁴⁹

तद्यथा त्वग्रत्तमांसमेदोऽस्थिमज्जाशुक्रसत्वनिति । (च. वि. 8/102)

Chronicle of *Sara* according to *Sushruta* – 8.⁵⁰

अथ सारान् वक्ष्यामः ... प्रधानमायुः सौभाग्ययोरिति । (सु. सू. 35/16)

Chronicle of *Sara* according to *Ashtanga Sangraha* – 8.⁵¹

साराण्यष्टौ त्वग्रत्तमांसमेदोऽस्थिमज्जाशुक्रसत्वनिति । (अ. सं. शा. 8/29)

Chronicle of *Sara* according to *Ashtanga Hrudaya* – 8.⁵²

त्वग्रत्तादीनिसत्त्वांतांयाग्याण्यष्टौ यथोत्तरं । (अ. ह. शा.3/117-118)

Chronicle of *Sara* according to *Kashyapa Samhita* – 9.⁵³

त्वग्रसृक्मांसमेदोऽस्थिमज्जाशुक्रणि धातवः ।

ओजः सत्त्वं च सर्वं च तत्सारं तु निबोध मे ॥ (का.सं.सू. 28)

Chronicle of *Sara* according to *Brihat Samhita* – 7.⁵⁴

सप्त भवन्ति च सारा मेदोमज्जात्वग्ऽस्थिरशुक्रणि ।

रुधिरं मांसं चेति प्राणभृतां तत्समासफलं ॥

(बृ.सं.पुरुष लक्षणाध्याय-96)

The Chronicle of *Sara* by various *Samhita* is also not similar. *Vagabhatta* and *Charaka* have followed the same sequence, but the *Sushruta Samhita* sequence is reversed. *Kashyapa* has followed the sequence of *Charaka* but has included an additional *Sara* i.e. the *Oja Sara*.

In *Bruhat Samhita*, written by *Varahmihira* does not follow any specific sequence for the description of *Sara*.

Table No. 1: Description of Sara in Different Samhita

Sr. No	CHARAKA SAMHITA	SUSHRUTA SAMHITA	ASTANGA SAMGRAH	ASTANGA HRIDYAM	KASHYAP SAMHITA	BRUHAT SAMHITA
1	<i>Tvak Sara</i>	<i>Satva Sara</i>	<i>Tvak Sara</i>	<i>Tvak Sara</i>	<i>Tvak Sara</i>	<i>Meda Sara</i>
2	<i>Rakta Sara</i>	<i>Shukra Sara</i>	<i>Rakta Sara</i>	<i>Rakta Sara</i>	<i>Rakta Sara</i>	<i>Majja Sara</i>
3	<i>Mamsa Sara</i>	<i>Majja Sara</i>	<i>Mamsa Sara</i>	<i>Mamsa Sara</i>	<i>Mamsa Sara</i>	<i>Tvak Sara</i>
4	<i>Meda Sara</i>	<i>Asthi Sara</i>	<i>Meda Sara</i>	<i>Meda Sara</i>	<i>Meda Sara</i>	<i>Asthi Sara</i>
5	<i>Asthi Sara</i>	<i>Meda Sara</i>	<i>Asthi Sara</i>	<i>Asthi Sara</i>	<i>Asthi Sara</i>	<i>Shukra Sara</i>
6	<i>Majja Sara</i>	<i>Mamsa Sara</i>	<i>Majja Sara</i>	<i>Majja Sara</i>	<i>Majja Sara</i>	<i>Rudhira Sara</i>
7	<i>Shukra Sara</i>	<i>Rakta Sara</i>	<i>Shukra Sara</i>	<i>Shukra Sara</i>	<i>Shukra Sara</i>	<i>Mamsa Sara</i>
8	<i>Satva Sara</i>	<i>Tvak Sara</i>	<i>Satva Sara</i>	<i>Satva Sara</i>	<i>Ojas Sara</i>	
9					<i>Satva Sara</i>	

1.3.6: General Considerations of Medho-Sara Person: -

The words "*Meda*" and "*Sara*" make into the phrase "*Medho Sara*."

Sara is a literal translation of the essence of *Dhatu* or *Bala* or *Vishuddhatara Dhatu* signifying the functions, qualities, and quantities of a *Dhatu*'s.

Comparing the *Medho Sara* individuals to those of other *Sapta Sara* is that the individual of *Medho Sara* possesses the high quality of *Meda Dhatu*.

Particularly in *Varna* (complexion), *Swara* (voice), *Netra* (eyes), *Kesha* (scalp Hair), *Loma* (body hair), *Nakha* (Nails), *Danta* (Teeth), *Oshta* (Lips), *Mutra* (Urine), and *Purisha* (Feces), the *Medho Sara* people will have *Snigdhata* (unctuous). *Vitta* (wealth), *Aishwarya* (prosperity), *Sukha* (Happiness), *Upabhoga* (Enjoying), *Pradana* (Excessively liberal), *Arjava* (Straightforward), *Sukumara* (Delicate), and *Upachara* (Polite behaviour) will all be bestowed upon them.⁵⁵

People with *Medho Sara* are claimed to have *Snigdhata* expressed in *Swara* (voice), *Mutra* (urine), and *Sweda* (sweat). They possess the distinguishing qualities of *Ayasa Asahishnuta* (Intolerance to physical exertion) and *Bruhat Shareera* (large body frame)⁵⁶

There will be *Sushareera*, *Vitta*, and *Putra* among the *Medho Sara* individuals.⁵⁷

All the above-mentioned qualities can be classified into two groups

- i. Physical characteristics
- ii. Socio-psychological characteristics

Brief description of physical characteristics.

1. **Varna:** *Tejo mahabhuta* is the primary determinant of *Twak Varna*. The primary factor responsible for both the typical and atypical skin colouration is the *Pitta Dosha*, namely the *Bhrajaka pitta* situated in the *Twak*. During the *Garbhavasta* period, the fetus's complexion is determined by the dominance of *Tejobhuta*, coupled with other factors, as outlined below.

- i. *Tejo mahabhoota* combined with *Jala mahabhoota* results in *Goura varna*.

- ii. *Tejo mahabhoota* and *Prithvi mahabhoota* are combined to form *Krishna varna*.
- iii. *Tejo mahabhoota* and *Akasha mahabhoota* are combined to form *Krishna-Shyama varna*.
- iv. *Tejo mahabhoota*, *Jala mahabhoota*, and *Akasha mahabhoota* combine to become *Shyama varna*.

Acharya Charaka states that there are four ***Prakrita Varna***, namely *Krishna*, *Krishna Syama*, *Syamavadata*, and *Avadata*.⁵⁸ In addition, there are *Atigoura* and *Atikrisna*, both of whom are *Nindita*. Factors responsible for normal skin colour according to *Vagbhata*⁵⁹ are as per the table given below.

Table no. 2: Skin complexion according to *Vagbhata*

S.N	Color	Sukra Varna	Garbhini Ahara & Vihar	Mahabhuta Samyoga
1	Goura	Shukla/Ghritabha varna	Ksheeradi Madhur	Teja+jala+akash
2	krishna	Taila	Tiladi vidhahi Annasevana	Teja+prithvi+vayu
3	Shyava	Madhu	Mishra Ahara	Sarva Bhuta Sanyoga

***Chaya and Prabha*:** These are the factors, which are having a connection with skin complexion. *Chaya* conceals the *Varna*, while *Prabha* brightens it. *Chaya* can be appreciated with proximity, whereas *Prabha* is apparent from a distance.⁶⁰

Tejo mahabhoota is the basis of all forms of *Prabha* and is categorized into seven, viz. *Rakta*, *Syava*, *Peeta*, *Pandu*, *Sita*, *Harita*, and *Asita*.⁶¹

Varna in normal is everlasting from birth to death, *Chaya* may alter owing to *Arishta Lakshana* (*Asanna Mrityu Lakshana*), whereas *Prabha* changes according to the transitory state of health. The regular complexion of the body is the product of these three only.

Table No. 3: *Chaya Nirupana - Panchamahabhuta Sambandha*⁶²

	Type	Lakshana
1	Nabhasi	Nirmala, neelavarna, snehayukta, saprabha
2	Vayavi	Ruksha, syavavarna, hatahprabha
3	Agneya	Visudharakta, deeptabha, darsanapriya
4	Apya	Shudha, vaiduryavimala, susnigdha
5	Parthiva	Sthira, snigdha, ghana, syama, sweta

Bhrajaka Pitta and skin colour: *Bhrajaka pitta* is claimed to be situated in the skin and imparts its characteristic colour and sheen to the skin. It has also been said that it governs the normal and abnormal temperature of the body. Acharya Charaka has not acknowledged this *Pitta* as a separate entity, but he has unified the tasks attributed to it among those of *Pitta* in general. He has asserted that the formation of normal and abnormal temperature of the body, as well as the normal and abnormal complexion of the skin, is linked to *Pitta*.⁶³ Acharya Chakrapani confirms Charaka's opinion and clarifying the causative factor for these functions is *Bhrajaka pitta*.

Acharya Bhela: *Bhrajaka Pitta* is that which is responsible for the expression of the specific characteristic of the body, creating various *Prabha* of the head, hands, feet, back, sides, abdomen, thighs, face, nails, eyes, hair and brightens them.

Acharya Vagbhata: *Bhrajaka pitta* is found in the skin. It is so-called because it provides lustre to the skin and makes it radiate. Commenting on the above,⁶⁴

Arunadutta: It is called *Bhrajaka pitta* because it performs *Dipana* and *Pachana* of constituents required for *Abhyanga*, *Lepa*, *Parisheka*, etc. It is located in the *Bahya Twak*, in its stratum known as *Avabhasini*.

Relation of Varna with Dosha:

- **Relationship with Vata Dosha:** In Charaka Samhita, *Vata dosha* is bestowed with the property of encouraging *Varna*. Among the five forms of *Vayu*, *Udana Vayu* is accountable for *Varna Utpatti*.
- **Udana Vata:** *Udana Vayu* transfers the *Anna Rasa* to all the *Sukshma Avayava*, nourishes it, and consequently endows the body with *Bala*, *Varna*, and *Swara*. It refers to the total sustenance of the *Rasa Dhatu* or enrichment of *Rasa Dhatu*.⁶⁵

Relationship with Pitta: *Pitta* is accountable for *Prkruta Varna* (*Utpatti/Prakashana*) and *Vaikrta Varna*. Along with other activities like *Darshana*, *Pakti*, etc., other significant functions are *Deha Mardava*- Which maintains the texture/softness of the body, and *Prabha* (body complexion).⁶⁶

- **Bhrajaka Pitta:** This *Pitta* situated in the *Tvacha* is described as *Bhrajakagni*. It digests the *Aushadha* which is tropically applied on the skin in the form of *Alepa*, *Avagaha*, *Abhyanga*, and *Parisheka* and is also responsible for imparting *Varna*.

Relationship with Kapha Dosha: In the context of *Prakruti Lakshana*, it is noted that individuals belonging to *Kapha Prakruti* possess *Prasanna Snigdha Varna*, *Sukumara*, and *Avadata Gatra*(fair) which implicitly implies that *Kapha Dosha* has a key part in the *Utpatti* of *Varna*.

Relation of Varna with Dhatu: *Varna* is largely a product of the equilibrium of all the *Dhatu*. Each *Dhatu* has a distinct role in the development and upkeep of *Sharira Varna*.

Table No. 4: Relation of Dhatu Sara Lakshana and Varna

Dhatu	Sara lakshana related to Varna
Rasa	Snigdha, Shlakshna, Prasanna, Saprabha tvak
Rakta	Mukha, pani, pada, snigdha rakta varna
Meda	Snigdha varna
Majja	Mrudu anga, Snigdha varna
Shukra	Prasanna, snigdha Varna

The Specific *Varna* assigned to each *Dhatu Sara* may be supported by the *Panchabhoutika* structure of that particular *Dhatu*. For example, *Meda Dhatu* promotes Snigdha Varna, which can be due to the combination of *Pruthvi Mahabhuta*, *Jala Mahabhuta*, and *Teja Mahabhuta* with their *Guna*.

- 2. Swara:** Speech is the consequence of *Manasika Prasannata* because of this mental stress is alleviated. This leads to the attainment of *Urja*, *Utsaha*, *Bala*, *Varna*, and *Spoorti*.⁶⁷ The words which are spoken are reinstated in *Smruti Patala*, the recollection of which is termed as *Smruti*.

The *Atma* acquaintances with *Buddhi*, and subsequently, in turn, orders the *Manas*. Thus, the *Manas* under the influence of *Buddhi* kindles the *Jatharagni*, which will further stimulate the *Udana Vata*. The speech is created by the outflow of air (*Udana Vata*) through the larynx and vibrations of vocal cords. This air while passing via the larynx, mouth, and nasal passages, will again be affected by the union and disunion of different portions of *Mukha* like *Danta*, *Oshta*, *Jihva*, etc.⁶⁸

The words which we pronounce are of two kinds:

1. **Dhwanyatmaka Shabda**, which expounds merely as sounds without any particular significance.

2. **Varnatmaka Shabda**, which is pronounced as syllables (*Akshara*) produces words and sentences.⁶⁹

Various terms are inscribed in *Ayurveda* and *Vyakarana* classics to indicate *Prakruta* and *Vaikruta Swara*.

Prakruta Swara – *Sanunada, Prasanna, Gambheera, Snigdha, Mahaswara*.⁷⁰

Vaikruta Swara - *Ruksha* (dry), *Chala* (unbalanced), *Kshama* (feeble), *Vibaddha* (episodic),⁷¹ *Bhinna* (cracked), *Manda* (less audible), *Gadgada* (stammering), *Hata Vak* (loss of voice).⁷²

3. **Netra**: The factors that encourage *Snigdhata* to *Netra* include *Vartma Mandala*, *Pakshma Mandala*, and *Swetha Mandala*.⁷³ As *Jala Mahabhuta* is prominent in these structures, it supports the preservation of *Ardhrata*, thereby exuviating off dirt, dust, and friction. The following structures contribute to the upholding of humidity and shine in the eye -

Glands of Moll: are adapted apocrine sweat glands that are located on the border of the eyelid. They are adjacent to the base of the eyelashes within the distal eyelid edge and anterior to the Meibomian glands. Glands of Moll empty into the neighbouring lashes. Lipids that are released from the Glands of Moll and Zeis add to the superficial layer of the tear film, delaying evaporation.⁷⁴

Glands of Zeis are unilobed sebaceous glands positioned at the border of the eyelid. These glands create an oily material that is discharged into the middle region of the hair follicle through the excretory ducts of the sebaceous lobule.⁷⁵

Conjunctival sac: It is the space into which the lacrimal fluid is secreted, confined by the conjunctival membrane between the palpebral and bulbar conjunctiva, the sac is

open anteriorly through the palpebral fissure when the eye is open (between the eyelids) and is a closed space while the eye is closed.⁷⁶

4. Hair (Kesha, Loma): Synonyms of Body Hair: 1) *Loma* 2) *Roma* 3) *Sharmashu* 4) *Tanuruha* 5) *Masuri*

Synonyms of Scalp Hair: 1) *Kesha* 2) *Chikura* 3) *Kacha* 4) *Bala* 5) *Tirthwak* 6) *Shirorooha* 7) *Shirasija* 8) *Moordhaja* 9) *Ashrahs* 10) *Shiroruha* 11) *Kuntals*

Keshotpatti

In Ayurveda, *Kesha* is considered as *Mala*. During the manufacture of *Asthi Dhatu* the *Dhatvagni paka*, will lead to the creation of 2 primary products

1. *Sara Dhatu*

2. *Kitta*

The *Kesha* & *Loma* are the *Mala* of *Asthi Dhatu*, associated with *Swedavaha Srotas*.⁷⁷

The *Sara Bhaga* of *Meda Dhatu* will emerge into *Asthi Dhatu*, whilst the *Kitta Bhaga* helps in the production and nutrition of *Kesha* and *Loma*.^{78,79,80} Some other scholars like Shabdastoma Mahanidhi, Sharangadhara, and Vedic index consider that *Kesha* is the *Upadhatu* of *Majja Dhatu*.⁸¹

Panchamahabhootatva Of Kesha

According to Ayurveda, *Kesha* is predominant with *Parthiva Mahabhoota*, it is owing to their *Gunas* (qualities) like *Guruta* (Heaviness), *Sthiratwa* (Stability). In *Kesha*, *Guruta* is characterized as insolubility and not as the weight of hair. *Kesha* is considered under the *Pitruja Bhava*.

Kesha Sankhya

It is challenging to estimate the number of *Kesha* (hairs) on the body. *Kesha* is innumerable. Numerous arguments have been noted in rethe *Kesha* (Hair) count of classics. The summation of the *Kesha*, according to several texts is as follows:

- 3.5 crores are the total amount of human hairs, according to Manusmurti.
- According to Acharya Charak, the number of *Kesha*, *Loma*, and *Shamashru* is equivalent to the number of *Dhamanyagra* which is 29956.⁸²
- The total number of hairs stated by Aptopadesha is 72 crores," according to Vidyotini Tika of Charak Samhita.⁸³
- There are four primary oblique Dhamani, which are further subdivided into several branches, according to Susrut Samhita. In light of this, it is reasonable to assume that the body is covered in an innumerable number of *Kesha*.⁸⁴

Keshabhoomi

Kesha (Hair) is present in specific areas of the skin, such as the pubic and scalp regions, but it does not cover the entire skin. Keshabhoomi is specifically used to refer to the scalp. Hair buds are already present in the genital and axillary areas. There are no hair buds on the plantar surfaces of the hands and feet. Keshabhoomi is the location of hair roots. Procedures like *Nasya* and *Abhyanga* nourish hair. All nutrients reach the hair through the roots; robust roots provide for optimal hair growth, optimum feeding, and protection from *Vatadi Dosha*.

Kesha Varna

A healthy person is symbolized by lustrous black hair. Different hair colours result from the influence of Prakruti, Jati, Vansha, Desha, Kala, etc. For example, hair colour varies among Prakrutis.

Dhusara Varna is common in *Vata Prakruti*

Kapil Varna usually found in *Pitta Prakruti* -

Krishana Varna predominantly present in *Kapha Prakruti*

As per *Desha*,

Blond Hair are usually seen in European population

Black Hair are found in Asian and African population

The colour of hair similar to *Bhramara's* has been cited when discussing hair beauty. It is said that *Pancha* is responsible for the creation of the colour of hair.

Tejo Mahabhoota is mainly responsible for imparting colour to *Kesha*. The many hues of colour in *Kesa*, *Loma*, and *Twacha* as well as the various structures found in the *Jangama* and *Sthavara* kingdoms may generally be attributed to *Mahabhoota's* composition.⁸⁵

Table No. 5: *Panchabhoutika* Composition of Different *Varna*⁸⁶

<i>SUSHRUT</i>	<i>CHARAK</i>
<i>Gaura varna --Tejas + Ap</i>	<i>Gaura varna -- Tejas + Ap + Akash</i>
<i>Krishna varna -- Tejas + Prithvi</i>	<i>Krishna varna -- Tejas + Prithvi + Vayu</i>
<i>Krishna shyama -- Tejas+ Prithvi + Akasha</i>	<i>Shyama varna -- Tejas+ Prithvi + Akasha +Ap + Vayu</i>
<i>Gaura shyama -- Tejas+ Akasha+ Ap</i>	--

Kesha Praman

There are two criteria for assessing the *Praman* (quantity) by

1. Numbering
2. Quantity

Since both *Ghanata* (denseness) and *Kesha Dirghata* (length) are employed as adjectives in this case, both *Pramanas* are allowed according to Shastra (text).

Dense, long hair is indicative of excellent health. It is referred to as *Kalitya* or *Indralupta* when the amount or density of hair diminishes. Nevertheless, the *Purusha Prakruti* is also a factor contributing to this.

Table No. 6: Characteristics Of Kesha in Different Prakruti

PRAKRUTI	DENSITY	LONGINESS	GUNA
<i>Vata</i>	<i>Alpa</i>	<i>Alpa</i>	<i>Ruksha</i>
<i>Pitta</i>	<i>Alpa</i>	-	<i>Mrudu</i>
<i>Kapha</i>	<i>Ghana</i>	<i>Dirgha</i>	<i>Snigdha</i>

Kesha Vruddhi

According to Ayurveda, *Rasa Dhatu* supplies nourishment to every bodily part. Scalp hair has a greater growth capacity than other materials. Among these, endocrine stimulation causes the hair in a specific area to grow at the appropriate age throughout puberty.

As per Acharya Charak, consumed food is broken down into an assailable nutritional fluid (*Aahara rasa*), which is then separated into two components: the excretory/waste matter (*Kitta*) and the essential fluid (*Sara bhaga*).

Numerous items, including sweat, urine, beard and head hair follicles, body hair, and so on, are produced and fed by the *Kitta Bhaga* (excretory/waste matter).⁸⁷

According to Sushruta, *Kesha* is fed by the final portion of *Dhamani*, which is connected to the *Romakoopa*(hair follicles).⁸⁸

Kesha In Relation to Dhatu Sara& Prakruti

As explained here under each major *Prakruti* & *Sara*, *Kesha*'s nature has been associated with various *Prakruti* of humans.

Vata Prakruti: Charak claims that those with *Vata Prakruti* have coarse hair on their bodies, faces, and heads.⁸⁹ According to Acharya Sushruta, the beard, moustache, fingernails, and hair of a *Vata Prakruti* are frequently coarse and grisly.⁹⁰ Vagbhatta

and Sharangdhara stated that *Dhusara* and *Sphutita* (dusty/grey) coloured hair are characteristics of *Vata Prakruti* people, and they are few.⁹¹

Pitta Prakruti: *Pitta Prakruti* people, according to *Charak*, *Sushruta*, and *Sharangdhara*, have sparse, soft, and small hair on their body, face, and head, with early wrinkles, grey hair, and baldness.⁹² *Vagbhata* noted that in *Pitta Prakruti*, the colour of the *Kesha* is *Pingala* and *Roma* is in small numbers.⁹³

Kapha Prakruti: As per *Acharya* by *Sushruta*, *Vagbhata*, and *Sharangdhara*, *Kapha prakruti's* hair is dark black, curly, thick, and *Snigdha*.⁹⁴

Medho Sara's hair:

Individuals who exhibit the ideal kind of *Snigdhatava* have excessively smooth skin and well-groomed hair on their head, face, and body.⁹⁵

Relation between Hair and Sweda Vaha Srotas:

The moola of *Sweda Vaha srotas* is called the *Lomakooop*.⁹⁶ As a result, *Sweda vaha Srotas* and *Kesha* are directly related. If any pathological conditions arise in *Sweda Vaha Srotas*, they will either directly or indirectly affect hair. The sebaceous gland is connected to the hair root, according to recent research information.

Sweda is in charge of *Romakooop's*(hair follicles) upkeep and *Twacha's Snigdhata*.⁹⁷

If *Sweda* is implicated in a variety of pathologies, the skin will itch and a fetid smell will emit from the body.⁹⁸ Every *Acharya* describes the premonitory signs of the sickness, *Aswedana* & *Atiswedana* in the diseases.⁹⁹

5. **Nakha:** It is said that *Nakha* is the *Mala* of *Asthi Dhatu*.¹⁰⁰ *Sara Bhaga* produces *Asthi Dhatu* after *Asthyagni Paka*, and *Kitta Bhaga*, propelled by *Vyana Vata*, reaches the tips of the fingers to procedure *Nakha*. [B. P. Pu. Kh. 3/180] Because there is no nerve supply to them, they do not have *Sparsha jnana*. It is regarded

as one due to its *Swarupa* and *Kathinyata*, which are comparable to *Asthi*, and its preponderance of *Prithvi Mahabhoota*.¹⁰¹

The nail bed, which is made up of melanocytes, lymphatics, blood arteries, and nerves, gives the nail plate and cuticle their shine.¹⁰²

6. **Danta:** Also referred to as "*Ruchakasthi*," the term "*Danta*" refers to a type of bone tissue. *Ruchakasthi*, thus, refers to bones that have a taste-giving purpose.

varieties of dental eruptions

1. *Samudga*: reduction in quantity as a result of constant falling.

2. *Samvrita*: are unlucky and unclean.

3. *Vivruta*: are exhausted, constantly drenched in saliva, exposed, easily discoloured, and prone to illness.

4. *Danta Sampat*: this type of tooth has the best characteristics—complete, even, smooth, white, unctuous, clean, free of disease, and slightly protruding upper jaw teeth.

Apavitra Danta (Inauspicious teeth): These include teeth at birth, the first molar eruption, the eruption of scattered teeth, the presence of fewer or more teeth, dreadful teeth, discoloured teeth, and fractured teeth.¹⁰³

7. **Oшта:** There are two of these: *Adharoshta* and *Urdhvoshtha*. Given its delicate consistency, it belongs to *Matruja Bhava*.¹⁰⁴ Ectopic sebaceous glands, or Fordyce patches, are typically seen on the inner cheeks, gums, and lips. It keeps suppleness intact.¹⁰⁵

8. **Mutra:** After passing through the *Mutravaha Siras* (renal vessel and ureter) and arriving at *Basti* (urinary bladder), the liquid portion of *Kitta Amsha* (wastage) of *Ahara* is called *Mutra*.¹⁰⁶

Aaharasya rasah saarah saaraheno maladravah

Siraabhi tatjalam neetam vastou mootratva maapnu yaat ||

Under the effect of *Samana Vata*, the food is subjected to *Paka*, which causes the *Ahara Rasa* to separate into *Sara* and *Kitta*. While *Kitta Bhaga's Dravamsha* produces *Mutra*, *Sara Bhaga* nourishes the body. *Susruta* says *Mutra* enters *Basti* through multiple tiny pores like a fresh pitcher fills up with water from those tiny pores and is submerged in water up to its mouth.¹⁰⁷

9. **Pureesha:** *Pureesha* is the *Sandra Amsa* (solid particle) of *Kitta Bhaga*.¹⁰⁸

Pakwaasayantu praaptasya soshyamaanasya vahnina

Paripindita pakwasya vaayuh syaat katu bhaavatah ||

After entering *Pakwashaya*, the meal takes on a semi-solid form and is partially dried out by the *Jatara Agni*.¹⁰⁹ We refer to this as *Pureesha*. *Malaranjaka Pitta* is the cause of the odd colour the excrement has. Therefore, if *Pureesha* is prepared according to the above instructions, it will float on water, be readily expelled without causing discomfort, and have very little bad odour.

Normal faeces may contain trace amounts of cholesterol from your body. One type of fatty acid that is present in cell membranes is cholesterol. It also forms bile acids, which aid in food digestion and enable the body to synthesise hormones and vitamin D. Eating foods high in fibre causes the fibre to bind to bile acids during digestion, which causes your body to excrete some cholesterol. Your body eventually experiences a decrease in cholesterol as a result of this. On the other hand, a high-fibre diet typically results in decreased calorie consumption since fibre increases satiety and reduces hunger.¹¹⁰

10. **Sweda:** The *Mala* of *Meda* is *Sweda*.¹¹¹ Its primary purpose is to remove the body's extra *Kleda*. *Swedavaha Srotas* drive out the *Dravata* within *Koshta* in the form of *Sweda*, and the *Vatadi Dosha* within *Rasadi Dhatu* obtains *Kleda*

from the *Snehamsha*.¹¹² It maintains the skin's sheen, hydration, and gloss.¹¹³ The surface of the skin has a vast number of tiny holes known as *Roma Kupa*. The sebaceous gland, which secretes an oily substance, and the sweat glands, both open onto the skin through their ducts. As a result, after sweating, the skin becomes more radiant.¹¹⁴

11. Bruhat Shareera:

Bruhat Shareeramiti Prabala Kayam / Upachita Shareera.

The one with a large body frame or which is properly nourished.¹¹⁵

12. Ayasa Asahishnuta:

Ayasa Asahishnumiti Kashtakari Karma Akshamam.

These people are unable to perform physically demanding jobs.¹¹⁶

1.3.7: Socio-Psychological Characters:

Vitta:

“Vittam Dhanadi, Vittam Bhogapratyayayoho”

One who is wealthy.¹¹⁷

Aishwarya:

State of being supremacy or sovereignty, with power and prosperity.¹¹⁸

Sukha:

“Tatra Sukham Swabhavato Anukoola Vedaneeyam”

Happy, Favorable, State of goodness, prosperous.¹¹⁹

Upabhoga:

“Vishayasevajanya Sukhabhede”

Luxuries lifestyle. ¹²⁰

Pradana:

Extremely liberal. ¹²¹

Arjava or Ruju

candid, forthright, genuine, sincere, truthful, and unequivocal ¹²²

Sukumara:

“Sukumara Komalaha”

Gentle, tender or Delicate ¹²³

Upachara:

“Chikitsayam, Sevayam”

Serves people, Social or Polite behaviours ¹²⁴

Table No. 7: Physical Characteristics of Medho Sara from Different Samhita

Sr. No.	Charaka Samhita	Sushruta Samhita	Brahata Samhita
1	Snigdha Varna	--	--
2	Snigdha Swara	+	--
3	Snigdha Netra	--	--
4	Snigdha Keshha	--	--
5	Snigdha Loma	--	--
6	Snigdha Nakha	--	--
7	Snigdha Danta	--	--
8	Snigdha Oshta	--	--
9	Snigdha Mutra	+	--
10	Snigdha Pureesha	Snigdha Sweda	--
11	--	Bruhat Sharrera	Sushareera
12	--	Ayasa Asahishnuta	--
13	--	--	Putra

Table No. 8: Socio-Psychological Characteristics of *Medho Sara* in Different *Samhita*

Sr. No	Characteristics	<i>Charaka Samhita</i>	<i>Sushruta Samhita</i>	<i>Brahata Samhita</i>
1	<i>Vitta</i>	+	-	+
2	<i>Aishwarya</i>	+	-	-
3	<i>Sukha</i>	+	-	-
4	<i>Upbhoga</i>	+	-	-
5	<i>Pradana</i>	+	-	-
6	<i>Arjava</i>	+	-	-
7	<i>Sukumara</i>	+	-	-
8	<i>Upachara</i>	+	-	-

Factors influencing *Medho Sarata*:

Every person's *Sara* is most likely determined during *Shukra-Shonita Samyoga* (union of sperm and ovum).^{125,126} However, the prenatal care of Mother Ahara, and Mother Vihara have a significant impact on *Garbha* and the formation of *Sara*.¹²⁷ The level of *Medho Sara* is also influenced by external and endogenous variables after childbirth. Because of this, *Medho Sara*'s position varies depending on the person. As a result, the *Tvak sarata* level is dynamic. It can be made better or worse depending on whether Ahara and Vihara are adopted correctly or incorrectly.

Factors deteriorating the level of *Medho Sara*:

Ayurveda Samhita does not specifically include these variables. However, based on the logic and what we know, we can group the following factors:

1. *Medho-vaha Srotodusti* is caused by the following factors: *Varuni Atisevana*, *Medadikya Mamsa Bhakshana*, *Divaswapna*, and *Alpa vyayama*.¹²⁸ This will cause *Meda Dhatu* to get vitiated.
2. *Ati Sampooranaat* (eating too much food), such as *Guru*, *Snigdha*, *Madhura*, *Sheeta ahara*, *Alpa vyayama*, *Alpa vyavaya*, *Achintana*, *Diwaswapna*, *Dharsha Nityatvaat* (never be stressed), and *Beeja Swabhava*—are the causative factor for *Ati Sthoulya*.¹²⁹
3. Causing factors of *Ati Krusha* such as *Ruksha Anna Pana*, *Jara*, *Vikara Anushaya*, *Krodha*, *Shareerika-Manasika-Vachika Kriya Atiyoga*, *Shoka*, *Nidra Vega Vinigraha*, *Ruksha Udvaratana*, *Snana Abhyasa*, and *Langhana*, *Pramitashana*.¹³⁰
4. The vitiation of *Kapha Dosha* results in the vitiation of *Meda Dhatu* due to *Ashrayashrayi Bhava Sambandha*. *Kapha Prakopak karana* include *Diwaswapna* (day sleeping), *Alpa vyayama*, *Alasya*, and the consumption of *Ahara* that is primarily *Madhura*, *Amla*, *Lavana*, *Guru*, *Snigdha*, *Sheeta*, *Abhishyandi*, and *Picchila* in there *gunas*. Food items like *Godhuma*, *Tila*, *Pishta*, *Hayanaka*, *Yavaka*, *Dadhi*, *Dugdha*, *Payasa*, *Naishadha*, *Itkata*, *Masha*, *Maha Masha*, *Krushara*, *Ikshu varga*, *Anupa-Udaka Mamsa* and *Vasa* along with food habits like *Samashana* (repeated eating) and *Adhyashana* (overeating).¹³¹

1.3.8: Aims and Objectives of Sara Pareeksha

इति साराण्यष्टौ पुरुषाणां बलमानविशेषज्ञानार्थमुपदिश्यते ।

The aforementioned passages make it abundantly evident that the primary goal of the *Sara pariksha*(examination) is to evaluate the patient's *Bala* (strength) both individually and collectively by the *Sapta Dhatu* (seven body tissues).^{132,133} Both before and following the description of *Sara*, *Charaka* has underlined the purpose of the *Sara pariksha*(examination).

The assessment of the patient's *Bala* is crucial in determining the disease prognosis and the appropriate treatment dosage.¹³⁴

Charaka has stated unequivocally that the patient's *Bala* needs to be thoroughly examined in light of *Sarata's* parameters. It shouldn't be based just on physical appearance. Occasionally, a doctor may make a poor choice based solely on physical appearance, believing that a patient's strength stems from his corpulence or his leanness. However, it is noted that some people with enormous bodies may have *Alpa Bala*, and some people with small bodies may have *Balavan*, analogous to how an ant may lift a particle that is many times heavier than the ant itself. Therefore, it is important to assess (the patient) holistically.¹³⁵

Additionally, according to *Sushruta*, *Anga Pratyanga Pramana Pareeksha* and *Sara Pareeksha* should be carried out to evaluate an individual's *Ayu Pramana* (life span), or whether they fit into the categories of *Madhyama Ayu*, *Hruswa Ayu*, or *Uttama Ayu*.¹³⁶

Acharya Charaka and *Acharya Vagbhata* suggest that *Sara Pareeksha* be conducted to evaluate *Bala* (body strength).

Therefore, it is advised that each subject be thoroughly evaluated at the level of *Dhatu* for its *Sarata* to evaluate the *Bala* of subjects.

1.3.9: Meda Dhatu, Formation of Its Sara Through Dhatu Parinaman

Among the *Sapta dhatu*, *Meda* is a significant *Dhatu* that has been given the same weight as *Dosha*.¹³⁷ Because it smoothes (*Snihyati*) the body, it gets its name.

" Medhyati Snihayati Anen Iti Medah. "

The word "*Meda*" literally comes from the root "***Jhimida Snehane***," which denotes *Sneha*, Fat, Oil, etc. (***Vachasptyam***).

It refers to *Sneha*, or the body's fatty material, sometimes referred to as fat.

Fat is the term for the body's adipose tissue, which acts as a reserve of energy.

Synonyms of Meda Dhatu:

- **Mamsaj and Mamsatej:** *Mamsa-agnipaka* transforms *Mamsa Dhatu* into *Meda Dhatu*.
- **Asthikruta:** *Meda* is what forms *Asthi dhatu* is formed.
- **Vasa and Vapa:** *Vasa* is referred to as the fatty material that is found in *Mamsa*, and it is known as *Vapa* when the fatty material is found in the abdomen.
- **Majja:**

"Asthi Madhyagata Sneha"

is called as *Majja*.
- **Goda:**

"Mashtishkgata Sneha"

is called as *Goda* or *Mastulunga*.

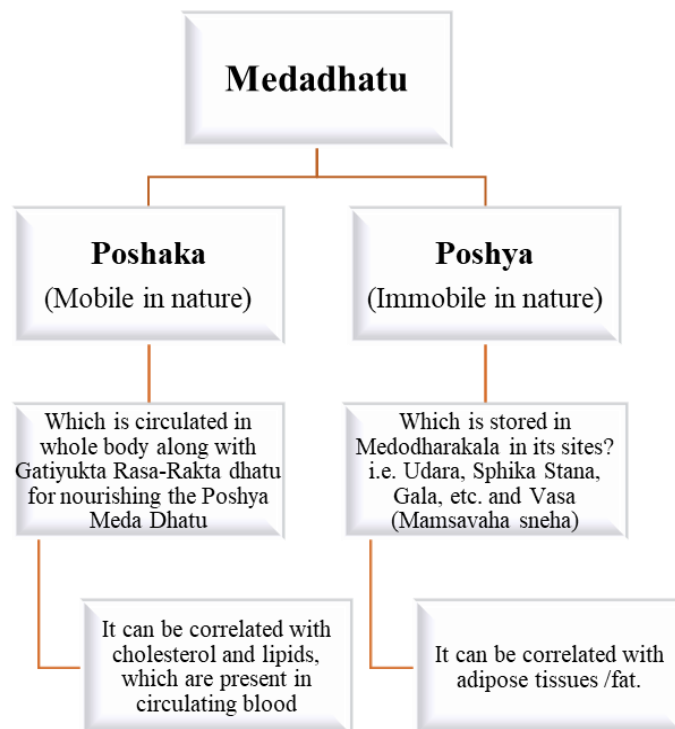
Swarupa and Sthana of Meda Dhatu:

Poshaka and *Poshya* are the two varieties of *Meda dhatu*. Of these two, *Poshaka Meda Dhatu* is *Gatiyukta* (movable); it circulates throughout the body in tandem with *Rakta Dhatu* or *Gatiyukta Rasa*, to nourish *Poshya Meda dhatu*. This can be correlated to the recent, research findings which has shown that lipids and cholesterol are present and circulate in the blood.

The second, *Poshya Meda Dhatu*, which is present in *Medho Dharakala*, is *Gati-vivrajita* (immobile by nature). The *Udara* (abdomen) and *Anu-asthi* (small bones) are the locations of *Medho Dharakala*. *Poshya Meda* has depots at *Udara*, *Sphik*, *Stana*, and *Gala*.¹³⁸ It appears as *Vasa* in *Mamsa* as well. Pieces of evidence suggest that the omentum and subcutaneous tissue are the primary locations of fat depots.

Additionally, *Meda Dhatu* is regarded as a *Drava Dhatu* with dominance of *Sneha* (which is mostly dominated by *Jala Mahabhuta* and is *Guru* and *Snigdha gunayukta*, *Teja* and *Bhrajishnuta yukta*). *Tejo Mahabhuta*, *Apa Mahabhuta*, and *Prithvi Mahabhuta* are also present in *Meda Dhatu*.¹³⁹ and can be identified as *Sukshma Bhaga* (minute part) because of *Mamasa-agnipaka*, who is in charge of *Meda Dhatu's* subsequent change to other *dhatu*s.

Chart no 2: *Sthana and Swarupa of Meda dhatu*



Pramana of Meda dhatu :

Two *Anjali* make up the entire amount of *Meda Dhatu*, while three *Anjali* make up the *Vasa* (fat of the muscle). As a result, the total measured body elements are $56\frac{1}{2}$ *Anjali*, and the overall *Meda Dhatu* content of the body can be roughly calculated from this equation to be between 11 and 12%. Additionally, it fits the definition of contemporary physiology. However, *Sushruta Samhita* accepts it as a general concept; individual differences may exist in this equation, and precise measurement of body humorous is impossible because of the body's unpredictable and constantly changing nature.¹⁴⁰

Karma of Meda dhatu :

Sushruta Samhita states that *Meda dhatu's* main functions include those of *Sneha*, *Sveda Dradhatva*, *Pravrutti* and *Asthi pusti*." The further roles of *Meda Dhatu* that *Astanga Sangraha* mentions are *Gatra* and *Netra Snigdhatu*¹⁴¹ *Meda dhatu's* primary

function is *Snigdhata/Snehana*, which can enhance the lustre of eyes, skin, hair, and other tissues. One possible cause of *Snigdha gatrata* as a *Lakshana* in *Sthaulya* is a spike in *Meda's Snehana* function. Furthermore, modern physiology collaborates with the equivalent of *Snehana Karma* in its explanation about the development of cell membranes and binding of bodily tissue.

Nourishment of successive *dhatu's* and its *Upadhatu* like *snayu* and *Sandhi* is one of *Meda Dhatu's* various functions. Because of this the successive of *Meda Dhatu* i.e. *Asthi Dhatu*, is directly connected to *Snayu* and *Sandhi*. Mentioned as *Upadhatu* of *Meda Dhatu* as per *Charka Samahita* are *Snayu* and *Sandhi*.¹⁴² *Sandhi* assists with joint development, whereas *Snayu* supports the *Asthi*.

The formation of *Sveda* (sweat), referred to as *Mala* of *Meda Dhatu*, is also considered another one of *Meda's* functions.¹⁴³ *Sveda* is *Meda's Upadhatu*, according to *Acharya Sharangdhara*.

Another role that is ascribed to *Meda* is “*Drudhatva*”, which is made feasible by *Snayu Upadhatu*. When considered as a source of energy, *drudhatva* is about twice as potent as the other two remaining macronutrients—protein and carbohydrates. Additionally, excess energy is stored in the body as *Meda*, which aids in binding and supports a variety of organs.

Medovaha Srotas :

Medovaha Srotas are the channels that feed the *Meda Dhatu* or the vessels that transport the nutrient material to the *Meda Dhatu's sthana* (location). According to Dr. C. Dwarkanath, the channels that provide nutrients to the adipose tissue are known as the *Medovaha Srotas*. The *Medovaha Srotas* were regarded by Dr. Ghaneker B.G. as the

omentum and perinephric tissue's capillaries. The network of capillary blood capillaries that supply the fat cells is mostly responsible for keeping them together.¹⁴⁴

Moola of Medovaha Srotas : The three Acharya state that it can be listed as follows:

- According to *Acharya Charaka*: *Vrikka* and *Vapavahana*
- According to *Acharya Sushruta*: *Vrikka*, and *Kati*
- According to *Acharya Vagbhat*: *Vrikka*, and *Mamsa*

Vrikka: Although *Vapavahana*, *Kati*, and *Mamsa* are each named as a second *Moola* independently, the three Acharyas have universally accepted *Vrikka* as the primary *Moola* of *Medavaha Srotas*. While *Charaka* took a physiological approach, *Sushruta* and *Vagbhat* gave more weight to anatomical considerations while deeming *Kati* and *Mamsa* to be "*Moola*" of the *Medovaha Srotas*.

To a certain extent, the definition provided by Dr. Ghanekar for *Medovaha Srotas* appears to be appropriate. In his opinion, each *Srotas* should have its own pathway and "*Moola*"; concurrently, it symbolises the channel's borders. Thus, the definition begs the question of whether the omentum and perinephric tissue should be the only places where *Medas* and *Medovaha Srotas* are prevalent, or if other places should be considered. The truth is that adipose can be discovered deposited in a variety of locations than those listed above. Since the epidermis has some fat underneath it, it is reasonable to assume that *Meda Dhatu* exists throughout the body and that the organs or regions listed above are only sites of transformation.

Given *Vrikka*'s embryology, morphology, and physiology, it is challenging to identify *Vrikka* as the kidneys. *Acharaya Sharangadhara* asserts that *Vrikka* nourish *Meda Dhatu* in the stomach region, while *Acharaya Charaka* calls them "*Moola*." Therefore, the metabolism of fat must be closely tied to these structures. However, neither

Ayurveda nor modern science sees them serving this purpose. The features of fat metabolism are satisfied, if we consider the two organs that are located above the two kidneys, namely the supra-renal glands, as *Vrikka*.

Vapavahana : *Vapavahana* is referred to as the second mula of the *Medovaha srotas*. *Acharya Chakrapani* has identified it as *Tailvartika*, however Dr. Ghaneker has classified it as omentum.

Kati: *Acharya Susruta* has explicitly identified the precise location as *Kati*, which is typically the area where fat tends to gather.

Mamsa : Explaining *Vagbhata's* recognition of *Mamsa* as the fundamental component and root of *Medovaha Srotas* is a challenging task. However, we can regard the *Vasa* (*Mamsagata Sneha*) as being located very close to *Mamsa* and beneath the epidermis, and so the entire *Tvak*(skin) attached to *Mamsa* contains *Vasa* can be considered as the *Mula*(root) of the *Medovaha Srotas*.

Ashary-ashrayee Bhava of Meda:

"*Ashary-ashrayee bhava*" is based on the integration of *Dosha* and *Dushya* for their physiological functions.¹⁴⁵ Though *Ashary-ashrayee bhava* signify content and the container, this cannot be applied generally. Similar features of homogeneity of a *Dhatu* or *Dosha* may serve as a reason for the nutrition or vitiation of a *Dosha* or *Dhatu*, and it is in this context that *Meda dhatu* can be seen as a site of the resident *Kapha Dosha* since in the nourishment or vitiation of *Kapha dosha*, *Meda dhatu* plays a vital role and vice versa.

Utpatti of Meda dhatu:

There are numerous viewpoints and ideas about the genesis of *Meda dhatu*, some of them are as follows.

- *Acharya Charak*, opines that the *Rakta dhatu* is blended with *Tejo Mahabutha* and *Jala Mahabutha*, and with the influence of by the *Agni Mahabutha* which made firm, The *Rakta Dhatu* is transforms into *Mamsa Dhatu*, that again gets transformed by its own *Agni*, "*Meda dhatvagni*," and getting combined with the qualities of *Jala Mahabutha* and stirred up by the *Agni Mahabutha*, gets transformed into the *Meda dhatu*.¹⁴⁶ *Meda dhatu* is predominant in by *Prithvi Mahabutha* and *Jala Mahabhuta*.¹⁴⁷
- When the *Mamsa dhatvagni* operates upon the *Poshaka*, *Mamsa Dhatu* and due to this *Mamsa dhatvagni paka* it is separated into the following three sections.

1. The Gross form - *Sthula bhaga*: Which produces of *Sthayi Mamsa Dhatu* (stable muscle tissue) or *Poshya Mamsa Dhatu*
2. The Minute form – *Sukshma bhaga*: Which is accountable for the subsequent alteration of it into *Poshaka Meda Dhatu*.
3. The waste product – *Kitta bhaga*: is commonly referred to as *Khamala*.

The *Sukshma bhaga (Poshaka Medo dhatu)* under the influence of *Meda Dhatvagni* gets transformed into

1. The gross form - *Sthula bhaga* creating the *Sthayi* (stable adipose tissue) or *Poshya Meda dhatu*
2. The Minute form – *Sukshma bhaga*: This is accountable for the subsequent alteration of it into *Poshaka Asthi Dhatu*
3. The waste product – *Kitta Bhaga*: *Sveda* as a *Mala bhaga*

In this manner, the process runs and *Meda Dhatu* gets nourished by *Snigdha Guna Pradhana Amsha of Anna-rasa*.

1.3.10: Dhatu Parinamana Siddhanta:

Dhatu Parinamana Siddhanta (formation of tissues) can be understood with the help of the following three *Nyaya* (theorys).

1. Kshira Dadhi Nyaya:

Based on this theory, *Chakrapani* mentions that the gradual metamorphosis of *Dhatu* is akin to souring milk, in which the entire milk is changed to curd. Thus, the full *Rasa Dhatu* gets converted into *Rakta Dhatu*, similarly, the whole *Rakta dhatu* gets transformed into *Mamsa dhatu* and *Mamsa dhatu* into *Medo Dhatu* and so on.¹⁴⁸

2. Kedarikulya Nyaya:

As per this to this *Nyaya*, as after filling one Kedara of an agricultural field, through Kulya, water continues further to fill up another Kedara of the field (as seen in terrace farming) the *Rasa* provide nutrition to *Rakta Dhatu* and nourishes it completely, then it continues to deliver the nourishment to the successive dhatu i.e *Mamsa Dhatu*. Thus, the nutrition is taken to all the *Dhatu* in the form of *Ahara Rasa*. Due to this sequence, each *Dhatu* can pick up the nutrients specific to it. According to this *Nyaya*, in case of an adverse condition, only one specific *Dhatu* alone can get pathologically impaired without engaging other *Dhatu*.¹⁴⁹

As per *Acharya Charaka*, *Rasa Dhatu* takes one whole day to reach and nourish *Rakta Dhatu* however *Acharya Sushruta* opines that it can take up to five days for *Rasa Dhatu* to reach *Raktha Dhatu*. Hence *Rasa Dathu* requires 6 days as per *Acharya Charaka* or 30 days as per *Acharya Sushruta* to reach the *Sukra Dhatu*. The issue with this

understanding is that in general, we observe an immediate increase in *Shukra Dhatu* (semen) after consuming milk.^{150,151}

3. *Khale Kapot Nyaya*:

As per this *Nyaya* (theory), like an a flock or a flight of pigeons (*Kapot*) in huge numbers, visits a piece of land and flies away to various places after picking up the required grains. The grains reach distinct places at different times through the pigeons, based on the distance they travel. In the same way, *Rasa* includes nutrients for all the *Dhatu* and feeds nutrients to all of them concurrently by different pathways. Each *Dhatu* picks up the nutrients of its choice and the nearest *Dhatu* like *Rakta Dhathu* will receive the nutrition earlier than others. The comparison in supporting this *Nyaya* is this notion explains why a particular *Ahara* or *Aushadha* affects only a particular tissue or organ without impacting the other.¹⁵²

Out of these three theories', commentators have chosen only one or other for concept explanation, but we have accepted that at one time or the other, all these theories work in the body. Therefore, a full view is being offered here as follows:

The conduction of *Samana Vata* makes *Ahara Rasa* produced and absorbed in *Pakavashaya* to reach *Hrudaya*.¹⁵³ This *Rasa* is again being put into circulation from the *Hrudaya* through *Srotas* (huge channels) and then pushed through smaller ones with the help of *Vyana vayu*.¹⁵⁴ The *Rasa* ultimately enters the *Sthayi dhatu*, as extra-cellular fluid as mentioned in *Kedari kulya Nyaya*. This contains nutrients for all *Dhatus*, yet cells of specific tissue have selective permeability for specific substances only in accordance with *Khale kapota Nyaya*. The nourishment thus absorbed is acted upon by concerned *Dhatva agni* to convert it into *Sthayi dhatu*, just like the conversion of *Kshira* (milk) into *Dadhi* (curd) as per the principles of *Kshira-dadhi Nyaya*. Thus in any of above described way *Meda Dhatu* is generated when *Meda Poshakamsa* is attained in

Medovaha Srotas. Because, according to a ayurveda, every *Dhatu* is generated from its own *Srotas*. So, *Meda Dhatu* is created from the *Medovaha srotas* in the form of *Parinam Apadhya-mana Dhatu*.

Other scholars of Ayurveda think that, *Medo dhatu* is produced in the *Medo-dhara kala* the. Thus, the sustenance of *Meda* depends upon the quantity and quality of *Ahara Rasa* which in turn impacts the proportion of *Meda* in the body.¹⁵⁵ Excessive intake of *Snigdha*, *Madhura*, and *Guru Dravya* may induce *Meda Dhatvagni-mandhya*, resulting in *Medo vriddhi* due to over nutrition of *Meda*. The same *Snigdha*, *Madhura*, and *Guru Dravya* if consumed in lesser quantity and instead switch to *Laghu*, *Rukshadi Dravya* in a higher quantity, may produce *Meda kshya* or undernourishment of *Meda* due to *Meda Dhatvagni-vriddhi*.^{156,157}

Both the above-mentioned conditions can be led to the manifestation of *Avara Meda Sara*. When adequate amount of nutrients identical to *Meda Dhatu*, is taken, it will first lead to igniting of *Meda Dhatvagni*, which leads to the formation of *Meda Dhatu* with its excellent essence and will be conferred with its all *Gunas*, performing desired *Karma* ascribed for *Meda Dhatu*, present in defined *Matra* (quantify), promoting *Snigdha* to *Netra*, *Varna*, *Swara*, *Nakha Loma*, *Kesha*, etc., is known as *Pravara Meda Sara*. The same condition if present at a moderate level is known as *Madhyama Meda Sara*.

Agni plays a significant role in this entire process for *Meda dhathu* and its *sara* foramation particularly *Jatharagni*, *Rasa-Meda Dhatvagni*. and *Apya-Parthiva Bhutagni*.

1.3.11: Pathophysiology of Fat / Lipid

Lipids are fatty organic molecules soluble in fat solvents but insoluble in water. Living organisms employ lipids during metabolism for energy.¹⁵⁸

Lipids can be classified into many categories based on their chemical structure and properties.

1. Simple lipids are compounds formed by the esterification of fatty acids with alcohols. Simple lipids like neutral fats which are Triglycerides, Glycerol esters of various fatty acids and waxes which are Cholesterol and its esters.

2. Compound lipids are esters formed by combining fatty acids with alcohols. These lipids contain extra groups in addition to the alcohols and acids. Compound lipids like Phospholipids are esters that consist of phosphoric acid and a nitrogenous base, such as lecithin, Glycolipids are esters that include both a carbohydrate and a nitrogenous base, specifically known as cerebrosides, Sulpholipids are Esters composed of sulphuric acid and Lipoproteins are Proteins bound to lipids.

3. Derived lipids: Derivatives created by the hydrolysis of 1 and 2, and which yet possess the physical properties of lipids. Derived lipids are Saturated Fatty acids, unsaturated Fatty acids, Sterols and Fat-soluble vitamins.

Although lipids are found in both blood plasma and cells, the makeup of lipids varies greatly between the two. Research is typically conducted on the composition of plasma lipids because it accurately depicts the status of lipid metabolism in reality.

Blood's lipid composition is dynamic and ever-changing, with the addition and removal of lipids from the blood processes leading to the composition that is seen at any given time.

The intestine's absorption, the synthesis of fat, and the mobilisation of that fat are the possible causes of the addition of lipids, whereas Fat deposition in the depot, Fat

oxidation in the tissue; and Fat utilisation for the construction of tissue components are the possible causes of lipid removal in blood.¹⁵⁹

Physiologically, the body's lipids divide into two separate components:

- 1) Element fixed / Structural lipids
- 2) Element Variable.

While it is impossible to draw a clear distinction between the two, it has often been observed that the former's worth does not alter, even in the worst of malnutrition, while the latter does.

Cytoplasm and cell membranes of all organs are formed of Structural lipids so that their fat content does not decline in starvation. Structural lipids are comprised mostly of phospholipids. It remains an intrinsic constituent of the cell protoplasm and is needed for its existence

The majority of the element variable is made up of neutral fat. The so-called fat depots, or adipose tissue, are where it is mainly found. It continues as free form and symbolises stored energy. It has been highlighted that depot fat is not static but in a perpetual state of change, due to its ongoing creation and breakdown in the body.

A third kind of fat, known as brown fat, which has a high metabolic rate has been detected in neonates but not in adults.¹⁶⁰

1.3.12: Adipose Tissue:

Amount: Fat makes up about 12% of a man's total body weight. The essential part of it remains preserved in the so-called adipose tissue, which is referred to as the depot fat.

Distribution: There are differences in the distribution of fat within different fat depots. For example, subcutaneous tissue comprises around 50% of fat, peripheral tissue 15%,

mesentery 20%, omentum 10%, and intramuscular connective tissue approximately 5%, on average. These are the intra-cellular fats that remain within the cells of adipose tissue.

Composition: Mixed triglycerides make up the majority of the fat in the depot. Lecithin, cholesterol, and trace amounts of polyunsaturated fatty acids are also present.

Specificity: Dietary fat and depot fat are not interchangeable. With the regular diet, the depot fat of each species is a characteristic one. However, depot fats may differ from dietary fat to a greater extent if the diet is changed, either in terms of quantity or quality, particularly when the animal has been starved. On average, depot fats are more unsaturated than dietary fats, one intriguing element is that unsaturated fats are more prevalent under the epidermis than in the deeper sections.

Sources of depot fats: The following sources have the potential to produce depot fats.

- 1) Food fat - which is the key source.
- 2) Carbohydrates - Carbohydrates in diet may be easily transformed into fats. The process of this conversion causes the respiratory quotient (R.Q.) to increase because it transforms carbohydrates, an oxygen-rich material, into an oxygen-deficient one.
- 3) Proteins: New research indicates that the carbohydrates that proteins make have the potential to be transformed into fats. ¹⁶¹

1.3.13: Functions Of Depot Fats:

1. Mechanical functions: Although it remains concealed inside, it provides structure to the limbs and body. The fat surrounding tissues keeps the internal organs in place and provides a protective barrier against trauma.
2. Physical functions: Subcutaneous fat is essential for thermoregulation due to its inability to conduct heat.

3. Chemical functions: It signifies potential energy that is stored. A substantial amount of energy can be stored as fat in adipose tissue, in a highly concentrated condition without water. One gramme of fat provides 9.3 calories. Fats constitute around 12% of the total body weight, serving as an energy reserve equivalent to 1,100 C/Kg of body weight.¹⁶²

1.3.14: Plasma Lipids:¹⁶³

Main Plasma lipids are:

1. Cholesterol along with its esters
2. Triglycerides.
3. Phospholipids.
4. Non-esterified fatty acids.

1. Cholesterol and its esters:

One unsaturated steroid alcohol is cholesterol. Long-chain saturated and unsaturated fatty acids have esterified two-thirds of the plasma cholesterol, leaving the remaining third as unesterified cholesterol. Although the suprarenal contains the most amount, the brain contains 17% of it, primarily in free form. There is a clear correlation between the amount of activity and the distribution of cholesterol in various muscle types. Compared to voluntary muscles, the cholesterol concentration of the cardiac and smooth muscles is higher. Phospholipids and cholesterol are inextricably linked. In addition, each tissue seems to have a specific ratio of phospholipids to cholesterol. In humans, LDL carries 60–70% of cholesterol, HDL carries 20–30%, and VLDL carries 5–10%.

Synthesis of Cholesterol:

The metabolism of acetyl CoA, fatty acids, glucose, and, to a lesser degree, amino acids through their metabolites provides the vegetarian's body with all of the cholesterol it needs. Merely 0.3 grammes of cholesterol are provided daily by a non-vegetarian diet. The ability to produce cholesterol exists in most tissues. The production of cholesterol is linked to the liver, adrenal cortex, skin, intestinal wall, testis, ovary, and aorta, albeit the rate of synthesis varies depending on the tissue.

Functions:

1. Establishes the cell membrane's structural component.
2. Serves as a precursor to the synthesis of steroid hormones and bile acids.
3. It influences cell permeability.
4. It prevents the red blood cells from succumbing to haemolysis.
5. It stops toxins from entering into the cells.
6. It is closely related to the defensive system of the body. Blood cholesterol is known to decrease during an acute infection and to rise following recovery.
7. In order to form cell membranes and insulate neurones, it is also required for the production of vitamin D.

Catabolism:

The primary location of cholesterol catabolism is the liver. It appears that the liver converts 60% of the total cholesterol it contains into bile acids, which are then released as bile. The remaining 40% is excreted into the intestine as a bile solution, where some of it is reabsorbed and some is transformed into coprosterol by gut bacteria. Together with the bile salts, coprosterol is excreted in faeces. The neutral sterol portion of the bile salts may be reabsorbed, but this will inhibit the liver's ability to further break down cholesterol and produce more bile acids through a feedback loop. A number of steroid

hormones are produced with cholesterol as a precursor. These hormones are created in the bloodstream, altered or removed by the liver, and mostly excreted through urine while still containing the steroid ring. Irradiation of the skin converts a small amount of cholesterol to 7-dehydrocholesterol, which is then converted to cholecalciferol (Derivative of Vitamin D3). Finally, the majority of vitamin D3 is excreted through the skin or in faeces. The gut contains more unsaturated fatty acids when cholesterol is absorbed. The absorption of cholesterol is limited by saturated fatty acids. Bile salts play a crucial role in absorption.

2. Triglycerides:

Triglycerides fall under the category of fats and are esters of three fatty acids plus glycerol. Fatty acid concentrations are used to divide them into two groups.

(a) Simple triglyceride: The three fatty acids are all of the same type.

(b) Mixed triglyceride: Each of the three fatty acids is a different kind.

The specific gravity of triglycerides is less than one (0.86). In addition to being transported in trace amounts as LDL and HDL, they are mostly carried as chylomicrons and VLDL. These are the primary lipid storage types in humans.

3. Phospholipids:

These types are classified as conjugated lipids, which are made up of fatty acids and glycerol with a certain component. For instance. Lecithin is mostly found in brain tissue and is composed of phosphoric acid and choline. 25% of phospholipid is made up of LDL and 30% is HDL. In adipose tissue, phospholipids, cholesterol, and cerebroside are not deposited. They do, however, exist in all other tissues and serve specific physiological and structural roles in the cells. There are phospholipids in every type of

tissue and cell. They are not required in meals because the colon, liver, brain, and other tissues can effectively biosynthesise them. The body effectively absorbs and breaks down dietary phospholipids.

4. Non-essential fatty acids:

While they make up a very small portion of plasma protein, they are significant providers of energy.

1.3.15: Plasma Lipoproteins:

These large, globular particles are responsible for carrying triglycerides and cholesterol through the blood. They can be classified into four groups based on the density, size, and proportion of proteins, fats, cholesterol, and triglycerides. There are four types of lipoproteins: chylomicrons, low-density lipoproteins (LDL), very low-density lipoproteins (VLDL), and high-density lipoprotein (HDL).

Function of Lipoproteins:

Although their exact function is unknown, they are thought to provide a channel for the movement of fatty substances from the liver to other parts of the body. For example, the rate at which triglycerides are turned over in lipoproteins can reach 1.5 gm/h, meaning that this might make up as much as 10–20% of the total lipids that the body needs for energy. Because there are many lipoproteins and almost no free fatty acids in the circulation during fat synthesis, fats made from carbohydrates in the liver are transported to the adipose tissue via lipoproteins. Since cholesterol and phospholipids are not known to be transported in any significant way by other means, their transportation by lipoproteins may be even more crucial.

The majority of plasma phospholipids, cholesterol, and triglycerides (except from those in chylomicrons) are synthesised in the liver, which is consistent with the fact that the lipoproteins are virtually totally produced there.

1. Chylomicrons: The largest and least dense lipoprotein particles are these ones. Plasma that has high chylomicron levels is "milky."
2. VLDL: Despite having a lower triglyceride content than chylomicrons, these particles are smaller than chylomicrons. Hyper-VLDL causes "turbid" plasma.
3. LDL: Less than chylomicrons and VLDL, they make up the majority (about 50%) of lipoproteins.
4. HDL: Among lipoproteins, it is the smallest and almost dense molecule.

1.3.16: Normal Lipid Transport and Metabolism:

The majority of the fat in our diet is made up of neutral fats, with trace amounts of steroid, glycolipid, and phospholipids. In addition to playing a vital physiological role in tissue, fats are required in the diet as a source of some essential fatty acids that the body is unable to synthesise. In human tissues, essential fatty acids such as arachidonic acid are the precursors of prostaglandins. In quantitative terms, phospholipids and cholesterol, which make up two thirds of plasma lipids, have far lower turnover than fatty acids. Triglycerides and free fatty acids are the main fats that are transported. A daily intake of 1-2 gm/kg of triglycerides is consumed. It is hydrolysed, absorbed, and changed back into a triglyceride in the intestinal mucosa within the lumen of the gut. Following their integration into chylomicrons and VLDL, these triglycerides are released into the mesenteric lymphatics and subsequently transported to the bloodstream via the thoracic duct, where they are distributed throughout the majority of tissues, including adipose tissue. reaches its peak in the blood 2–6 hours after eating, and it

usually leaves the plasma by 10–12 hours later. Although the lipid composition and apoprotein content of endogenous and exogenous triglyceride-rich particles differ, their general structures are comparable.

1.3.17: Fat Cells:¹⁶¹

Adipose tissue fat cells have undergone fibroblast transformation, enabling them to store 80–95% of their volume as almost pure triglycerides. Triglycerides are normally liquids, but when skin tissues are exposed to prolonged cold, the fatty acid chains in the triglycerides shorten or become more unsaturated over weeks, lowering their melting point and allowing the fat inside fat cells to always stay liquid. Since only liquid fat can be broken down and then moved from the cells, this is especially important. In addition to producing fat in the liver, fat cells can also convert carbs into fatty acids and triglycerides.

Adipose tissue contains lipoprotein lipase, which catalyses the quick conversion of adipose tissue's triglyceride and free fatty acids into lipoprotein triglycerides in plasma. This quick exchange causes the triglycerides in the fat cells to regenerate roughly once every two to three weeks. This highlights the dynamic nature of storage fat because it means that the fat that builds up in the tissues in a given month—even in obese people—is not the same fat that was stored in the months prior.

The body continuously goes through two processes to store triglycerides:

- (1) Lipogenesis,
- (2) Lipolysis.

1. Lipogenesis: Triglycerides (TG) in circulation, which are packed into lipoproteins and transported in the bloodstream, are made from fats found in food and by the liver. The lipoprotein lipase (LPL) enzyme mediates the

absorption of trans-glutaminase (TG) fatty acids. The capillary endothelium receives LPL, which is produced within fat cells and converts TG into free fatty acids and glycerol. The majority of FFA are then absorbed by nearby fat cells and esterified to produce TG by glycerol phosphate, which is made from glucose. The adipocyte's large lipid storage droplet is where these TGs are subsequently kept. When prolactin and insulin are present in large enough amounts, lipogenesis accelerates.

2. **Lypolysis:** Ketogenesis, the initial step in the breakdown of fat, primarily occurs in liver cells. Acetoacetic acid is created via a series of chemical reactions that convert fatty acids. It is categorised as a ketone body and can be converted into beta hydroxybutyric acid and acetone, two more ketone bodies. This is how the initial stage of fat breakdown, known as ketogenesis, occurs. After leaving liver cells, acetoacetic acid moves to other tissue cells where the citric acid cycle is used to oxidise it into acetyl-co.A. Stated differently, the last stage of the breakdown of fat and glucose is identical. A small portion of the ketone bodies are oxidised by the liver cells for their own energy requirements, while the majority are transported by the blood to other tissue cells for the last stage of catabolism. Adipose cells that process glucose also process glycerol.

The hormones listed below accelerate the rate of lipolysis:

- Catecholamines (the primary hormones being nor epinephrine and adrenaline)

Glucagon.

- Vasopressin, GH, ACTH, MSH, and TSH.
- Hormone-regulating chemicals - Glucocorticoids.

The following are a few significant traits of fat:

- A large portion of the carbohydrates in the diet are converted to fat before being used as an energy source.
- Certain organs prefer to use fat as fuel over glucose. Because fat has a calorific value of 9.3 Cal/gm, which is more than twice as high as that of carbohydrates and protein. As a result, fat is stored in the tissue as a basic form of energy.
- It provides essential fatty acids (polyunsaturated fatty acids) and fat-soluble vitamins (Vita A, D, E, and K). It is mostly needed in the diet for the substances to be absorbed.
- Despite not being stored in adipose tissue, phospholipids, cholesterol, and glycolipids are essential structural components of many human organs.
- During the process of creating carbohydrates, 10% of lipids (the glycerol component) may be converted to sugar.
- Fatty acids and ammonia can be converted by the liver into amino acids.
- The subcutaneous fat helps regulate body temperature because it is a poor heat conductor.
- The depot fats serve as packing materials for tissues, cushioning, and a mechanical means of protecting important organs.

1.3.18: Objective Parameters for This Study:

1. BODY FAT PERCENTAGE:

Body fat, which includes both stored and essential body fat, is calculated as the entire mass of fat divided by the total mass of a living organism, such as a human. Essential body fat is required to sustain reproduction and life. Due to the demands of pregnancy and other hormonal activities, women require a higher amount of body fat than males. Adipose tissue accumulates fat, part of which is used to protect internal organs in the chest and abdomen, to create storage body fat. The required fat percentage threshold is exceeded by the lowest suggested total body fat percentage.²⁸

The following are some ways that can be used to calculate body fat percentage.

- i. Hydrostatic Weighing:** When carried out accurately, this process is also very exact, and the results are typically repeatable. But because it depends on the subject's capacity to completely expel oxygen from their lungs while submerged in a water tank, the test is highly subjective. The measurements will be skewed by residual oxygen in the lungs. This process is repeated multiple times in a clinical setting, and an average is taken. It has several drawbacks, including an expensive tank, user difficulty, and extensive testing of the process.¹⁶⁴
- ii. Conventional BIA.** While the precision of conventional methods of Bioelectrical Impedance Analysis is unmatched, the procedure is cumbersome and somewhat subjective due to electrode placement. When applying electrodes and conductive jelly to the wrist and ankle, the user needs to be horizontal. Usually, a doctor's office or clinic uses this procedure.¹⁶⁵

- iii. **Calipers.** Callipers make skinfold measurements that are easy to take, reasonably priced, and portable. However, depending on the technician's skill level and the measuring location, the results could be highly subjective. Another problem is the callipers' quality. Cheap models that are provided for use at home are often not as accurate as those that are used by certified technicians. Furthermore, it becomes harder to properly "pinch" the skin of a fatter individual. Many people consider callipers to be intrusive and uncomfortable.¹⁶⁴
- iv. **NIR (Near Infra-Red).** Because it is easy to perform, quick, non-invasive and requires affordable equipment, this procedure has become more and more popular. Studies, however, have produced contradicting results, and both extremely thin and extremely overweight patients have experienced significant errors. Several articles indicate that additional studies are needed to validate this approach.¹⁶⁶
- v. **DEXA (Dual Energy X-ray Absorptiometry):** A contemporary technique for determining body composition, bone mineral density, and body fat percentage is called Dual energy X-ray absorptiometry, or DXA (formerly known as DEXA). The body is scanned using two different X-ray energies, one of which is absorbed more deeply by fat than the other. One image can be subtracted from another using a computer, and the result shows how much fat there is in relation to other tissues at each location. The overall body composition can be estimated by adding the amount over the entire image.¹⁶⁴

2. **BMI:** Body mass index (BMI), which is calculated by dividing a person's weight in kilogrammes by their height in meters squared, can be used to calculate body fat. The widely used body mass index (BMI) provides a metric that makes it possible to compare the levels of obesity in people with varying weights and heights. BMI is not a reliable measure of body fat, even though it generally rises with adiposity due to changes in body composition; for instance, people with higher muscle mass would have higher BMIs. For this reason, the boundaries between "normal" and "overweight" as well as "overweight" and "obese" are periodically contested.¹⁶⁷

3. **BIA (Bioelectrical Impedance Analysis):** The basic idea behind Bioelectrical Impedance Analysis (BIA) is that an individual's body is connected to two or more conductors, and a low-level, safe electric current (about 500 microamperes, or 50 kHz) is transmitted through the body. A measurement of body fat can be obtained by measuring the resistance between two electrodes since skeletal, muscular, and adipose tissue have different electrical resistances. The muscle that is free of fat is a great conductor because it contains a significant amount of water (about 73%) and electrolytes, whereas fat is anhydrous and not a strong electrical conductor.

Therefore, TANITA BC-1000plus, which runs on the BIA principle, is used to determine % BF in the current study. Tanita has developed well-researched proprietary formulas based on impedance, height, weight, gender, body type (normal adult or athletic build), and in certain cases, age, using a process known as multiple regression analysis. Tanita uses Dual Energy X-ray Absorptiometry (DEXA) as a reference

because of its accuracy and dependability, which many experts now deem to be superior to hydrostatic weighing.

The user is directed to place their bare feet on the measurement platform, which is equipped with the appropriate software (Healthy edge installed on the laptop), in order to record the percentage of BF. The software displays readings across the screen instantaneously.¹⁶⁸

Table No. 9: Norms of Body Fat Percentage¹⁶⁸

Body Type	Female	Male
Underfat	0-21%	0-8%
Healthy	21-33%	9 – 20%
Overfat	34-39%	21-25%
Obese	40% and above	26% and above

1.3.19: Disease Review - *Sthaulya*

Etymology- The word "*Sthaulya*" comes from *Mula Dhatu* "*Sthu*" and is suffixed with *Pratyaya* "*Ach*" to mean "big, thick, or bulky". ¹⁶⁹

The word "*sthaulya*" in this instance refers to the physical weight or heaviness of the body.

Amarakosha strongly emphasises *Sthoola* as the body's excessive expansion or growth.
¹⁷⁰

Nirukti of Sthaulya:

A person who has had substantial growth, particularly in the belly region, and who is heavy and bulky in physique is referred to as "*Sthula*", and the state in which they are found is called "*Sthaulya*". ¹⁷¹

Definition of *Sthaulya*:

मेदोमांसातिवृद्धत्वाच्चलस्फिगुदरस्तनः।

अयथोपचयोत्साहो नरोऽतिस्थूल उच्यते ॥९॥

An individual whose buttocks, belly, and breasts appear pendulous and whose equal level of energy does not accompany the increased bulk of his body is said to have an excessive and abnormal increase in *Meda dhatu* along with *Mamsa dhatu*. ¹⁷²

Definition of obesity (Contemporary sciences point of view):

Adipose tissue grows abnormally in obesity as a result of either an increase in the number or size of fat cells, or both. (Park)

Obesity is the result of an excessive buildup of adipose tissue in the body.

- A body weight that is 20% over the optimal body weight is considered obese.

Body mass index (BMI) is a common measure used to express obesity. A BMI of 30 or higher in men and 28.6 or higher in women is considered obese.

- An excess of adipose tissue mass is the state of obesity. (Harrison)
- Obesity is a condition characterised by an excessive quantity of body fat. (Davidson)

173

Synonyms of Obesity: Overweight, Corpulence, Adiposity, Fattiness, Turgidity, Stoutness, Enormity, Plumpness, and Embonpoint are some common synonyms of obesity.¹⁷⁴

Prevalence of obesity: - There is much concern over the rising incidence of obesity that is medically serious. Women are more likely to be obese, and the prevalence of obesity in children is concerningly rising among the impoverished. Perhaps the most common type of malnutrition in affluent nations, affecting both adults and children, is obesity. Due to the lack of precise data and the lack of consensus on the definitions of obesity, it is very challenging to estimate the scope of the issue and compare prevalence rates across nations. In wealthy nations, it is thought to impact 10 to 20 per cent of children and adolescents and 20 to 40 per cent of adults.¹⁷⁵

Epidemiological factors: Obesity has a complicated aetiology with several causal pathways.¹⁷⁶

Age: While obesity can strike at any age, it is most common in middle age. It is expected that adult obesity will follow childhood and adolescent obesity. Both sexes experience an increase in fat after puberty and as adults. Adult hyperplastic obesity is very challenging to treat using traditional techniques. Men's fat contents almost doubles between the ages of 20 and 50, whereas women's fat contents rise by roughly 50% throughout that time.

Sex: Statistically, women are more likely than males to be obese. About 15% of the young women's body weight is made up of fat, and this is more than that of the young men. Hormonal changes throughout puberty and adolescence cause the body to store extra fat, especially in females. According to the Framingham USA study, women gain the most weight between the ages of 45 and 49, while men gain the most between the ages of 29 and 35.

Race: Gujarat is currently the second-largest state in India in terms of the prevalence of heart disease and obesity. Six out of ten individuals are either abdominally adipose or have generalized obesity. It is now commonly known that obesity in the US is on the verge of becoming an epidemic. According to the IOTF, one of the biggest challenges to human health and well-being as the twenty-first-century approaches is obesity, which raises the likelihood of developing potentially fatal disorders including diabetes mellitus and cardiac ailments in fetuses.

Socioeconomic Status: It is evident that obesity and socioeconomic position are inversely correlated. However, it has been discovered that obesity is more prevalent in lower socioeconomic categories in certain wealthy nations. Only the wealthy elite can experience it in developing nations. Numerous surveys have revealed that, correspondingly, the medium and upper social levels had higher obesity prevalence. Oily and alcoholic foods contribute to obesity in lower-class people, whereas starchy foods make up the majority of fast food and inexpensive meals.

Therefore, it is clear that poor eating habits and lifestyle choices are the primary causes of obesity rather than a lack of money.

Urbanization: The foods that are prepared with fat and sugar, such as bread and biscuits, are the most convenient. These foods are continuously consumed by the

metropolitan population, which also lessens the demand for physical activity. Obesity is also caused by these patterns, which increase energy consumption and reduce energy output.

Classification of *Sthaulya*:

To facilitate diagnosis, prognosis, and straightforward therapy, diseases ought to be categorised based on their severity and chronicity. As a result, *Sthaulya* must be classified; however, our classics do not provide a clear classification for this. Regarding the classification of *Sthaulya*, *Astang Samgraha*, *Astang Hridaya*, and *Sarangadhara* have shed some light, as described below.

Three varieties of *Sthaulya*, namely *Adhika*, *Madhya*, and *Hina*, have been mentioned for better management while narrating the indication of *langhana upakrama*.¹⁷⁷ *Vaman* is not recommended in *Atisthauya*, according to *Acharya Charaka* (Cha. Vi. 2/8). *Vamana* is contraindicated in *Sthaulya* according to *Acharya Sushruta*, although it is recommended for *Medo roga* (Su. Chi. 33/14–18), and *Acharya Sharangadhara* agreed with *Acharya Sushruta*.

Based on the cited sources above, *Sthaulya* can be categorised as:

- As per *Acharya Charaka*: *Sthula* and *Atisthula*
- As per *Acharya Sushruta*: *Sthaulya* and *Medo roga*
- As per *Acharya Vagbhata*: *Adhik*, *Madhya* and *Hina*
- As per *Acharya Sharangadhara*: *Meda dosha*

Based on the aforementioned references, *Sthaulya* has the following correlations with various forms of obesity:

1. *Hina Sthaulya* can be correlated to being Overweight with a BMI of 25 to 29.90 kg/m² - No secondary diseases or problems with less than four adverse effects.

-Least than a year in length.

2. *Madhyam Sthaulya*, can be considered as a class 1 and class 2 obese person with a BMI between 30 and 34.99 kg/m² and few complications from comorbidities.

-With less than eight negative consequences.

-Duration of one to five years.

3. *Ati Sthaulya*, defined as severe or morbid obesity with a BMI of more than 40 kg/m² and systemic problems or secondary diagnosis.

-With each of the eight negative outcomes.

-With a term of more than five years.

Classification of Obesity:

Several factors, including the disease's beginning to occur, severity, histology, and distribution of fat, are used to classify obesity. These factors are included below.

1) Based on the following Onset: i. gradual; ii. insidious; iii. rapid

2) Based on the following severity levels: i. Mild; ii. Moderate; iii. Severe

3) Based on the clinical state: i. Regal; ii. Envious; iii. Pitiable

4) Based on Body Mass Index

i. Being overweight is 25 to 29.9 kg/m², Class I obesity is 30 to 34.9 kg/m², class II obesity is 35 to 39.9 kg/m², and class III obesity is severe or morbid obesity (> 40 kg/m²).

5) Considering the etiological variables

i. Physiological: Passively observed during pregnancy and puberty.

ii. Pathological: It is further separated into three categories, namely.

External, endogenous, and idiopathic

a. Exogenous: Sedentary lifestyles and overeating are the causes.

b. Endogenous: Caused by endocrine disorders: polycystic ovarian syndrome, hyperthyroidism, hypothalamic syndrome, hyperinsulinism, Cushing's syndrome,

c. Idiopathic: When all other potential explanations for weight growth have been looked into and discarded, obesity is classified as idiopathic.

6) Based on the distribution of fat:

i. Generalised: Exogenous obesity is typically associated with generalised obesity.

ii. Central type: Common in hypothyroidism or Cushing's syndrome, it affects only the trunk and neck.

iii. Superior type: Common in hypothyroidism or Cushing's syndrome, it affects the face, neck, arms, and upper torso.

iv. Inferior type: Consists of wasting in the upper half of the body together with involvement of the lower trunk and legs.

v. Girdle type: Associated with pituitary or hypothalamic abnormalities, including the hips, buttocks, and abdomen.

vi. Breaches type: Found in hypogonadal syndrome; involves primarily the buttocks.

vii. Lipomatous type: Characterised by localised fat deposits throughout the body, often known as adiposis dolorosa or Dercum's disease when accompanied by pain and tenderness over the fatty lumps.

viii. Predicted upon histopathology

a. Hyperplastic obesity is characterised by an increase in adipocytes, a protracted history, and a poor prognosis.

b. Hypertrophic obesity: better prognosis, history of adult-onset, and increased adipocyte size.¹⁷⁸

1.3.20: Nidan of *Sthaulya*:

Early diagnosis of the illness allows us to halt its progression. Both subjective and objective diagnostic methods are described in Ayurvedic texts. The following is how *Acharya Sushruta* refers to "*Chakshu Indriya Vigneya Bhava*":

चक्षुरिन्द्रियविज्ञेयाः शरीरोपचयापचयायुर्लक्षणबलवर्णविकारादयः

This means that the diagnosis of both overnutrition (*Sthaulya*) and undernutrition (*Karshya*) can be made solely by inspection.¹⁷⁹

In addition, *Sthaulya* can be diagnosed using *Pratyaksha*, *Anumana*, and *Aptopadesh Pariksha*, among other helpful diagnostic techniques.

As per *Astavidha Pariksha*, *Akriti Pariksha* is capable of diagnosing *Sthaulya* (*Roga pariksha Cha. 1*)

Anthropometry of the body was mentioned by *Acharya Charaka* in *Dasha-vidha Pariksha* (Ch.Vi. 8/117). *Acharya Sushruta* has also recounted it (Su.Su. 35/12-13). For *Sthaulya* patients, it might offer a relative measurement and objective standards.

The table provides a summary of the measurements that *Acharya Charaka* and *Acharya Sushruta* described for various *Anga Pratyanga*.

Table no10: Explains the *Pramana Pariksha* in Ayurvedic treatises

Measurement	Pramana in Angula		Inch	Cm.
	Ch.	Su.		
Ayama (Height)	84	120	63-90	157.50-225.00
Vistar	84	-	63	157.50
Sirah Parinah (Head circumference)	32	-	24	60.00
Sirah Ayama (Height of head)	16	-	12	30.00
Griva parinah (Neck circumference)	22	20	15-16.5	37.50-41.25
Griva Ayama (Height of neck)	04	-	03	07.50
Vaksha Parinaha (Chest circumference) (Vajsa - 24 + Pitha - 16 + Kaksa — 8)	48	-	36	96.00
Bhuja Parinaha (Mid arm circumference)	16	16	12	30.00
Bahu Parinaha (Fore aim circumference)	12	-	09	22.50

Udara Parinaha (Abdomen circumference) (Kati-16 + Udara-12 + Parshva-12 = Kati-18 su)	40	-	30	75.00
Sroni parinaha (hip circumference) (Kati 16 + udara-12 + Parsa-12+trika-12)	52	-	39	97.50
Uru parinaha (Thigh circumference)	30	32	22.5-24	56.29-60.00
Jangha Madhya Parinaha	16	18	12-23.5	30.33-75.00

The *Nidana* of *Sthaulya* has been analytically discussed by *Acharya Charaka* in Cha. Su. 21. The majority of them have external causes. *Acharya Sushruta* and *Vagbhat* have both mentioned endogenous reasons. *Vagbhat* has also identified "*Ama*" as a contributing element. Only *Charaka* has identified *Beeja-dosha* as a contributing factor in addition to others.

When it comes to *Sthaulya*, endogenous reasons include things like *Dosha*, *Dhatu*, *Mala*, *Srotas*, etc., whereas exogenous causes include things like diet and exercise regimes.

There are four groups into which all of the causal elements listed in the Ayurvedic treatises can be divided.

- a. *Nidana - Aharatmaka*
- b. *Nidana - Viharatmaka*
- c. *Nidana - Manas*
- d. *Nidana - Anya*

The following tabulation of these causes is provided for better understanding: ¹⁸⁰⁻¹⁸⁴

Table no 11: Aharatmaka Nidana of Sthaulya

No.	Aharatmaka Nidana	Ch.	Su	A S	A.H.	MN.	B.P.
1.	Ati sampurana (Over eating)	+	-	+	-	-	-
2.	Santarpana	+	-	+	+	-	-
3.	Adhyasana	-	+	-	-	-	-
4.	Guru Aharasevana (Excessive consumption of Heavy food)	+	-	-	-	-	-
5.	Madhura Aharasevana (Excessive consumption of sweet food)	+	-	+	+	-	+
6.	Sheeta Aharasevana (Excessive consumption of cold diet)	+	-	-	-	-	-
7.	Snigdha Aharasevana (Excessive consumption of unctuous food)	+	-	+	+	-	+
8.	Sleshmala Aharasevana (Kapha increasing food)	+	+	-	-	+	+
9.	Navannasevana (Usage of fresh grains)	+	-	-	-	-	-
10.	Nava madya sevana (Usage of fresh alcoholic preparation)	+	-	-	-	-	-
11.	Gramya Rasasevana (Usage of domestic animal's meat & soups)	+	-	-	-	-	-

12.	Audak Rasa sevana (Usage of Aquatic animal's meat & soups)	+	-	-	-	-	-
13.	Manisa sevana (Excessive use of meat)	+	-	+	+	-	-
14.	Paya Vikar sevana (Excessive usage of milk and it's preparations)	+	-	+	+	-	-
15.	Dadhi Sevan (Excessive use of curd)	+	-	-	-	-	-
16.	Sarpi sevana (Usage of Ghee)	+	-	-	+	-	-
17.	Ikshu Vikara sevana (Usage of sugarcane Preparations)	+	-	-	+	-	-
18.	Guda Vikara sevana (Usage of jaggery's preparations)	+	-	-	-	-	-
19.	Shall sevana (Excessive use of Rice)	+	-	-	-	-	-
20.	Godhum sevana (Excessive use of wheat)	+	-	-	-	-	-
21.	Masha sevana (Usage of phasilous mungo)	+	-	-	-	-	-
22.	Rasayan Sevana	+	-	-	-	-	-
23.	Vrushya Sevana	+	-	-	-	-	-
24.	Bhojanotara Jal-pana	-	-	+	-	-	+

Table No. 12: Viharatmaka Nidana of Sthaulya

No.	Viharatmaka Nidana	Ch.	Su.	A.S.	A.H.	MN.	B.P.
1.	Avyayam (Lack of physical exercise)	+	+	+	-	+	+
2.	Avyavaya (Lack of sexual life)	+	-	+	-	-	-
3.	Divaswap (Days sleep)	+	+	+	-	+	+
4.	Asana Sukha (Luxurious sitting)	+	-	+	+	-	-
5.	Swapnaprasangat (Excessive sleep)	+	-	+	+	-	-
6.	Gandhamalyanu Sevana (Using of perfumes garlands)	+	-	-	-	-	-
7.	Bhojanotar snana (Bathing after taking the meals)	+	-	-	-	-	-
8.	Bhojanotar Nidra (Sleeping after meal)	-	-	-	-	-	+
9.	Bhojanottar Aushadha sevana (Drugs after meal)	-	-	+	-	-	-

Table No. 13: Manasika Nidana of Sthaulya

No.	Manasika Nidana	Ch.	Su.	A.S.	A.H.	MN.	B.P.
1.	Harshnityatvat (Uninterrupted cheerfulness)	+	-	+	+	-	-
2.	Achintanat (Lack of anxiety)	+	-	+	+	-	-
3.	Manasonivritti (Relaxation from tension)	+	-	+	+	-	-
4.	Priyadarshana	+	-	-	-	-	-
5.	Saukhyena	-	-	-	+	-	-

Table no. 14: Anya Nidana of Sthaulya

No.	Anya Nidana	Ch.	Su.	A.S.	A.H.	MN.	B.P.
1.	Amarasa	-	+	-	-	-	+
2.	Snigdha Madhura Basti Sevana (Administration of unctuous & Sweet enema)	+	-	+	+	-	-
3.	Tailabhyanga (Massaging of oil)	+	-	+	+	-	-
4.	Snigdha Udvartana (Unctuous unction)	+	-	-	-	-	-
5.	Bijadoshaswabhavat (Heredity)	+	-	-	-	-	-

1.3.21: Etiology of Obesity

Contemporary science has identified three primary categories of causes for obesity.

- i. Exogenous: When dietary practices, smoking, overeating, or an overactive appetite are the primary causes.
- ii. Endogenous: In cases where hormones play a role.
- iii. Miscellaneous: A variety of factors, including age, sex, occupation, socioeconomic status, psychogenic factors, environmental factors, drugs, metabolic imbalance, heredity, and hypothalamic trauma, might contribute to the development of obesity.¹⁸⁵

Aharatmaka Nidana of Sthaulya

In *Sthaulya*, *Ahara-rasa* is largely responsible for the formation of *Meda Dhatu*. Thus, according to *Acharya Sushruta*, the quantity and quality of *Ahararasa* determines *Sthaulya* and *Karshya*.¹⁸⁶ *Samanya Vishesh Siddhanta* by *Acharya Charaka* states that an excess of one material (*Dravya Samanya*), another of comparable quality (*Guna Samanya*), or a third of similar activity (*Karma Samanya*) leads to an excess of *Dhatu*. Similar to how increasing the intake of *Aharatmaka Nidana*, as previously mentioned, results in an excess of *Meda dhatu*.

Viharatmaka Nidana of Sthaulya

In the end, all of the *Aharatmaka Nidana* reduces physical activity, which aggravates *Kapha dosha* and results in the deposition of *Meda*. The *Abhishyandi* feature of *Viharatmaka Nidana*, similar to *Divaswapna*, obstructs the body's microchannels, or *Srotas*, particularly in the *Medovaha srotas*.¹⁸⁷ Reduced metabolic rate during sleep is also a significant contributor to the synthesis of extra fat.

Manas Vyapara of Sthaulya

A person's physical activity has decreased as a result of adapting to the modern sedentary lifestyle, while mental activity has increased. As a result, illnesses brought on by psychogenic causes are more common these days. Because *Sthaulya* is also classified as a psychosomatic ailment, *Acharyas* has also discussed various psychogenic reasons for the condition in *Ayurvedic* manuscripts.

According to Acharya Charaka

तत्रातिस्थूलकृशयोर्भूय.....क्षुदतिमात्रं पिपासातियोगश्चेति ॥४॥

Acharya Charaka mentions two psychological components, *Harshanitya* and *Achintana*, that are accountable for *Meda vridhhi*. These elements cause *Meda*

deposition because they are *Kapha doshas* aggravating factors. Those who possess this kind of mental health and joy are more inclined to engage in material pleasures and extra energy that is stored as *Meda*.¹⁸⁰

Beeja-dosha in causing Sthaulya

According to Acharya Charaka, *Beeja-dosha* is an important factor causing *Medo vridhhi*. A malfunction in *Beeja-bhaga-avayava*, or the portion of *Beeja* that shares genetic similarities, could result in an organ's development going awry.¹⁸⁰ Additionally, according to Acharya Bhava Mishra, a stout but feeble physique is predisposed to grow when there is an elevated percentage of *Meda* and a decreased proportion of *Shukra* in *Beeja* at the moment of conception.¹⁸³

Furthermore, it is said that overeating, especially while taking *Madhura Rasa* during pregnancy, is a contributing factor to the birth of obese children, suggesting the involvement of hereditary factors in the genesis of *Sthaulya*.

Other factors responsible for Sthaulya

Ati-sevana Rasayan Vrishya Dravya: Acharya Charaka mentions *Vrishya dravyas* and *Rasayana* prescribed for *Karshya's chikitsa* can lead to the production of *Sthaulya*.¹⁸⁰

Thus, overindulgence in *Vrisya* and *Rasayana* medications may result in *Sthaulya*. Once more, *Sthaulya* is caused by the overindulgence of *Brimhana Basti*, *Taila Abhyanga*, and *Snigdha Udavartana*.¹⁸⁰ Numerous studies conducted recently have demonstrated that a significant amount of nutrients can be absorbed and processed through the rectum and large intestinal mucosa. Therefore, excessive consumption of *Brimhana* and *Vrisya Basti* may result in the causation of *Sthaulya*.

To put it briefly, if *Ahara* has the following qualities: i.e. *Madhura* in *Rasa*, *Guru-Sheeta-Manda-Shalakshna* and *Snigdha* in *Guna*, *Sheeta* in *Virya*, *Madhura* in *Vipaka* and *Prithvi* along with *Jala* in *Mahabhuta*. It will elevate *Meda dhatu* and *Kapha dosha*, and similarly elevate *Avyayama*, *Sukha*, *Vihara*, *Achinta*, etc. and so forth. A build-up of *Meda dhatu* in the body due to *Manasika Bhavas* will result in *Medo roga*.

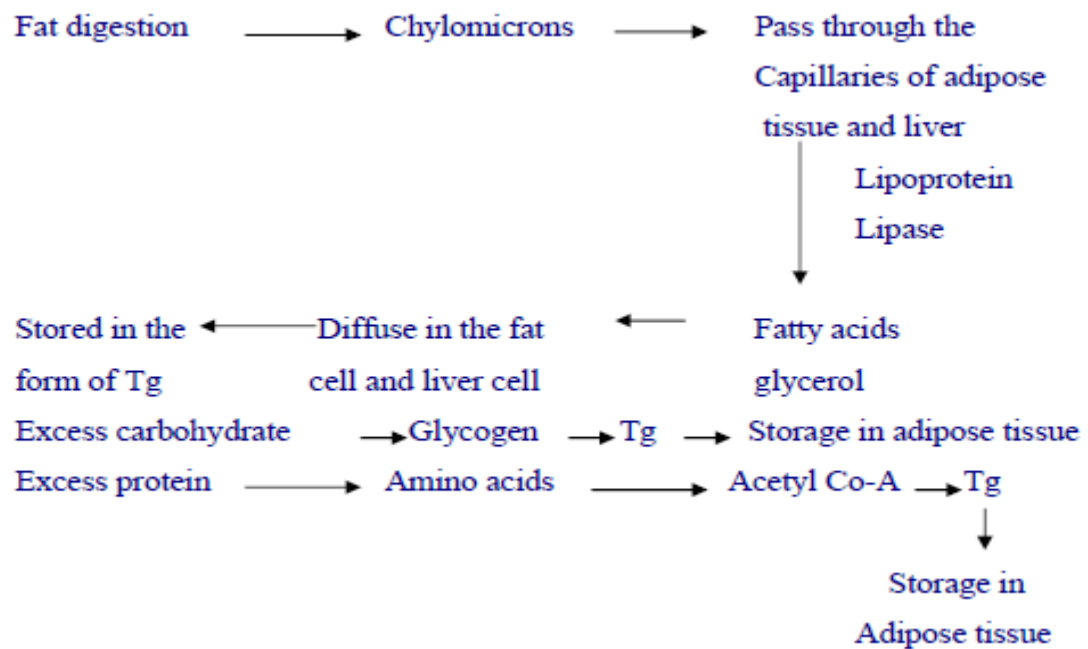
1.3.22: Aetiopathogenesis of Obesity:¹⁸⁸

- 1. Diet pattern:** The key factors influencing the equilibrium of body weight are energy expenditure and calorie intake. The hypothalamus, which communicates to the body whether or not it is hungry, is responsible for controlling body weight. Our consumption of fat has increased and our consumption of carbohydrates has decreased during the past 50 years.

The notion is that eating a rich diet causes the hypothalamus process to malfunction. A high-fat diet has the drawback of being too rich in calories but lacking in fibre, despite current research suggesting that fibre is crucial for controlling body weight. The average daily consumption of fibre nowadays is approximately 12–13 grammes, however, in underdeveloped nations, it ranges from 40–60 grammes.

- Animal fat contains a high quantity of saturated fatty acids, which raise blood cholesterol and increase the risk of heart disease. Fat also gives food flavour, which stimulates our hunger centres and causes us to eat more. All fats are similar in terms of calories, with 9 calories per gramme. Proteins and carbohydrates provide fewer calories per gramme than fat does. Thus, a diet heavy in fat raises the risk of obesity and its related problems.

Chart No. 3: Transformation of fat from food into stored fat (Tg)



Thus, triglycerides account for 90% of the body fat that is stored in our bodies.

2. **Physical Activity:** The surplus energy held in reserve as a result of insufficient physical exercise.

The entire energy Expenditure is calculated as follows: RME (resting metabolic expenditure) + the thermogenic effect of exercise + the thermogenic effect of food. When sleeping, the rate of calorie expenditure is lower than when B.M.R. is measured formally.

A person may burn roughly 1 kcal per minute when sleeping, but a vigorous runner may burn up to 30–40 kcal per minute. A minor's eight hours of manual labour could result in up to 300 Kcal in expenses. It is exceedingly challenging to determine the precise number of calories burned.

A person who maintains a constant weight with normal food intake and energy expenditure and who is in calorie balance. If that individual raises his daily caloric intake by just 200 Kcal or a mere 10% increase. He will consume 73000

additional calories after a year. Now, the calorie equivalent of one pound of adipose tissues (450 gm), or 90% Tg by mass, is roughly 3500 Kcal.

3. **Drugs:** When certain medicines are used for extended periods of time, obesity might develop.

This is particularly true for hormonal preparations taken by women, such as hormone replacement therapy and oral contraceptives. One typical negative effect of oral contraceptive medications is weight gain. In a recent study, researchers found that when women used the contraceptive tablets, their levels of the satiety hormone cholecystokinin were significantly lower.

A hormone called cholecystokinin reduces appetite. When the body produces less of it, women will naturally feel hungry and eat more than they need, which leads to obesity. Weight issues might arise from the long-term usage of steroids in the treatment of asthma.

4. **Genetic factors:** Genetic factors can either increase a person's propensity to develop obesity or play a significant part in its pathophysiology. It has long been understood that obesity is a heterogeneous collection of illnesses rather than a single disorder.

A group led by Zhang et al. that was investigating the genetics of obesity was successful in 1994 in characterising the obesity gene, *ob*, in mice and identifying its human counterpart. The discovery of the *ob* gene and its protein product provided significant evidence to the country that genetic abnormalities are a contributing factor to obesity.

Adipose tissue, or fat, produces the protein known as "leptin," which comes from the Greek word "leptos", which means thin. It is believed to function as an afferent satiety centre in the brain.

Adipocytes from obese individuals have substantially more ob m-RNA than those from persons with normal body weight, according to research by Considine et al. It appears that leptin synthesis by individual cells grows to nearly twice the starting value due to hypertrophy of adipocytes, as evidenced by the fact that serum leptin increases substantially more in obese people than does m-RNA.

One possible connection between the brain's regulation of food intake and leptin's role as a satiety hormone could be the appetite-stimulating (orexigenic) hypothalamic peptide neuropeptide Y. As demonstrated by Rohner-Jenander and in one study, low amounts of neuropeptide Y have the opposite effect of high ones, which stimulate food consumption.

Elevated glucocorticoid and insulin secretion is the primary metabolic alteration brought on by neuropeptide Y. Intracerebroventricular neuropeptide Y infusions also raise leptin m-RNA levels in adipose tissue, which in turn causes fat accumulation, obesity, and insulin resistance in muscle, a stage leading to non-insulin-dependent diabetic diabetes (NIDDM). Therefore, the majority of obesity syndrome symptoms are caused by elevated neuropeptide Y concentrations in the brain. It is unclear why genetically obese rodents have high hypothalamic concentrations of neuropeptide Y, and the cause certainly varies depending on the kind of obesity.

However, it is essentially impossible to identify the ob gene in every obese person. Niki et al. (1996) conducted molecular screening for the human obese gene in Japanese and Asian Indian individuals who were linked to obesity. Their findings indicated that mutations in the ob gene's coding areas are unlikely to be easily recognized.

5. **Endocrine Aspect of Obesity:** Obesity is occasionally diagnosed as the result of a hormonal imbalance. We classify these patients as having endogenous adiposity. Thus, hypopituitarism, hypothyroidism, hypogonadism, and Cushing's disease are commonly associated with obesity. However, it is not a necessary component of these circumstances. Among the illnesses linked to obesity are:
 - i. Cushing's syndrome: When the adrenal glands are overstimulated by too much ACTH from the pituitary, they may develop hyperplasia. This syndrome is characterized by fat accumulation over the dorsal posterior cervical area, in the supraclavicular fossa, and on the trunk. Usually, the arms and legs are unharmed.
 - ii. ii. Thyroid Disease: The underactivity of the thyroid gland is known as "hypometabolism," which is the reason for obesity. Severe hypothyroidism can result in some increased fat, but the majority of the extra weight is really oedema, which goes away when thyroid hormone replacement therapy is started.
 - iii. iii. polycystic ovarian syndrome: This condition has been related to obesity, irregular menses or amenorrhea, and mild hyperthyroidism. Androgens are overproduced by the ovaries. Virilizations is uncommon, despite the prevalence of hirsutism. Although the exact relationship between obesity and polycystic ovarian syndrome is unknown, the two disorders frequently coexist.
6. **Psychogenic obesity:** Although it is generally acknowledged that psychological variables have a role in the development of obesity, efforts to identify a particular personality type that is associated with obesity have proven fruitless.

A significant portion of the initial research on the psychological aspects of obesity originated from studies on lone individuals who had undergone thorough psychiatric examinations. Examining the psychological aspects of obesity reveals a variety of methods for solving the issue. One of these originates from Bruch's comprehensive research, which distinguishes between two forms of obesity.

Reactive obesity is the first type, which is caused by overindulging in food as an emotional response to external circumstances. Bruch claims that this kind of anomaly is a manifestation of an improper reaction to the child's eating circumstances during their growth and development. Development is the name given to the second kind of obesity. These people rarely experience emotional issues. After research, a few characteristics became apparent and were dubbed the fat trait. Depression was not severe, but it was prevalent. Eating had been utilised a lot to help ease the emotional deprivation feelings that these patients had experienced since infancy and which had historically been linked to unstable marriages in many of their families.

These traits add to the stereotype of fat patients as "difficult" patients that has long existed. It is believed that overeating is a maladaptive coping mechanism for anxiety and sadness. significant onset of sadness, anxiety, and irritability following a period of intense calorie restriction. According to other research, fasting or crash diets used in isolation without any kind of therapeutic support may exacerbate mental health issues.

Divergent views exist regarding the extent to which individuals may direct their own lives. These attitudes are known psychologically as Locus of control or LOC. Those who identify as internal locus of control (LOC) feel they have a

fair level of this kind of control. On the other hand, those who have an external locus of control (LOC) orientation believe that most things happen to them and are not within their control.

It has been proposed that those who have an external LOC orientation may ascribe their overeating to outside circumstances over which they have little control, which could contribute to the development of obesity. This is because these persons typically assign blame to outside causes. The inability to control one's food intake, or self-regulatory deficiency, most likely puts the person in danger of gaining weight.

Some studies looked at a more focused food-related attitude known as cognitive restraint, while others attempted to find global attitudes that would be pertinent to the aetiology of obesity. The following are some ways that it has been suggested that cognitive restraints might contribute to obesity. People feel cheated when they consciously try to limit their food consumption. They may overeat if there is any kind of disturbance to their cognitive regulation, which allows their experience of deprivation to manifest. It has been suggested that this counter-regulation results from an all-or-nothing perspective on food consumption. It is argued that dieters feel like they have transgressed when they stray from their planned food consumption. Dieters who adopt the binary mindset of "either I'm on a diet or I am out of control of my food intake" tend to overindulge in food after their diet plan is not followed. This creates a pattern of constant dieting followed by binge eating, which may eventually result in obesity.

When compared to harmonious support, parental neglect significantly raised the danger, according to Lissaue and Rensen (1994). Children who were dirty and

neglected were far more likely than averagely groomed children to become obese adults. The parents of the fat youngsters claim that their children have more behavioural issues.

1.3.23: Purvarupa of Sthaulya:

None of the Ayurvedic texts have described the *Purvarupa* 's for *Sthaulya*.

Acharya Charaka says that the *Medovaha Sroto-dusti Lakshanas*, which are also referenced as *Prameha's Purvarupa*, are *Sthaulya's purvarupa*, as the *Prameha's* and *Sthaulya's* pathophysiology are comparable.¹⁸⁹ The two important factors implicated in the aetiology of *Prameha* are *Bahudrava Shleshma* and *Abaddha Meda*, and they are also shown to be induced in *Sthaulya*.¹⁹⁰ Thus, *Purvarupa* of *Sthaulya* can be identified with *Shleshma Sanchya* and *Medo dusti Lakshana* linked *Purvarupa* of *Prameha* and *Medovaha Sroto-dusti Lakshanas* as mentioned by *Acharyas*.

Purvarupa of *Sthaulya* can be applied to symptoms associated with *Meda Dushti*, such as *Atinidra*, *Anga gaurav*, *Tandra*, *Alasya*, *Shaithilya*, *Visra Sharira gandha*, etc.

According to contemporary medical research, obesity and overweight do not exhibit any premonitory symptoms. Thus, modest symptoms that are related to it can be regarded as premonitory symptoms.

1.3.24: Rupa of Sthaulya:

Acharyas asserts the symptomatology of *Sthaulya* in depth; to comprehend them, the following details must be clarified.

As per *Acharya Charaka*

मेदोमांसातिवृद्धत्वाच्चलस्फिगुदरस्तनः।

अयथोपचयोत्साहो नरोऽतिस्थूल उच्यते ॥९॥

This indicates that the pendulous buttocks, abdomen, and breast deform from the excessive growth of fat and flesh and that the greater mass lowers the equivalent gain in energy. Consequently, the individual's physical activity is less enthusiastic.¹⁸⁰ In addition to these primary symptoms, *Sthaulya* has eight impairments, which are:

- i. *Ayuso-hrasa*
- ii. *Javoparodha*
- iii. *Kriccha-Vyavaya*
- iv. *Daur-balya*
- v. *Daur-gandhya*
- vi. *Sveda-badha*
- vii. *Kshudh-atimatrata*
- viii. *Pipasa-atiyoga*

The following detailed pathophysiology of *Ashta Dosha* of *Sthaulya* occurrence has been stated.¹⁹¹

- i. *Ayusho-hrasa*: Life expectancy decreases as a result of improper nutrition for other *Dhatus*.
- ii. *Javoparodha*: This is brought on by *Saukumarya*, *Medadhatu's Shaithilya*, and *Guru* qualities.
- iii. *Kriccha-vyavaya*: The sex act becomes challenging because *Medo dhatu* obstructs the genital channel and produces less semen.

- iv. *Daur-balya*: This is the outcome of the *Dhatus*'s malnourished state, which causes a disturbed metabolism.
- v. *Daur-gandhya*: The scent of a bed is caused by excessive perspiration, the morbid character of vitiated *Meda*, and the inherent quality of *Medo dhatu*.
- vi. *Sveda-badha*: This condition is caused by the combination of *Kapha* and *Meda*, as well as by the attributes of *Bahutva*, *Vishyandi*, and the *Guru*, and by *Meda*'s incapacity to withstand the pressure of exercise.
- vii. *Kshudh-atimatrata* and *Pipas-atiyoga*: Excessive appetite and thirst are caused by vitiation of *Vata dosha* due to restriction of *Meda* and increased *Agni* in *Koshtha*.

Charaka has named the following as the *pratyatma Lakshana* of *Sthaulya*: *Chala Sphika* (pendulous buttocks), *Chala Udara* (pendulous abdomen), *Chala Stana* (pendulous breast), *Ayatha Upachaya* (improper growth), and *Anutsaha* (lack of enthusiasm) ¹⁸⁰

The following table is a summary of all the *Sthaulya* symptoms that have been mentioned in different Ayurveda manuscripts.

Table no. 15: Rupa of Sthaulya

No.	Rupa	Ch.	Su.	A.S.	A.H.	MN.	B.P.	Y.R
1.	Chala Sphika	+	-	+	+	+	+	-
2.	Chala udara	+	-	+	+	+	+	-
3.	Chala stana	+	-	+	+	+	+	-
4.	Ayathana Upachaya	+	-	+	-	+	+	-
5.	Anutsaha	+	-	+	-	+	+	-
6.	Ayushohrasa	+	-	-	-	-	+	-
7.	Javoparodha	+	-	-	-	-	+	-
8.	Kricch Vyavaya	+	-	-	-	-	-	+
9.	Daurbalya	+	-	+	-	-	-	-

10.	Daurgandhya	+	+	+	-	+	+	+
11.	Svedabadha	+	-	-	-	-	-	+
12.	Kshudhatimatra	+	+	+	-	+	+	+
13.	Pipasatiyoga	+	+	+	-	+	+	+
14.	Kshudra svasa	-	+	+	-	+	+	+
15.	Nidradhikya	-	+	+	-	+	+	+
16.	Gatrasada	-	+	-	-	+	+	+
17.	Gadgadvani	-	+	+	-	-	-	-
18.	Krathana	-	+	-	-	+	+	+
19.	Alpaprana	-	+	+	-	+	+	+
20.	Survakriyasu Asamarthata	-	+	-	-	+	+	-
21.	Alpavyavaya	-	+	-	-	+	+	-
22.	Kasa	-	+	-	+	-	-	-
23.	Shvasa	-	+	+	-	-	-	-
24.	Snigdhangata	-	+	-	+	-	-	-
25.	Udaraparshva Vridhhi	-	+	-	+	+	+	-
26.	Alasya	-	-	+	-	-	-	-
27.	Ama	-	-	-	+	-	-	-
28.	Moha	-	-	-	-	+	+	+
29.	Saukumarata	+	+	-	-	-	-	-
30.	Anga Saithilya	+	+	-	-	+	+	-
31.	Alpabala	-	-	+	-	-	-	-

1.3.25: Obesity - Clinical Features. ¹⁹²

Its expression is contingent upon multiple circumstances. The following are the clinical manifestations of obesity as they are presented in different contemporary medical texts. In most circumstances, the patient's look will reveal the diagnosis.

- BMI increases can be used to detect obesity; a person is considered obese if their BMI is above 30 for men and above 28.6 for women.
- Skin fold thickness: A measurement of more than 20 mm in a man and more than 28 mm in a woman indicates obesity.
- Waist-hip ratio: If the ratio is higher in men than in women (above 1.0 and above 0.8, respectively), the type of obesity is android or man-pattern obesity; if it is lower, it suggests gynecoid-type of obesity or female-pattern obesity.

Obesity-related complications such as dyspnoea, bronchitis, and hernia are frequently seen as clinical features in obese individuals.

One of the more prevalent clinical characteristics of obesity is a protuberant abdomen.

Development skinfold in the peritoneal region, below the breast, near the axilla.

exertional dyspnoea and generalised lethargic state.

The most problematic characteristics of an obese person are their varicose veins and ankle oedema.

Menstrual irregularities and sterility are also noted in obese women.

The risk of fungal infection in the skin fold area is increased in obese individuals.

Contemporary perspective

It is quite difficult to diagnose someone as obese because so many variables need to be taken into account. Visual inspection is usually sufficient for diagnosis in the majority of instances, but determining the extent of obesity is also crucial. These criteria can be used to define obesity.

The most commonly used parameters are -

- i. Body Mass Index
 - ii. Skinfold thickness
 - iii. Waist circumference
 - iv. Waist / Hip ratio
 - v. Relative Weight (Rw)
 - vi. Age-specific weight for height table
 - vii. Ponderal Index
- i. Body Mass Index (kg/m^2) is calculated by dividing the actual body weight by the square of the height. This index offers a good representation of obesity in non-hypertrophied athletes. Classification of obesity according to B.M.I.
 - a. Underweight: body weight less than 18.5 kg/m^2 ($<18.5 \text{ kg/m}^2$)
 - b. Normal weight: body weight between 18.5 and 24.9 kg/m^2 (<18.5 to 24.9 kg/m^2)
 - c. Overweight: body weight between 25 and 29.9 kg/m^2 (<25.0 to 29.9 kg/m^2)
 - d. Class-I obesity: body weight between 30 and 34.9 kg/m^2 (<30.0 to 34.9 kg/m^2)
 - e. Class-II obesity: body weight between 35 and 39.9 kg/m^2 (<35.0 to 39.9 kg/m^2)
 - f. Class III Morbid Obesity: Greater than 40 kg/m^2 ($> 40 \text{ kg/m}^2$)
 - ii. Skinfold Thickness: Skinfolds are a useful tool for estimating the thickness of the subcutaneous layer, which contains the majority of adipose tissue.

The four most often utilised sites for measuring skinfolds are the supra iliac, subscapular, triceps, and biceps. The technique is cheap, but it needs an experienced observer and isn't suitable for extremely obese individuals whose skinfolds can't fit between the measuring calliper's jaws. This approach to estimating intra-abdominal fat is unreliable.

- iii. Waist circumference: The measurement of waist circumference to determine the dangers of obesity. Due to extra visceral and abdominal fat, men with waist circumferences larger than 35 inches (88 cm) are more likely to develop diabetes mellitus, hypertension, and cardiovascular disease.
- iv. Waist/hip ratio: Research has shown that both men and women who have high waist/hip circumference ratios are at higher risk of high blood pressure, serum cholesterol levels, and death.

The following is the average value:

It ranges from 0.75 to 1.10 for men with an average of approximately 0.93 and from 0.70 to 1.00 for women, with an average of approximately 0.83.

The minimum circumference, measured in the horizontal plane when the person is standing, between the iliac crest and the costal border is known as the waist circumference. Measured across the buttocks, the hip circumference is the largest in the horizontal plane. An indicator of the percentage of intra-abdominal fat is provided by the ratio of the former to the latter.

- v. Relative Weight: calculated using acceptable weight tables, the Relative Weight (Rw) is the actual weight divided by the desired weight. If the Relative Weight (Rw) surpasses 120 per cent is considered Obese and if the Relative Weight (Rw) > 200 per cent is called Severe obesity.

vi. Ponderal Index:
$$\frac{\text{Height (Cm)}}{\sqrt{\text{weight(kg)}}}$$

According to Ayurveda theories

Ayurvedic literature states that skin is composed of six to seven layers; however, *Charaka Samhita* does not provide a precise measurement for each layer of skin. However, *Acharya Sushruta* has provided specific measurements for every layer in the pattern that follows.

Table No.16: Seven Layers of Skin

Skin Layer	Pramana	Measurement in CM.
1 st layer	1/18 Yava	0.013
2 nd layer	1/16 Yava	0.014
3 rd layer	1/12 Yava	0.019
4 th layer	1/8 Yava	0.029
5 th layer	1/5 Yava	0.046
6 th layer	1 Yava	0.234
7 th layer	2 Yava	0.468

1.3.26: Samprapti of Sthaulya:

Any disease's *samprapti* provides us with the disease's mode of genesis. Understanding *Samprapti* aids in understanding the distinctive characteristics of diseases such as *Dosha*, *Dushya*, *Sroto-dushti*, *Ama*, and *Agni*. It has been said that *Sthaulya* is a *Dushya*-dominating disease or *Medaja Vyadhi*.¹⁹³ According to *Acharya Charaka*, "*Ahara*" is the most frequent causative factor for *Medo vridhhi* in *Sthaulya*. *Acharya Sushruta*,

however, has acknowledged *Ama dosha* as the most important cause for *Sthaulya*.¹⁹⁴

As said by Charaka,

मेदसाऽऽवृतमार्गत्वाद्वायुः कोष्ठे विशेषतः।

चरन् सन्धुक्षयत्यग्निमाहारं शोषयत्यपि ॥५॥

तस्मात् स शीघ्रं जरयत्याहारं चातिकाङ्क्षति।

विकारांश्चाश्रुते घोरां कांश्चित्कालव्यतिक्रमात् ॥६॥

Owing to *Meda*'s blockage of *Shrotas*, the *Vata dosha*, which mostly moves into the stomach, stirs up the *Jatara Agni* and causes it to absorb food. The reprehensible man has an abnormal appetite and quickly breaks down food. Overeating generates more *upadana-rasa*, leading to an overabundance of *Meda Dhatus* and *Sthaulya*.

According to Acharya Sushruta, *Ama Rasa* is caused by *Adhyasana*, *Avyayama*, *Diva-swapana*, and *Kapha vardhaka ahara*. The body is moved by the *Madhura Bhava Ama Rasa*. This *Rasa*'s *Snigdamsha* results in *Medo vruddhi*, which leads to excessive stoutness.¹⁹³

Any disease's appearance involves the vitiation of some fundamental elements, which are as follows.

Dosha, Dushya, Srotas, and Agni

- i. **Dosha:** Even though *Sathurya* is a *Kapha dosha*-predominant *vyadhi*, *Pitta dosha* and *Vata dosha* nevertheless play a role. Together, these three Doshas contribute to *Sthaulya*'s pathogenic process.
 - a. *Kapha dosha:* *Sthaulya* is regarded by the majority of Ayurvedic experts as *Kaphaja Vyadhi*. Additionally, *Sthaulya* is described by Acharya Charaka under *Shleshma Nanatmaja Vyadhi*.¹⁹⁵ *Kapha dosha* becomes

vitiated due to overindulgence in *Guru*, *Snigdha*, *Sheeta*, *Madhura*, *Picchila*, and *Abhishyandi* - *Ahara* and *Vihara*, such as *Achintana*, *Diwaswapna*, etc. The majority of symptoms of *Sthaulya*, such as *Anga-Gaurav*, *Nidra-Adhikya*, *Alasya*, *Gatra-Sada*, etc., fall within the category of *Kapha dosha vridhhi*. The *Sthaulya Rogi* is typically associated with *Kapha Prakriti*. For this reason, their physical activity is slow and sluggish.

- b. *Pitta dosha*: The majority of obese people have *Tikshna agni*, however, there are very few *Pittaja Lakshana*. wherein *Pitta Dosa* also increases. Moreover, the *Pitta Dosa Vridhhi Lakshanas* mention symptoms such *Swedadhikya*, *Atipipasa*, and *Dauragandhya*.
- c. *Vata Dosha*: Two circumstances are produced in *Sthaulya* by *Vata dosha*. Firstly, the *Agni* is aroused by the state of *Aavrita Vata*, which in turn raises the need for eating (*Abhyavaharan Shakti*) and causes the body to absorb the nutrients.

समानो अग्निसमीपस्थः कोष्ठे चरति सर्वतः

अन्नं गृह्णाति पचति विवेचयति मुञ्चति (A.H.Su. 12/8)

The second is *Vyana Vayu's* inactivity. It is *Vyana vayu's* responsibility to distribute and circulate *Dhatus* in an appropriate manner.

व्यानेन रसधातुर्हि विक्षेपोचितकर्मणा (Ch.Chi. 15/36)

Sanga in *Medo-vaha srotas* prevents *Vyana vayu* from transporting nutrients to each *Dhatus*. Therefore, it is possible to conclude with certainty that *Saman Vayu* is involved based on the evidence of *Agni sandhukshana*, and the incorrect distribution of fat in the body indicates the involvement of *Vyana vayu*.

- ii. **Dushya:** The pathological process cannot proceed in the absence of *Dosha-dushya Sammurchana*. *Sthaulya* is a *Dushya* dominating condition (Su.Su. 24/9) as described by *Acharya Sushruta*. The disease is characterised by the excessive generation of aberrant *Meda dhatu*. Since *Kapha dosha* is seated in each of these *Dhatus* according to *Ashray-ashrayee bhava*, *Rasa*, *Mamsa*, *Meda*, *Majja*, and *Shukra Dhatus* are *Dushyas* in this case. Thus, excessive quantity and quality increased the particular *Dhatu*, and vitiation of *Kapha dosha* likewise vitiates the aforesaid *Dushyas Poshaka-amsha*. Excessive consumption of *Guru*, *Snigdha*, and *Madhuradi Guna* dominate diet in *Sthaulya* leads to an accumulation of *Medo dhatu* in the body.
- iii. **Srotas:** Along with the presence of other *Srotas*, the involvement of *Medo-vaha Srotas* is the primary component in *Sthaulya*. According to the *Charaka Samhita*, vitiating variables for *Medo-vaha Srotodusti* include *Diva-swapna*, *Avyayam*, and excessive consumption of *Madura ahara Dravya* and *Varuni*. It shows that both *Rasa-vaha* and *Medo-vaha srotas* are involved. *Sweda-vaha srotas* are implicated, causing *Ati-Sweda* and *Daur-gandhya*. The involvement of *Udaka-vaha srotas* is shown by the presence of *Ati-pipasa*. Increased fat deposition inside the *vasa* (muscle) in the aetiology of *Sthaulya* suggests that *Mamsa-vaha srotas* is involved.
- iv. **Agni:**
- a. **Jatharagni:** In *Sthaulya*, a blockage of the *Meda dhatu* by vitiated *Vata dosha* causes *Vata* to stay in the *Kostha*, which leads to *Tikshna agni*. The question that now arises is how *Ama* formation can take place when *Tikshna agni* is present. In an attempt to put an end to this dispute,

Acharya Chakrapani and *Acharya Dalhana* have explained that during the *Tikshna agni* stage, a person may pursue *Adhyasana* and *Kalavyatita Ahara Sevana*. This causes an *Agni* disturbance, which may then lead to the production of *Ama*. Furthermore, *Acharya Dalhana* has clarified that a lower degree of *Medo-dhatvagni* than *Jatharagni* is more responsible in the *Sthaulya* for the production of *Ama* ¹⁹³

- b. **Dhatvagni:** As stated below, *Dhatvagni* is referred to in accordance with *Vagbhata* as *Kaya-agni amsha*, which is contained in every *Dhatu*.

स्वस्थानस्थस्य कायाग्नेरंशा धातुषु संश्रिताः

तेषां सादातिदीप्तिभ्यां धातुवृद्धिक्षयोद्भवः (A.H. Su. 11/34)

Specifically, *Dhatvagni mandya* of a particular *Dhatvagni* generates *Vridhhi* of that *Dhatu* and vice versa; *Ushma* presented in *Dhatu* is a part of *Jatharagni* and is governed by it. The *Kshya* of complete *Dhatu* occurs in the state of *Dhatavagni mandya*.

As mentioned at the *Jatharagni* level, *Sthaulya Medo-dhatvagni Poshaka amsha* is vitiated.

Therefore, an excess of *Medo dhatvagni* leads to an accumulation of more *Meda Dhatu* in their depots. Additionally, good *Jatharagni* encourages *Meda Dhatu poshaka Rasa* to form in greater quantities, which means that *Medo dhatvagni* may not perform its job as intended. Furthermore, when *Sukshma* and *Sara* parts are produced at a lower rate at the *Medo dhatvagni* level, *Asthi*, *Majja*, and *Shukra Dhatu* experience a fall in *poshaka Rasa*.

Four groups comprise the aetiological components that *Acharyas* described:

- a. *Dosha Dushti-kara: Guru, Sheeta, Madhura guna* dominated diet.

- b. *Dhatu Daurbalya-kara*, which includes *Achintana*, *Avyavaya*, *Avyayam*, and *Nityaharsh*.
- c. *Agni mandya-kara*: *Madhura*, *Snigdha* - *Pradhan Bhojan* and *Ati Bhojana*.
- d. *Beeja dosha*: This hinders *Medo dhatvagni poshaka amsa* and, in the end, serves as the foundation for *Sanchaya* of *Ama* in *Medo dhatu*, which culminates in *Sthaulya*. Both hypertrophic and hyperplastic obesity can occur in people with a hereditary predisposition.

Sthaulya's *hetus* can be divided into four sections. All of them eventually lead to *Kapha dosha Vriddhi*, but, because of this overly vitiated *kapha dosha*, *Jatharagni mandyata* gives rise to *Ama utpatti*, which in turn leads to *sanga* in *Medo-vaha srotas*, which in turn leads to *Medo dhatu agni-mandya*, which in turn leads to *medo-vridhi* (*Amarupa*), which in turn leads to *Sthaulya*.

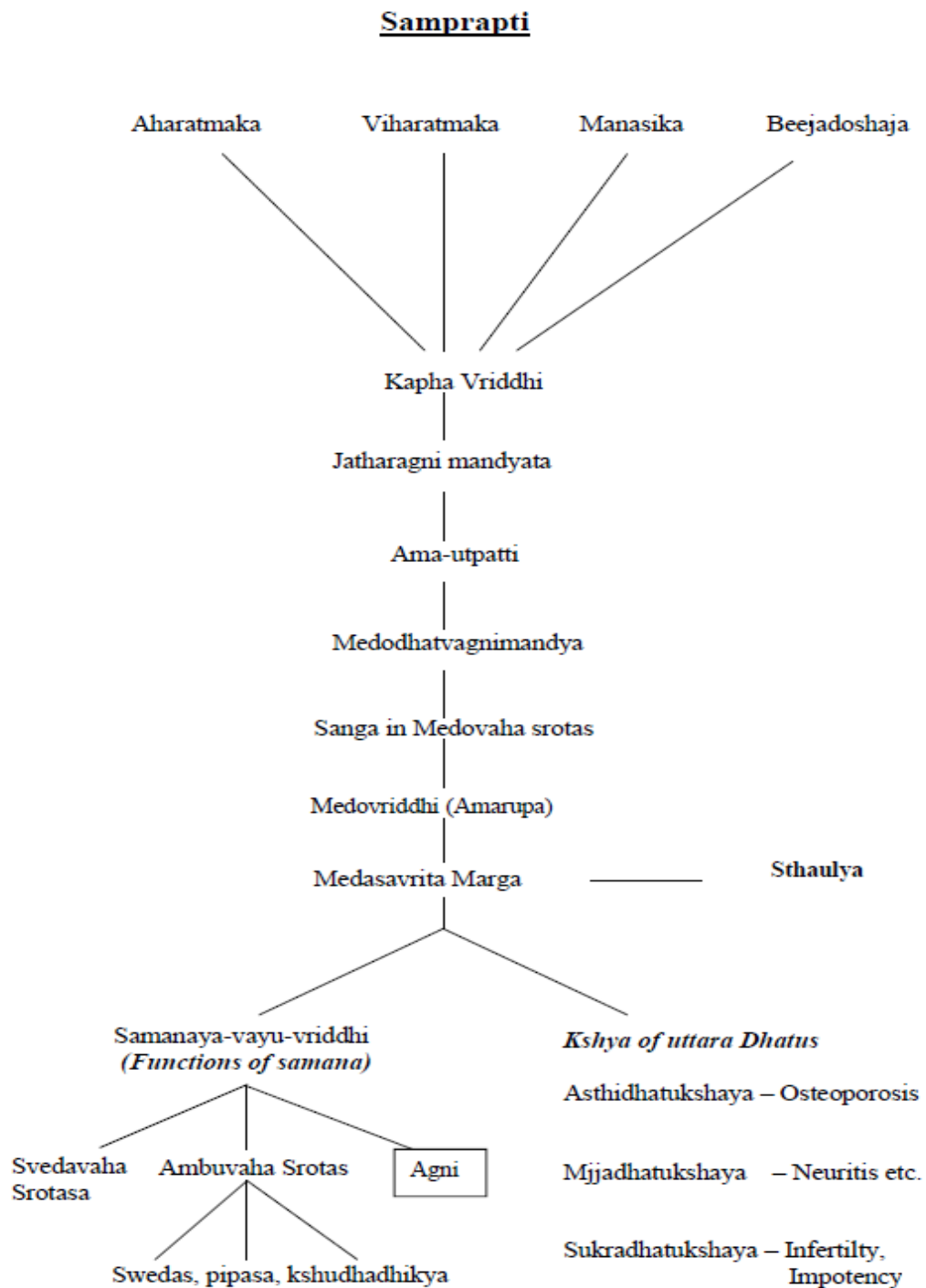
When this *Amarupa meda* obstructs the *Samanya-Vayu* channel, it increases the function of *Samana*, which is found in *Sweda-vaha*, *Ambu-vaha srotas*, and *Agni sthan*.

Ambu-vaha sroto dushti lakshana such as *sweda*, *pipasa*, and *kshudha dhikya* manifest. However, because of the barrier of *srotas*, the transformation of *uttara-dhatu* 's does not occur as intended.

Kshaya of these *Dhatus*, such as *Asthi*, *Majja*, and *Sukra*, therefore, occurs for this reason. This leads to the development of symptoms such as osteoporosis, neuropathic pain, and infertility.

Here is a schematic representation of the entire disease manifestation process.

Chart No. 4: Samprapti



Samprapti Ghatakas

- Udabhava sthana - Amasaya
- Sanchar sthana - Rasayani

- Vyakta sthana - Whole body
- Adhithana - Whole body specifically udara, sphika, stana
- Dosha - Tridosha, Samana-vayu, Apana-vayu, Vyana-vayu, Pachak-pitta, Kledaka-kapha,
- Dushya – Rasa-dhatu and Meda-dhatu
- Agni mandya – Medo dhatvagni mandya, Jatharagni mandya
- Ama – Medo dhatugata
- Pradhanata – Dhatvagni mandya, Santarpan janya
- Srotasa – Anna-vaha srotas, Rasa-vaha srotas, Mamsa-vaha srotas, Medo-vaha srotas
- Sroto dushti - Sanga, Vimarga gaman, Avarana
- Swabhava - Chirakalina

1.3.27: Pathophysiology of obesity:

The pathophysiology of obesity is based on the general principle that increased functional demand stimulates enlargement (hypertrophy) and/or proliferation of the cells involved (hyperplasia). This suggests that in severely obese individuals, there may be an increase in the number and/or size of adipose cells, which may be due to either functional demand at a given age or sex or genetic, endocrine, behavioural, psychological, or iatrogenic factors. Adipose cells diminish in size during weight loss, although hyperplasia does not change.¹⁹⁶

It can be challenging, if not impossible, to distinguish clearly between the normal and pathological stages of excessive adipose tissue accumulation. But there's no denying that enormous obesity is unhealthy and needs to be considered a pathological condition.

The main feature of adult-onset obesity is little hyperplasia and hypertrophy of adipose cells. Aside from the standard depot's expanded size. For example, in obesity, the epicardium adipose tissue, the omentum, the subcutaneous tissue, and the retroperitoneal tissues may extend to the area where they are ordinarily absent.

Obesity is primarily caused by three components in its pathogenesis: ¹⁹⁶

i. High levels of lipid accumulation

ii. Reduced levels of lipid mobilisation

iii. Reduced utilisation of fat

i. High levels of lipid accumulation: Increased food consumption or hypothalamic abnormalities are the causes of excessive lipid deposition. hyper lipogenesis or hyperplasia of adipose cells. Increased food intake through the metabolism of proteins, carbs, and fats ultimately turns into fat, which is then stored in fat depots.

ii. Reduced levels of lipid mobilisation: Defective cells, aberrant autonomous innervation, or a reduction in lipolytic hormones are the possible causes of diminished lipid mobilisation. Adipose tissue's unsaturated fatty acid mobilisation is stimulated by adrenaline and thyroid; abnormalities in these two processes result in reduced lipid mobilisation, which in turn produces excessive lipid accumulation, which eventually causes obesity.

iii. Reduced utilisation of fat: Ageing, poor lipid oxidation, poor thermogenesis, or inactivity are the causes of diminished lipid utilisation. It is the primary pathophysiology of obesity in middle life.

1.3.28: *Sthaulya Upadrava*.

Chronic *sthaulya* consistency causes some unusual consequences, which deform multiple systems and organs and ultimately culminate in *Ojo dusti* and death.

Extreme *sthaulya* intensity and severity brought on by *Ati-kshudha* and *Ati-pipasa*, as well as the appearance of serious complications and even death as a result of carelessness; if *Kala vyatikrama* takes place, then *Vata dosha* and *Pitta dosha* dominance will lead to a variety of issues.

As per Acharya *Charaka*,

विकारांश्चाश्रुते घोरान् कांश्चित्कालव्यतिक्रमात्॥६॥

एतावुपद्रवकरौ विशेषादग्निमारुतौ। एतौ हि दहतः स्थूलं वनदावो वनं यथा॥७॥

(Ch.Su.21/6-7)

Agni and *Vata dosha* are the two complicated factors that are the particular agents of chaos because of the chronic consistency of *Sthaulya*.

Here, Acharya Gangadhara has explained *Kala Vyatikrama* as a later stage of life.

Both of these theories appear to be correct since therapeutic starvation and a very low-calorie diet have been linked to increased problems and even mortality in older obese people. Acharya *Charaka* did not name any particular *Upadhravas*, however certain treatises have mentioned a handful.¹⁸⁰

Table No. 17: Upadravas Sthaulya

Upadrava	Su	A.S.	A.H.	M.N.
Ama Roga	-	-	+	-
Arsha	-	+	+	-
Atisara	-	-	-	-
Bhagandara	+	+	+	+
Jvara	+	+	+	+
Jantuvaha (Parasitic diseases)	-	-	-	-
Kamala	-	-	-	-
Kasa	-	-	+	-
Kshudha	-	-	+	-
Mutrakrichhata	-	-	+	-
Prameha	-	+	+	-
Pramehapidika	+	+	-	+
Shleepada	-	-	-	-
Sanyasa	-	-	+	-
Udara Roga	-	+	+	-
Urustambha	-	+	-	-
Vata Vikara	+	-	-	+
Vridhhi	+	+	-	+

Following a comprehensive study, these *Upadravas* can be further classified into the following patterns.

- i. *Upadravas* as a result of *Agni Vikriti*: The emergence of *Upadravas* such as *Atisara*, *Ajirna*, *Arsa*, and *Udararoga*, among others, can be attributed to *Agni* malfunction and *Ama* creation.
- ii. *Upadravas* as a result of vitiated *Meda*, especially *Baddha Meda*, *Vidradhi*, *Apachi*, *Slipada*, *Visarpa*, *Pramehapidika*, etc. In addition to these, illnesses

caused by the vitiation of *Meda*, such as *Vridhhi*, *Granthi*, *Galganda*, *Arbuda*, etc., can be considered *Upadravas* of *Sthaulya*. According to *Acharya Sushruta* *Granthi* and *Vrana* are described as signs of *Medo-gata Vata dosha*.¹⁹⁷

The symptoms of *Medo-gata Pitta*, which include *Medoja Granthi*, *Daha*, and *Vamana*, might appear as *Upadravas* in *Sthaulya* patients.¹⁹⁸

The cause of *Mutrakriccha*, *Prameha*, and other *upadravas* is vitiated *Meda*, especially *Abaddha Meda*.

The most common side effect of *Sthaulya* is *Prameha* because its *Nidana* and *Dosha Dushya* are comparable.

Charaka has explained the relationship between *Madhumeha* and *Meda*, in *Nidhan stana* and *chikitsa stana* of *charaka Samhita*.^{181,189}

Additionally, *Acharya Sushruta* has mentioned *Apathya Nimitaja Prameha*, which is caused by a *Stula* person's overeating habit.

Due to dominant *Meda Dushya*, *Madhumeha* is described as a symptom of *Medo-vridhhi* and as a *Meda janya vyadhis* (disease).

Sthaulya and *Meha* are listed as disorders of *Medo-gata Sleshma*.¹⁹⁸

- iii. In patients with *Sthaulya*, *upadravas* can cause due to *Avarana* which will lead to the *utpatti* of *Vata vyadhi*, *Urustambha*, *jwara*, etc., the reason for this may arise from *Vata dosha* obstruction by *meda*.
- iv. *Sthaulya's upadravas* were affected by *sweda-badha* and poor personal cleanliness. *Bahya Krimi* has this kind of impact. *Kushtha* events recorded by *Bahya Krimi* are widely recognised.

Hence, vitiated *Meda* and *sweda-badha* may result in parasite illness and *Kushtha*-like consequences. Once more, *Meda* is identified as the seat of *Medogata Kushtha* and *Kriccha Sadhya Shvitra*.

- v. *Upadrava* can happen as a result of *dusti* of *prana* in *sthaulya* patients and may be caused by *Vyadhi kshamatva* because of *Prana vikriti* and *Oja Dushti* this will lead to *Kasa, Swsa, Sanyasa etc upadravas*.

Sanyas can result from *Prana* and *Oja's dushti*, which is brought on by an excessive amount of *Ama* forming. After coma is observed in cases of CHD and CVA, we may treat *sanyas* as syncope or coma.

Obesity-related problems are more likely in both CHD and CVA.

1.3.29: Complications of Obesity.

A type feature of the disease called obesity can lead to numerous serious and minor ailments.

Diabetes, the most common metabolic condition that also causes kidney disease, significantly shortens life expectancy. Being overweight increases the risk of developing several different diseases.

Obese people are considerably more likely than slender people to have hypertension, adult-onset diabetes, and hyper-lipidaemia—three of the strongest risk factors for coronary artery disease.¹⁹⁹

Furthermore, losing weight significantly improves these conditions, indicating that obesity may have a role in their genesis. Obesity can cause a variety of orthopaedic disturbances, such as low back pain, and aggravated osteoarthritis, especially in the knees and ankles, and frequently result in large calluses on the feet and neck.²⁰⁰

A typical issue in obesity is reduced glucose tolerance and hyperglycaemia while fasting. Obesity is linked to a marked resistance to the action of insulin, which raises the need for insulin and leads to hyperinsulism.

1.3.30: Sadhya-Asadhyata of Sthaulya

Sahaja Sthaulya's is considered as *Asadhyata* (incurable) or poor prognosis, according to the majority of Acharyas. Additionally, *Acharya Charaka* stressed that treating *Sthaulya* is more challenging than treating *Karshya* (emaciated).

The poor prognosis for *Sthaulya* has been mentioned by *Acharya Charaka* as

मेदस्यतीव संवृद्धे सहसैवानिलादयः।

विकारान् दारुणान् कृत्वा नाशयन्त्याशु जीवितम् ॥८॥

This means that an obese person or *Sthaulya* is more likely to die from different health problems, extreme hunger, and thirst if their weight is not well managed.¹⁸⁰

1.3.31: Prognosis Of Obesity.

If left untreated, the prognosis is bad and tends to worsen. An obese person can easily lose up to 5 kg of weight; this explains the fleeting effectiveness of many well-known diet plans. According to statistical research, a weight loss of 12 kg was maintained as the benchmark for a successful course of treatment. Drug therapy for obesity is typically not necessary in the short term because obesity is a problem that cannot be anticipated to go away without ongoing care, and many obese people will often stubbornly refuse to change despite their best efforts. Obese people die from secondary metabolic problems 4–5% more often than people with normal weights.

Most people are unaware of how different it is to achieve additional weight loss; numerous clinic experiences have revealed that patients find it challenging to keep their weight loss. Given that this necessitates some long-term energy intake reduction.²⁰¹

1.3.32: Metabolic Healthy Obese.

Embracing the complex interplay between an individual's weight, metabolism, and overall health in the context of metabolically healthy obesity.

Since being overweight or obese with inappropriate subcutaneous fat buildup on the body has become a prevalent problem, one of the most prominent topics among academics. and additionally, its link to the rising danger of metabolic syndrome.²⁰²

However, the identification of an obese subgroup known as Metabolically healthy Obese, or MHO, with no obvious co-morbidities lends credence to the idea that there are protective variables that can be used to prevent or treat obesity-associated metabolic dysfunction.

Definition and Epidemiology: Traditionally, a body mass index (BMI) of 30 kg/m² defines obesity.²⁰³ Despite the consensus that obesity causes metabolic disorders such as type 2 diabetes, hypertension, and dyslipidaemia, However, studies have found that some obese persons have low-risk or healthy characteristics that are on the verge of minor insulin resistance; these people are known as metabolically healthy obese (MNO) people. In obese patients, the observed frequency of MHO ranges widely, ranging from 10–30% based on metabolic health parameters set by various reports.²⁰⁴

Metabolic Health Indicators: Additional metrics used to characterise the metabolic health of obese individuals include.²⁰⁴

1. Unlike lean individuals, metabolically unhealthy obese (MUO) patients usually have insulin resistance, whereas MHO subjects have normal insulin sensitivity similar to lean people.

2. Compared to MUO people, MHO had better lipid profiles with higher HDL cholesterol and lower triglyceride levels.

3. Inflammatory Markers: MHO people had lower levels of interleukin-6 (IL-6) and C-reactive protein (CRP), which suggests less systemic inflammation.

4. Adipokines: Compared to other components like Adiponectin, higher levels of adipokines have been seen in certain settings (such as MUO) and other settings (e.g., leptin), indicating heterogeneity of fat tissue function across MHO & MUO individuals.

Pathophysiological Mechanisms: There are several factors involved in the MHO phenotype, although their exact causes are unknown. Numerous theories have been proposed about why some people are bigger than others.

Fat Distribution: The primary cause of metabolic dysfunction is visceral adiposity rather than overall fat mass. MHO individuals tend to have safer subcutaneous fat instead of intra-abdominal fat, which is more biologically "toxic" visceral fat.

Function of Adipose Tissue: Adipocyte function is significantly influenced by adipogenicity and inflammatory characteristics. Patients with MHO frequently have reduced inflammation and a higher capacity for adipose tissue to grow without ectopic fat deposition, which results in a decrease in the expression of cells that cause IR.

Genetic and Epigenetic Variables Associated with Obesity-Related Illnesses: An individual's susceptibility to metabolic diseases is influenced by both genetic predispositions and epigenetic alterations.²⁰⁴

Prognosis and Clinical Implications: The existence of an MHO phenotype has significant clinical ramifications. Despite having a superior metabolic profile than MUO obese adults, MHO individuals are not completely protected against all of the

adverse impacts of gaining excess body weight. As they become older and/or accumulate additional risk factors, some MHO people may eventually become metabolically unwell.²⁰⁵

Additionally, when developing treatment strategies, the distinction between MHO and MUO is important. For those with various metabolic profiles, they could result in alternative weight loss beginning and prioritisation (with a focus on metabolic health rather than just lowering body weight).

1.4 JUSTIFICATION

This study is justified by the rising incidence of obesity, especially in India, where swift socio-economic transformations have resulted in a dual challenge of undernutrition and obesity. The World Health Organization (WHO) has classified obesity as a serious public health issue, related to several metabolic disorders such as diabetes, hypertension, and cardiovascular diseases. Notwithstanding its importance, the comprehension and categorisation of obesity within conventional paradigms, especially Ayurvedic medicine, are still inadequately investigated. This research aims to reconcile contemporary biomedical theories with traditional Ayurvedic doctrines by examining the biochemical alterations linked to *Medho Sara* (the quality of adipose tissue) and *Sthaulya* (obesity).

Comprehending *Medho Sara* and *Sthaulya*:

In Ayurveda, *Medho Sara* signifies a physiological state characterised by healthy fat tissue that facilitates bodily activities, whereas *Sthaulya* indicates a pathological condition characterised by excessive adiposity. The distinction between these two stages is essential for precise diagnosis and treatment. However, present clinical methods often fail to notice this distinction due to a lack of objective markers. This study seeks to elucidate these notions by analysing biological markers that can objectively distinguish between *Medho Sara* and *Sthaulya*.

Importance of Biochemical Parameters:

The analysis of biochemical indicators such as adipokines (e.g., Adiponectin and Leptin), lipid profiles, and blood glucose levels is vital for understanding the metabolic implications of body fat distribution. Previous research has suggested that distinct adipokines play key roles in regulating metabolism and inflammation. By evaluating

these characteristics in individuals with high BMI, this study will contribute to understanding how healthy and pathological states of adipose tissue manifest biochemically.

Confronting Metabolically Healthy Obesity:

A significant occurrence within the obesity spectrum is Metabolically Healthy Obesity (MHO), characterised by individuals possessing extra body fat yet lacking the usual metabolic problems linked to obesity. Understanding the metabolic distinctions between MHO and those with pathological obesity can inform prevention methods and therapeutic therapies. This study attempts to explore these disparities by linking body fat percentage with biochemical markers, so providing insights into the intricacies of obesity.

Potential for Clinical Application: Establishing objective measures for discriminating between *Medho Sara* and *Sthaulya* can considerably impact clinical practice. Accurate classification may lead to more individualised treatment approaches that meet the specific needs of individuals based on their metabolic profiles rather than just on BMI or physical appearance.

By explaining these links, the research has the potential to educate therapeutic practices, better preventative interventions for obesity-related disorders, and contribute to a more nuanced knowledge of metabolic health in varied populations. The findings could pave the way for future research targeted at developing integrated ways to manage obesity that respect both old knowledge systems and contemporary scientific breakthroughs. This method could enhance health outcomes by tackling underlying metabolic disorders rather than merely weight loss.

2. MATERIALS & METHODS

2.1: Study Design.

A Case/Clinical Series Observational Study

2.2: Source of the Study.

Data was collected through a structured questionnaire, clinical examination, and blood investigation of the patient attending the Utsaha OPD of KAHER Sri BMK Ayurveda Mahavidhyalaya, Belagavi. The study was carried out after obtaining Institutional Ethics Committee permission and written informed consent from all the participants.

2.3: Informed Consent.

Informed consent Form (ICF)/ Participant information sheet in English, Kannada, and Marathi as per their preferred language, was obtained from each participant before the study-related procedures. Participants were also informed of their right to opt out of the study without giving any reasons.

2.4: Methodology.

Steps of Study: - The present work has been executed in the following steps: -

- I. Validation of the Case sheet/Questionnaire on Medho Sara and Sthaulya for reliability and consistency
- II. Identify the individuals of Medho Sara or Sthaulya from the enrolled participants.
- III. Assessment of Anthropometric parameters, Body fat Percentage, and Bio-chemical parameters in identified Subjects.
- IV. Analyzing and comparing the results.

I. Validation of the Case sheet and Questionnaire on Medho Sara and Sthaulya for reliability and consistency.

Ia: Development of a questionnaire

Ib: Valid Study

Ic: The process of validating and standardizing a questionnaire.

Stage Ia: Developing the Questionnaire: A preliminary inventory of things pertaining to *Medho Sara* and *Sthaulya* was compiled, utilizing the classical description of their characteristics, and subsequently transformed into an interrogative format and provided in questionnaires. We meticulously designed the study and adapted certain questions to align with current circumstances and enhance the Ayurvedic system.

Later, focus group interviews were done with individuals and healthcare experts to examine thoughts about the positive and negative features of the questionnaire. A preliminary version of the questionnaire was finalized based on the traits of *Medho Sara* and *Sthaulya* and focus groups. The questionnaire items were designed to be clearly comprehensible and answerable by subjects aged 16 years and older.

Stage Ib: Validity Trial Study: A survey was conducted among 30 patients who were attending the Utsaha Outpatient Department (OPD) at KAHER Sri BMK Ayurveda Mahavidhyalaya, Belagavi. The subjects were given a questionnaire and explained the contents in local languages (Kannada and Marathi) and were given appropriate time to complete the questionnaire independently.

The participants were allowed to record their responses in a way that best represented them by selecting one of the three alternatives presented for each topic.

(Annexure-I). The participants were given appropriate time to complete the questionnaire.

Stage Ic: The process of validating and standardizing a questionnaire: The validation was carried out on 30 completed surveys, with practically all items answered. The demographic and anthropometric details were assessed and entered. The data analysis was done using the program 'Statistical Package for Social Sciences', Version 22 (SPSS Inc., Chicago, IL, USA). For the durability of the conversion of replies into numerical format, the inputs were translated into a linear scale of 0 to 3.

For validation, each portion of the questionnaire was viewed as an independent scale, and these scales were assessed for their reliability using Cronbach's alpha.²⁰⁶

While validating the scales, alpha values greater than 0.7 and item-total correlation greater than 0.2 were considered acceptable. Wherever the value of Alpha was greater than Cronbach's coefficient alpha, the relevant items were eliminated, the complete process of validation was repeated, and thereafter, the scales were finished. For data deduction, factor analysis was carried out, and factor loading above 0.4 was considered.

To assess the *Brihat Sharira* in *Medho Sara*, the **Body Surface Area** evaluation formula created by Du Bois and Du Bois²⁰⁷ was employed. The validated questionnaire was printed on A4-sized paper and distributed to subjects.

II. Identify the individuals of Medho Sara or Sthaulya from the enrolled participants using the validated tools.

To identify the individuals having the characteristics of *Medho Sara* and *Sthaulya*, 305 (based on sample size calculation) normal individuals having endomorph and

mesomorph body types, age group between 18 to 55 years, and who were willing to participate in the study were enrolled.

a. Socio demographical study: -

Prashna Pariksha completes it via questionnaire. This has been carried out in order to track *Medho Sara's* and *Sthaulya's* dissemination throughout society. Name, age, sex, religion, job, education, address, and eating habits, income level, and addictions are all included.

b. Assessment of Physical Characteristics: -

The Physical Characteristics of *Medho Sara* and *Sthaulya* like *Chala*, *Sphiga*, *Udara* & *Sthana*(CSUS), *Ayata upachaya* (Improper growth), *Utsaha Hani* (diminished level of energy), *Swedadhikya* (Excess sweating), *Daurgandhya* (Foul smell), *Ayasa Swasa* (Dyspnoea on exertion), *Nidradhikya* (Excessive sleep), *Ati Kshudha* (Excessive hunger), *Ahara Kala* (Frequency of food intake), *kshudha souhitya* (feeling of satiety after food), *Alpa vyayama* (Poor physical endurance), *Anga gourava* (feeling of heaviness), *Anga Shitilata* (Flabbiness of the body), *Gatra Sada* (Fatigue), *Snigdha Varna*(luster), *Snigdha Keshha*(Hair), *Snigdha Purisha*(Stool) and *Bruhatshareera* are examined by *Prasna Pariksha* (asking certain relevant questions through validated questionnaire).

Their height was measured with a calibrated stadiometer (seca), Participants were asked to stand in bare feet that were held together, the head was level with a horizontal Frankfort plane.

Weight was recorded using digital scales to the nearest 100 g, Equipment was calibrated routinely by standard weights (4×10 kg and 8×10 kg). Patients were asked to wear light clothing and bare feet.

Body Mass Index (BMI) was calculated by dividing the weight (in kilograms) by the height (in meters) squared ($\text{BMI} = \text{kg}/\text{m}^2$).¹⁹⁹

In the scoring scheme for Medho Sara, out of a total score of 54, the individuals who scored above 36 were selected for further assessment. Those who scored below 36 were considered Avara Sara and were discarded for further study.

A similar assessment pattern was employed for the identification of Sthaulya individuals also.

Individuals who met the requirements for both Medho Sara and Sthaulya were identified and placed in the appropriate categories.

III. Assessment of Anthropometric parameters, Body fat Percentage, and Bio-chemical parameters in selected Subjects.

From the above-identified participants of *Medho Sara* (n=51) and *Sthaulya* (n=29) were taken up to undergo an assessment of Anthropometric parameters, Body Fat Percentage, and Bio-Chemical changes, a minimum of 3 hours post glucose intake.

i. Anthropometric parameters:²⁰⁸

1. Height (from the existing record)
2. Weight (from the existing record)
3. Body Mass Index (BMI) (from the existing record)
4. Waist Circumference: measured with a non-stretch Teflon tape (SECA 203) midway between the lower rib margin and the iliac crest, at the end of expiration. (ref)
5. Hip circumference was measured as the maximum circumference at the level of the buttocks

6. Waist-hip ratio (WHR) [by calculation]
7. Mid- circumference of a calf, thigh, and upper arm
8. Body Fat Percentage using TANITA BC-1000plus: The subject was instructed to place his or her bare feet on the measuring platform, which is linked to relevant software (Healthy Edge loaded on the laptop) which displays the on the screen. ¹⁶⁸
 - Principle: Tanita BC – 1000plus uses the Bioelectrical Impedance Analysis (BIA) approach to analyse body composition. Body impedance is determined when a low-level, safe electrical signal—roughly 500 microamperes at 50 kHz—is transported through the body via fluids and water. As fat tissue contains little water, it acts as an impedance to the signal. (Muscle typically has between 50–70% hydration, while fat has about 10-15%) The body's total amount of fat and lean tissue is then determined using this impedance data, through an approach known as multiple regression analysis. ¹⁶⁸

ii. **Biochemical profiling:**

- For this, 15 ml of blood will be collected from participants of each group, from the anti-cubital vein under aseptic conditions. It was collected in a plain tube, from which serum was separated and used for estimation of the following

Haemogram

- a. CBC
- b. Lipid profile (Triglycerides, Cholesterol, HDL-C, LDL-C),
- c. Blood glucose and Insulin
- d. Creatinine, Alkaline phosphatase and CRP

iii. Special Investigations

The following special biochemical parameters were studied:

- a. Serum levels of adipocytokines (adiponectin and leptin),
- b. Inflammatory markers (IL-6, TNF- α)

a. Assessment of Adiponectin: Adipocyte complement-related 30 kDa protein (ACRP30), another name for Adiponectin, is a serum protein that is released and only expressed by differentiated adipocytes. Human Adiponectin ELISA kits from Krishgen Biosystem²⁰⁹ on Epoch (sl. number 2105135) were used to measure serum Adiponectin levels by immune enzymatic methods (ELISA-based)

At 450 nm, absorbance is measured.

Reference range: between 2 and 32 ug/ml

b. Assessment of Leptin: Leptin is mostly produced and secreted by adipocytes, and its concentration in serum is directly correlated with the quantity of adipose tissue. ELISA-based immune enzymatic methods were used to measure serum leptin levels. Commercial Human Leptin ELISA kits were obtained from Krishgen Biosystem²¹⁰ and were assessed on Epoch (sl. no. 2105135). At 450 nm, absorbance is measured. 0.5–100 ng/mL is the standard calibration range.

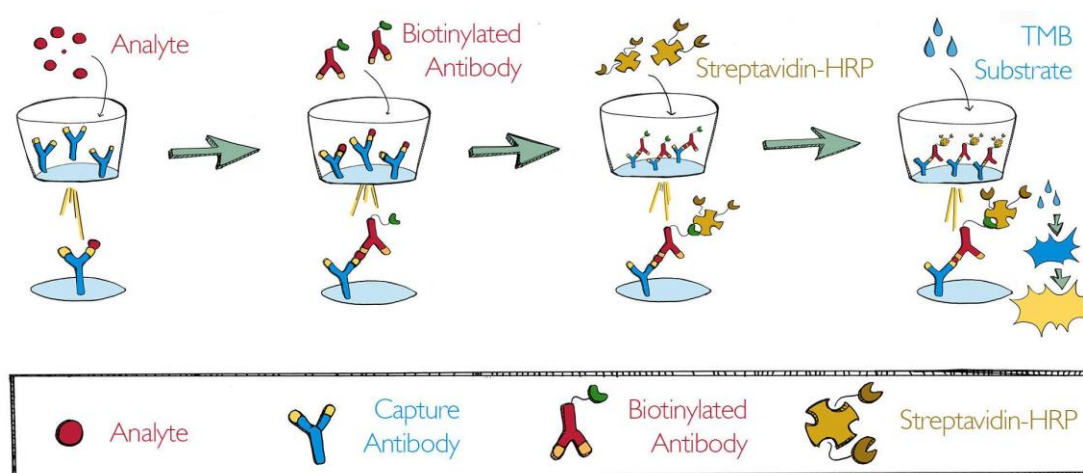
c. Evaluation of IL-6: Human IL-6 is a 20.9 kD protein with 184 amino acids. It is a strong lymphoid cell growth factor that promotes the growth and survival of certain B and T lymphocytes immune enzymatic methods (ELISA-based) were used to measure IL-6 levels. Commercial Human IL6 ELISA kits were obtained from Krishgen Biosystem²¹¹ and analysed on Epoch (sl. number 2105135). The range of the dynamic assay is 6.25 pg/ml to 400 pg/ml.

d. Assessment of the tumour necrosis factor- α : TNF- α , also known as tumour necrosis factor- α , is a strong lymphoid factor that kills a variety of cancer cells as well

as some other target cells. TNF- α in humans is a 17.4 kDa protein with 157 residues of amino acids. utilising commercially available Human TNF- α ELISA kits from Krishgen Biosystem²¹² on Epoch (sl. number 2105135), TNF- α was measured utilising immune enzymatic methods (ELISA based). Assay Range for 1.56 to 100 ng/ml

Principle: The sandwich ELISA technique is used in the procedure. Microwells are pre-coated with monoclonal antibodies. Pipetted samples and standards are placed into microwells, where the antibodies bind to the Adiponectin, Leptin, IL-6, and TNF- α present in the sample. To create a complex, the biotin-labeled antibody is added, pipetted, and then streptavidin-HRP is incubated. Following a wash to eliminate any non-specific binding, the microwells are filled with the substrate solution (TMB), and colour develops in a proportion to the sample's levels of adiponectin, leptin, IL-6, and TNF- α . Next, a stop solution is added to halt the development of colour.²¹³

Figure No.5: Adiponectin sample concentration determination



iv. Analysing and comparing the results obtained

Medho Sara and *Sthaulya* were calculated by points scored for each character and were graded as follows:

Table No.18: Score assigned to *Medho Sara* and *Sthaulya*

Score	Medho Sara	Sthaulya
Above 45	Pravara Sara	Ati Sthaulya
Between 36 - 45	Madhyama Sara	Madhyama Athaulya
Below 27	Avara Sara	Alpa Athaulya

2.5: Study Population:

I. Inclusion criteria:

- i. Participants of either sex, BMI ≥ 25 kg/m²
- ii. No history of major illness
- iii. Not taking any kind of medication that affects the weight (paroxetine, valproic acid, Fluoxetine, mirtazapine, olanzapine, prednisone, chlorpromazine, amitriptyline, fexofenadine and pseudoephedrine, chlorpropamide, Insulin, atenolol, Birth-control pills, levothyroxine) before participation in the study²¹⁴
- iv. The volunteer should be willing to abide by trial procedures and give written informed consent.

II. Exclusion criteria:

- i. Individuals suffering from any infectious disease.
- ii. Individuals taking weight gain supplements.
- iii. Individuals undergoing elective surgeries (abdominoplasty).
- iv. Individuals suffering from psychological disorders.
- v. Non-ambulatory
- vi. Pregnant and lactating females

2.6: Ethical Considerations:

I. Approval of the Ethics Committee:

Before initiating the study; approval for the study protocol, written informed consent document including participant information sheet, consent form updates, and participant recruitment procedures will be obtained (e.g. advertisements in colleges, offices, etc.) from the Institutional Ethics Committee.

II. Informed Consent:

Informed written consent was obtained from each participant in the prescribed format before the performance of study-related procedures (i.e. physical examination, laboratory screening or any other investigational procedure). The participants were be given full information about the study as well as a description of any foreseeable risks and discomforts. Participants was also be informed of their right to opt out of the study at any time without giving any reasons.

III. Good Clinical Practice (GCP):

The study was conducted in accordance with the principles of Good Clinical Practice that has its principles as reported in the Declaration of Helsinki

2.6: Statistical Considerations:

I. Sample Size:

On the base of the outcome of previous data on the prevalence of 73% and with a precision of 5 % and confidence of 95 %, the sample size will be – 305.

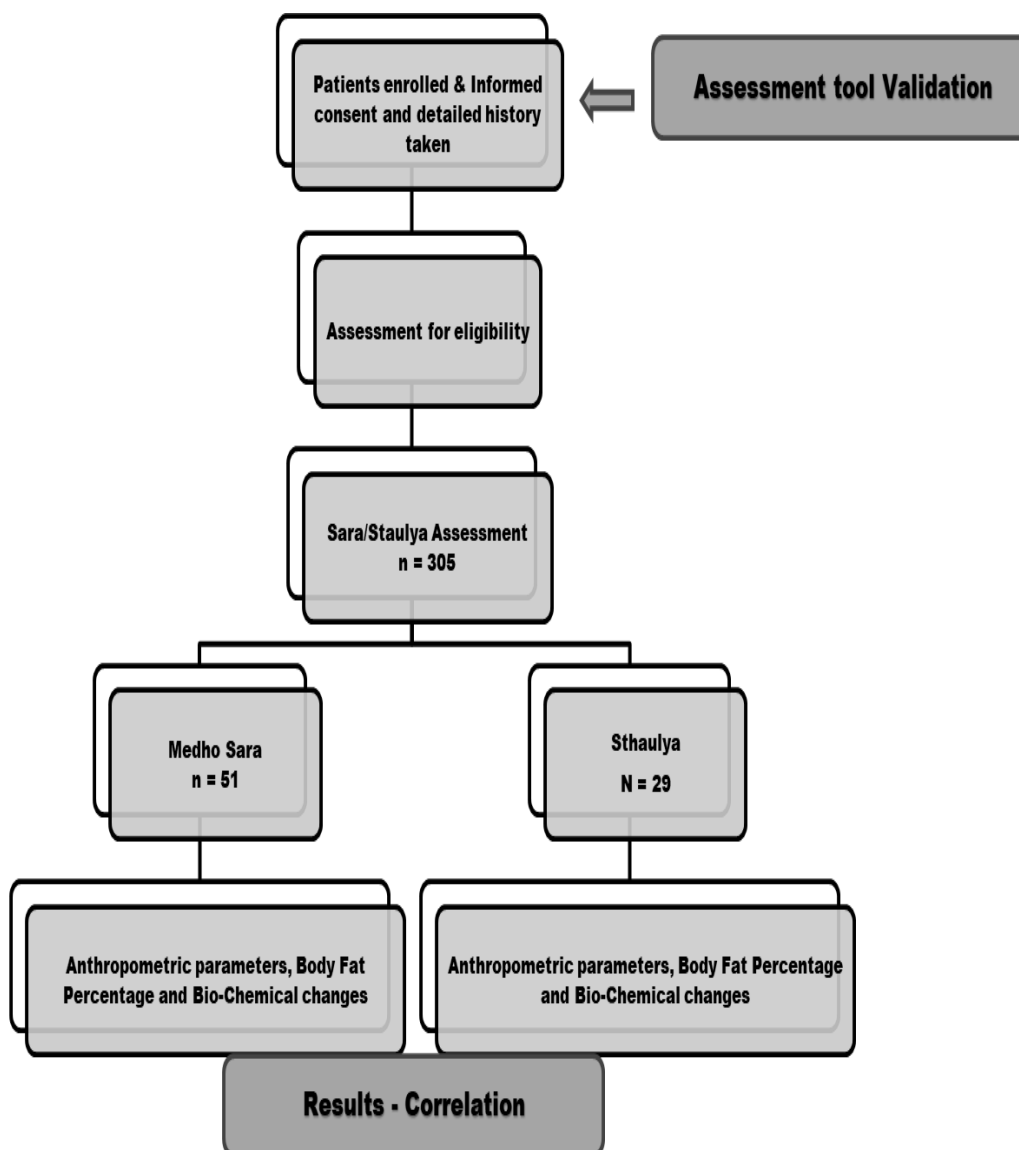
Formula

$$n = Z^2pq/d^2$$

Z= 1.96 p = 73% q = 27%
--

2.7: Study Design:

Chart No 5: Study Design



3. DATA ANALYSIS PLAN

- The completed case sheets were gathered and data input was performed in the SPSS software version – 28.
- The demographic information and the questionnaire answers were entered using the 'string' and 'numerical' formats, respectively.
- Data cleansing was done after the data entry.
- Categorical variables were presented in number and percentage (%) and continuous variables (presented as mean $\pm$ SD).
- For continuous variables, comparisons between groups were done using a t-test, and for categorical variables, a chi-square test was employed.
- To determine whether there was a correlation between the study's objective and subjective parameters, the responses were compiled, and the results were evaluated using pertinent statistical tests such as the Pearson correlation analysis and Spearman's correlation

4. OBSERVATIONS & RESULTS

4.1: Questionnaire Development and Validation

Table No. 19: Questionnaire Development and Validation

Phases	Nature of activity	Methods	Domains	Number of items	Response range	Addition or subtraction
I	Development of construct	Literature review	-	21 Medho Sara 33 - Sthaulya	-	-
II	Development of Construct	FGD	-	54 + 14 = 68	-	14 anthropometric added
III	Development of Construct	Synthesize literature review and FGD	-	44	-	Subtraction of 24 overlapping items
IV	Item generation	Develop items	4	44	-	-
V	Establishment of face validity and content validity	Expert validation	4	32	3-point Likert Scale + ANT	Removal of 12 items
VI	Cognitive Interviewing	Pretesting	4	32	3-point Likert Scale + ANT	
VII	Establishment of construct validity	Item analysis and factor Analysis	4	32 (14+18)	3-point Likert Scale + ANT	

This table displays the different phases of questionnaire development and validation, which also contains any additions or deletions, activities, techniques, domains, and item count.

Phase I: The literature is reviewed to design the questionnaire. "*Medho Sara*" and "*Sthaulya*" as two domains, and included 21 items of *Medho Sara* and 33 items of *Sthaulya*.

Phase II: Focus Group Discussions, or FGDs, were conducted to obtain more

information about the proposal. In addition to the 54 items chosen in Phase, this added 14 more items, for a total of 68 items.

Phase III: Data from the literature review and focus groups are combined and After synthesis, 24 overlapping elements were removed, leaving 44 components.

Phase IV: the creation of forty-four items and the definition of four domains

Phase V: Validation to evaluate the items' suitability and comprehensibility; following verification, there are 32 items in total. Twelve items were removed, and a three-point Likert scale and anthropometric measurements (ANT) were added.

Phase VI: Conducting cognitive interviews to ensure that the items are comprehensible and unambiguous

Phase VII: Using factor analysis and item analysis, the questionnaire's constructs are examined for validity.

To ensure the validity and reliability of the questionnaire, the method heavily emphasizes item selection, validation, and reduction.

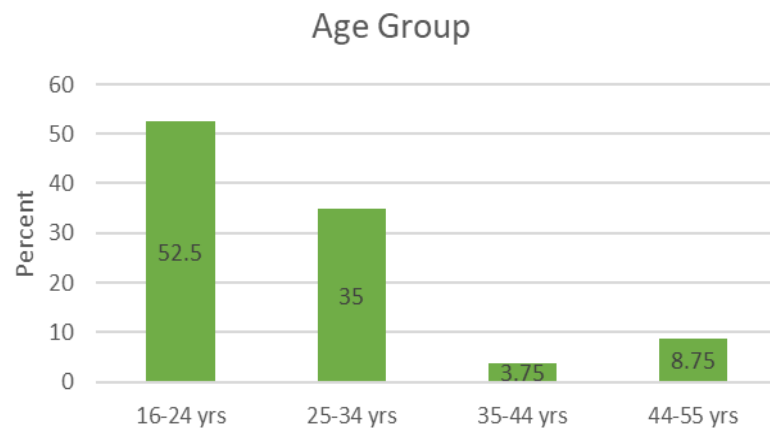
4.2: Age Group Distribution.

Table No. 20: Age-wise distribution of the participants

Age Group	Frequency	Percent
16-24 yrs	42	52.5
25-34 yrs	28	35.0
35-44 yrs	3	3.8
45-55 yrs	7	8.8
Total	80	100.0

Among 80 participants 42 (52.5 %) were from the age group of 16-24yrs, 28 (35 %) participants were from 25- 34 years, 3 (3.8%) participants were from 35-44 years, and 7 (8.8%) participants were from the age group of 45-55years.

Chart No. 7: Age-wise distribution of the participants



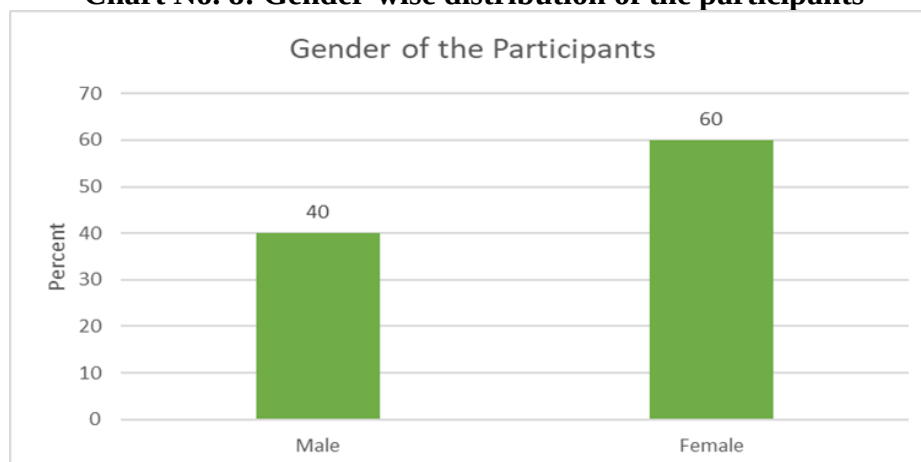
4.3: Gender-wise distribution.

Table No. 21: Gender-wise distribution of the participants

Gender	Frequency	Percent
Male	32	40.0
Female	48	60.0
Total	80	100.0

Among 80 participants 32 (40%) were male, and 48 (60 %) were female

Chart No. 8: Gender-wise distribution of the participants



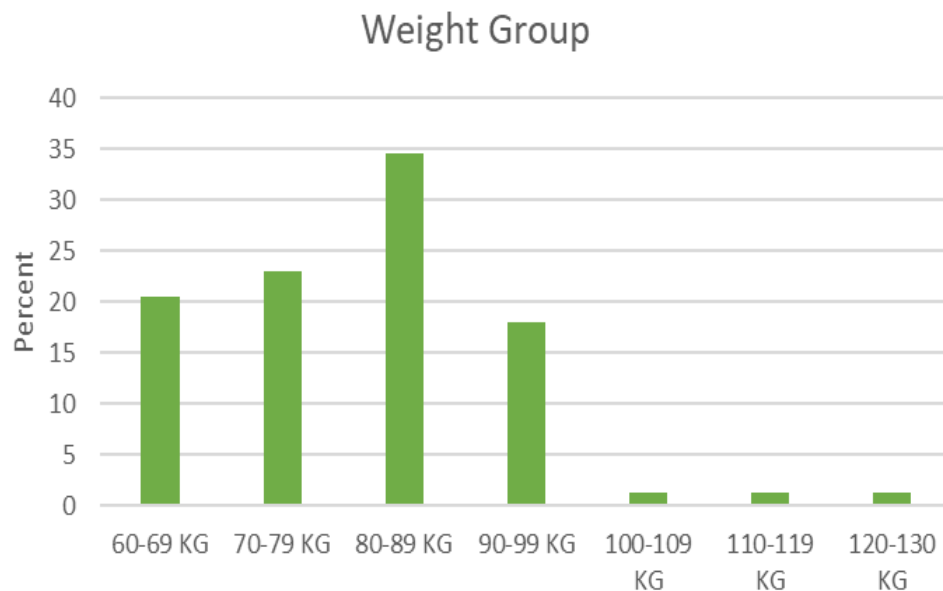
4.4: Weight distribution.

Table No. 22: Weight distribution of the participants

Weight Group	Frequency	Percent
60-69 KG	16	20.0
70-79 KG	18	22.5
80-89 KG	27	33.8
90-99 KG	14	17.5
100-109 KG	1	1.3
110-119 KG	1	1.3
120-130 KG	1	1.3
Total	80	100.0

Among 80 participants 16 (20 %) were of the weight group of 60-69 Kg, 18 (22.5 %) were of 70- 79 Kg, 27 (33.8%) were of 80-89 Kg, 14 (17.5%) were of 90-99 Kg, and 1 (1.3%) each in following 100-109 Kg, 110-119 Kg, and 120-130 Kg.

Chart No. 9: Weight distribution of the participants



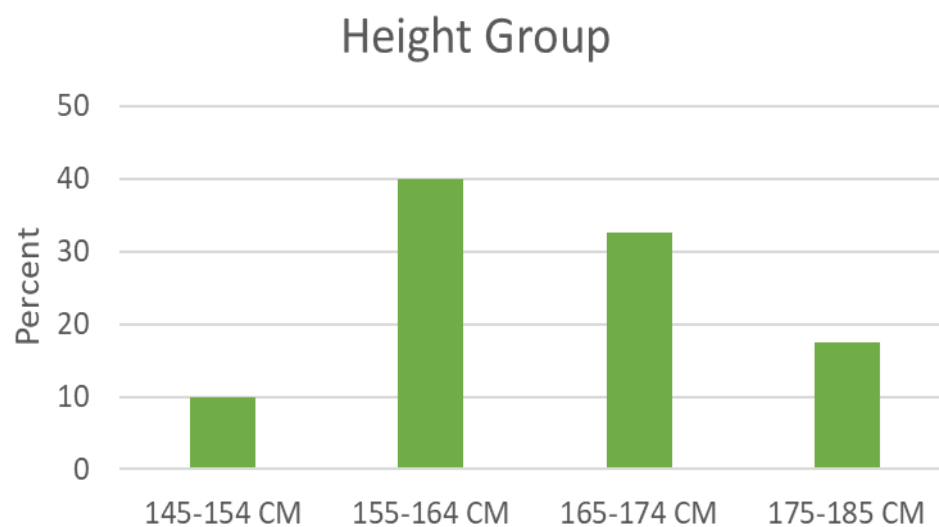
4.5: Height wise Distribution.

Table No. 23: Height-wise distribution of the participants

Height Group	Frequency	Percent
145-154 CM	8	10.0
155-164 CM	32	40.0
165-174 CM	26	32.5
175-185 CM	14	17.5
Total	80	100.0

Among 80 participants 8 (10 %) were in the height group of 145-154 cm, 32 (40 %) were in the height group of 155-164 cm, 26 (32.5 %) were in the height group of 165-174 cm, and 14 (17.5 %) were of the height group of 175-185 cm.

Chart No. 10: Height-wise distribution of the participants



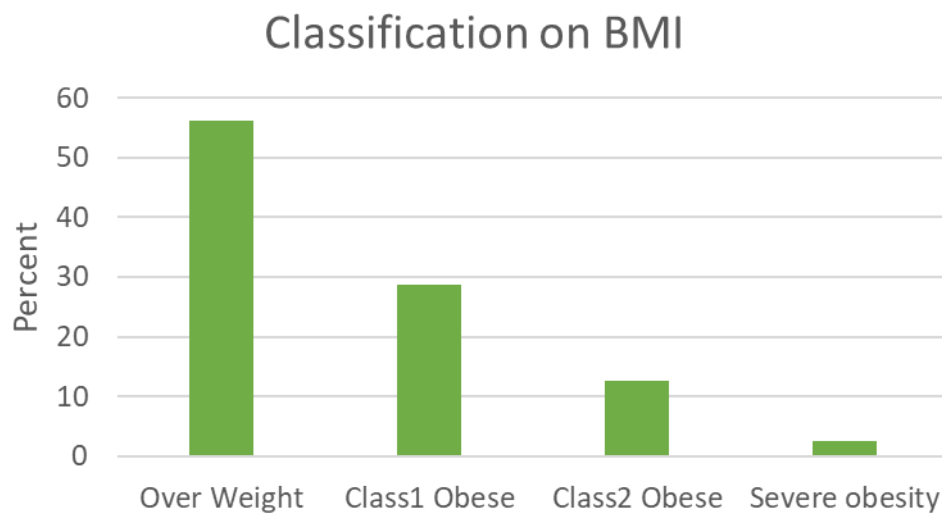
4.6: Classification Based on BMI

Table No. 24: BMI classification distribution of the participants

Classification on BMI	Frequency	Percent
Over Weight	45	56.3
Class-1 Obese	23	28.7
Class-2 Obese	10	12.5
Severely obesity	2	2.5
Total	80	100.0

Among 80 participants 45 (56.3 %) were overweight, 23 (28.7 %) were Class-1 Obese, 10 (12.5%) were Class-2 Obese and 2 (2.5%) were severely obese.

Chart. No. 11: BMI classification distribution of the participants



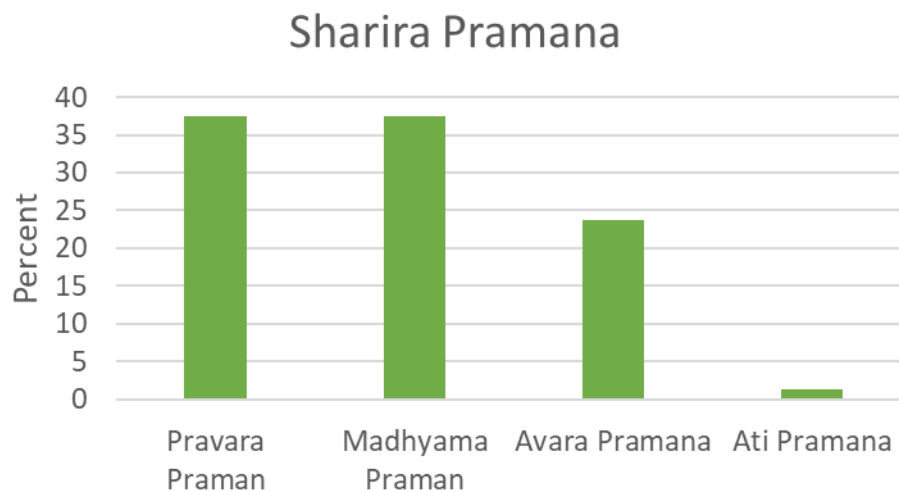
4.7: Distribution based on *Sharira Pramana*

Table No. 25: *Sharira Pramana* distribution of the participants

Sharira Pramana	Frequency	Percent
Pravara Praman	30	37.5
Madhyama Praman	30	37.5
Avara Pramana	19	23.8
Ati Pramana	1	1.3
Total	80	100.0

Among 80 participants 30 (37.5 %) were *Pravara Praman*, 30 (37.5 %) were *Madhyama Praman*, 19 (23.8%) were *Avara Pramana* and 1 (1.3%) were *Ati Pramana*.

Chart No. 12: *Sharira Pramana* distribution of the participants



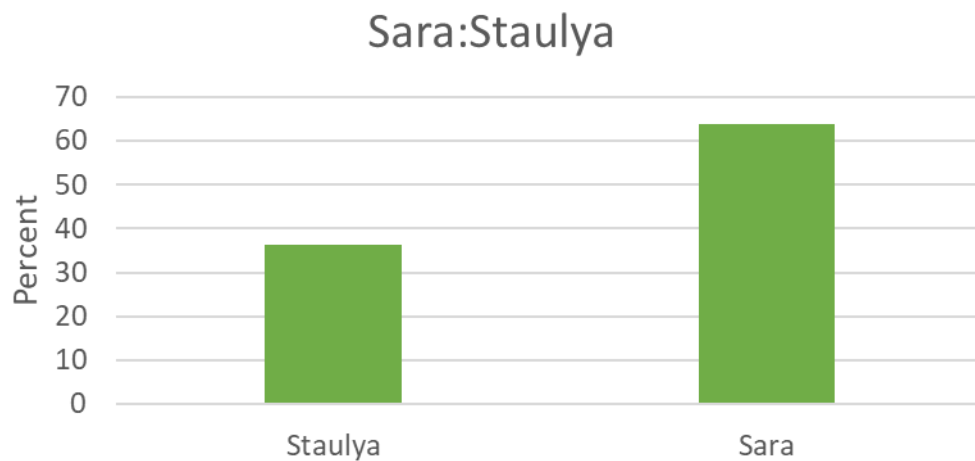
4.8: Distribution on *Medho Sara* vs *Sthaulya*

Table No. 26: Distribution based on *Medho Sara* and *Sthaulya*

Sara : Sthaulya	Frequency	Percent
Sthaulya	29	36.3
Sara	51	63.7
Total	80	100.0

Among 80 participants 29 (36.3 %) were identified as *Sthaulya*, and 51 (63.7 %) were identified as *Medho Sara* based on the score they received.

Chart No.13: Distribution based on *Medho Sara* and *Sthaulya*



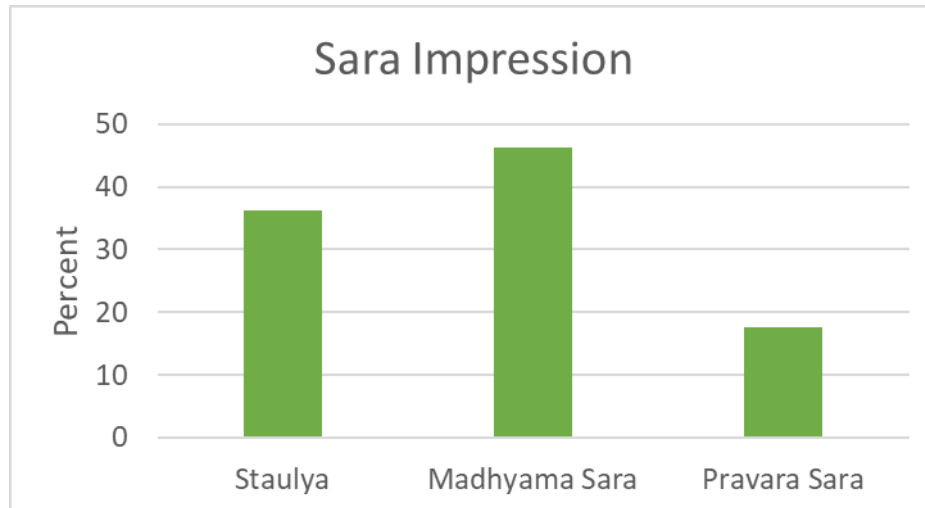
4.9: Medho Sara Impression

Table No.27: Distribution based on the classification of *Medho Sara*

Sara Impression	Frequency	Percent
Sthaulya	29	36.3
Madhyama Sara	37	46.3
Pravara Sara	14	17.5
Total	80	100.0

When further subdivisions of *Medho Sara* and *Sthaulya* were analysed among 80 participants 29 (36.3 %) were *Sthaulya*, 37 (46.3 %) were *Madhyama Sara*, and 14 (17.5%) were *Pravara Sara*.

Chart No.14: Distribution based on the classification of *Medho Sara*



4.10: Comparison of Age, Height, Weight, Body Fat Percentage and Body Surface Area to *Medho Sara* and *Sthaulya*

Table No. 28: Comparison of Age, Ht, Wt, BF% and BSA to *Medho Sara* and *Sthaulya*

	Sthaulya Mean $\pm$ S.D	Sara Mean $\pm$ S.D	P-Value
Age	29.41 $\pm$ 9.71	25.96 $\pm$ 7.03	0.07
Weight (Kg)	88.07 $\pm$ 13.03	77.36 $\pm$ 10.33	0.001*
Height(cm)	164.31 $\pm$ 9.85	164.15 $\pm$ 8.48	0.937
Body Fat %	39.21 $\pm$ 3.31	34.65 $\pm$ 5.56	0.001*
Body Surface Area	1.94 $\pm$ 0.18	1.84 $\pm$ 0.16	0.008*

* $P \leq 0.05$ statistically significant

In our study, the mean value of Weight distribution among *Sthaulya* was 88.07 $\pm$ 13.03 and 77.36 $\pm$ 10.33 for *Medho Sara*. Similarly, the mean values of Body Fat were 39.21 $\pm$ 3.31 for *Sthaulya* and 34.65 $\pm$ 5.56 for *Medho Sara*.

There was a highly significant difference in the mean Weight and Body Fat Percentage values among *Sthaulya* and *Medho Sara* with (P=0.001).

Furthermore, the mean value of Body Surface Area distribution among *Sthaulya* was 1.94 $\pm$ 0.18, and 1.84 $\pm$ 0.16 was *Medho Sara*.

There was a significant difference in the mean Body Surface Area distribution with $P < 0.05$ among *Sthaulya* and *Medho Sara*.

4.11: Pearson's Correlation of Score of *Medho Sara* to Weight, Height, Body Fat Percentage and Body Surface Area.

Table No. 29: Pearson's Correlation of Score for *Sara* to Weight, Height, BF% and BSA

Medho Sara Score	r	p
Weight	-.518**	<.001
Height	-.102	.369
Body Fat Percentage	-.405**	<.001
BSA	-.409**	<.001

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

The above table displays Pearson's correlation assessment of body surface area (BSA), weight, height, body fat percentage, correlation coefficients (r) and p-values between the *Medho Sara* Score and these physical parameters. The direction and intensity of the association between the *Medho Sara* Score and the corresponding variable are shown by each correlation coefficient.

The *Medho Sara* Score tends to decline significantly at $p < 0.001$ as weight increases, according to a strong negative connection between weight and $r = -0.518$.

Height and the *Medho Sara* Score had a negligible link, as indicated by the weak negative correlation at $r = -0.102$ and the significant relationship at $p = 0.369$, indicating that height had no discernible influence on the *Medho Sara* Score.

The Body Fat Percentage shows a moderate negative association with a p-value of less than 0.001, suggesting a meaningful relationship between higher body fat percentages and lower *Medho Sara* Scores.

Body Surface Area (BSA) showed a moderate negative association ($r = -0.409$) with body fat %, suggesting a significant ($p < 0.001$) relationship between greater BSA and lower *Medho Sara* Scores.

4.12: Comparison of Complete Blood Count to *Medho Sara* and *Sthaulya*

Table No.30: Comparison of Complete Blood Count to *Medho Sara* and *Sthaulya*

Complete Blood Count	Sthaulya Mean $\pm$ S.D	Sara Mean $\pm$ S.D	P-Value
Haemoglobin	12.31 $\pm$ 1.55	12.32 $\pm$ 1.67	0.989
WBC COUNT(CELLS/CUMM)	8844.83 $\pm$ 2110.79	7724.78 $\pm$ 2152.15	0.027*
NEUTROPHILLS	58.59 $\pm$ 6.91	58.59 $\pm$ 9.29	0.999
LYMPHOCYTES	35.07 $\pm$ 6.13	33.98 $\pm$ 8.01	0.528
EOSINOPHILLS	4.97 $\pm$ 1.96	4.92 $\pm$ 1.91	0.922
MONOCYTES	1.38 $\pm$ 0.49	1.29 $\pm$ 0.46	0.441
ESR(mm/1st hr)	26.93 $\pm$ 15.64	21.57 $\pm$ 12.38	0.095

* $P \leq 0.05$ statistically significant

The mean values of WBC count(cells/cumm) among *Sthaulya* were 8844.83 $\pm$ 2110.79 and 7724.78 $\pm$ 2152.15 for *Medho Sara*. There was a significant difference in the mean WBC count(cells/cumm) among *Sthaulya* and *Medho Sara* ($P=0.027$). other parameters like Hemoglobin, Neutrophils, Lymphocytes, Eosinophils, Monocytes and ESR didn't show any significant difference in their mean value

4.13: Pearson's Correlation of Score for *Medho Sara* to CBC

Table No. 31: Pearson's Correlation of Score for *Medho Sara* to CBC

Score of Sara	R	P
Haemoglobin (g/dL)	-.068	.548
WBC COUNT(CELLS/CUMM)	-.210	.061
NEUTROPHILS	.095	.403
LYMPHOCYTES	-.126	.265
EOSINOPHILS	-.061	.588
MONOCYTES	.077	.499
ESR (mm/1st hr)	-.134	.235

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

When a Pearson's correlation was conducted amongst the parameters of CBC, no variables were found to have a significant correlation with Score *Medho Sara* indicating that CBC has very little influence in modifying *Medho Sarata* in an Individual.

4.14: Comparison of Lipid Profile to *Medho Sara* and *Sthaulya*

Table No.32: Comparison of Lipid Profile to *Medho Sara* and *Sthaulya*

Lipid Profile	Staulya Mean $\pm$ S.D	Sara Mean $\pm$ S.D	P-Value
Total Cholesterol (mg/dl)	139.31 $\pm$ 20.46	136.41 $\pm$ 22.74	0.572
HDL Cholesterol (mg/dl)	46.55 $\pm$ 17.97	47.68 $\pm$ 26.66	0.839
LDL Cholesterol (mg/dl)	66.24 $\pm$ 12.52	61.2 $\pm$ 15.48	0.138
Triglycerides (mg/dl)	147.97 $\pm$ 54.97	159.39 $\pm$ 66.06	0.433
VLDL (mg/dl)	34.03 $\pm$ 23.29	42.66 $\pm$ 54.97	0.424
Total Cholesterol : HDL Ratio	4.13 $\pm$ 4.68	7.59 $\pm$ 20.35	0.371
LDL:HDL Ratio	1.61 $\pm$ 0.41	1.95 $\pm$ 3.36	0.59

* $P \leq 0.05$ statistically significant

Contrary to the general understanding, in our study, we noticed that none of the variables of the lipid profile was found to be the statistically significant mean differences between *Medho Sara* and *Sthaulya*.

4.15: Pearson's Correlation of Score for *Medho Sara* to Lipid Profile

Table No.33: Pearson's Correlation of Score for *Medho Sara* to Lipid Profile

Score of Sara	p	R
Total Cholesterol (mg/dl)	-.150	.185
HDL Cholesterol (mg/dl)	.124	.272
LDL Cholesterol (mg/dl)	-.196	.082
Triglycerides (mg/dl)	.033	.771
VLDL (mg/dl)	.193	.086
Total Cholesterol: HDL Ratio	.223*	.047
LDL: HDL Ratio	.148	.189
Blood Sugar(mg/dl)	-.195	.082
CRP (mg/dl)	.054	.635
Serum Creatinine (mg/dl)	-.161	.153
Alkaline Phosphate (U/L)	.036	.754

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson's correlation assessment of Lipid Profile with a score for *Medho Sara* showed that the *Medho Sara* Score and total cholesterol (mg/dl) had a weak negative association ($r = -0.150$), which is statistically not significant and suggests a minor link. $p = 0.185$. The data indicates a weak positive correlation ($r = 0.124$) between HDL cholesterol (mg/dl) and *Medho Sara* Scores, suggesting a slight relationship between the two. The statistical insignificance of this link is indicated by the p-value of 0.272.

The *Medho Sara* Score and LDL cholesterol (mg/dl) showed a weak negative association ($r = -0.196$), which is statistically not significant and indicates a minor relationship between the two. p is 0.082.

The minimal positive correlation between triglyceride levels and the *Medho Sara* Score (mg/dl) at $r = 0.033$ indicates that there is no significant link between triglyceride levels and the score. The *Medho Sara* Score and VLDL (mg/dl) exhibit a weak positive correlation at $r = 0.193$, suggesting a minor association between the two. However, at $p = 0.086$, the relationship is statistically not significant.

The data indicates a minor positive connection between total cholesterol and HDL ratios ($r = 0.223$), indicating a slight association between higher total cholesterol and *Medho Sara* scores. The statistical significance of $p = 0.047$ is shown at the $p < 0.05$ level. A modest link between LDL and HDL ratios is implied by the poor positive correlation between LDL and HDL ratios ($r = 0.148$), and the *Medho Sara* Score ($p = 0.189$) is statistically not significant. Blood sugar is statistically not significant at $p = 0.082$ and has a slight negative correlation ($r = -0.195$) indicating a minor association between blood sugar levels and the *Medho Sara* Score.

There is no statistically significant link between CRP (mg/dl) and the *Medho Sara* Score, as indicated by the minimal positive correlation at $r = 0.054$. P is equal to 0.635. Serum creatinine (mg/dl) has a slight negative association that is statistically not significant ($p = 0.153$) and suggests a minor relationship between serum creatinine levels and the *Medho Sara* Score ($r = -0.161$).

The *Medho Sara* Score and Alkaline Phosphate (U/L) have a low positive correlation ($r = 0.036$), which suggests that there is no relevant association between the two. The correlation is statistically not significant ($p = 0.754$).

4.16: Comparison of Biochemical Variables to *Medho Sara* and *Sthaulya* group

Table No. 34: Comparison of Biochemical Variables to *Medho Sara* and *Sthaulya* group

Biochemical Variables	Staulya Mean $\pm$ S.D	Sara Mean $\pm$ S.D	P-Value
Blood Sugar(mg/dl)	92.3 $\pm$ 21.67	88.67 $\pm$ 24.09	0.504
CRP (mg/dl)	2.12 $\pm$ 1	2.27 $\pm$ 1.07	0.522
Serum Creatinine (mg/dl)	0.92 $\pm$ 0.39	0.86 $\pm$ 0.1	0.243
Alkaline Phosphate (U/L)	121.62 $\pm$ 17.01	122.45 $\pm$ 20.95	0.856
Adiponectin level (ug/ml)	15.28 $\pm$ 5.74	18.63 $\pm$ 6.59	0.025*
Leptin Level (ng/ml)	21.78 $\pm$ 18.63	14.59 $\pm$ 14.82	0.042*
Interleukin-6 (pg/ml)	8.64 $\pm$ 1.28	8.77 $\pm$ 1.57	0.707
TNF- α levels(pg/ml)	8.92 $\pm$ 1.59	8.9 $\pm$ 1.55	0.962
Serum Insulin level (mIU/L)(3hrs)	20.98 $\pm$ 10.86	19.36 $\pm$ 13.7	0.586

* $P \leq 0.05$ statistically significant

The mean values of Adiponectin levels among *Sthaulya* were 15.28 $\pm$ 5.74 and 18.63 $\pm$ 6.59 among *Medho Sara* with $p=0.025$ i.e., the difference is statistically significant. Similarly, the mean values of Leptin also found to be significantly different, were 21.78 $\pm$ 18.63 among *Sthaulya* and 14.59 $\pm$ 14.82 in *Medho Sara* with $p=0.042$.

4.17: Pearson's Correlation of the Adiponectin and Leptin with Score for *Medho Sara*

Table No.35: Pearson's Correlation of the Adiponectin and Leptin with Score for *Medho Sara*

Adiponectin	r	p
Sara_score	.225*	.045
Leptin	r	p
Sara_score	-.267*	.017

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

In the analysis of Pearson's correlation assessment of Adiponectin and Leptin with the Score of *Medho Sara*, there existed a significant negative correlation of Leptin with *Medho Sara* Score at $r = -.267$ and $p = 0.017$. suggesting a meaningful relationship between higher Leptin levels and lower *Medho Sara* Scores.

There exists a significant positive correlation of Adiponectin with *Medho Sara* Score at $r = .225$ with $p = .045$. suggesting that Adiponectin levels are associated with higher *Medho Sara* Scores.

4.18: Comparison of Anthropometric measurements to Medho Sara and Sthaulya

Table No. 36: Comparison of Anthropometric measurements to Medho Sara and Sthaulya

Anthropometric measurements	Staulya	Sara	P-Value
Mid Arm circumference of Lt	36.64±12.54	31.38±2.88	0.005*
Mid Arm circumference of Rt	35.35±4.06	31.32±5.22	0.001*
Mid Thigh Circumference of Lt	56.86±8.76	52.21±8.4	0.022*
Mid Thigh Circumference of Rt	58±8.39	53.22±8.19	0.015*
Mid calf circumference of Lt	40.03±4.22	37.3±3.14	0.001*
Mid calf circumference of Rt	40.32±4.22	37.52±3.13	0.001*
Chest Circumference	101.57±6.23	97±6.16	0.002*
Waist circumference	104.9±9.08	97.34±11.99	0.004*
Hip Circumference	116.88±10.87	106.41±9.24	0.001*
Waist:Hip Ratio	0.9±0.06	0.92±0.06	0.076
Skinfold thickens of Biceps	29.68±7.25	27.48±4.96	0.111
Skinfold thickens of Triceps	34.53±7.44	33.81±4.88	0.602
Ayama (anguli)	65.69±3.82	66.43±5.88	0.544
Vistara - Arm spam Circumference(anguli)	28.97±2.13	30.12±8.94	0.498
Wrist Joint Circumference(anguli)	7.59±1.05	7.06±1.1	0.04*
Ankle Joint Circumference(anguli)	11.1±2.18	10.45±1.72	0.144
Neck Circumference(anguli)	14.17±2.41	13.75±1.25	0.298

* $P \leq 0.05$ statistically significant

Anthropometric measurements, averages, standard deviations, and p-values indicating the significance of differences between the two groups, "Staulya" and "Medho Sara," are presented in the above table.

In terms of the Left Mid Arm Circumference, *Medho Sara* has a substantially smaller mean of 31.38 cm (± 2.88) than *Staulya*, which is 36.64 cm (± 12.54), with a p-value of 0.005, suggesting a statistically significant difference. Likewise, comparable findings are seen in the Right Arm, where *Staulya's* mean is 35.35 cm (± 4.06), whereas *Medho Sara's* is 31.32 cm (± 5.22), with a p-value of 0.001.

Staulya's mean in the Left Mid-Thigh Circumference is 56.86 cm (± 8.76) compared to *Medho Sara's* 52.21 cm (± 8.4), and the p-value of 0.022 indicates significance. There is also a significant difference in the right thigh, with values of 53.22 cm (± 8.19) for *Medho Sara* and 58 cm (± 8.39) for *Staulya* ($p = 0.015$).

With p-values of 0.001, the *Staulya* group's left and right calf circumferences are both considerably greater than *Medho Sara's* (37.3 cm and 37.52 cm), at 40.03 cm and 40.32 cm, respectively. With a p-value of 0.002, the chest circumference in *Staulya* (101.57 cm) is substantially greater than that in *Medho Sara* (97 cm). *Staulya's* waist circumference is significantly different than *Medho Sara's*, measuring 104.9 cm compared to 97.34 cm ($p = 0.004$).

In terms of hip circumference, *Staulya* measures 116.88 cm, while *Medho Sara* measures 106.41 cm ($p = 0.001$). This difference is statistically significant.

A p-value of 0.076 in the Waist: Hip Ratio measurement indicates that there is no significant difference between the groups. There were no discernible variations in the skinfold thickness of the triceps and biceps ($p = 0.602$ and 0.111 , respectively). Except for wrist joint circumference, which has a p-value of 0.04, indicating a marginal significance, other metrics such as *Ayama*, wrist joint circumference, and neck circumference similarly did not demonstrate significant differences, with p-values above 0.05.

4.19: Pearson's Correlation of Score of *Medho Sara* to Anthropometry

Table No. 37: Pearson's Correlation of Score of *Medho Sara* to Anthropometry

Score of Sara	r	p
Mid Arm circumference of Lt	-.220	.050
Mid Arm circumference of Rt	-.349**	.002
Mid-Thigh Circumference of Lt	-.235*	.036
Mid-Thigh Circumference of Rt	-.259*	.021
Mid-calf circumference of Lt	-.320**	.004
Mid-calf circumference of Rt	-.335**	.002
Chest Circumference	-.410**	<.001
Waist circumference	-.298**	.007
Hip Circumference	-.480**	<.001
Waist: Hip Ratio	.298**	.007
Skinfold thickness of Biceps	-.155	.169
Skinfold thickness of Triceps	-.090	.426
Height Circumference(anguli)	.044	.700
Arm spam Circumference(anguli)	.069	.541
Wrist Joint Circumference(anguli)	-.211	.060
Ankle Joint Circumference(anguli)	-.170	.131
Neck Circumference(anguli)	-.286*	.010

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

This table displays the Pearson's Correlation coefficients (r) and matching p-values (p) between the *Medho Sara* score and the different body measurements.

Medho Sara and Left Mid Arm Circumference had a weakly negative connection ($r = -0.220$), which was marginally significant ($p = 0.050$). Similar findings were noted for

the right mid-arm circumference, which showed a very significant p-value of 0.002 and a somewhat negative connection with *Medho Sara* ($r = -0.349$).

A weak negative correlation was observed between the left Mid-Thigh Circumference and *Medho Sara* ($r = -0.235$, marginally significant at $p = 0.036$), and a weak negative correlation was also observed between the right Mid-Thigh Circumference and *Medho Sara* ($r = -0.259$, marginally significant at $p = 0.021$).

The results indicate that there was a moderate negative association ($r = -0.320$) between the left and right mid-calf circumference and *Medho Sara* ($p = 0.004$). The correlation was found to be very significant. The Waist Circumference showed a similar strong negative connection with *Medho Sara* ($r = -0.298$, $p = 0.007$) as did the Chest Circumference ($r = -0.410$, very significant).

Waist: Hip Ratio showed a moderately positive association at $r = 0.298$ significant with $p = 0.007$, whilst Hip Circumference showed a large negative link with *Medho Sara* at $r = -0.480$ and highly significant with $p = 0.001$. The skinfold thickness of the triceps and biceps had a non-significant connection ($p = 0.169$ and 0.426 , respectively) and a weak negative correlation ($r = -0.155$ and -0.090 , respectively) with *Medho Sara*.

There was no significant link found between *Anguli Pramana* of Height Circumference and Arm Span Circumference ($r = 0.044$, $p = 0.700$ and $r = 0.069$, $p = 0.541$, respectively). While there was a weak negative correlation ($r = -0.211$, -0.170 , and -0.286) between *Anguli Pramana* of Wrist Joint Circumference, Ankle Joint Circumference, and Neck Circumference and *Medho Sara*, the association was not statistically significant ($p = 0.060$, 0.131 , and 0.010).

The majority of the measured body circumferences and the Score of *Medho Sara* show significant negative relationships, meaning that when these circumferences

rise or fall, the Score of *Medho Sara* does as well. The Waist: Hip Ratio and the *Medho Sara* Score have a positive association, meaning that as the ratio rises, so does the score.

4.20: Comparison of Body Mass Index (BMI) distribution among *Medho Sara* and *Sthaulya*

Table No.38: Comparison of Body Mass Index (BMI) distribution among *Medho Sara* and *Sthaulya*

BMI	Staulya	Sara	P-Value
Body Mass Index	32.71±4.75	28.68±3.49	0.001*

* $P \leq 0.05$ statistically significant

In the study, the mean Body Mass Index distribution among *Sthaulya* was 32.71±4.75 and 28.68±3.49 for *Medho Sara* with $P=0.001$ depicting the difference as highly significant.

4.21: Distribution of subjects according to the Classification of BMI

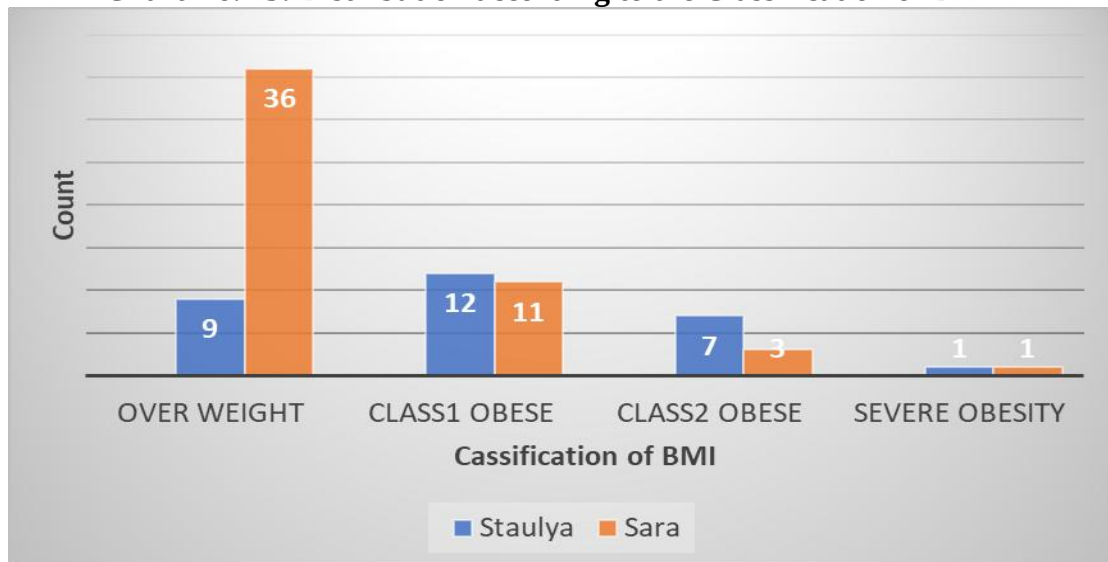
Table No. 39: Distribution of subjects according to the Classification of BMI

Classification of BMI	Staulya	Sara	Total	X ²	α - Value
Over Weight	9	36	45	12.758	.005
Class1 Obese	12	11	23		
Class2 Obese	7	3	10		
Severe obesity	1	1	2		
Total	29	51	80		

* $P \leq 0.05$ statistically significant

Here, a higher number of subjects are found in Overweight under *Medho Sara*, and an almost equal number of subjects from *Medho Sara* and *Sthaulya* belong to Class1 Obesity, χ^2 showed a significant difference in Classification of BMI to *Medho Sara* and *Sthaulya* (p-value=0.005).

Chart No. 15: Distribution according to the Classification of BMI



4.22: Distribution of subjects according to Age group

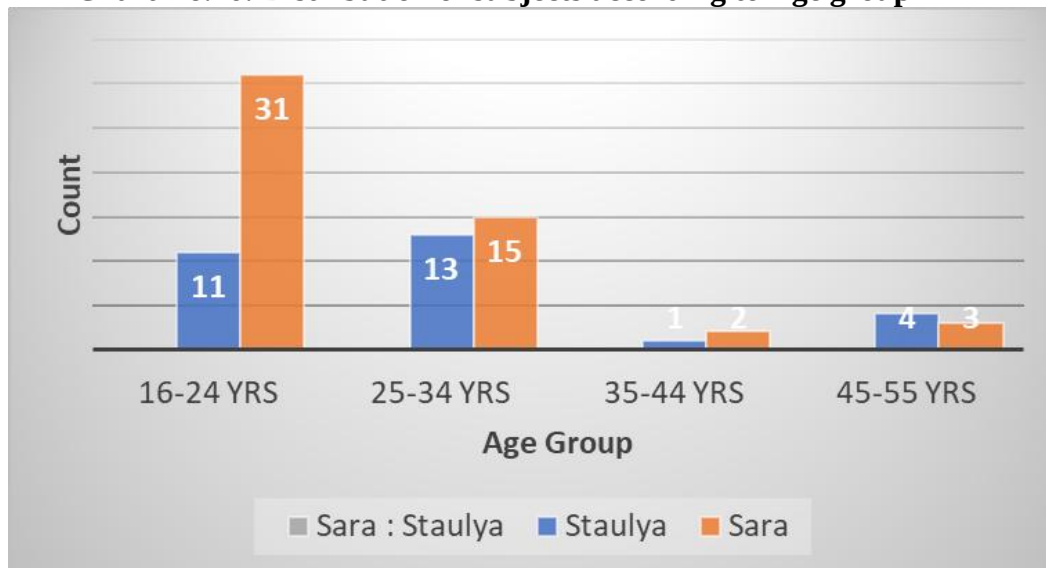
Table No.40: Distribution of subjects according to Age group

Age Group	Staulya	Sara	Total	X2	α – Value
16-24 yrs	11	31	42	4.428	.219
25-34 yrs	13	15	28		
35-44 yrs	1	2	3		
45-55 yrs	4	3	7		
Total	29	51	80		

* $P \leq 0.05$ statistically significant

In the table it can be noted that there is a higher number of subjects between the age group of 16 to 24 years falling under *Medho Sara*, however, this difference was not noteworthy (p-value=.219). As seen in the graph, 42 subjects fall under the age group of 16-23.

Chart No.16: Distribution of subjects according to Age group



4.23: Distribution of subjects according to *Sarira Pramana*

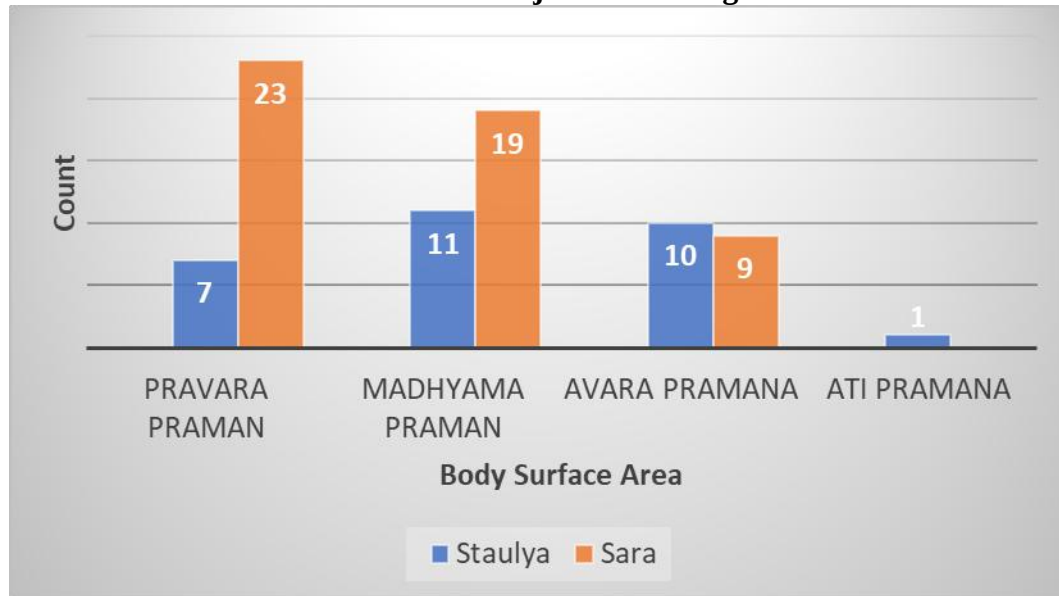
Table No.41: Distribution of subjects according to *Sarira Pramana*

Sarira Pramana	Staulya	Sara	Total	X2	α - Value
Pravara Praman	7	23	30	6.133	0.105
Madhyama Praman	11	19	30		
Avara Pramana	10	9	19		
Ati Pramana	1	0	1		
	29	51	80		

* $P \leq 0.05$ statistically significant

In the above table no.17, a higher number of subjects are found in *Pravara Praman* under *Medho Sara*, however, this difference was not noteworthy (p-value=0.105). Overall, 30 subjects fall under the *Pravara Praman* as seen in the graph.

Chart No. 17: Distribution of subjects according to Sarira Pramana



4.24: Pearson's Correlation of Adiponectin with Anthropometric

Table No. 42: Pearson's Correlation of Adiponectin with Anthropometric

Adiponectin	r	p
Age	-.094	.405
Weight(Kg)	-.379**	.001
Height(cm)	.130	.249
Body Mass Index	-.519**	<.001
Body Fat Percentage	-.353**	.001
Body Surface Area	-.217	.053

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

On analysing Pearson's correlation of Adiponectin with Anthropometric parameters among the cases in our study, it was found that there existed a significant Negative correlation of Adiponectin with Weight, Body Mass Index, and Body Fat Percentage at $r = -.379, -.519, \text{ and } -.353$ respectively with statistical significance of $p < 0.05$.

4.25: Pearson's Correlation of Adiponectin with Anthropometric

Table No. 43: Pearson's Correlation of Adiponectin with Anthropometric

Adiponectin	r	p
Mid Arm circumference of Lt	-.233*	.037
Mid Arm circumference of Rt	-.382**	.000
Mid-Thigh Circumference of Lt	-.191	.090
Mid-Thigh Circumference of Rt	-.235*	.036
Mid-calf circumference of Lt	-.238*	.033
Mid calf circumference of Rt	-.275*	.014
Chest Circumference	-.342**	.002
Waist circumference	-.174	.123
Hip Circumference	-.416**	<.001
Waist: Hip Ratio	.178	.114
Skinfold thickness of Biceps	-.123	.276
Skinfold thickness of Triceps	-.072	.527
Height Circumference(anguli)	.234*	.036
Arm spam Circumference(anguli)	.016	.885
Wrist Joint Circumference(anguli)	-.183	.105
Ankle Joint Circumference(anguli)	-.063	.582
Neck Circumference(anguli)	-.090	.429

**. Correlation is significant at the 0.01 level, *. Correlation is significant at the 0.05 level (2-tailed).

The link between adiponectin levels and several demographic and physical parameters, such as age, weight, height, body mass index (BMI), body fat percentage, and body surface area (BSA), is explained by the above table, which also provides the Pearson's correlation coefficients (r) and their significance (p -values).

Age had a weak negative correlation ($r = -0.094$) with adiponectin levels, indicating a limited link; however, this was not statistically significant ($p = 0.405$), indicating that age has no discernible effect on adiponectin levels. Adiponectin levels tend to decline with weight (kg), according to a moderately negative correlation with a value of $r = -0.379$. This association is statistically significant at $p = 0.001$.

The data indicated that there is a weak positive correlation ($r = 0.130$) between height (cm) and adiponectin levels, but this correlation is not statistically significant ($p = 0.249$), indicating that height does not significantly affect adiponectin levels.

The body mass index (BMI) and adiponectin have a strong inverse association, with a strong negative correlation ($r = -0.519$) showing that higher BMI is significantly related to lower levels of adiponectin and a highly statistically significant relationship ($p < 0.001$). Body Fat Percentage and Adiponectin Levels are correlated, with a considerable negative correlation ($r = -0.353$) showing a statistically significant relationship ($p = 0.001$) between higher body fat and lower adiponectin levels.

Body Surface Area (BSA) and adiponectin levels have a mild negative correlation ($r = -0.217$), which suggests a minor relationship. However, the correlation is not statistically significant ($p = 0.053$).

4.26: Pearson's Correlation of Adiponectin with other Biochemical parameters

Table No. 44: Pearson's Correlation of Adiponectin with other Biochemical parameters

Adiponectin level	r	P
Haemoglobin (g/dL)	.011	.922
WBC COUNT(CELLS/CUMM)	-.238*	.033
NEUTROPHILS	-.214	.056
LYMPHOCYTES	.120	.291
EOSINOPHILS	.150	.184
MONOCYTES	-.070	.537
ESR(mm/1st hr)	-.120	.288
Total Cholesterol (mg/dl)	-.204	.069
HDL Cholesterol (mg/dl)	.142*	.021
LDL Cholesterol (mg/dl)	-.115	.310
Triglycerides (mg/dl)	-.085	.452
VLDL (mg/dl)	.141	.213
Total Cholesterol: HDL Ratio	.245*	.028
LDL: HDL Ratio	.216	.054
Blood Sugar(mg/dl)	-.297**	.008
CRP (mg/dl)	-.027	.809
Serum Creatinine (mg/dl)	.185	.100
Alkaline Phosphate (U/L)	-.143	.207

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

On analyzing Pearson's correlation of Adiponectin with Bio-chemical parameters among the cases in our study, it was found that there existed a significant Negative correlation of Adiponectin with WBC and Blood sugar at $r = -.238$, and $-.297$ respectively with statistical significance of $p < 0.05$. At the same time, the Adiponectin level showed a Positive correlation with HDL cholesterol and Total Cholesterol: HDL ratio at $r = 0.142$ and 0.245 respectively with statistical significance of $p < 0.05$. All the other parameters in the group didn't exhibit any correlation to Adiponectin in our analysis.

4.27: Pearson's Correlation of Leptin with Anthropometric Parameters

Table No. 45: Pearson's Correlation of the Leptin with Anthropometric

Leptin	r	p
Age	.238*	.034
Weight(Kg)	.526**	<.001
Height(cm)	.010	.933
Body Mass Index	.579**	<.001
Body Fat Percentage	.334**	.002
Body Surface Area	.379**	.001

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

On evaluating Pearson's correlation of Leptin with Anthropometric parameters among the cases in our study, it was found that there existed a significant Positive correlation of Leptin with Weight, Body Mass Index, Body Fat Percentage and Body Surface Area (BSA) at $r = .526$, $.579$, $.334$ and $.379$ respectively with statistical significance of $p < 0.05$.

4.28: Pearson's Correlation of the Leptin with Anthropometric parameters

Table No.46: Pearson's Correlation of the Adiponectin with Anthropometric

Leptin	r	p
Mid Arm circumference of Lt	.323**	.003
Mid Arm circumference of Rt	.401**	<.001
Mid-Thigh Circumference of Lt	.117	.303
Mid-Thigh Circumference of Rt	.132	.242
Mid-calf circumference of Lt	.237*	.034
Mid-calf circumference of Rt	.183	.104
Chest Circumference	.458**	<.001
Waist circumference	.358**	.001
Hip Circumference	.395**	<.001
Waist: Hip Ratio	-.139	.219
Skinfold thickness of Biceps	.232*	.039
Skinfold thickness of Triceps	.221*	.049
Height Circumference(anguli)	-.052	.644
Arm spam Circumference(anguli)	-.122	.281
Wrist Joint Circumference(anguli)	.157	.164
Ankle Joint Circumference(anguli)	.346**	.002
Neck Circumference(anguli)	.144	.202

**, Correlation is significant at the 0.01 level (2-tailed).

*, Correlation is significant at the 0.05 level (2-tailed).

The table presents the correlations between leptin and several anthropometric measurements of the body, evaluating the strength and significance of these interactions by computing Pearson correlation coefficients (r) and matching p-values (p-values).

The left mid-arm circumference and leptin have a statistically significant positive connection ($r=0.323$, $p=0.003$). The right arm's mid-arm circumference had a much higher positive association ($r=0.401$, $p<0.001$) than the left arm's.

A statistically significant positive correlation ($r=0.237$, $p=0.034$) was seen in the left mid-calf circumference. There was no statistically significant change in the right mid-calf circumference ($r=0.183$, $p=0.104$). At $r=0.458$, $p<0.001$, there is a substantial strong positive association between chest circumference and A substantial positive connection ($r=0.358$, $p=0.001$) is seen with waist circumference.

There is a strong positive association ($r=0.395$, $p<0.001$) between hip circumference and Waist: Hip Ratio has shown a negative connection ($r=-0.139$, $p=0.219$) that is not statistically significant.

There is a statistically significant positive association ($r=0.232$, $p=0.039$) between the skinfold thickness of the biceps and a statistically significant positive association ($r=0.221$, $p=0.049$) between the skinfold thickness of the triceps.

There is a significant positive association ($r=0.346$, $p=0.002$) between ankle joint circumference (anguli).

There was no statistically significant difference in the height circumference (anguli) at $r=-0.052$, $p=0.644$, arm spam circumference (anguli) at $r=-0.122$, $p=0.281$, wrist joint circumference (anguli) at $r=0.157$, $p=0.164$, and neck circumference (anguli) at $r=0.144$, $p=0.202$.

This suggests that larger body size or obesity in certain regions as mentioned above is linked to elevated leptin levels. whereas, a statistically significant correlation between leptin levels and some parameters was not observed.

4.29: Pearson's Correlation of the Leptin with other Biochemical parameters.

Table No. 47: Pearson's Correlation of Adiponectin with other Biochemical parameters

Leptin level	r	p
Haemoglobin (g/dL)	.112	.323
WBC COUNT(CELLS/CUMM)	.189	.093
NEUTROPHILS	.068	.549
LYMPHOCYTES	-.028	.804
EOSINOPHILS	.050	.658
MONOCYTES	-.153	.175
ESR (mm/1st hr)	-.096	.396
Total Cholesterol (mg/dl)	.141	.211
HDL Cholesterol (mg/dl)	-.112	.324
LDL Cholesterol (mg/dl)	.114	.315
Triglycerides (mg/dl)	.085	.455
VLDL (mg/dl)	-.096	.396
Total Cholesterol: HDL Ratio	-.120	.288
LDL : HDL Ratio	-.079	.487
Blood Sugar(mg/dl)	.190	.091
CRP (mg/dl)	.020	.859
Serum Creatinine (mg/dl)	.133	.239
Alkaline Phosphate (U/L)	.060	.595

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

On analyzing Pearson's correlation of Leptin with Bio-chemical parameters among the cases in our study, it was found that there existed no significant correlation of Leptin with Haemoglobin (g/dL), WBC Count(Cells/Cumm), Neutrophils, Lymphocytes, Eosinophils, Monocytes, ESR (mm/1st hr), Total Cholesterol (mg/dl), HDL Cholesterol (mg/dl), LDL Cholesterol (mg/dl), Triglycerides (mg/dl), VLDL (mg/dl), Total Cholesterol: HDL Ratio, LDL: HDL Ratio, Blood Sugar(mg/dl), CRP (mg/dl) and Serum Creatinine (mg/dl).

5. DISCUSSION

5.1 Discussion about choosing the topic:

'Evidence-based medicine' is the catchphrase of the present day these days. Research is therefore necessary for revalidation and revitalization in both the basic and applied fields of *Ayurveda*.

Dhatu Sara is one of those principles for which the *Ayurveda* classics provide relatively little information. It is one of the *Dasha Vidha Atura Pariksha* that is used to assess an individual's *Ayu* (Life span) and *Bala* (strength)

Even though it is very important, it is typically overlooked while the patient is being examined. The absence of objective tools presents a practical challenge for a doctor when diagnosing *Dhatu Sara* in an individual. One of *Dhatu Sara*'s concerns is *Medho Sara*, which requires more comprehension and application in clinical settings. Furthermore, there's a good chance that someone will misdiagnose and treat it incorrectly by supposing it to be a pathological disease of *Medha Dhathu*, or *Sthaulya*.

To develop objective parameters for the evaluation of *Medho Sara*, make its determination easier and more uniform, and distinguish it from the pathological condition of *Medha Dhatu–Sthaulya*, the current study titled "Biochemical changes in Individuals of High BMI with special reference to *MEDHO SARA* (excellence of adipose tissue) and *STHAULYA* (obesity)" was conducted.

5.2 Development and validation of the Questionnaire:

The validated questionnaire developed for this study has 18 items, the subjective part consisting of four options designed on a Likert scale. The objective part of the case sheet contains 14 items which emphasize mainly anthropometric assessments.

The validated questionnaire was resourceful in identifying and differentiating the individuals with *Medho Sara* and *Sthaulya Lakshana*.

5.3 Age Group:

In this study, 52.5 % of Participants were from the age group of 16-24 years, and 35 % of the participants were from 25- 34 years, Adolescence brings about significant changes in body composition. There is a noticeable variation in the physical composition of boys and girls, which includes both lean and fat body mass. Compared to girls in this age range, boys typically gain more lean mass and less body fat.²¹⁵

5.4 Gender:

In this study 60 % were female and 40 % were male. During adolescence and maturity, females gain more body fat than males and this is healthy and entirely usual. Because a female needs more energy for her reproductive function and has a larger amount of necessary fat than a male of equivalent fitness, a female should always have a higher percentage of body fat.²¹⁶

5.5 Weight Distribution

As this distribution makes clear, a sizable portion of individuals (33. 8%) fall into the 80–89 kg weight range, closely followed by the 70–79 kg (22. 5%) and 60–69 kg (20%) weight categories. According to the results, a sizable portion of the respondents may fall into the higher weight category and be overweight or obese.

Significance: The greater proportion of individuals falling into the heavier weight categories warrants worry because of the connection between obesity and other harmful disorders like metabolic syndrome, diabetes, and cardiovascular diseases. A large number of individuals who weigh less than 100 kg may suggest that, maybe, people in these weight ranges are unusual or rare in the sample that was intended.

5.6 Height Distribution:

In our Study 40 % of the participants fall into the 155–164 cm height category, 32.5 % fall into the 165–174 cm height category, and 17.5 % fall into the 175–185 cm height category. At 10% of the total, the height group 145-154 cm has the lowest share. Indicating the population is in parallel with the general population distribution among Indians as mentioned in previous studies.

Significance: Since height influences disease risks and general health, it is also suggested as a predictor in several epidemiological studies. For example, height is associated with an increased risk of musculoskeletal disorders, some types of cancer, and cardiovascular problems. The gathered data on height distribution enables the recruitment of participants based solely on height and investigates the relationship between height and specific health outcomes like obesity and *Medho Sara*.

5.7 Classification Based on BMI

The distribution of obesity and overweight in our study demonstrated that

Overweight: Of the 80 individuals, 45 are found to be overweight, accounting for 56.3%. This is somewhat more than half of the participants. It should be highlighted that such a prevalence could indicate that many of the study participants may be at risk of getting obesity-related disorders such as metabolic syndrome, diabetes, and cardiovascular disease.

Class-1 Obese: Twenty-three people, or 28.7% of the sample, are enrolled in the study in this group. Class-1 obesity is generally associated with a less severe form of obesity than other classes but are still more likely than those who are normal weight to experience specific health concerns.

Class-2 Obese: 5% of the sample is classified as Class-2 obese; as a result, the community accepts those who fall into this more extreme obesity category. This degree

of obesity increases the risk of developing serious illnesses like type 2 diabetes, cardiovascular disease, and other metabolic syndromes.

Severe Obesity: 2.5% of individuals had Extreme Obesity and demonstrated a further group of participants who had the highest likelihood of experiencing negative health outcomes.

The aforementioned findings of the high prevalence of overweight and obesity in society is a matter of concern, these conditions are usually linked to the emergence of several chronic conditions, including dyslipidemia, hypertension, and glucose-insulin resistance etc, but in our study, we didn't find any such chronic disease amongst most of our participants, indicating the presence of a condition called Metabolic healthy Obese and which gave scope for further exploration of Medho Sara in them.

5.8 Sharira Pramana

The term "*Sharira Praman*" refers to the participant distribution concerning body size constitution.

Pravara Sharira Praman has thirty-seven participants, five per cent of whom are *Pravara* often means excellence or superiority. In this instance, it may be used to describe individuals who suit the ideal standards set by *ayurveda*, in fitness levels and body measurements.

Madhyama Sharira Praman had 37 as well. *Madhyama Sharira Praman* typically refers to middle or moderate. This suggests that, according to the features included in the classification method, this group are medium or moderate in terms of fitness levels and body measurements.

With 23.8% of participants, *Avara Sharira Praman* is known as lower or inferior, and the terms themselves imply that they are probably considered to be of a lower caliber than the *Pravara Sharira Praman* and *Madhyama Sharira Praman* participants.

"Ati" implies "excessive" or "very large" and accounts for 3% of participants, this subject may have qualities that deviate greatly from the norm.

Significance: The distribution of participants between the "*Madhyama Sharira Praman*" and "*Pravara Sharira Praman*" categories suggests that a balanced model of the samples might be considered optimal and average characteristics. It is implied that individuals with extreme manifestations of the given attribute are rather uncommon by the finding that over 24.1% of participants fall into either the Avara Pramana or the Ati Pramana category.

5.9 *Medho Sara vs Sthaulya*

29 participants, representing 36.3%, are categorized as "*Sthaulya*." and 51 participants out of 80, which is 63%, are categorized as "*Medho Sara*." Prevalence of *Sthaulya*: Participants can be classified as having *Sthaulya* implying that there is a high proportion of the population at risk with obesity. This could imply the necessity of approaches aimed at weight loss, alterations in eating habits, and physical activity to reduce the effects of obesity on health.

Prevalence of *Medho Sara*: The majority of the participants, 51 (63.7%) fall under the "*Medho Sara*" category to explain their overall adiposity status as being mild or moderate in this group of patients. Based on these characteristics, this group is expected to have a lower risk of obesity-related health problems and arguably represents perhaps the ideal physical constitution from an *Ayurvedic* point of view.

5.10 *Medho Sara Impression*

Classifying participants using the characteristics named "*Sthaulya*," "*Madhyama Sara*," and "*Pravara Sara*" based on the constitutions or conditions of the body. We observed that *Sthaulya* forms 36.3% of participants indicated that in 29 of 80 subjects, *Sthaulya* mostly implies overweight or obesity which is the pathological condition of

deposition of excessive fat. This classification seems to indicate that these participants are of a larger build, and may be prone to health conditions associated with overweight and obesity including metabolic syndrome, cardiovascular diseases and other related diseases.

Another 46.3% of Participants and identified as *Madhyama Sara* they encompass a moderate degree of body constitution that consists of adequate and healthy fat and other characteristics that signify good health. In this regard, such people are apt to be in good health, maintaining an optimal level of body fat and lean tissues; in the normal biological state, they socially do not have defects in body shape and can lead an active and healthy life.

Pravara Sara has 17.5% of participants, i.e. 14 out of 80 are considered to have a superior or excellent body essence. This is the category of persons with the most desirable health parameters, these are people with ideal body composition and proportions of fat and muscles. These are perfectly healthy persons by the usual criteria, with protective strength, energy and overall good condition, they can be compared with Metabolic healthy Obese and may benefit from dietary modifications, and increased physical activity to reduce the risk of diseases related to obesity.

5.11 Discussion on Results

5.11.1 Comparison of Age, Height, Weight, Body Fat Percentage and Body Surface Area to *Medho Sara* and *Sthaulya*

When the Weight, Body Fat Per cent and BSA of the participants belonging to *Sthaulya* and *Medho Sara* analyses were done several observations were made.

In the *Sthaulya* Group, the Mean Weight was 88. 7 g with a (+/-) SD 13. 03 kg, thus, the majority of the participants in this group fall within the weight range of 75. 04 kg and 101. 10 kg.

The Participants categorized as *Medho Sara* have a comparatively lower average weight of 77. 36 kg, with an SD of ± 10 kg weight rage lying between 67. 03 kg and 87. 69 kg. The mean weight of the filtered subjects of *Sthaulya* and *Medho Sara* groups are significantly different with a p-value of 0. 001.

The body fat per cent of the corresponding subjects of the *Sthaulya* was an average of 39. 21 per cent with a SD of 3. 31%, within the possible range of 35. 90% to 42. 52%.

In the case of *Medho Sara*, the mean body fat percentage is comparatively less, which is 34. 65 %, an SD of 5. 56%. This suggests 29. 09% to 40. 16% for most participants (mean $\pm$ SD), for most participants.

There is also a statistically significant difference in mean body fat percentage between the two groups the p-value = 0. 001.

The average BSA for the *Sthaulya* was observed as 1.94 m², with a SD of 0.18 m², indicating most participants have a BSA between 1.76 m² and 2.12 m² (mean $\pm$ SD) and for the *Medho Sara* group, the mean BSA is slightly lower at 1.84 m², with an SD of 0.16 m². This suggests most participants in this group have a BSA between 1.68 m² and 2.00 m² (mean $\pm$ SD). The difference in BSA between the two groups is statistically significant with a p-value less than 0.05.

The changes between the groups depict considerable differences in weight, body fat percentage and body surface area. The *Sthaulya* group consisting of subjects with greater mean weight and BMI stands in complete opposition to the *Medho Sara* group which equips lesser mean values in the mentioned parameters. The marked differences in these parameters thus provide enough evidence that the two groups are naturally different in terms of body composition and structure, and this may mean that they are likely to have different health risks and may in one way or another, call for distinction in kind of interventions or management programs.

5.11.2 Correlation of Score of *Medho Sara* to Weight, Height, Body Fat Percentage and Body Surface Area

Pearson's correlation analysis, for assessing the relationship between the *Medho Sara* Score and various physical parameters: weight, height, body fat percentage, and body surface area (BSA) revealed that there was a significant negative relationship between weight and the *Medho Sara* Score; whereby the correlation coefficient was - 0. 518. A negative correlation implies that weight is often likely to decrease while the *Medho Sara* Score is likely to increase, or conversely. The calculated p-value of less than 0. 001 is that this correlation is significant, which implies that the likelihood of these findings was not arrived at by mere chance. This shows a positive and strong correlation where the *Medho Sara* Scores decrease as the weights increase consistently.

The nature of the relationship between height and the *Medho Sara* Score is negative, though not very strong with a correlation coefficient of -0. 102. The p-value of 0. 369 thus it can be concluded that the difference is not statistically significant meaning that there is no significant correlation between height and the *Medho Sara* score in this sample. Thus, differences in height do not have a major bearing on the *Medho Sara* Score.

However, there is a moderate negative relationship between body fat percentage and the *Medho Sara* Score of $r = -.405$ compared with a p-value of less than 0.001 which indicates that there is Statistical significance which means that, there is a negative correlation between the increased body fat percentage and the *Medho Sara* Scores. This indicates that the *Medho Sara* Score reduces as the body fat percentage rises or Barakat et al. (2015) moderate negative correlation is +0.54 which indicates a rather significant association.

The correlation between BSA and the *Medho Sara* Score is moderate and negatively directed, given by $r = -0.409$. Hence, the negative sign depicts that with an increase in the value of BSA, the value of *Medho Sara* Score will decrease. The results of the study indicated that a p-value of less than 0.001 means that this relationship is significant.

These relationships consistency and strength, suggest that the *Medho Sara* Score is largely determined by body composition parameters, especially weight and body fat percentage.

5.11.3 Comparison of Biochemical Variables to *Medho Sara* and *Sthaulya* group

Comparing the mean levels of adiponectin for “*Sthaulya*” and “*Medho Sara*”, Asserted that the participants in the “*Sthaulya*” have a mean adiponectin level of 15.28 $\mu\text{g/mL}$, (SD) 5.74 $\mu\text{g/mL}$. This means that most participants in this group have adiponectin levels which are approximately within the range of 9.54 $\mu\text{g/mL}$ to 21.02 $\mu\text{g/mL}$ (mean $\pm$ SD) and the “*Medho Sara*” group has a significantly higher mean adiponectin level 18.63 $\mu\text{g/mL}$ with an S.D. of approximately 6.59 $\mu\text{g/mL}$. About 95% of the participants in this group have adiponectin levels varying from approximately 12.04 $\mu\text{g/mL}$ to 25.22 $\mu\text{g/mL}$. The p-value of 0.025, it can be concluded that the difference in the adiponectin concentration of the “*Sthaulya*” and “*Medho Sara*” groups is statistically significant.

In the comparison of mean levels of leptin, between "Sthaulya" and "Medho Sara." Showed that the participants in the "Sthaulya" group have a mean leptin level of 21.78 ng/mL, with a standard deviation of 18.63 ng/mL, indicating a wide range of leptin levels. Most participants in this group have leptin levels between approximately 3.15 ng/mL and 40.41 ng/mL (mean $\pm$ SD) and in "Medho Sara" group has a lower mean leptin level of 14.59 ng/mL, with a standard deviation of 14.82 ng/mL. The p-value of 0.042 indicates that the difference in leptin levels between the "Sthaulya" and "Medho Sara" groups is statistically significant.

Adiponectin: It was previously suggested that participants with higher Medho Sara scores were leaner, and they displayed a higher affinity of proportionate adiponectin, which exhibits anti-inflammatory and insulin-sensitizing activity.

Leptin: People who are categorized in this group as "Sthaulya" which is equivalent to obesity have higher concentrations of leptin – a hormone that plays a role in energy balance and fat intake. Leptin resistance is commonly observed in obese people, and high levels of leptin are consequently observed in such individuals.

The idea of Medho Sara is contrasted with metabolically healthy obesity (MHO), which is defined as having greater levels of Adiponectin than obese people with metabolic syndrome (MetS).²¹⁷

Studies from Brazil suggest that Adiponectin levels decreased as the number of Mets components rose, according to data that supported these findings. Adipose tissue secretes a protein called adiponectin, which has anti-inflammatory properties. Adiponectin levels in serum are decreased in patients with obesity, Type II diabetes, hypertension, and MetS, according to a different study.^{218, 219}

Research indicates that obese people's adipose tissue has an overexpression of the leptin gene.²²⁰ Moreover, there are significant positive correlations between body fat percentage and plasma leptin levels.^{221, 222}

5.11.4 Comparison Body Mass Index (BMI) distribution among *Medho Sara* and *Sthaulya*

Distribution of Body Mass Index (BMI) participants in the study in terms of *Sthaulya* and *Medho Sara*. As a result of the study, it was realized that the “*Sthaulya*” group have a mean Body Mass Index of 32. 71 with a standard deviation of 4. 75. This implies that the majority of the participants in this group have BMIs that are between about 27. 96 to 37. 46 (mean $\pm$ SD). A BMI of 30 or higher is considered as obesity hence the “*Sthaulya*” group qualifies to be obese on average.

Regarding the mean BMI, it is lower in the “*Medho Sara*” group, 28. 68 and S.D. equals 3. 49. This implies that close to all people in this bracket have a body mass index that averagely stands at around 25. 19 to 32. 17 (mean $\pm$ SD). The BMI level for participants in this group moves participants to the overweight category but not necessarily the obese category.

The p-value of 0.001 In the study where the test variable is BMI, the group “*Sthaulya*” has a higher mean BMI than the “*Medho Sara*” group

The two groups also differ concerning the BMI indicating that the corresponding health risks differ as well. Obesity is envisaged by a higher BMI and leads to several health complications including cardiovascular diseases, diabetes, and metabolic syndrome. hence, in “*Sthaulya*” group the participants having a higher average BMI may be at higher risk towards such conditions than their counterparts in “*Medho Sara*” group. Such an important difference could help design special health promotion and prevention initiatives and programs addressing the needs and demands of each of the groups,

especially in the area of weight and diet and their effects on health conditions of the ‘*Sthaulya*’ group.

5.11.5 Adiponectin with Anthropometric Parameters

Pearson’s correlation coefficient test was conducted to establish the correlation between adiponectin levels and the participant’s anthropometric measures including weight, BMI and body fat percentage in the study’s sample.

What was noticed at that point is that Weight with Adiponectin had a correlation coefficient of -0.379. This of course means that the occurrence of increased body weight among the participants will be characterized by low adiponectin levels.

The correlation coefficient of Body Mass Index (BMI) with Adiponectin obtained was -0.519, illustrated a negative relationship between BMI and adiponectin levels. This implies that as the BMI increases, meaning the body mass as compared to height is high, then the adiponectin is low.

The coefficient of correlation of Body Fat Percentage with Adiponectin was approximately -0.353 which implies a moderate negative relationship between the body fat percentage and adiponectin level. This means that in line with the degree of obesity, where the per cent body fat is high, the level of adiponectin is low.

Being statistically significant with the values of $p < 0.05$ means that the correlations observed equal or exceed the level of chance in this sample of patients. As 0.05 indicates the possibility of chance is below 5% this says that the observed relationships are not arbitrary. In other words, conclusions, pointed out by these negative correlations, can be considered as genuine and not identified by chance; thus, the findings are considered reliable and significant.

Adiponectin is a protein that is secreted by fat tissue in the body and it has functions that counteract inflammation and insulin resistance. It is almost always inversely proportional to body fat and obesity health risks.

Higher body weight, BMI and especially percentage of body fat are accompanied by significant negative correlations with adiponectin levels. This is in line with previous findings that lower adiponectin levels are often found in those who have more body fat, i.e. higher adiposity and its metabolic derangements like obesity type 2 diabetes or cardiovascular diseases.

Results underscore the potential role of adiponectin as a marker for obesity-attributed health liabilities. These results also provide a possible link between obesity and the negative correlation seen concerning adiponectin suggesting that as weight, BMI, and body fat percentage increase in individuals they may experience decreased levels of circulatory adiponectin and perhaps an increased risk for metabolic & cardiovascular diseases.²²³ This relationship may be important for assessing metabolic healthfulness in individuals and developing strategies through targeted intervention to restore adiponectin levels by weight control and other cellular modifications.

5.11.6 Leptin with Anthropometric Parameters

Pearson's correlation analysis of the association between leptin levels and anthropometric parameters (weight, Body Mass Index [BMI], body fat percentage, and Body Surface area. These analyses found that all of these parameters were positively correlated.

Leptin and Weight: 0.526(+) (Strong Positive Correlation) This indicates that as body fat increases, so do levels of the hormone leptin.

The correlation coefficient for Leptin with Body Mass Index (BMI) was 0.579, showing a strong positive correlation between BMI and leptin levels. Together, this suggests that

higher levels of leptin are correlated with the overall increase in body mass relative to height.

Leptin with Body Fat Percentage had a correlation coefficient of 0.334 and showed a moderate positive relationship. Therefore, as body fat percentage increases, leptin levels follow a fairly similar trajectory to the relationship with weight and BMI but is far less strong.

The correlation coefficient between Leptin with Body Surface Area (BSA) was 0.379 which indicates a significant moderate positive relationship between BSA and leptin levels. It suggests that larger individuals, who usually have more body fat (higher BSA), also produce more leptin.

Since the p-values for all these correlations are less than 0.05, we can tell that the relationships observed here have statistical evidence. This means it is <5% likely that these positive correlations are simply due to random chance, indicating they are most probably real and meaningful.

Leptin is secreted by adipose (fat) tissue and influences balance energy homeostasis, appetite, and metabolism. For instance, its production is strongly associated with body fat so if it increases in proportion to the quantity of fat stored within your system.

Highly significant positive correlations of leptin with weight, BMI, body fat percentage and BSA revealed the increase in anthropometric parameters related to gain in Leptin levels. It occurs actually better with weight and BMI, but it is particularly strongly evident in studies of large body mass and adiposity dependent range from adds a role to leptin function.

Leptin resistance is often observed in obesity - a situation of high area under the leptin curve, representing that higher amounts are being produced and released from fat with constantly having more fat mass around it. ²²⁴ The increased leptin causes the body to

stay hungry even if fed and slows down metabolism which leads to all of that weight gain since people will be too tired to exercise. These findings may help to refine our knowledge of metabolic and hormonal phenotypes in individuals, which could be targeted with intervention for the management not only of body weight but also health-related risks.

Such data demonstrate that leptin continues to serve as a biomarker of adiposity and may potentially be used in the future for the management of obesity and associated metabolic abnormalities. Strong correlations with crucial anthropometrical parameters, the strong relationship between leptin levels and fat depots as well as energy balance mean that it is closely related to the size of one's own body.

6. SUMMARY

The dissertation entitled “Biochemical Changes in Individuals of High BMI with special reference to *MEDHO SARA* (excellence of adipose tissue) and *STHAULYA* (obesity)” comprises the following:

6.1 Introduction:

The introduction emphasises the *Ayurvedic* phenomenon of *Dhatu Sara*, *Medho Sara* and *Sthaulya* with special reference to how healthy states differ from pathological states of adipose tissue. It highlights the significance of learning these ideas both for obesity identification and prevention, particularly as India embraces a disease pattern where overweight individuals are metabolically normal (metabolically healthy obesity) that is swiftly being accompanied by increasing rates of unhealthy weight.

6.2 Objective:

The study was focused on estimating the index of *Medho Sara* and *Sthaulya Lakshana* in individuals with high BMI and checking for biochemical parameters associated with it. It focused on biochemical changes and adipokine levels in relation to *Medho Dhatu* and *Sthaulya*.

It aims to differentiate the physiological conditions from pathological states by investigating body fat percentage, serum lipid profile, and blood glucose levels, with evaluation of Body Mass Index (BMI). This study aims to design a tool that incorporates the above criteria and provides an objective estimation of visceral adiposity in particular with metabolically healthy obese subjects for understanding better these metabolic risks.

6.3 Review of Literature:

Under review of literature, a detailed review of the concept of *Medho Sara* and *Sthaulya* in Ayurvedic literature is traced through etymology, definition and classification along with its contemporary science equivalence. It also explains the findings on different conditions of excess Adiposity like Obesity and Metabolic healthy obesity. It also includes details regarding physical features (skin colouration and voice), and socio-psychological traits (strength or happiness) ascribed to different Sara types. The document also cites the classic texts of *Ayurveda* and recent academic research.

6.4 Materials and Methods:

It describes all stages of the work such as

- i. Validation and standardization process, a questionnaire was developed on the concept of *Medho Sara* and *Sthaulya* based on statistical treatment necessary arrangements were made and tested for accuracy.
- ii. Characteristics of Participants: At baseline, 305 subjects were screened through validated tools for identification of *Medho Sara* (healthy adiposity) or *Sthaulya* (obesity).
- iii. Evaluations: Anthropometric measurement, body fat % and biochemical profiles including lipid profile, glucose and insulin level, adiponectin/leptin and IL-6/TNF-a was assessed on 80 identified subjects.
- iv. Analyzing and comparing the results.

This study intends to biologically distinguish between normal and unhealthy states of Adiposity using these assessments.

6.5 Observation and Results:

Demographic variables such as Age, gender, weight, height, BMI, Sharira Pramana, Sara vs Sthaulya, Sara Impression. Comparison between Age, height, weight, BF%, BMI and BSA to Medho Sara and Sthaulya along with Pearson correlation for the same.

Comparison and correlation between CBC, Lipid Profile, Adiponectin, Leptin, IL-6, TNF-a, and Anthropometric parameters to the of Medho Sara and Sthaulya was explained.

6.6 Discussion:

Results and observations were discussed in this session, along with justifications and a critical evaluation of the findings.

6.7 Conclusion:

This study developed and validated a subjective assessment tool for Medho Sara and Sthaulya. The Anthropometric parameters like Body Weight, Body Fat Percentage, Body Surface area, Body Mass Index, Mid Arm, Mid-Thigh, Calf, Chest, Waist, and Hip Circumference along with Waist-hip ratio were found to have a significant association with Medho Sara and Sthaulya, hence can be designated as an objective tool for the assessment of the same.

In biochemical parameters, Adiponectin and Leptin were found to be ideal for differentiating Medho Sara from Sthaulya

7. CONCLUSION

This study has developed and validated a subjective assessment tool for *Medho Sara* and *Sthaulya*. It also emphasizes the importance of knowing obesity and its associated factors distribution among the population. The high rates of overweight and obesity found among study participants are troubling, as these conditions can lead to the development of chronic diseases like metabolic syndrome, diabetes and cardiovascular illnesses. Nevertheless, the absence of these conditions in a significant proportion of participants provides support to "Metabolic Healthy Obese" individuals who still deserve attention.

The study has also unfolded the details regarding the types of participants based on *Sharira Pramana* and the difference between *Sthaulya* (obesity) and *Medhosara*. This suggests that these groups are associated with concomitant differences in BMI, adiponectin and leptin levels along with this the Anthropometric parameters like Body Weight, Body Fat Percentage, Body Surface area, Body Mass Index, Mid Arm, Mid-Thigh, Calf, Chest, Waist, and Hip Circumference along with Waist-hip ratio were also found to have a significant difference between *Medho Sara* and *Sthaulya*, hence can be designated as an objective tool for the assessment of the same.

These results indicate the importance of considering their particular health needs in designing health promotion and prevention programs for these groups.

7.1. LIMITATION OF STUDY

This study on *Medho Sara* and *Sthaulya*, while very thorough in breadth, had several constrictions:

1. **Sample Size and Generalizability:** The study recruited a limited number of problematic statements and therefore findings cannot easily be professionally spoken. The demographic profile of the sample is dominated by young adults and an overrepresentation of females compared to what is typical for the Indian population in terms of age and sex.

2. **Subjective Assessment of *Medho Sara* and *Sthaulya*:** Although the assessment of *Medho Sara* and *Sthaulya* included questionnaires, as well as interviews that could lead to a bias-driven response due to subjectivity.

3. **Limited Geographical and Cultural Realm:** The study was carried out in a certain geographical area therefore the results might not apply to different regions with other dietary habits, lifestyles and genetic backgrounds.

4. **Potential Confounding Variables:** The study is unable to exclude the influence of all possible confounding variables such as diet habits, physical activity level, socioeconomic status and underlying medical conditions on body composition or metabolic health.

5. **Lack of Longitudinal Data:** The Study is based on a cross-sectional design, which collects the data once hence limiting the ability to interpret causality or changes in *Medho Sara* and *Sthaulya* over time. It is a hospital-based case series study that simply brings association but future follow-up or a prospective study would allow evaluation of the effect of individual variables more precisely

Hence, to make the values of these parameters more precise and generalize, and to explore new things, further extensive and emphasized study is to be done.

7.2. SCOPE FOR THE FURTHER RESEARCH

The findings from the trial on *Medho Sara* and *Sthaulya* further pave the way for an interesting line of future research with broader depths to explore in this area.

1. The longitudinal studies can be undertaken in future by assessing *Medho Sara* and *Sthaulya*. It may lead to better characterization of the development of metabolic health and potentially its first impact on disease, shedding light on the natural history of these conditions
2. Results should be generalized to larger and more diverse populations. This may include participants across different regions, age groups and ethnicities providing an idea of the various characteristics of *Medho Sara* as well as *Sthaulya* in the larger population.
3. Modern medical diagnostics, including advanced imaging techniques (MRI, CT scans), more detailed metabolic panels and genetic testing could perhaps provide a better-rounded analysis of body composition and different aspects of your overall health. The integration attempts to synthesize *Ayurvedic* understanding with the anatomy and physiology of contemporary medical science which, in turn, might translate into a broader spectrum of disease conditions that can be diagnosed or managed at the treating stage.
4. A more detailed investigation of the biochemical and physiological mechanism involved in *Medho Sara* and *Sthaulya* which may include hormonal, genetic & metabolic pathways will open up future options for consideration. This might be achieved by conducting further studies on adipokines, inflammatory markers, and other biomarkers.

5. Experimental studies could be conducted to understand the effects of dietary, lifestyle and therapeutics in these patients with features of *Medho Sara* and *Sthaulya*. This would situate them to develop strategies for managing and even reversing these conditions.
6. Partnering with others such as endocrinologists, nutritionists, psychologists and bioinformatics specialists can broaden the scope of research to make it more comprehensive.
7. Qualitative research exploring the cultural and psychosocial determinants of *Medho Sara*, *Sthaulya* including body image, and unique health perceptions/lifestyle choices are required for a deeper understanding of individual variability in these dimensions. For instance, it may examine how body weight norms, eating and exercise habits vary between different societies.
8. Out of seven *Sara*'s mentioned in *Ayurveda*, this study was concentrated only on *Medho Sara*, the subjective and Objective parameters for assessment of the other six *Sara*'s can enhance the *Ayurvedic* concepts more understandable.
9. Thus far, no epidemiological study has been conducted on adipocytokines to establish the typical values of these markers in healthy individuals. Research can be done to confirm the intra-population variations and determine physiologically meaningful adiponectin cut-off values for future risk assessment and illness prevention.

8. BIBLIOGRAPHIC REFERENCES

1. Acharya JT. Charaka Samhita by Agnivesa, Reprint ed. Varanasi: Chaukhamba Orientalia; 2011. p.247.
2. Lewis rice, Amara kosha of Amara simha, 2nd ed. Mysore: Mysore University; 1989. p.218.
3. Acharya JT. Sushruta Samhita by Sushruta.reprint ed, Varanasi; Chowkamba Sanskrit Sansthan; 2010; p.67.
4. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p183
5. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 514.
6. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
7. Lewis rice, Amara kosha of Amara simha, 2nd ed. Mysore: Mysore University; 1989. p.218.
8. Gupta Umeshchandra. Vaidyaka Shabda Sindhu. 4 Reprint ed. Varanasi: Chaukhamba orientalia; 1999. p.1113.
9. Lewis rice, Amara kosha of Amara simha, 2nd ed. Mysore: Mysore University; 1989. p. 218.
10. Sir Williams Monier. M, An English Sanskrit Dictionary, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 549.
11. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
12. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.152.

13. Agnivesh, Charaka samhita, Sutrasthana, chapter 21, sloka 4, Editor Dr. Gangasahaya Pandeya, 5th edition, Varanasi, chaukhamba Sanskrit samsthan, 1997; Pg- 278.
14. Vd. Ganesh Krishna Garde, AshtangaHrudaya, Anmol prakashan, Sutrasthana, 11/10 pg. 52, 2013.
15. Mohan V, Deepa R. Obesity & abdominal obesity in Asian Indians. Indian J Med Res. 2006;123:593–6. [PubMed]
16. World Health Organization (WHO). Obesity: preventing and managing the global epidemic. Report of a WHO consultation. (1-253). World Health Organ Tech Rep Ser. 2000;894:i–xii. [PubMed]
17. Geneva: WHO; 2012. [accessed on November 28, 2017]. World Health Organization (WHO). World Health Statistics 2012. Available from : http://www.who.int/gho/publications/world_health_statistics/EN_WHS2012_Full.pdf.
18. World Health Organization (WHO). Obesity and overweight face sheet [accessed on December 16, 2017]. Available from: <http://www.who.int/dietphysicalactivity/publications/obesity/en>
19. Kelly T, Yang W, Chen CS, Reynolds K, He J: Global burden of obesity in 2005 and projections to 2030. Int J Obes (Lond) 2008, 32:1431–1437.
20. Wildman RP, Muntner P, Reynolds K, McGinn AP, Rajpathak S, Wylie-Rosett J, et al: The obese without cardiometabolic risk factor clustering and the normal weight with cardiometabolic risk factor clustering: prevalence and correlates of 2 phenotypes among the US population (NHANES 1999–2004). Arch Intern Med 2008, 168:1617–1624.

21. Velho S, Paccaud F, Waeber G, Vollenweider P, Marques-Vidal P: Metabolically healthy obesity: different prevalences using different criteria. *Eur J Clin Nutr* 2010, 64:1043–1051.
22. Denis GV, Obin MS: ‘Metabolically healthy obesity’: origins and implications. *Mol Aspects Med* 2013, 34:59–70278.
23. Pataky Z, Bobbioni-Harsch E, Golay A: Open questions about metabolically normal obesity. *Int J Obes (Lond)* 2010, 34(Suppl 2):S18–S23.
24. Bahadur Radhakanthdeva. *Shabdhakalpadruma*. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; vol 4 p. 456.
25. Sir Williams Monier. M, *An English Sanskrit Dictionary*, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 549.
26. Acharya J T. *Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta*. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p.515.
27. Acharya J T. *Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta*. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
28. Villines Z. Body fat percentage charts for men and women [Internet]. 2023. Available from: <https://www.medicalnewstoday.com/articles/body-fat-percentage-chart#summary>.
29. E.E. Blaak. Gender differences in fat metabolism. *Current Opinion in Clinical Nutrition and Metabolic Care*. 2001, 4:4 DB-602
30. Kalra S, Kapoor N, Verma M, Shaikh S, Das S, Jacob J, et al. Defining and Diagnosing Obesity in India: A Call for Advocacy and Action. *Journal of Obesity* [Internet]. 2023 Nov 7;2023:1–13. Available from: <https://doi.org/10.1155/2023/4178121>

31. Apte, Vaman Shivaram. Revised and enlarged edition of Prin. V. S. Apte's The practical Sanskrit-English dictionary. Poona: Prasad Prakashan, 1957-1959. 3v.1673.
32. Bahadur Radhakanthdeva. Shabdhakalpadruma. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; vol 4 p. 337.
33. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
34. Gupta Umeshchandra. Vaidyaka Shabda Sindhu. 4 Reprint ed. Varanasi: Chaukhamba orientalia; 1999. p.1113.
35. Lewis rice, Amara kosha of Amara simha, 2nd ed. Mysore: Mysore University; 1989. p. 218.
36. Sir Williams Monier. M, An English Sanskrit Dictionary, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 549.
37. Gupta Umeshchandra. Vaidyaka Shabda Sindhu. 4 Reprint ed. Varanasi: Chaukhamba orientalia; 1999. p.1113.
38. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
39. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p183.
40. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p396.
41. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p 396.
42. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.

43. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
44. Jyotirmitra Acharya, Astanga Sangraha; 2nd ed: Varanasi; Chowkhamba Samskrit Series, p 191.
45. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p 407.
46. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
47. Jyotirmitra Acharya, Astanga Sangraha; 2nd ed: Varanasi; Chowkhamba Samskrit Series, p 324.
48. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
49. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
50. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.152.
51. Jyotirmitra Acharya, Astanga Sangraha; 2nd ed: Varanasi; Chowkhamba Samskrit Series, p 324.
52. Paradakara H S Sastri. Ashtangahrdaya by Vagbhata.reprint ed, Varanasi; Chowkamba Surbharati Prakashan; 2005; p 407.
53. Sharma Hemaraja. Kashyapa Samhita of Kashyapa. Reprint ed. Varanasi: Chaukhamba Sanskrit sansthan; 2010. p. 54.
54. Upadyaya Baladeva. Brihat Samhita of Varamihiracharya. 1st ed. Varanasi Varanasiya Sanskrit vishvavidyalaya; 1989. p. 772.

55. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
56. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.152.
57. Upadyaya Baladeva. Brihat Samhita of Varamihiracharya. 1st ed. Varanasi Varanasiya Sanskrit vishvavidyalaya; 1989. p. 772.
58. Bramanand Tripathi, Charaka samhita, 6th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 1999. p. 989.
59. Shrikanta Murthy, Astnga Sangraha, 1st ed. Varanasi: Chaukhambha Orientalia; 1996. p.15.
60. Bramanand Tripathi, Charaka samhita, 6th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 1999. p. 1021-1022.
61. Bramanand Tripathi, Charaka samhita, 6th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 1999. p.1021.
62. Bramanand Tripathi, Charaka samhita, 6th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 1999. p. 1021.
63. Bramanand Tripathi, Charaka samhita, 6th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 1999. p. 259.
64. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 2002. p. 194.
65. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 616.
66. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 109.

67. Shivkumar Goud. Ayurvedik Shreera Kriya Vignana. New ed. Maharashtra: Naath Pustak Bhandar; 1990. p. 35.
68. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 260.
69. M. Ram Sunder Rao. Shareera Kriya Vignana. 5th ed. Vijayawada: M. Madhava Publishers; 2001. p. 370.
70. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
71. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 462.
72. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 771.
73. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278.
74. B. M. Chatterjee. Handbook of Ophthalmology. 6th ed. New Delhi: CBS Publishers; 2004. p. 255.
75. B. M. Chatterjee. Handbook of Ophthalmology. 6th ed. New Delhi: CBS Publishers and Distributors; 2004. p. 257
76. Dartt DA, Hodges RR, Li D, Shatos MA, Lashkari K, Serhan CN. Conjunctival goblet cell secretion stimulated by leukotrienes is reduced by resolvins D1 and E1 to promote resolution of inflammation. The Journal of Immunology [Internet]. 2011 Mar 1;186(7):4455–66. Available from: <https://doi.org/10.4049/jimmunol.1000833>
77. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515.

78. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 79
79. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515
80. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 2002. p. 436
81. Chandrabhushan Jha. Sharangadhara Samhita, 1st ed, Varanasi: Chaukhambha Orientalia; 2006. p. 46
82. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 338
83. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 258
84. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 385
85. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 342
86. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 348
87. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 177
88. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 385
89. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 265

90. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 361
91. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 2002. p. 402
92. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 361
93. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 2002. p. 403.
94. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 350
95. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 350
96. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 251
97. Shivprasad Sharma. Ashtanga sangraha, 3rd ed, Varanasi: Chaukhambha Orientalia; 2012. p. 149
98. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 17
99. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 218
100. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 253
101. Shivkumar Goud. Ayurvedik Shreera Kriya Vignana. New ed. Maharashtra: Naath Pustak Bhandar; 1990. p. 207

102. Institute for Quality and Efficiency in Health Care (IQWiG). In brief: Structure of the nails [Internet]. InformedHealth.org - NCBI Bookshelf. 2024. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK513133/>
103. Hemangi Mehta. A comparative study between Pratisara and Gandoosha in Danta Veshta wsr to Pyorrhoea Alveolaris. Jamnagar: 2002. p. 30
104. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 369
105. Professional CCM. Sebaceous glands [Internet]. Cleveland Clinic. 2024. Available from: <https://my.clevelandclinic.org/health/body/24538-sebaceous-glands>
106. Chandrabhushan Jha. Sharangadhara Samhita, 1st ed, Varanasi: Chaukhambha Orientalia; 2006. p. 54.
107. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 279
108. Chandrabhushan Jha. Sharangadhara Samhita, 1st ed, Varanasi: Chaukhambha Orientalia; 2006. p. 54.
109. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 512
110. <https://www.nlm.nih.gov/medlineplus/ency/article/003588.htm>
111. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515
112. Chandrabhushan Jha. Sharangadhara Samhita, 1st ed, Varanasi: Chaukhambha Orientalia; 2006. p. 298
113. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.68

114. M. Ram Sunder Rao. Shareera Kriya Vignana. 5th ed. Vijayawada: M. Madhava Publishers; 2001. p. 251
115. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.152
116. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.152
117. Bahadur Radhakanthdeva. Shabdhakalpadruma. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; Vol 4. p. 386
118. Sir Williams Monier. M, An English Sanskrit Dictionary, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 549.
119. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 342
120. Bahadur Radhakanthdeva. Shabdhakalpadruma. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; Vol 2. p. 1233
121. Sir Williams Monier. M, An English Sanskrit Dictionary, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 1009.
122. Sir Williams Monier. M, An English Sanskrit Dictionary, Reprint ed., New delhi: Bharatiya Granth Niketan; 2006. p. 367.
123. Bahadur Radhakanthdeva. Shabdhakalpadruma. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; Vol 4. p. 362
124. Bahadur Radhakanthdeva. Shabdhakalpadruma. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; Vol 2. p. 1203
125. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 340

126. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p.354
127. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 387
128. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 251
129. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 116
130. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 118
131. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 122
132. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278
133. Shastri K. N., Chaturvedi. G. N., Charak Samhita, reprint ed., Varanasi: Chaukambha Bharati Academy, 2001: (1) 771.
134. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 278
135. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 152
136. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 340
137. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 116

138. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p.117
139. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515
140. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 75
141. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 68
142. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 514
143. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515
144. Tortora Gerard J, principles of anatomy and physiology, 8th ed.USA, Harpercollins Publishers.1996.p.128.
145. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Chokamba Sanskrit surabharati, prakashan; 2002. p. 186
146. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 515
147. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 339
148. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 514
149. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 175

150. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 175
151. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 60
152. Acharya J T, Acharya N R. Sushruta samhita of Sushruta, Nibandha Sangraha vyakhya of Dalhana. 7th ed. Varanasi: Chaukhamba orientalia; 2002. p. 60
153. Chandrabhushan Jha. Sharangadhara Samhita, 1st ed, Varanasi: Chaukhambha Orientalia; 2006. p. 68
154. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 516
155. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. p. 175
156. Shivprasad Sharma. Ashtanga sangraha, 3rd ed, Varanasi: Chaukhambha Orientalia; 2012. p. 152
157. Hari Sadashiva Shastri Paradakar, Astanga Hrudaya, 7th ed, Varanasi: Choukamba Sanskrit surabharati, prakashan; 2002. p. 188
158. Gurr MI, Harwood JL, Frayn KN. Lipid Biochemistry: An Introduction. John Wiley & Sons; 2008. 35 p.
159. Ridgway N, McLeod R. Biochemistry of Lipids, Lipoproteins and Membranes. Elsevier; 2015. 116 p.
160. Chatterjea M, Shinde R. Textbook of Medical Biochemistry: Eighth Edition. Wife Goes On; 2011. 347 p.
161. Bastard JP, Fève B. Physiology and Physiopathology of Adipose Tissue. Springer Science & Business Media; 2012. 58 p.

162. Sanders T a. B. Functional Dietary Lipids: Food Formulation, Consumer Issues, and Innovation for Health. Elsevier; 2023. 129 p.
163. Foundation AH. Plasma Lipids: Optimal Levels for Health. Academic Press; 2013. 86 p.
164. Clark RR, Kuta JM, Sullivan JC. Prediction of per cent body fat in adult males using dual-energy x-ray absorptiometry, skinfolds, and hydrostatic weighing. Medicine & Science in Sports & Exercise [Internet]. 1993 Apr 1;11(4):528-534. Available from: <https://doi.org/10.1249/00005768-199304000-00017>
165. Sun SS, Chumlea WC, Heymsfield SB, Lukaski HC, Schoeller D, Friedl K, et al. Development of bioelectrical impedance analysis prediction equations for body composition with the use of a multicomponent model for use in epidemiologic surveys. American Journal of Clinical Nutrition [Internet]. 2003 Feb 1;77(2):331–40. Available from: <https://doi.org/10.1093/ajcn/77.2.331>
166. Brooke-Wavell K, Jones PRM, Norgan NG, Hardman AE. Evaluation of near infra-red interactance for assessment of subcutaneous and total body fat. PubMed [Internet]. 1995 Jan 1;49(1):57–65. Available from: <https://pubmed.ncbi.nlm.nih.gov/7713052>
167. Nuttall FQ. Body Mass Index. Nutrition Today [Internet]. 2015 May 1;50(3):117–28. Available from: <https://doi.org/10.1097/nt.0000000000000092>
168. Tanita. TANITA BC-1000Plus Body Composition Monitor: Peak Health Monitoring | Tanita [Internet]. Tanita. Available from: <https://tanita.com/products/bc-1000plus?Color=White>
169. Vachaspatyam Vol-2 Work No.94 : Raj, Gazapatti : Free Download, Borrow, and Streaming : Internet Archive [Internet]. Internet Archive. 1962. Available from: <https://archive.org/details/in.ernet.dli.2015.314325/page/n1/mode/2up>

170. amarakosha [Internet]. Available from:
<https://sanskritdocuments.org/sanskrit/amarakosha/>
171. Mishra Bramhashankar. Bhavaprakasha Vidyotini Tika, Madhya Khanda 39, 11, edition, Varanasi, Chaukhambha Sanskrit, Sansthana; 2004.
172. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Sutrasthana, Ashtauninditiya Adhyaya, 21/8-9, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016. p. 401.
173. Nieto-García FJ, Bush TL, Keyl PM. Body Mass Definitions of Obesity. Epidemiology [Internet]. 1990 Mar 1;1(2):146–52. Available from:
<https://doi.org/10.1097/00001648-199003000-00011>
174. Matarazzo JD. Behavioral health and behavioral medicine: Frontiers for a new health psychology. American Psychologist [Internet]. 1980 Jan 1;35(9):807–17. Available from: <https://doi.org/10.1037//0003-066x.35.9.807>
175. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of Obesity and Trends in the Distribution of Body Mass Index Among US Adults, 1999-2010. JAMA [Internet]. 2012 Jan 18;307(5):491. Available from:
<https://doi.org/10.1001/jama.2012.39>
176. Scheinker D, Valencia A, Rodriguez F. Identification of Factors Associated With Variation in US County-Level Obesity Prevalence Rates Using Epidemiologic vs Machine Learning Models. JAMA Network Open [Internet]. 2019 Apr 26;2(4):e192884. Available from:
<https://doi.org/10.1001/jamanetworkopen.2019.2884>
177. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Vimanasthana, Trividhakukshiya Viman Adhyaya, 2/8, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016, p. 671.

178. Peterkova VA, Vasyukova OV. About the new classification of obesity in the children and adolescents. Problems of Endocrinology [Internet]. 2015 Apr 15;61(2):39–44. Available from: <https://doi.org/10.14341/probl201561239-44>
179. Sushruta. “Sushruta Samhita”, Revised by Nagarjuna, Vol III, edited by Dr. P.V. Sharma. Varanasi: Chaukhambha Visvabharati Prakashan, Sutrasthana 10/5, P. 114.
180. Yadavji Trikamji Acharya, Agniveshakrita Charaka Samhita Chakrapani Commentary, Sutrasthana 21/3, Varanasi, Chaukhambha Sanskrita Sansthan; 2009.
181. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Nidanasthana, Pramehanidan Adhyaya, 4/5, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016, p. 613.
182. Vagbhat, Ashtanga Hridaya with Sarvangasundara teeka, Nidana Sthana- 10/3, edited by Hari Shastri Paradkar , Akola, published by Varanasi,Chaukhambha Sanskrit Sansthan, 2010, page no. 502.
183. Mishra Bramhashankar. Bhavaprakasha Vidyotini Tika, Madhya Khanda 39, 11 edition, Varanasi, Chaukhambha Sanskrit Sansthana; 2004
184. Vagbhat , Ashtang Hridaya with Sarvangasundari Tika and Ayurveda Rasayana Tika, Sutrasthana, Dvividhopakramaniya Adhyaya, 14/11 , edited by Prof K.R.Srikantha Murthy,Varanasi, Chowkhamba Krishnadas Academy 2014.P. 193.
185. Aien Khan Afridi, Alam Khan. Prevalence and Etiology of Obesity - An Overview. Pakistan Journal of Nutrition [Internet]. 2003 Dec 15;3(1):14–25. Available from: <https://doi.org/10.3923/pjn.2004.14.25>
186. Sushruta. “Sushruta Samhita”, Revised by Nagarjuna, Vol III, edited by Dr. P.V. Sharma. Varanasi: Chaukhambha Visvabharati Prakashan, Sutrasthana 10/5, P. 116.

187. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Vimanasthana, Trividhakukshiya Viman Adhyaya, 2/8, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016, p. 671.
188. Raj M, Kumar RK. Obesity in children & adolescents. PubMed [Internet]. 2010 Nov 1; Available from: <https://pubmed.ncbi.nlm.nih.gov/21150012>
189. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Chikitsasthana, Vaatvyadhi Adhyaya, 28/19, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016. p. 938.
190. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Nidanasthana, Pramehanidan Adhyaya, 4/5, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016, p. 613.
191. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Sutrasthana, Ashtauninditiya Adhyaya, 21/30, edited by Tripathi Brahmanand. Varanasi: Chaukhambha Surbharati Prakashan; 2016. p. 405.
192. Malina RM, Bouchard C, Bar-Or O. Growth, Maturation, and Physical Activity [Internet]. Human Kinetics eBooks. 2004. Available from: <https://doi.org/10.5040/9781492596837>
193. Shastri A, Ayurved Tattva Sandipika hindi commentary on Susrutasamhita of Maharshi Sushruta, Chaukhambha Orientalia, Varanasi, Sutrasthan; 2016. 81.
194. Kale VS. Mnorama hindi commentary on Charaksamhita of Agnivesha, Chaukhambha Orientalia Delhi, Sutrasthan, 2016; 21: 5-83-.30, 308.
195. Kale VS. Mnorama hindi commentary on Charaksamhita of Agnivesha, Chaukhambha Orientalia ,Delhi,2016 Sutrasthan, 2016; 20: 17, 286.

196. Redinger RN. The pathophysiology of obesity and its clinical manifestations. PubMed [Internet]. 2007 Nov 1; Available from: <https://pubmed.ncbi.nlm.nih.gov/21960798>
197. Shastri AD Etal, Sushruta Samhita, Part-II, Nidana Sthana, Chaukhambha Sanskrita Sansthan Publication, Varanasi, Edition; 2012. 28
198. Gupta A, Ashtanga Hridaya, Sutrasthan, Chaukhambha Prakashan, Varanasi, Edition; 2012. 189 p.
199. Sebaiy MM. Literature Review on Obesity: Causes, Treatment and Correlation with Pandemic COVID-19. Pharmaceutical Drug Regulatory Affairs Journal [Internet]. 2021 Jan 1;4(1). Available from: <https://doi.org/10.23880/pdraj-16000124>
200. Delitto A, George SZ, Van Dillen L, Whitman JM, Sowa G, Shekelle P, et al. Low Back Pain. Journal of Orthopaedic and Sports Physical Therapy [Internet]. 2012 Apr 1;42(4):A1–57. Available from: <https://doi.org/10.2519/jospt.2012.42.4.a1>
201. Costanzo P, Cleland JGF, Pellicori P, Clark AL, Hepburn D, Kilpatrick ES, et al. The Obesity Paradox in Type 2 Diabetes Mellitus: Relationship of Body Mass Index to Prognosis. Annals of Internal Medicine [Internet]. 2015 May 4;162(9):610–8. Available from: <https://doi.org/10.7326/m14-1551>
202. Engin A. The Definition and Prevalence of Obesity and Metabolic Syndrome. Advances in Experimental Medicine and Biology [Internet]. 2017 Jan 1;1–17. Available from: https://doi.org/10.1007/978-3-319-48382-5_1
203. Obesity [Internet]. Cleveland Clinic. 2024. Available from: <https://my.clevelandclinic.org/health/diseases/11209-weight-control-and-obesity>

204. Smith GI, Mittendorfer B, Klein S. Metabolically healthy obesity: facts and fantasies. *Journal of Clinical Investigation* [Internet]. 2019 Sep 15;129(10):3978–89. Available from: <https://doi.org/10.1172/jci129186>
205. Blüher M. Metabolically Healthy Obesity. *Endocrine Reviews* [Internet]. 2020 Mar 4;41(3). Available from: <https://doi.org/10.1210/endrev/bnaa004>
206. Taber KS. The Use of Cronbach’s Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education* [Internet]. 2017 Jun 7;48(6):1273–96. Available from: <https://doi.org/10.1007/s11165-016-9602-2>
207. Shuter B, Aslani A. Body surface area: Du Bois and Du Bois revisited. *European Journal of Applied Physiology* [Internet]. 2000 Jun 13;82(3):250–4. Available from: <https://doi.org/10.1007/s004210050679>
208. Casadei K, Kiel J. Anthropometric Measurement. 2022 Sep 26. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 30726000.
209. Krishgen Biosystems. Adiponectin (ADPN) [Internet]. Krishgen Biosystems. 2024. Available from: <https://krishgen.com/product/details/genlisa-human-adiponectin-adpn-elisa/>
210. Krishgen Biosystems. Leptin (LEP) [Internet]. Krishgen Biosystems. 2024. Available from: <https://krishgen.com/product/details/human-leptin-lep-elisa/>
211. Krishgen Biosystems. GENLISA Human Interleukin 6 (IL-6 / IL6) ELISA [Internet]. Krishgen Biosystems. 2024. Available from: <https://krishgen.com/product/details/genlisa-human-interleukin-6-il6-elisa/>
212. Krishgen Biosystems. TNF-Alpha (TNFa / TNA-alpha / TNFA) [Internet]. Krishgen Biosystems. 2024. Available from:

<https://krishgen.com/product/details/human-tnf-alpha-tumor-necrosis-factor-alpha-elisa/>

213. Hayrapetyan H, Tran T, Tellez-Corrales E, Madiraju C. Enzyme-Linked Immunosorbent Assay: Types and Applications. *Methods in Molecular Biology* [Internet]. 2023 Jan 1;1–17. Available from: https://doi.org/10.1007/978-1-0716-2903-1_1
214. Mutchler C. Are Weight Gain Medications Safe? When To Use Them [Internet]. Health. 2023. Available from: <http://www.health.com/health/gallery/0,,20545602,00.html#birth-control-7>
215. Baker ER. Body Weight and the Initiation of Puberty. *Clinical Obstetrics & Gynecology* [Internet]. 1985 Sep 1;28(3):573–9. Available from: <https://doi.org/10.1097/00003081-198528030-00013>
216. Wu BN, O’Sullivan AJ. Sex Differences in Energy Metabolism Need to Be Considered with Lifestyle Modifications in Humans. *Journal of Nutrition and Metabolism* [Internet]. 2011 Jan 1;2011:1–6. Available from: <https://doi.org/10.1155/2011/391809>
217. Yosae S, Khodadost M, Esteghamati A, Speakman JR, Djafarian K, Bitarafan V, et al. Adiponectin: An Indicator for Metabolic Syndrome. *Iranian Journal of Public Health* [Internet]. 2020 Jun 6; Available from: <https://doi.org/10.18502/ijph.v48i6.2921>
218. Von Frankenberg AD, Reis AF, Gerchman F. Relationships between adiponectin levels, the metabolic syndrome, and type 2 diabetes: a literature review. *Archives of Endocrinology and Metabolism* [Internet]. 2017 Dec 1;61(6):614–22. Available from: <https://doi.org/10.1590/2359-3997000000316>

219. Hong X, Zhang X, You L, Li F, Lian H, Wang J, et al. Association between adiponectin and newly diagnosed type 2 diabetes in population with the clustering of obesity, dyslipidaemia and hypertension: a cross-sectional study. *BMJ Open* [Internet]. 2023 Feb 1;13(2):e060377. Available from: <https://doi.org/10.1136/bmjopen-2021-060377>
220. Obradovic M, Sudar-Milovanovic E, Soskic S, Essack M, Arya S, Stewart AJ, et al. Leptin and Obesity: Role and Clinical Implication. *Frontiers in Endocrinology* [Internet]. 2021 May 18;12. Available from: <https://doi.org/10.3389/fendo.2021.585887>
221. Fujita Y, Kouda K, Ohara K, Nakamura H, Iki M. Leptin mediates the relationship between fat mass and blood pressure. *Medicine* [Internet]. 2019 Mar 1;98(12):e14934. Available from: <https://doi.org/10.1097/md.00000000000014934>
222. Ostlund RE, Yang JW, Klein S, Gingerich R. Relation between plasma leptin concentration and body fat, gender, diet, age, and metabolic covariates. *The Journal of Clinical Endocrinology & Metabolism* [Internet]. 1996 Nov 1;81(11):3909–13. Available from: <https://doi.org/10.1210/jcem.81.11.8923837>
223. Lei X, Qiu S, Yang G, Wu Q. Adiponectin and metabolic cardiovascular diseases: Therapeutic opportunities and challenges. *Genes & Diseases* [Internet]. 2022 Nov 17;10(4):1525–36. Available from: <https://doi.org/10.1016/j.gendis.2022.10.018>
224. Myers MG, Leibel RL, Seeley RJ, Schwartz MW. Obesity and leptin resistance: distinguishing cause from effect. *Trends in Endocrinology and Metabolism* [Internet]. 2010 Sep 17;21(11):643–51. Available from: <https://doi.org/10.1016/j.tem.2010.08.002>

9. ANNEXURE

A. DATA COLLECTION – CASE PERFORMA

MODIFIED PATIENT INFORMATION SHEET (version 8)

Protocol Title: Bio-Chemical Changes in Individuals of High BMI with special reference to MEDO SARA (excellence of adipose tissue) and STAULYA (obesity)
Guide: Dr.Pradeep L Grampurohit Co-Guide: Dr.Sunil Jalapure. Scholar: Dr.Sumith Kumar M

SI No		OPD / IPD No	
Name		Age & Sex	_____Yrs M /F
Religion		Place	
Marital stat	M /Um	Education	IL/ <10 th /D / PG
Date	/ /	Occupation	

OBJECTIVE ASSESSMENT:

1. Weight	Kg	
2. Height	cm	
3. BMI	Kg/m ²	
4. Mid arm	cm	cm
5. Mid-thigh	cm	cm
6. Mid- Calf		
7. Chest	cm	
8. Waist	cm	
9. Hip	cm	
10. Waist-hip ratio		
11. Skin fold thickness	Biceps	Triceps
12. Fat %		
13. BSA		
14. Anguli Pramana	Ayama(Ht)	Vistara (Arm span)
	Wrist joint	Ankle joint
	Neck	

[Ideal for Ayama & Vistara by thumb = 84, Neck = 22, by index for wrist = 12, by index for Ankle = 14]

SUBJECTIVE CRITERIA:		Staulya	Sara
1.	Assessment of Chala, Sphiga, Udara & Sthana(CSUS)		
A	Absent	0	3
B	CSUS only on brisk walking which is felt by patient	1	2
C	CSUS observable by others on brisk walking	2	1
D	CSUS even on normal walk	3	0
2.	Ayata upachaya (Improper growth)		
A	Proportionate body	0	3
B	Disproportionate body	3	0
3.	Utsaha Hani		
A	Unimpaired utsaha	0	3
B	Anutsaha but do not hamper routine work.	1	2
C	Anutsaha which hamper routine work.	2	1
D	Anutsaha which restricts routine work.	3	0
4.	Swedadhikya (Excess sweating)		
A	No sweating	0	3
B	Sweating after moderate work	1	2
C	Sweating after mild work	2	1
D	Sweating even in resting condition	3	0
5.	Daurgandhya (Foul smell)		
A	Not present	0	3
B	Felt by patient	1	2
C	Felt by others	2	1
D	Felt by patient & others	3	0
6.	Ayasa Swasa (Dyspnoea on exertion)		
A	Absent	0	3
B	Dyspnoea on moderate work	1	2
C	Dyspnoea on mild work	2	1
D	Dyspnoea even at rest	3	0
7.	Nidradhikya (Excessive sleep)		
A	Sleep of 6-7 hours per day	0	3
B	Sleep of 8 hours per day	1	2
C	Sleep of 10 hours per day	2	1
D	Sleep of more than 10 hours per day	3	0
8.	Ati Kshudha (Excessive hunger)		

A	Feels hunger at next annakala only	0	3
B	Feels hunger for once in between Anna kala	1	2
C	Feels hunger for more than twice in between Anna kala	2	1
D	Feels hunger always	3	0
9.	Ahara Kala (Frequency of food intake)		
A	Two large meals a day	0	3
B	One small meal and two large meals a day	1	2
C	Three large meals a day	2	1
D	More than three times a day	3	0
10.	kshudha souhitya (feeling of satiety after food)		
A	Feels comfort after food	0	3
B	Feels discomfort but performs routine work	1	2
C	Feels discomfort and hampers routine work	2	1
D	Feels discomfort and unable to perform work	3	0
11.	Alpa vyayama (Poor physical endurance)		
A	Can do routine exercises	0	3
B	Can do moderate exercise with difficulty	1	2
C	Can do only mild exercises with difficulty	2	1
D	Cannot even do mild exercises	3	0
12.	Anga gourava (feeling of heaviness)		
A	No heaviness in body	0	3
B	Feels heaviness but it doesn't hamper routine work	1	2
C	Feels heaviness which hampers routine work	2	1
D	Feels heaviness which restricts routine work	3	0
13.	Anga Shitilata (Flabbiness of the body)		
A	No flabbiness in body	0	3
B	Flabbiness in one anatomical region	1	2
C	Flabbiness in more than one region	2	1
D	Generalized flabbiness in body	3	0
14.	Gatra Sada (Fatigue)		
A	No fatigue.	0	3
B	Fatigue on moderate work.	1	2
C	Fatigue on mild work.	2	1
D	Fatigue even on no work.	3	0
15.	Snigdha Varna (lustre)		

A	Skin lustre not uniform throughout the body	3	0
B	Skin complexion get affected external factors	2	1
C	Exposed parts of body have no radiant appearance	1	2
D	Exposed parts of body have clear complexion	0	3
16.	Snigdha Kesha (Hair)		
A	Hair has split ends	3	0
B	Use any hair conditioners / mehendi frequently	2	1
C	Hair got good tensile strength (when pulled from both ends, does not get cut)	1	2
D	Always have Shiny scalp hair	0	3
17.	Snigdha Pureesha (Stool)		
A	Difficulty in passing stool	3	0
B	Broken and dry stools	2	1
C	Expel unbroken, semisolid stools most often	1	2
D	Pass stools regularly every day without any difficulty	0	3
18.	Brihat Sharira (BSA)		
A	Body surface area (1.81 +/- 0.19 m(2))	0	3
B	Body surface area (1.99 +/- 0.16 m(2))	1	2
C	Body surface area (2.21 +/- 0.22 m(2))	2	1
D	Body surface area (<2.21 +/- 0.22 m(2))	3	0
Total Score (54)			

Impression:

Score	Medho Sara		Staulya	
Above 45	Pravara Sara		Hina	
Between 36 - 45	Madhyama Sara		Madhyama	
Between 27 - 36	Avara Sara		Adhika	

Comment:

Signature of the Scholar: _____

Signature of Guide: _____

B. INFORMED CONSENT & PATIENT INFORMATION SHEET**1. Kannada
KAHERS'S****SHRI B.M. Kanakanwadi Ayurveda Mahavidyalaya Shahapur,
Belagavi.****ತಾಳ್ಮೆ ಮಾಹಿತಿ ಶೀಟ್**

ಈ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವ ಮೊದಲು, ಅಧ್ಯಯನವನ್ನು ನಿಮಗೆ ವಿವರಿಸಬೇಕು. ದಯವಿಟ್ಟು ಇಲ್ಲಿ ಒದಗಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಎಚ್ಚರಿಕೆಯಿಂದ ಓದಿ. ನೀವು ಭಾಗವಹಿಸಲು ಒಪ್ಪಿಕೊಂಡರೆ, ತಿಳುವಳಿಕೆಯುಳ್ಳ ಸಮ್ಪ್ರದಾಯ ನಮೂನೆಯಲ್ಲಿ ಸಹಿ ಮಾಡಿ. ಈ ಡಾಕ್ಯುಮೆಂಟ್ ಪ್ರತಿಯನ್ನು ನಿಮಗೆ ನೀಡಲಾಗುವುದು

ಸಂಶೋಧನಾ ಅಧ್ಯಯನಗಳ ವಿವರಗಳು

ಪ್ರೊಟೊಕಾಲ್ ಶೀರ್ಷಿಕೆ: ಮೆಡೊ SARA (ಕೊಬ್ಬುಳ್ಳ ಅಂಗಾಂಶ ಉತ್ಕೃಷ್ಟತೆ) ಮತ್ತು Shtaularyaa (ಬೊಜ್ಜು) ವಿಶೇಷ ಸಂಬಂಧಿಸಿದಂತೆ ಹೈ BNI ನ ಇಂಡಿವಿಜ್ವಲ್ಸ್ ಜೈವಿಕ ರಾಸಾಯನಿಕ ಬದಲಾವಣೆಗಳನ್ನು.

ಪ್ರಿನಿಪಲ್ ಇನ್ವೆಸ್ಟಿಗೇಟರ್ ಡಾ. ಸುಮಿತ್ ಕುಮಾರ್ ಎಮ್ ಎಂ ಎಡಿ (ಐ)

ಸಂಶೋಧನಾ ಅಧ್ಯಯನ ಉದ್ದೇಶ

ನೀವು ಮೆಡೊ SARA (ಕೊಬ್ಬುಳ್ಳ ಅಂಗಾಂಶ ಉತ್ಕೃಷ್ಟತೆ) ಮತ್ತು Shtaularyaa (ಬೊಜ್ಜು) ವಿಶೇಷ ಸಂಬಂಧಿಸಿದಂತೆ ಹೆಚ್ಚಿನ BNI ನ ವ್ಯಕ್ತಿಗಳಲ್ಲಿ ಜೈವಿಕ ರಾಸಾಯನಿಕ ಬದಲಾವಣೆಗಳ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಆಹ್ವಾನಿಸಲಾಗುತ್ತಿದೆ. ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಹೆಚ್ಚಿನ BNI ನ ವ್ಯಕ್ತಿಗಳಲ್ಲಿ ಸಾರಾ ಮತ್ತು Shthuly ಮಾನದಂಡಗಳ ಅಸೆಸ್ಮೆಂಟ್ ಮಾಡಲು ಮತ್ತು ಸಾರಾ ಮತ್ತು Shthuly ವ್ಯಕ್ತಿಗಳಲ್ಲಿ ಜೀವರಾಸಾಯನಿಕ ಬದಲಾವಣೆಗಳನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನೀವು ಸಂಭಾವ್ಯ ವಿಷಯವಾಗಿ ಆರಿಸಲ್ಪಟ್ಟಿದ್ದೀರಿ. ಮೆಡ್ಲೋ ಸಾರಾನ ಪರಿಕಲ್ಪನೆಯು ಆಯುರ್ವೇದ ಶಾಸ್ತ್ರೀಯಗಳಲ್ಲಿ ಉಲ್ಲೇಖಿತವಾಗಿದೆ ಮತ್ತು ರೋಗಗಳ ರೋಗನಿರ್ಣಯ ಮತ್ತು ರೋಗನಿರ್ಣಯದಲ್ಲಿ

ಇದನ್ನು ಬಳಸಲಾಗುತ್ತಿದೆ. ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆ ಮೆಡೊ ಸಾರಾ ಮತ್ತು ಸೌಲಿಯಾ ನಡುವಿನ ಭಿನ್ನಾಭಿಪ್ರಾಯಗಳನ್ನು ಅರ್ಥಮಾಡಿಕೊಳ್ಳಲು ನಮಗೆ ಸಹಾಯ ಮಾಡುತ್ತದೆ ಎಂದು ನಾವು ಭಾವಿಸುತ್ತೇವೆ, ಇದು ವಯಸ್ಸಿನಲ್ಲೇ ಚಯಾಪಚಯ ಅಪಾಯವನ್ನು ಊಹಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ.

ಈ ಅಧ್ಯಯನವು 2 ವರ್ಷಗಳ ಅವಧಿಯಲ್ಲಿ 305 ವಿಷಯಗಳನ್ನು ನೇಮಿಸುತ್ತದೆ.

ಅಧ್ಯಯನ ವಿಧಾನಗಳು ಮತ್ತು ಭೇಟಿ ನೀಡುವಿಕೆ ವೇಳಾಪಟ್ಟಿ

ನೀವು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಒಪ್ಪಿಕೊಳ್ಳುತ್ತೇನೆ, ನಿಮ್ಮ ಆರೋಗ್ಯ, ಯೋಗಕ್ಷೇಮ ಅಥವಾ Nado ಸಾರಾ ಮತ್ತು Shthuly ಆಯುರ್ವೇದಿಕ್ ವಿವರಣೆಯನ್ನು ಸಂಬಂಧಿಸಿದಂತೆ ಯಾವುದೇ ರೋಗಗಳು ನಿರ್ಣಯಿಸಲು ವಿನ್ಯಾಸಗೊಳಿಸಲಾಗಿದೆ ಒಂದು ಪ್ರಶ್ನಾವಳಿಯನ್ನು ತುಂಬಲು ಕೇಳಲಾಗುತ್ತದೆ. ನೀವು ಸಮಯದಲ್ಲಿ ನಾಡಿ, ರಕ್ತದೊತ್ತಡ, ಎತ್ತರ, ಕುಳಿತು ಎತ್ತರ, ತೂಕ, ಸೊಂಟದ ಸುತ್ತಳತೆ ಸೊಂಟದ ಸುತ್ತಳತೆ, ಚರ್ಮ ಪಟ್ಟು ದಪ್ಪ, ಕೊಬ್ಬು% [ಬಿಯಾ ಮೂಲಕ], ಕರು ಮಧ್ಯದಿಂದ ಸುತ್ತಳತೆ ತೊಡೆಯ ಮತ್ತು ಮೇಲಿನ ತೋಳಿನ ರೀತಿಯ ಮೌಲ್ಯಮಾಪನ ಮಾನದಂಡಗಳಲ್ಲಿ ನಿಯತಾಂಕಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲಾಗುತ್ತದೆ ಜೀವರಾಸಾಯನಿಕ ಪ್ರೊಫೈಲಿಂಗ್‌ಗೆ ಜೀವವಿಜ್ಞಾನದ ಪರಿಸ್ಥಿತಿಗಳಲ್ಲಿ ನಿಮ್ಮ ವಿರೋಧಿ ಘನವಧುವಿನ ಅಭಿಧಮನಿಯಿಂದ ಭೇಟಿಗಳು ಮತ್ತು 15 ಮಿಲಿ ರಕ್ತವನ್ನು ಂಗ್ರಹಿಸಲಾಗುತ್ತದೆ.

ಈ ಸ್ಕ್ರೀನಿಂಗ್ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯ ಸಮಯ

ಇದು ಅಧ್ಯಯನಕ್ಕಾಗಿ ಸುಮಾರು 45 ನಿಮಿಷಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತದೆ.

ಉದ್ದೇಶಕ್ಕಾಗಿ ನಾವು ಲಿಖಿತ ಒಪ್ಪಿಗೆಯನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತೇವೆ.

ತೀವ್ರವಾದ ಅಪಾಯಗಳು ಮತ್ತು ಲಾಭಗಳು

ಯಾವುದೇ ಅಪಾಯವಿಲ್ಲ. ಬದಲಾಗಿ, ನಿಮ್ಮ ಆರೋಗ್ಯ ಮತ್ತು ಯೋಗಕ್ಷೇಮದ ಬಗ್ಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳುವಂತೆಯೇ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವ ಮೂಲಕ ನಿಮಗೆ ಲಾಭವಾಗುತ್ತದೆ. ಹೇಗಾದರೂ, ಈ ಅಧ್ಯಯನದ ಫಲಿತಾಂಶಗಳನ್ನು ನಿರೀಕ್ಷಿಸಲಾಗಿದೆ

ಅಧ್ಯಯನದಿಂದ ದೂರವಿರುವುದು

ನಿಮ್ಮ ಒಪ್ಪಿಗೆಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳಲು ಮತ್ತು ಯಾವುದೇ ಸಮಯದಲ್ಲೂ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ನಿಷೇಧಿಸದೆ ನೀವು ನಿಲ್ಲಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ತೆಗೆದುಕೊಳ್ಳುವುದನ್ನು ನಿಲ್ಲಿಸಲು ನೀವು ನಿರ್ಧರಿಸಿದರೆ, ನೀವು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಗೆ ತಿಳಿಸಬೇಕು

ನಿಮ್ಮ ವೈದ್ಯರು, ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ ನಿಲ್ಲಿಸಿರಬಹುದು

– ಪ್ರಮುಖ ತನಿಖಾ ಮತ್ತು / ಅಥವಾ ಅಧ್ಯಯನ ಸಿಬ್ಬಂದಿಗಳ ಸೂಚನೆಗಳನ್ನು ಅನುಸರಿಸಲು ವಿಫಲವಾಗಿದೆ.

ನೀವು ಪ್ರತಿಕೂಲ ಘಟನೆಗಳು / ಗಂಭೀರ ಪ್ರತಿಕೂಲ ಘಟನೆಗಳನ್ನು ಅನುಭವಿಸಿದರೆ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಯು ಹಾನಿಕಾರಕವಾಗಬಹುದು ಎಂದು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ ನಿರ್ಧರಿಸುತ್ತಾನೆ.

– ನೀವು ಚಿಕಿತ್ಸೆಯ ಅಗತ್ಯವಿರುವಾಗ

– ಅಧ್ಯಯನವನ್ನು ರದ್ದುಗೊಳಿಸಲಾಗಿದೆ.

ಇತರ ಆಡಳಿತಾತ್ಮಕ ಕಾರಣಗಳು

ವಿಷಯದ ಹಕ್ಕುಗಳು

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆ ಸಂಪೂರ್ಣವಾಗಿ

ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿರುತ್ತದೆ ನಿಮ್ಮ ಪ್ರಶ್ನೆಗಳು

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಇಚ್ಛೆಯ ಸಂಬಂಧಿಸಿದ ಎಂದು ಲಭ್ಯವಾಗುತ್ತಿವೆ

ಯಾವುದೇ ಹೊಸ ಮಾಹಿತಿ ಸಂದರ್ಭದಲ್ಲಿ, ನೀವು ಅಥವಾ ನಿಮ್ಮ ಕಾನೂನು

ಪ್ರತಿನಿಧಿ ಮುಖ್ಯ ಸಂಶೋಧಕರು ಅಥವಾ ಅವನ / ಕುಶಲತೆಯಿಂದ Hriiprejentativ

ಮೂಲಕ ಉಂಟು ತಿಳಿಸಲಾಗುವುದು.

ಅಧ್ಯಯನದಲ್ಲಿ ಸಹಿ ಮತ್ತು ಭಾಗವಹಿಸುವ ಮೂಲಕ, ನಿಮ್ಮ ಯಾವುದೇ ಕಾನೂನು ಹಕ್ಕುಗಳನ್ನು ನೀವು ಹೊಂದಿಲ್ಲ.

ಅಧ್ಯಯನ ಮತ್ತು ವೈದ್ಯಕೀಯ ದಾಖಲೆಗಳ ಗೌಪ್ಯತೆ

ಇದಕ್ಕೆ ಸಂಗ್ರಹಿಸಲಾದ ಮಾಹಿತಿ ನಿಮ್ಮ ದಾಖಲೆಗಳು, ಅನ್ವಯವಾಗುವ

ಕಾನೂನುಗಳು ಮತ್ತು ನಿಬಂಧನೆಗಳ ವ್ಯಾಪ್ತಿಗೆ ಸಾರ್ವಜನಿಕವಾಗಿ ಲಭ್ಯವಿರುವುದಿಲ್ಲ

ನಿಮ್ಮ ಇನ್ವೆಸ್ಟಿಗೇಟರ್ (ಗಳು) ಮಾತ್ರ ಸಂಗ್ರಹಿಸಿದ ಗೌಪ್ಯ ಮಾಹಿತಿಯನ್ನು

ಪ್ರವೇಶಿಸಬಹುದು.

ಆದಾಗ್ಯೂ, ನಿಯಂತ್ರಕ ಏಜೆನ್ಸಿಗಳು, ಸಂಸ್ಥೆಯ ನೈತಿಕ ಸಮಿತಿಗೆ ನಿಮ್ಮ ಮೂಲ ವೈದ್ಯಕೀಯ ದಾಖಲೆಗಳಿಗೆ ನೇರವಾಗಿ ಪ್ರವೇಶವನ್ನು ನೀಡಲಾಗುತ್ತದೆ. ಲಗತ್ತಿಸಲಾದ ಮಾಹಿತಿಯುಕ್ತ ಸಮ್ಮತಿ ಫಾರ್ಮ್‌ನಲ್ಲಿ ಸಹಿ ಮಾಡುವ ಮೂಲಕ, ನೀವು ಅಥವಾ ನಿಮ್ಮ ಕಾನೂನು ಪ್ರತಿನಿಧಿಯು ನಿಮ್ಮ ಅಧ್ಯಯನ ಮತ್ತು ವೈದ್ಯಕೀಯ ದಾಖಲೆಗಳಿಗೆ ಅಂತಹ ಪ್ರವೇಶವನ್ನು ಅನುಮತಿಸುತ್ತಿದ್ದೀರಿ. ಕೇಸ್ ರಿಪೋರ್ಟ್ ಫಾರ್ಮ್‌ನಲ್ಲಿ ಸಂಗ್ರಹಿಸಿದ ಮತ್ತು ನಮೂದಿಸಿದ ಡೇಟಾ ಸಂಸ್ಥೆಗಳ ಆಸ್ತಿಯಾಗಿದೆ. ಯಾವುದೇ ಪ್ರಕಟಣೆಯ ಸಂದರ್ಭದಲ್ಲಿ, ನಿಮ್ಮ ಗುರುತನ್ನು ಗೌಪ್ಯವಾಗಿ ಉಳಿಯುತ್ತದೆ.

ಪಾಲ್ಕೊಳ್ಳುವಿಕೆಯ ವೆಚ್ಚಗಳು

ಅಧ್ಯಯನದ ಉದ್ದೇಶಕ್ಕಾಗಿ ಮಾತ್ರ ಎಲ್ಲಾ ಖರ್ಚುಗಳನ್ನು ಸಂಶೋಧನಾ ವಿದ್ವಾಂಸರು ಹೊಂದುತ್ತಾರೆ ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಕೊಳ್ಳಲು ನಿಮಗೆ ಯಾವುದೇ ಪಾವತಿಯಿಲ್ಲ. ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆ ಸಂಪೂರ್ಣವಾಗಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿರುವುದರಿಂದ, ಪಾಲ್ಕೊಳ್ಳುವಿಕೆಯಿಂದಾಗಿ ನೀವು ಆರ್ಥಿಕವಾಗಿ ಪರಿಹಾರವನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನೀವು ಭಾಗವಹಿಸಿದರೆ, ಮೌಲ್ಯಮಾಪನವನ್ನು ಉಚಿತವಾಗಿ ವೆಚ್ಚ ಮಾಡಲಾಗುವುದು.

ಸಂಶೋಧನೆ ದುರ್ಬಳಕೆ ಮತ್ತು ಪರಿಹಾರ

ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಚಿಕಿತ್ಸೆಯ ಯಾವುದೇ ಬದಲಾವಣೆಗಳನ್ನು ಮಾಡುವುದಿಲ್ಲ. ಹೇಗಾದರೂ, ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಯ ನೇರ ಪರಿಣಾಮವಾಗಿ ಸಂಭವಿಸುವ ಯಾವುದೇ ದೈಹಿಕ ಗಾಯ ಅಥವಾ ಅನಾರೋಗ್ಯದ ಕುರಿತು ಈ ಸಂಸ್ಥೆಯಲ್ಲಿ ನೀವು ವೈದ್ಯಕೀಯ ಆರೈಕೆಯನ್ನು ನೀಡಲಾಗುವುದು. ಈ ವೈದ್ಯಕೀಯ ಆರೈಕೆ ನಿಮಗೆ ಯಾವುದೇ ವೆಚ್ಚದಲ್ಲಿ ಮಾಡಲಾಗುವುದಿಲ್ಲ. ಈ ಸಮ್ಮತಿಯ ಫಾರ್ಮ್‌ನಲ್ಲಿ ಸಹಿ ಮಾಡುವ ಮೂಲಕ, ನಿಮಗೆ ಯಾವುದೇ ಕಾನೂನು ಹಕ್ಕುಗಳು ಇರುವುದಿಲ್ಲ.

ನೀವು ಪ್ರಶ್ನೆಗಳನ್ನು ಹೊಂದಿದ್ದರೆ ಸಂಪರ್ಕಿಸಲು ಯಾರು

ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳನ್ನು ನೀವು ಹೊಂದಿದ್ದರೆ, ನೀವು ತನಿಖೆದಾರರನ್ನು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ಒಂದು ಅಧ್ಯಯನದ ಪಾಲ್ಕೊಳ್ಳುವವರ ಹಕ್ಕುಗಳ ಬಗ್ಗೆ ನಿಮಗೆ ಯಾವುದೇ ಅನುಮಾನಗಳು ಅಥವಾ

ಪ್ರಶ್ನೆಗಳು ಇದ್ದಲ್ಲಿ ದಯವಿಟ್ಟು ಕಾರ್ಯದರ್ಶಿ, ಎಥಿಕ್ಸ್ ಕಮಿಟಿ, ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಅನ್ನು ಸಂಪರ್ಕಿಸಿ.

ತನಿಖಾಧಿಕಾರಿಗಳ ಸಂಪರ್ಕಗಳು:

1. ಸಂಶೋಧನಾ ವಿದ್ವಾಂಸ:

ಡಾ. ಸುಮಿತ್ ಕುಮಾರ್ ಎಂ. ಎಮ್ಡಿ (ಐ)

ಸಹಾಯಕ ಪ್ರೊಫೆಸರ್

KLEU ಶ್ರೀ BMK ಆಯುರ್ವೇದ ಮಹಾವಿದ್ಯಾಲಯ ಬೆಳಗಾವಿ

Ph. ಇಲ್ಲ 9995635703

2. ಗೈಡ್:

ಡಾ. ಪ್ರದೀಪ್ ಎಲ್ ಗ್ರಾಮಪುರೋಹಿತ MD (ಪಿಎಚ್ಡಿ)

ಪ್ರಾಧ್ಯಾಪಕ

KLEU ಶ್ರೀ BMK ಆಯುರ್ವೇದ ಮಹಾವಿದ್ಯಾಲಯ ಬೆಳಗಾವಿ

Ph.No 9448569289

ತಿಳಿವಳಿಕೆಯ ಸಮ್ಮತಿ ನಮೂನೆ

ಸಂಶೋಧನಾ ಅಧ್ಯಯನಗಳ ವಿವರಗಳು:

ಪ್ರೊಟೋಕಾಲ್ ಶೀರ್ಷಿಕೆ: Medo SARA (ಕೊಬ್ಬುಳ್ಳ ಅಂಗಾಂಶ ಉತ್ಕೃಷ್ಟತೆ) ಮತ್ತು STAULYA ವಿಶೇಷ ಉಲ್ಲೇಖ (ಬೊಜ್ಜು) ಉನ್ನತ BMI ನ ಇಂಡಿವಿಜ್ವಲ್ಸ್ ಜೈವಿಕ ರಾಸಾಯನಿಕ ಬದಲಾವಣೆಗಳನ್ನು

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ: ಡಾ. ಸುಮಿತ್ ಕುಮಾರ್ ಎಂ. ಎಮ್. (ಐ)

ವಿಷಯದ ವಿಷಯಗಳು

ಹೆಸರು:

ವಿಷಯ ಸಂಖ್ಯೆ:

ವಿಳಾಸ:

ಲಿಂಗ:

ಜನನದ ದಿನಾಂಕ _____

(ಡಿಡಿ / ಎಂಎಂ / ಯುವೈವೈ)

ಭಾಗ I - ರೋಗಿಯಿಂದ ತುಂಬಬೇಕು

ಇ, _____ agree ವಿವರಿಸಿದಂತೆ ಮತ್ತು ರೋಗಿಯ ಮಾಹಿತಿ ಶೀಟ್ ತಿಳಿಸಿರುವ ನಿಬಂಧನೆಗಳು ಸಂಶೋಧನೆ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು. ಉದ್ದೇಶಿತ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ನನ್ನ ಭಾಗವಹಿಸುವಿಕೆಯು ನನ್ನಲ್ಲಿ ವಿವರಿಸಲ್ಪಟ್ಟಿದೆ. _____
(ಭಾಷೆ) ಡಾ. ಸುಮಿತ್ ಕುಮಾರ್ ಎಂ.

ನಾನು ಸಂಪೂರ್ಣವಾಗಿ ಚರ್ಚಿಸಿ ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ ನನಗೆ ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ ನೀಡಲಾಗಿದೆ ಮತ್ತು ತೃಪ್ತಿದಾಯಕ ಉತ್ತರಗಳು ಮತ್ತು ಮಾಹಿತಿಯನ್ನು ಸ್ವೀಕರಿಸಲಾಗಿದೆ.

ನನ್ನ ಭಾಗವಹಿಸುವಿಕೆ ವೈಯಕ್ತಿಕವಾಗಿದ್ದು ಮತ್ತು ನಾನು ಯಾವುದೇ
ಕಾರಣಗಳಿಗಾಗಿ ನೀಡದೆ ಮತ್ತು ವೈದ್ಯಕೀಯ ಆರೈಕೆ ಪರಿಣಾಮ ಆಗದೆ, ಯಾವುದೇ
ಸಮಯದಲ್ಲಿ ಹಿಂದಕ್ಕೆ ಪಡೆಯಬಹುದು ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ನನ್ನ ವೈದ್ಯಕೀಯ ದಾಖಲೆಗಳಿಗೆ ಸಹ ನಾನು ಅನುಮತಿಯನ್ನು ನೀಡಿದೆ
ಪ್ರಕಟಣೆಯ ಇತರ ಘಟನೆಗಳು, ನಾನು ಈ ಮಾಹಿತಿಯನ್ನು ನನ್ನ ಹೆಸರು ಅಥವಾ
ಇತರ ಗುರುತಿಸುವಿಕೆಗಳು ಮತ್ತು ಕಾರಣ ರಕ್ಷಣೆ ಪಡೆದಿವೆ ಈ ಮಾಹಿತಿಯ
ಗೌಪ್ಯತೆಯನ್ನು ಸಂರಕ್ಷಿಸಲು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು ಎಂದು ಅರ್ಥ.

[ಸಹಿ / ಥಂಬ್‌ಪ್ರಿಂಟ್ (ಬಲ / ಎಡ) ರೋಗಿಯ] (ಸಹಿ ದಿನಾಂಕ)

**ಭಾಗ II - ಪ್ರೋಷಕರು / ಕಾನೂನು ಪಾಲಕರಿಂದ ಭರ್ತಿ ಮಾಡಲು, ಅಲ್ಲಿ
ಅನ್ವಯವಾಗುತ್ತದೆ**

ಇ, _____ ಇಲ್ಲಿಂದ ಫಾರ್ (ಪ್ರೋಷಕರು / ಕಾನೂನು
ಪ್ರತಿನಿಧಿ) ಭಾಗವಹಿಸಲು ಮೇಲಿನ ರೋಗಿಯ ಒಪ್ಪಿಗೆ ಪ್ರಸ್ತಾವಿತ ಪರಿಶೋಧಕ
ಅಧ್ಯಯನದ ನೀಡಿ. ಅಧ್ಯಯನದ ಸ್ವಭಾವ, ಅಪಾಯಗಳು ಮತ್ತು
ಪ್ರಯೋಜನಗಳನ್ನು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ ಮತ್ತು ನಾನು ಅವುಗಳನ್ನು
ಸಂಪೂರ್ಣವಾಗಿ ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

[ಮೂಲ / ಕಾನೂನುಬದ್ಧ ಪ್ರೋಷಕರ ಸಹಿ / ತಮ್ಮಿಂಟ್ (ರೈಟ್ / ಲೆಫ್ಟ್)] (ಸಹಿ
ಮಾಡುವ ದಿನಾಂಕ)

ಭಾಗ III - ಸಾಕ್ಷಿ ತುಂಬಿದ, ಅಲ್ಲಿ ಅನ್ವಯವಾಗುತ್ತದೆ

ಸಾಕ್ಷಿ: _____

(ಸಾಕ್ಷಿ ಹುದ್ದೆ)

(ಸಾಕ್ಷಿಯ ಸಹಿ)

ಭಾಗ IV-ತನಿಖೆದಾರರ ಹೇಳಿಕೆ

ಇ, ರುಜುಮಾಡಿರುವ, ಈ ಮಾಹಿತಿಯುಕ್ತ ಸಮ್ಮತಿಯ ನಮೂನೆಯನ್ನು ಸಹಿ
ರೋಗಿಯ / ರೋಗಿಯ ಕಾನೂನು ಬದ್ಧ ಪ್ರತಿನಿಧಿಯು ಅಧ್ಯಯನ ಸಂಪೂರ್ಣವಾಗಿ
ವಿವರಿಸಲಾಗಿದೆ ಎಂದು ನನ್ನ ಜ್ಞಾನದ ಅತ್ಯುತ್ತಮ ಪ್ರಮಾಣೀಕರಿಸಬೇಕು ಮತ್ತು
ಸ್ಪಷ್ಟವಾಗಿ ಅವನ / ಅವಳ / ಅವನ ವಾರ್ಡ್‌s / ಕುಶಲತೆಯಿಂದ ವಾರ್ಡ್ ಪುರುಷರ
ಭಾಗವಹಿಸುವಿಕೆ ಸ್ವರೂಪ, ಅಪಾಯಗಳು ಮತ್ತು ಪ್ರಯೋಜನಗಳ ಅರ್ಥ
ಅಧ್ಯಯನದಲ್ಲಿ

(ತನಿಖಾಧಿಕಾರಿ ಹೆಸರು)

(ಸಹಿ)

(ದಿನಾಂಕ)

2. Marathi
KAHERS'S
SHRI B.M. Kanakanwadi Ayurveda Mahavidyalaya Shahapur,
Belagavi.

रुग्ण माहिती पत्रक

या संशोधन अभ्यासात भाग घेण्याआधी, अभ्यासाने आपल्याला स्पष्टीकरण दिले पाहिजे. येथे दिलेली माहिती काळजीपूर्वक वाचा. सहभागी होण्यासाठी आपण सहमत असल्यास, कृपया सूचित संमती फॉर्म वर स्वाक्षरी करा. आपल्याला या दस्तऐवजाची एक प्रत दिली जाईल

संशोधन अभ्यास संप्रेषण

प्रोटोकॉल शीर्षक: मेद सारा (चरबीयुक्त मेदयुक्त लावण्य) आणि STAULYA (लठ्ठपणा) विशेष संदर्भ सह उच्च बी एम व्यक्ती जैव-रासायनिक बदल.

प्राचार्य इन्व्हेस्टिगेटर डॉ. सुमित कुमार एम एम (आयए)

संशोधन अभ्यासांचा हेतू

आपण मेद सारा (चरबीयुक्त मेदयुक्त लावण्य) आणि STAULYA (लठ्ठपणा) विशेष संदर्भ सह उच्च बी एम व्यक्ती जैव-रासायनिक बदल संशोधन अभ्यासात सहभागी होण्यासाठी आमंत्रित केले जात आहेत. या अभ्यासात उद्देश उच्च बी एम व्यक्ती सारा आणि Sthaulya मापदंड मूल्यांकन करू आणि सारा आणि Sthaulya व्यक्ती जीवरासायनिक बदल अभ्यास केला पाहिजे.

या अभ्यासात आपण संभाव्य विषया म्हणून निवडले गेले आहात.

मेढे साराच्या संकल्पनेचा उल्लेख आयुर्वेदिक शास्त्रात केला गेला आहे आणि त्याचा रोग निदान व रोगनिदान करण्यासाठी वापरला जात आहे. आम्ही आशा करतो की आपल्या सहभागामुळे मेदो सारा आणि स्टॉलियामधील भिन्न फरक समजून घेण्यास आम्हाला मदत होईल जे लवकर वयात चयापचय जोखमीचे अंदाज लावण्यात मदत करेल.

हा अभ्यास 2 वर्षांच्या कालावधीत 305 विषयांची भरती करणार आहे.

अभ्यास करण्याची प्रक्रिया आणि अनुसूचीचे परिक्षण करा

आपण या आवृत्तीवर भाग घेणे मान्य असल्यास, आपण आपले आरोग्य, कल्याण किंवा Medho सारा आणि Sthaulya आयुर्वेदिक स्पष्टीकरण संबंधात कोणत्याही रोग मूल्यांकन करण्यात आली आहे की एक प्रश्नावली भरण्यासाठी विचारले जाईल. आपण दरम्यान नाडी, रक्तदाब, उंची, बसून उंची, वजन, कंबर, घेर, हिप घेर, त्वचा पट जाडी, चरबी% [BIA करून] वासराला

mid- घेर, मांडी आणि दंडाचा सारखे मूल्यांकन निकष घटके मूल्यमापन केले जाईल बायोकेमिकल प्रोफाइलिंगसाठी जैवविविध परिस्थितींतर्गत आपल्या विरोधी क्यूबॅटल शिरापासून भेट आणि 15 मिली रक्त जमा केले जाईल.

या स्क्रीनिंग प्रक्रियेमध्ये सहभागीय कालावधी

अभ्यासासाठी सुमारे 45 मिनिटे लागतील. आम्ही या उद्देशासाठी लेखी संमती देऊ. संभाव्य जोखीम आणि फायदे धोका नाही त्याऐवजी, या अभ्यासात सहभागी झाल्यामुळे आपल्याला त्याचा फायदा होईल कारण आपण आपले आरोग्य आणि कल्याण याविषयी प्रश्न विचारू शकता. तथापि, या अभ्यासाचे निष्कर्ष अपेक्षित आहेत

अभ्यासातून बाहेर येणे

आपण आपली संमती मागे घेण्यास मुक्त आहात आणि पूर्वग्रहदूषित न करता आपल्या सहभागास खंडित करू शकता. आपण या अभ्यासात घेतल्याबद्दल निर्णय घेतल्यास, मुख्य संशोधकास सांगू शकता

आपले डॉक्टर, प्राचार्य अन्वेषक थांबू शकतात

The मुख्य चौकशी आणि / किंवा अभ्यास कर्मचारींच्या सूचनांचे पालन करण्यास अयशस्वीता.

- आपण प्रतिकूल कार्यक्रम / गंभीर प्रतिकूल कार्यक्रम अनुभवत असल्यास
- मुख्य अन्वेषक निर्णय घेतात की आपले सहभाग चालू ठेवणे हानिकारक ठरू शकते.
- जेव्हा आपल्याला एखाद्या उपचाराची गरज असते
- अभ्यास रद्द झाला आहे.
- इतर प्रशासकीय कारणे

विषय अधिकार

या अभ्यासात आपला सहभाग संपूर्णपणे स्वयंसेवी आहे आपले प्रश्न

कोणतीही नवीन माहिती उपलब्ध झाल्यास आपल्या इच्छेशी संबंधित असेल, आपण किंवा आपल्या कायदेशीर प्रतिनिधीला मुख्य संशोधकाचे किंवा त्यांच्या प्रतिनिधीद्वारे वेळेनुसार माहिती दिली जाईल

अभ्यासावर स्वाक्षरी करून आणि सहभागी होऊन, आपल्याकडे कोणतेही कायदेशीर अधिकार नाहीत.

अभ्यास आणि वैद्यकीय रेकॉर्डची गोपनीय माहिती

या साठी गोळा माहिती लागू असलेले कायदे आणि नियमांनुसार आपल्या नोंदी

सार्वजनिकरित्या उपलब्ध केल्या जाणार नाहीत केवळ आपल्या इन्व्हेस्टिगेटरची (एकत्रित) गोपनीय माहितीमध्ये प्रवेश असेल.

तथापि, नियामक संस्था, संस्था नीतिशास्त्र समितीला आपल्या मूळ वैद्यकीय नोंदींमध्ये प्रत्यक्ष प्रवेश दिला जाईल. संलग्न ज्ञानाधिकार फॉर्ममध्ये साइन इन करून, आपण किंवा आपले

कायदेशीर प्रतिनिधी आपल्या अभ्यासासाठी आणि वैद्यकीय नोंदींमध्ये अशा प्रवेशाचे अधिकार देत आहेत.

प्रकरण रिझर्व्ह फॉर्ममध्ये गोळा केलेला आणि जमा केलेला डेटा ही संस्थाची मालमत्ता आहे. कोणत्याही प्रकाशन झाल्यास आपली ओळख गोपनीय राहील.

सहभागाचा खर्च

केवळ अभ्यास उद्देशानेचे सर्व खर्च संशोधन विद्वान द्वारे घेतले जातील आणि अभ्यासात सहभागी होण्यासाठी तुम्हाला कोणतेही पैसे नाहीत. आपली सहभाग पूर्णपणे स्वैच्छिक असल्याने, सहभागासाठी आपल्याला आर्थिकरित्या आर्थिक लाभ मिळणार नाही. आपण या अभ्यासात भाग घेतल्यास, मूल्यांकन विनामूल्य केले जाईल.

संशोधन संबंधित इजा आणि भरपाई

हॉस्पिटलने उपचारात कोणताही बदल केला नाही तथापि, या अभ्यासात आपल्या सहभागाचा प्रत्यक्ष परिणाम म्हणून उद्भवलेल्या कोणत्याही शारीरिक इजा किंवा आजारासाठी या संस्थेमध्ये आपल्याला वैद्यकीय मदत दिली जाईल. हे वैद्यकीय काळजी तुमच्यासाठी कोणत्याही कारणास्तव केले जाईल. या संमती पत्रावर स्वाक्षरी करून, आपल्याकडे कोणतेही कायदेशीर अधिकार नाहीत.

आपल्याला प्रश्न असल्यास त्याशी संपर्क साधावा

अभ्यासाशी संबंधित कोणतेही प्रश्न असल्यास आपण तपासकास संपर्क साधण्यास मुक्त आहात. अभ्यासातील सहभागी म्हणून आपण काही शंका किंवा प्रश्न असल्यास कृपया सेक्रेटरी, एथिक्स कमिटी, इन्स्टिट्यूटशी संपर्क साधा.

अन्वेषक संपर्क:

1. संशोधन विद्वान:

डॉ. सुमित कुमार एम. एमडी (आयए)

सहाय्यक प्राध्यापक

केएलयू श्री बीएमके आयुर्वेद महाविद्यालयलय बेलगाम

Ph. नाही 99 9 5,635703

2. मार्गदर्शक:

डॉ. प्रदीप. एल. ग्रामपुरोहित एमडी (पीएचडी)

प्रोफेसर

केएलयू श्री बीएमके आयुर्वेद महाविद्यालयलय बेलगाम

Ph.No 9448569289

सूचित संमती अर्ज

संशोधन अभ्यासांचा तपशील:

प्रोटोकॉल शीर्षक: मेद सारा (चरबीयुक्त मेदयुक्त लावण्य) आणि STAULYA विशेष संदर्भ (लठ्ठपणा) उच्च बी एम व्यक्ती जैव-रासायनिक बदल

प्रमुख संशोधकाचे: डॉ. सुमित कुमार एम. एमडी (आयए)

विषयाचा तपशील

नाव:

विषय क्रमांक:

पत्ता:

लिंग:

जन्म तारीख _____

(डीडी / MM /
YYYY)

भाग I - रुग्णाने भरले जावे

मी, _____ ने रुग्ण माहिती पत्रक मध्ये नमूद केल्यानुसार आणि अभ्यास केलेल्या अभ्यासामध्ये सामील होण्यासाठी. प्रस्तावित संशोधन अभ्यासक्रमातील माझ्या सहभागाचे स्वरूप मला समजावून सांगण्यात आले आहे _____ (भाषा) डॉ. सुमित कुमार एम.

मी पूर्णपणे चर्चा आणि समजले आहे मला रुग्ण माहिती पत्रक दिले गेले आहे आणि मला समाधानकारक उत्तरे आणि माहिती मिळाली आहे.

मी समजतो की माझा सहभाग स्वैच्छिक आहे आणि कोणत्याही कारणाशिवाय मी माझी वैद्यकीय निमे

मी माझ्या वैद्यकीय नोंदीसाठी परवानगी देखील दिली प्रकाशन इतर कार्यक्रम, मी ही माहिती माझ्या नावाने किंवा इतर अभिज्ञापक, आणि त्या मुळे काळजी सहन करणार नाही या माहितीची गोपनीयता साठवायची घेतले जाईल.

[स्वाक्षरी / अंगठा (उजवा / डावा) रुग्णांचा] (स्वाक्षरीची तारीख)

भाग II - पालक किंवा कायदेशीर पालकाने भरले जावे, जेथे लागू होईल

I, _____ याद्वारे उपरोक्त रुग्णास (पालक / कायदेशीर पालक)
प्रस्तावित संशोधन अभ्यासक्रमात सहभागी होण्यासाठी संमती देतो. अभ्यासाचे स्वरूप,
जोखीम आणि लाभ मला समजावून सांगण्यात आले आहेत आणि मी त्यांना पूर्णपणे समजून
घेत आहे.

पालक / कायदेशीर पालकांच्या [स्वाक्षरी / अंगठकाणी (उजवे / डावे)] (स्वाक्षरीची तारीख)

भाग III - भरलेले साक्षीदार असणे, जिथे लागू होईल

यांनी साक्षी दिली: _____
(साक्षीदार पद)

(साक्षीची स्वाक्षरी)

भाग IV- अन्वेषिकाचे वक्तव्य

ई, निम्न, माझ्या ज्ञान उत्तम या माहितीपूर्ण संमती फॉर्म साइन इन रुग्ण / रुग्णाची कायदेशीर
मान्य प्रतिनिधी अभ्यास पूर्णपणे स्पष्ट होते की प्रमाणित आणि स्पष्टपणे त्याच्या / तिच्या /
त्याच्या वॉर्ड / फेरफार प्रभाग पुरुष सहभाग स्वरूप, जोखीम आणि लाभ समजून अभ्यासात

(अन्वेषकांचे नाव (तारीख))

3. English
KAHERS'S
SHRI B.M. Kanakanwadi Ayurveda Mahavidyalaya Shahapur,
Belagavi.

PATIENT INFORMATION SHEET

Before you take part in this research study, the study must be explained to you and you must be given the chance to ask questions. Please read carefully the information provided here. If you agree to participate, please sign the informed consent form. You will be given a copy of this document to take home with you.

Details of the Research Study

Protocol Title: Bio-Chemical Changes in Individuals of High BMI with special reference to MEDO SARA (excellence of adipose tissue) and STAULYA (obesity).

Principal Investigator **Dr. Sumith Kumar M MD(Ay)**

Purpose of the Research Study

You are being invited to participate in a research study of Bio-Chemical changes in individuals of high BMI with special reference to *MEDO SARA* (excellence of adipose tissue) and *STAULYA* (obesity). The objective of this study is to do the assessment of *Sara* and *Sthaulya* parameters in individuals of high BMI and to study the biochemical changes in *Sara* and *Sthaulya* individuals.

You were selected as a possible subject in this study because you fulfill the inclusion criteria.

The concept of *Medho Sara* is mentioned in Ayurvedic classics and is being used in diagnosis and prognosis of diseases. We hope that your participation will help us to generate data on clear differentiation between *Medho Sara* and *Sthaulya* which may help to predict the metabolic risk at the early age.

This study will recruit 305 subjects over 2 years.

Study Procedures and Visit Schedule

If you agree to take part in this study, you will be asked to fill a questionnaire that is designed to assess your health, well-being or any diseases about the Ayurvedic explanation of *Medho Sara* and *Sthaulya*. You will be assessed for parameters in assessment criteria like pulse, blood pressure, height, sitting height, weight, waist circumference, hip circumference, skin fold thickness, fat % [by BIA], mid-circumference of the calf, thigh and upper arm during the visits and 15 ml blood will be collected from your anti cubital vein under aseptic conditions for Bio-Chemical profiling.

Duration Of Participation in This Screening Process

It will take about 45 minutes for the study. We would take a written consent for the purpose.

Potential Risks and Benefits

There is no risk. Instead you will be benefited by participating in this study as we would just ask you questions regarding your health and well-being. However, the outcomes of this study is expected to benefit the society and medical science at large.

Withdrawal From Study

You are free to withdraw your consent and discontinue your participation at any time without prejudice to you. If you decide to stop taking part in this study, you should tell the Principal Investigator.

Your doctor, the Principal Investigator may stop your participation in the study at any time for one or more of the following reasons.

- Failure to follow the instructions of the Principal Investigator and/or study staff.
- If you experience Adverse Events/Serious Adverse Events.
- The Principal Investigator decides that continuing your participation could be harmful.
- When you need a treatment, but it is not allowed in the study.
- The study is cancelled.
- Other administrative reasons.

Subject's Rights

Your participation in this study is entirely voluntary. Your questions will be answered clearly and to your satisfaction.

In the event of any new information becoming available that may be relevant to your willingness to continue in this study, you or your legal representative will be informed in a timely manner by the Principal Investigator or his/her representative.

By signing and participating in the study, you do not waive any of your legal rights to revoke your consent and withdraw from the study at any time.

Confidentiality of Study and Medical Records

Information collected for this study will be kept confidential. Your records, to the extent of the applicable laws and regulations, will not be made publicly available. Only your Investigator(s) will have access to the confidential information being collected.

However, Regulatory Agencies, Institution Ethics Committee will be granted direct access to your original medical records to check study procedures and data, without making any of your information public. By signing the Informed Consent Form attached, you or your legal representative is authorizing such access to your study and medical records.

Data collected and entered into the Case Report Forms are the property of the Institution. In the event of any publication regarding this study, your identity will remain confidential.

Costs of Participation

All expenses for study purpose alone will be borne by the Research Scholar and you will not have to make any payment for participation in the study. As your participation is purely voluntary, you will not be compensated financially for participation. If you take part in this study, the assessment of parameters related to the study will be done free of cost.

Research Related Injury and Compensation

The hospital does not make any provisions to compensate trial subjects for research related injury. However, you will be provided medical care at this institute for any physical injury or illness that occurs as a direct result of your participation in this study. This medical care will be at no cost to you. By signing this consent form, you will not waive any of your legal rights.

Who To Contact If You Have Questions

If you have any questions related to the study you are free to contact the investigators and you will be provided the available information. In case you have any doubts or questions about the rights as a study participant please contact the Secretary, Ethics Committee, Institute.

Investigators contact:

1. Research Scholar:
Dr. Sumith Kumar M. MD(Ay)
PhD Research Scholer
KAHER's Shri BMK Ayurved Mahavidhyalaya Belgaum
Ph. No 9995635703
2. Guide:
Dr. Pradeep. L. Grampurohit MD(Ay), PhD
Professor
KAHER's Shri BMK Ayurved Mahavidhyalaya Belgaum
Ph No: 9964144197

INFORMED CONSENT FORM**DETAILS OF RESEARCH STUDY:**

Protocol Title: Bio-Chemical Changes in Individuals of High BMI with special reference to *MEDO SARA* (excellence of adipose tissue) and *STAULYA* (obesity)

Principal Investigator: Dr. Sumith Kumar M. MD(Ay)

Subject's Particulars

Name:

Subject No:

Address:

Sex:

Date of Birth _____

(DD/MM/YYYY)

Part I – to be filled by patient

I, _____ agree to participate in the research study as described and on the terms set out in the Patient Information Sheet. The nature of my participation in the proposed research study has been explained to me in _____ (Language) by Dr. Sumith Kumar M.

I have fully discussed and understood the purpose and procedures of this study. I have been given the Patient Information Sheet and the opportunity to ask questions about this study and have received satisfactory answers and information.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reasons and without my medical care being affected.

I also give permission for information in my medical records to be used for research. In any event of publication, I understand that this information will not bear my name or other identifiers and that due care will be taken to preserve the confidentiality of this information.

[Signature/Thumbprint (Right / Left) of patient]

(Date of signing)

Part II – to be filled by parent / legal guardian, where applicable

I, _____ hereby give consent for the above patient to participate in the (parent / legal guardian) proposed research study. The nature, risks and benefits of the study have been explained clearly to me and I fully understand them.

[Signature/Thumbprint (Right / Left) of parent /legal guardian] (Date of signing)

Part III – to be filled witness, where applicable

Witnessed by: _____
(Name of witness) (Designation of witness)

(Signature of witness) (Date of signing)

Part IV– Investigator’s Statement

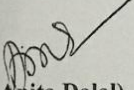
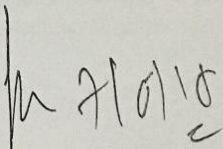
I, the undersigned, certify to the best of my knowledge that the patient/patient’s legally acceptable representative signing this informed consent form had the study fully explained and clearly understands the nature, risks and benefits of his/her / his ward’s / her ward’s participation in the study

(Name of Investigator)

(Signature)

(Date)

C. ETHICAL CLEARANCE LETTER

 KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH Deemed-to-be-University u/s 3 of the UGC Act, 1956	KLE ACADEMY OF HIGHER EDUCATION AND (Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956) Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI) JNMC Campus, Nehru Nagar, Belagavi-590 010, Karnataka State, India ☎: 0831-2444444 FAX: 0831-2493777 Web: http://www.kledeemeduniversity.edu.in E-mail: info@kledeemeduniversity.edu.in
Ref.No.KAHER/Ethic/2018-19/D- 123	29 th May 2018
To, Dr. Sumith Kumar M Ph.D. Part-Time Research Scholar, 2017-18 Batch, Faculty of Ayurveda, KAHER, Belagavi	
Dear Research Scholar,	
Sub:- Regarding Ethical Clearance.	
The KLE University Ethics Committee on Human Subjects for Ph. D Research Project met on Thursday, 19th April 2018 to consider your application for approval of the research project "Bio-chemical changes in individuals of high BMI with special reference to MEDHO SARA (excellence of adipose tissue) and STHAULYA (obesity)."	
As there are no ethical issues involved in your proposed research project, the Committee has provided approval for this research project.	
You are requested to report to Ethical Committee in case of the following:	
1. Any deviation from or change of the protocol. 2. All serious adverse events. 3. Any changes in study documents.	
 (Dr. Anita Dalal) Member Secretary, Ph.D. Ethical Committee (Human), KAHER, Belagavi	 (Dr. Anil Hogade) Chairman Ph.D. Ethical Committee (Human), KAHER, Belagavi.
CC to: - The Director Academic Affairs, KAHER, Belagavi. - The Director Research Foundation, KAHER, Belagavi. - The Registrar, KAHER, Belagavi	

D. PUBLICATIONS



The Bioscan 19(2)S1: 57-60, 2024
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

www.thebioscan.com

DEVELOPMENT AND VALIDATION OF A STANDARDIZED TOOL FOR ASSESSING THE MEDHO SARA (EXCELLENCE OF ADIPOSE TISSUE) WITH SPECIAL CONSIDERATION TO SNIGDHATA (UNCTUOUSNESS) EVALUATION.

SUMITH KUMAR M ^{1*}, PRADEEP GRAMPUROHIT ², SUNIL S. JALALPURE³, SHWETA PUJARI⁴

1. PhD Scholar, KLE Academy of higher education and research, Belagavi, Karnataka – 590010 & Associate Professor, Guru Gorakshnath Institute of Medical Sciences, Mahayogi Gorakshnath University, Gorakhpur, UP, India - 273007

2. Professor, KLE Shri BMK Ayurveda Mahavidyalaya, Belagavi, Karnataka. India.

3. Principal and Professor, College of Pharmacy, KLE Academy of higher education and research, Belagavi, Karnataka, India

4. Associate Professor, Dept of Samhita Siddhantha, Indian Institute of Ayurvedic Medicine & Research, Bangalore, Karnataka, India.

*Corresponding Author

*Email: drsumith@gmail.com

DOI: <https://doi.org/10.63001/tbs.2024.v19.i02.S1.pp57-60>

KEYWORDS

Medho Sara
Snigdhatta
Prakriti
Dhatu
Sara Purusha Lakshana
Phonation
Body Fat Percentage

Received on :
13.03.2024

Accepted on :
06.06.2024

*Corresponding
author

ABSTRACT

This study aimed to create a uniform assessment methodology for evaluating the *Medho Sara* (excellent level of adipose tissue), specifically emphasising analysing *Snigdhatta* (unctuousness). *Medho Sara* is one of the eight types of *Sara* described in the Ayurveda, and *Snigdhatta* is a subjective factor that enhances the overall quality of adipose tissue. The study utilised a cross-sectional survey approach to evaluate the correlation between *Medho Sara* norms and body fat percentage. A cohort of 253 individuals were enrolled, and their physical attributes, vocal parameters, and body fat percentage were assessed. The findings indicated that most of the subjects fell into the *Madhyama Sara* category, and there was a notable association between *Snigdha Oshta*, *Snigdha Purisha*, *Bruhat Shareera* and body fat percentage.

The study emphasises the significance of *Snigdhatta* in assessing *Medho Sara* and its correlation with body fat percentage. The results indicate that a sufficient quantity of adipose tissue is essential for specific physiological processes, such as enhancing the shine and appearance of hair, lips, and nails. The study highlights the importance of having a uniform instrument to evaluate *Medho Sara*, as it is crucial for the diagnosis and treatment of different health issues.

INTRODUCTION

As per the basic principles of the Ayurvedic medical system, the importance of *Sara* (excellence of tissues) (Amara, 1989) determination lies in exploring *Bala* (strength) of an individual *Dhatu* (tissues). (Agnivesha, 2011b) Since the *Bala* of individual *Dhatu* collectively provides *Bala of Sharira* (strength of the body).

Sara of respective *Dhatu*, when of excellent quality, promotes certain specific physical and socio-psychological characteristic features in *Shareera* (body) collectively termed as *Sara Purusha Lakshana* (signs of excellent body tissue). (Agnivesha, 2011b) Although every person is formed of the same fundamental entities (*Dosha* (body humour), *Dhatu* (tissue) and *Mala* (waste materials)) variations are still observed from person to person in the structural as well as functional aspects, depending upon numerous factors. Therefore, a physician faces practical difficulty in diagnosing *Sara*, due to a lack of objective parameters.

Medho Sara (adipose tissue excellence) is among the eight *Sara* mentioned by Ayurveda. In *Medho Sara*'s assessment

Snigdhatta (unctuousness) is one such subjective parameter mentioned in its *Lakshana* (clinical features) which can be decidedly used to assess the same. (Agnivesha, 2011b) *Snigdhatta* refers to unctuousness and oily (Vagbhata, 2005) and is the contribution of *Jala Mahabhuta* (the water element). (Agnivesha, 2011a) It promotes lustre to *Varna* (complexion), *Swara* (voice), *Netra* (eyes), *Kesha* (scalp hairs), *Loma* (body hairs), *Nakha* (nails), *Danta* (teeth), *Oshta* (lips), *Mutra* (urine), *Pureesha* (faeces), *Sweda* (sweat). (Agnivesha, 2011)

An adequate amount of body fat/adipose tissue is required to carry out certain physiological functions in the body, (Shah & Braverman, 2012) like promoting lustre to hair, lips, nails etc. Body fat percentage is one such scientific quantitative method of calculating the amount of body fat as a proportion of body weight. (Blaak, 2001) So, the main theme of this work was to analyze the relation between *Medho Sara* norms and Body fat percentage. Recent studies have shown Body Fat percentage to influence phonational behaviour. (Barsties et al., 2013a) Therefore, the determination of the consistency of voice parameters (frequency, intensity, Maximum Phonation Time) was selected as an objective parameter to be

established for measuring *Medho Sara*.

AIMS AND OBJECTIVES: To develop parameters to assess *Snigdha* in *Medho Sara* individuals.

MATERIALS AND METHODS:

Study Design: A cross-sectional survey study was undertaken, with written informed consent obtained from all study participants. Ethics clearance was acquired from the Institutional Ethics Committee of K.L.E. Academy of Higher Education & Research, Belagavi.

Survey Method: Self-administered questionnaire
Sampling Frame: By convenient sampling, the participants were selected from the patients attending "Utsaha OPD" of KAHER's Shri BM Kankanawadi Ayurveda Mahavidyalaya, Belagavi.

Sample Size: The sample size was estimated using Macorr Sample Size calculator software. (Sample Size Calculator for Market Research Surveys | MaCorr Research, n.d.) Considering a total population of 600 with a confidence level of 95% and confidence interval of 4.8% the sample size thus obtained is 246.

Inclusive Criteria: Participants, who had no confirmed mental illness, not associated with speech, language, hearing, respiratory, or any other motor/sensory deficits, irrespective of sex, between the age group of 16-30 years and were willing to participate in the study by providing written consent, were taken for this study.

Exclusive Criteria: Participants with endocrine abnormalities and female participants with a history of pregnancy and lactation were excluded from the study.

Socio-demographical study: It is done by questionnaire approach, which has been done to observe the distribution of *Medho Sara* in society. It contains name, age, sex, religion, occupation, education, residence, dietary habit, sleep habit, income grade and addictions. Besides this, these disciplines are also tested for their *Prakriti* (Ayurgenomics). (Wallace, 2020)

Assessment of Physical Characteristics: The Physical characteristics of *Medho Sara* like *Snigdha Varna*, *Snigdha Swara*, *Snigdha Netra*, *Snigdha Kasha*, *Snigdha Loma*, *Snigdha Nakha*, *Snigdha Danta*, *Snigdha Oshta*, *Snigdha Mutra*, *Snigdha Purisha*, *Snigdha Sweda*, *Bruhatshareera* (large body frame) and *Ayasa Asahishnuta* (intolerance to physical exertion) (Sushruta, 2004) are examined through questionnaire and clinical assessments. (Lee & Gallagher, 2008)

Experimental Study: The speech recording process of each participant was done to determine *Snigdha Swara* using PRAAT software, (Paul Boersma and David Weenink, n.d.) Body Fat Percentage was assessed using TANITA BC-1000 plus. (Tanita | BC-1000 PLUS Body Composition Scale, n.d.)

Preparation of the Participants: Every individual was instructed 1. Not to strain their voice by screaming; eating chilled, oily or fried foods.

2. Do not engage in smoking, alcohol, or caffeine. (Taking Care of Your Voice | NIDCD, n.d.)

3. Avoid using any cosmetic items like moisturizer, fairness cream, eyeliner, kajal, conditioners, nail polish, soap, oil etc. at least for a day. (Ravnbak et al., 2010) After having assured this, further assessments were carried out.

Phonation recording: The participant was advised to sit comfortably in a quiet location. Standard recording protocols were employed that comprised a condenser microphone situated 45 degrees off from the front of the mouth and a 4 cm mike-to-mouth distance. (Sundberg, 1995) In this investigation, the Philips Headphone IT with Mic SHM7410U model was chosen, which contained all the functions required for speech recording. (Philips SHM7410U/10 - Singular.Com.Cy, n.d.) Audio recordings are recommended to be produced on a computer with 16 bits of resolution and a signal sample rate of no less than 20 K Hertz. (Digital Audio Basics: Audio Sample Rate and Bit Depth, n.d.) The respondents were asked to phonate the vowel /a/ and hold it as stable as they could, in their regular voice, until they were ordered to stop. The subjects were taught to produce phonation at the physiologic bounds, without harming the voice during phonation at the extreme ranges. The participant accomplishes this job three times. (Maslan et al., 2011) The PRAAT software, using a manufacturer-defined algorithm, gathers fundamental frequency,

intensity and MPT (Maximum Phonation Time) information from the sample and develops the voice range profile. The above-mentioned factors, were extracted from the data and taken into consideration the terms of their relevancy in reflecting voice range profile above other parameters. (Sondhi et al., 2015)

Measurement of Body Fat Percentage: The participant was asked to tread barefoot on the TANITA BC-1000 plus and the appropriate values were recorded using Healthy Edge Plus Software. (Healthy Edge Lite Software (BC-1000 & BC-1500):, n.d.)

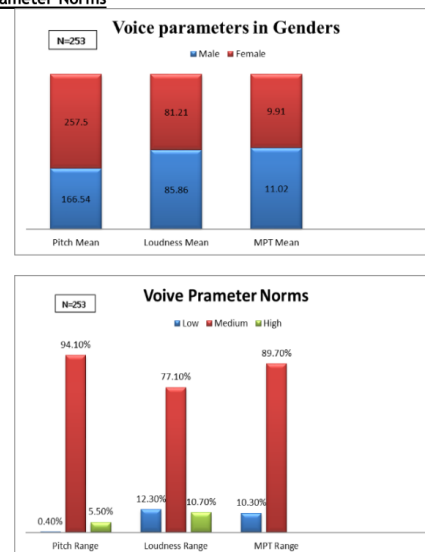
Statistical Analysis: The statistical analysis of data was performed using (IBM SPSS) statistics software version 22.0, the responses were summarised and outcomes were analysed with relevant statistical tests including Fisher's Exact, Spearman's Correlation, Mann Whitney U test and Kruskal Wallis test to elicit the relationship between subjective and objective parameters of the study. *Medho Sara* was computed by points scored for each character and the percentage score was classified as follows: 0-33 % score as *Avara Sara* (poor); 33 - 66 % score as *Madhyama Sara* (Moderate) > 66 % score as *Pravara Sara* (Excellent). (29)

OBSERVATION AND RESULT:

In the present study out of 253 participants, the majority were female 159 i.e. 62.8% and of the age group between 16 to 20 years 107 subjects (42.3%), 73 subjects each belonged to the age group of 21-25 and 26-30. *Prakriti*-wise distribution shows that a maximum of subjects was constituted with *Kaphavata* (40.7%) followed by *Kaphapitta* (24.9%), *Vatakapha* (18.2%), *Vatapitta* (10.7%), *Pittavata* (4.3%) and *Pittakapha* (1.2%).

Physical characteristics of *Medho sara* based distribution showed that the maximum number of subjects belong to the *Madhyama Sara* Category 72.7% followed by *Avarasara* 14.6% and only 12.7% of subjects belong to *Pravasara*. Subjects fall under the Healthy range of Body fat percentage was 111 (43.9%) followed by Under fat 86 (34.0%), Overfat 36 (14.2%) and very less in the Obese category 20 (7.9%). Pitch-based voice distribution showed that the maximum subjects had an Average pitch of 238 subjects (94.1%) followed by a high pitch of 14 subjects (5.5%) and 1 participant (0.4%) had a Low pitch score and Intensity-based voice distribution showed that the maximum subjects have Average intensity in 195 subjects (77.1%) followed by Low intensity in 31 (12.3%) and only 27 subjects (10.7%) have High-intensity score. Maximum Phonation Time-based voice distribution showed that the maximum subjects have an Average MPT of 227 subjects (89.7%) followed by Low MPT in 26 subjects (10.3%).

Chart. 1 Voice Parameters in Different Genders and Voice Parameter Norms



The crosstab between *Prakruti* and *Meda Sara* (Table 1) denotes an almost equal distribution of all *Prakruti* in the *Madhyama Sara* category. Fisher's Exact showed a significant difference between *Meda Sara* and *Prakruti* at Fisher's exact value = 18.428, $p > 0.05$. A Spearman's Rank Order correlation was run to determine the relationship and there was no correlation between them at $r_s = -0.011$, $p > 0.05$.

Table. 1 Medho sara to prakruti

Prakruti		Medho sara			Total
		Pravara	Madhyama	Avara	
Vata	Count	1	25	1	27
Pitta	%	28.3%	33.9%	18.8%	100%
Pitta	Count	2	9	0	11
Vata	%	36.4%	45.12%	13.3%	100%
Pitta	Count	0	3	0	3
Kapha	%	0	100%	0	100%
Kapha	Count	22	40	1	63
Pitta	%	34.9%	63.5%	1.6%	100%
Kapha	Count	17	85	1	103
Vata	%	16.5%	82.52%	0.9%	100%
Vata	Count	11	33	2	46
Kapha	%	23.9%	71.7%	4.3%	100%
Total		53	195	5	253

Correlation between physical characteristics of *Medho Sara* with Body Fat Percentage (Table 2) showed Characteristic features like *Snigdha Oshta*, *Snigdha Purisha* and *Bruhat Shareera* have a correlation, which was significant at $r_s = -0.128$, $p = 0.043$; $r_s = -0.0132$, $p = 0.035$; $r_s = 0.631$, $p = 0.000$ respectively.

Table 2 Correlation between physical characteristics of Medho Sara with body fat percentage.

Parameters for Medho Sara	Body fat percentage			
	N	r_s	P	Remark
<i>Snigdha Varna</i>	253	0.004	0.953	NS
<i>Snigdha Swara</i>	253	0.029	0.642	NS
<i>Snigdha Netra</i>	253	0.012	0.844	NS
<i>Snigdha Keshha</i>	253	0.055	0.385	NS
<i>Snigdha Loma</i>	253	-0.073	0.250	NS
<i>Snigdha Nakha</i>	253	-0.086	0.172	NS
<i>Snigdha Danta</i>	253	-0.036	0.571	NS
<i>Snigdha Oshta</i>	253	-0.128	0.043	S
<i>Snigdha Mutra</i>	253	0.052	0.381	NS
<i>Snigdha Pureesha</i>	253	-0.132	0.035	S
<i>Snigdha Sweda</i>	253	0.079	0.212	NS
<i>Bruhat Shareera</i>	253	0.631	0.000	HS
<i>Ayasa Asahishnu</i>	253	0.082	0.192	NS

When tested for correlation between voice parameters and body

fat percentage, it showed that the distributions of Fundamental frequency, Intensity and MPT, were not normally distributed. Hence Kruskal Wallis test was applied to test the association between these voice parameters and body fat percentage. The results suggest that there is a statistically significant difference between the underlying distributions of the Frequency scores in different body fat percentages (chi-square = 9.399, $p < 0.05$); however, there is no statistically significant difference between the underlying distributions of Intensity and MPT in different body fat percentage.

DISCUSSION

A study to extricate objective parameters for the assessment of *Medho Sara* through the valuation of *Snigdha* was undertaken, so that its determination gets easier and uniform. An analysis showed that the maximum number of subjects belonged to the Healthy range of body fat percentage accounting for 43.9%. It might be attributed to the age group selected for the assay, in which the percentage of body fat commonly falls under the Healthy range, (Silver et al., 1993) unlike those below 16 years and above 40 years, accounting for under-fat and over-fat ranges respectively.

Pravara and *Madhyama Sara* can be brought under the Healthy range of Body Fat percentage, because both of them, being in their normal *Pramanataha* (quantity) perform *Snehana Karma* (unctuousness) to the body. The Overfat and Obese range refers to the condition of *Sthoulya*, (obesity) which may arise through increased *Snehana* function of *Medho Vruddhi* (increase in adiposity) (*Gunataha* quantitatively) and *Karmataha* (Vagbhata, 2008a) (functionally). Whereas the Under-fat range accounts for the state of *Medho Kshaya* (decreases adiposity) (*Avara Sara*), which results in *Roukshya* (dry), *Karshya* (rough), *Mamsa Kshaya* (decrease of muscle tissue) etc. (Vagbhata, 2008b)

The crosstab between body fat percentage and Gender showed a higher incidence of a Healthy range of body fat percentage in females probably due to the physiological demands of childbirth and other hormonal processes. Moreover, women tend to accumulate a greater amount of adipose tissue in the gluteal-femoral region, following a gynoid pattern. In contrast, men tend to store more fat in the visceral/abdominal depot, following an android pattern. This review examines variations in regional adipose tissue deposition, mobilisation, and oxidation that may contribute to disparities in body fat distribution between genders. (Blaak, 2001)

The results suggest that there is a highly significant difference between the underlying distributions of the Frequency scores of males and females ($z = -12.787$, $p = 0.000$); Intensity scores of males and females ($z = -5.969$, $p = 0.000$); MPT scores of males and females ($z = -3.721$, $p = 0.000$). For females, endocrinological changes result in more massive vocal folds and consequently result in higher phonation frequency than the males. Males have substantially higher intensity and MPT than females, due to testosterone-driven vocal fold enlargement and vocal tract lengthening during adolescence and early adulthood (17-30 yrs).

Under fat subjects differed significantly as compared to other groups with lower values of Fundamental frequency $_{min, max}$. In contrast, being under fat is assumed to affect frequency via poor blood circulation, poor physical condition, psychological distress, and sometimes decreased muscle tension/tone. (Barsties et al., 2013b) It appears that overfat and obese subjects phonate at significantly higher values of Fundamental frequency $_{min, max}$ levels. They have greater diaphragmatic motion and weight and therefore have higher respiratory muscle strength. (Padkao & Boonla, 2020) Consequently, more respiratory airflow power is available, potentially resulting in higher subglottal pressure in phonatory airflow parameters as evidenced in the study of Solomon et al. (Solomon et al., 2011) Raising subglottal air pressure generally translates to increased frequency through more air which is pushed through the glottis thus expanding the glottal flow wave. Whereas subjects of Healthy BODY FAT PERCENTAGE lie midway between two extreme groups with normal phonational behaviour.

CONCLUSION

Although there are many characteristics mentioned in Ayurveda literature for assessment of *Medho Sara*, all of them are qualitative or subjective, and there is a need to adopt such a method which measures quantitatively, and coincides with our ancient concept of *Medho Sara*, this study aids to establish objective parameter for the

identification of *Medha Sara* subjects more easily and it proves that *Medha Sara* has got a significant association with BODY FAT PERCENTAGE and can be used as a precise parameter for *Medha Sara* examination. Though voice parameters (Fundamental frequency, Intensity, MPT) were selected to prove as objective parameters to assess *Medha Sara*, this study didn't find any significant evidence to support it.

Hence it is concluded that BODY FAT PERCENTAGE is the most reliable objective parameter to examine *Medha Sara* in a clinical examination.

REFERENCES

- Agnivesa. (2011). Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta (Vaidya Yadavaji Trikamji Acharya, Ed.; Reprint, Vol. 3). Chaukhamba Sanskrit Series.
- Agnivesha. (2011a). Charaka samhita by with Ayurveda deepika teeka of Chakrapanidatta (Vaidya Yadavaji Trikamji Acharya, Ed.; Reprint, Vol. 2). Chaukhamba Orientalia.
- Agnivesha. (2011b). Charaka samhita with Ayurveda deepika teeka of Chakrapanidatta (Vaidya Yadavaji Trikamji Acharya, Ed.; Reprint, Vol. 2). Chaukhamba Orientalia. <https://www.scienceopen.com/document?vid=92736359-5bed-4e2f-81ad-229dc09d8126>
- Amara, S. (1989). Amara-Kosha or Sanskrit thesaurus Tr. By Lewis Rice: Vol. 2nd Ed. Mysore Government.
- Barsties, B., Verfaillie, R., Roy, N., & Maryn, Y. (2013a). Do body mass index and fat volume influence vocal quality, phonatory range, and aerodynamics in females? *CoDAS*, 25(4), 310-318. <https://doi.org/10.1590/S2317-17822013000400003>
- Barsties, B., Verfaillie, R., Roy, N., & Maryn, Y. (2013b). Do body mass index and fat volume influence vocal quality, phonatory range, and aerodynamics in females? *CoDAS*, 25(4), 310-318. <https://doi.org/10.1590/S2317-17822013000400003>
- Blaak, E. (2001). Gender differences in fat metabolism. *Current Opinion in Clinical Nutrition and Metabolic Care*, 4(6), 499-502. <https://doi.org/10.1097/00075197-200111000-00006>
- Digital Audio Basics: Audio Sample Rate and Bit Depth. (n.d.). Retrieved April 5, 2022, from <https://www.izotope.com/en/learn/digital-audio-basics-sample-rate-and-bit-depth.html>
- Healthy Edge Lite software (BC-1000 & BC-1500): (n.d.). Retrieved April 5, 2022, from <https://support.tanita.eu/support/solutions/folders/60000480525>
- Lee, S. Y., & Gallagher, D. (2008). Assessment methods in human body composition. *Current Opinion in Clinical Nutrition and Metabolic Care*, 11(5), 566. <https://doi.org/10.1097/MCO.0B013E32830B5F23>
- Maslan, J., Leng, X., Rees, C., Blalock, D., & Butler, S. G. (2011). Maximum Phonation Time in Healthy Older Adults. *Journal of Voice: Official Journal of the Voice Foundation*, 25(6), 709. <https://doi.org/10.1016/J.VOICE.2010.10.002>
- Padkao, T., & Boonla, O. (2020). Relationships between respiratory muscle strength, chest wall expansion, and functional capacity in healthy nonsmokers. *Journal of Exercise Rehabilitation*, 16(2), 189. <https://doi.org/10.12965/JER.2040080.040>
- Paul Boersma and David Weenink. (n.d.). Praat: doing Phonetics by Computer. Retrieved April 5, 2022, from <https://www.fon.hum.uva.nl/praat/>
- Philips SHM7410U/10 - Singular.com.cy. (n.d.). Retrieved April 5, 2022, from <https://www.singular.com.cy/philips-shm7410u-headset-semi-open.html>
- Ravnbak, M. H., Philipsen, P. A., & Wulf, H. C. (2010). The minimal melanogenesis dose/minimal erythema dose ratio declines with increasing skin pigmentation using solar simulator and narrowband ultraviolet B exposure. *Photodermatology Photoimmunology and Photomedicine*, 26(3), 133-137. <https://doi.org/10.1111/j.1600-0781.2010.00508.x>
- Sample size calculator for Market Research Surveys | MaCorr Research. (n.d.). Retrieved April 5, 2022, from <https://www.macorr.com/sample-size-calculator.htm>
- Shah, N. R., & Braverman, E. R. (2012). Measuring Adiposity in Patients: The Utility of Body Mass Index (BMI), Percent Body Fat, and Leptin. *PLoS ONE*, 7(4), e33308. <https://doi.org/10.1371/journal.pone.0033308>
- Silver, A. J., Guillen, C. P., Kahl, M. J., & Morley, J. E. (1993). Effect of aging on body fat. *Journal of the American Geriatrics Society*, 41(3), 211-213. <https://doi.org/10.1111/J.1532-5415.1993.TB06693.X>
- Solomon, N. P., Helou, L. B., Dietrich-Burns, K., & Stojadinovic, A. (2011). Do obesity and weight loss affect vocal function? *Seminars in Speech and Language*, 32(1), 31-42. <https://doi.org/10.1055/S-0031-1271973>
- Sondhi, S., Khan, M., Vijay, R., Salhan, A. K., & Chouhan, S. (2015). Acoustic analysis of speech under stress. *International Journal of Bioinformatics Research and Applications*, 11(5), 417-432. <https://doi.org/10.1504/IJBRA.2015.071942>
- Sundberg, J. (1995). Vocal fold vibration patterns and modes of phonation. *Folia Phoniatrica et Logopaedica: Official Organ of the International Association of Logopedics and Phoniatrics (IALP)*, 47(4), 218-228. <https://doi.org/10.1159/000266353>
- Sushruta. (2004). *Sushruta Samhita* (Vaidya Jadavji Trikamji Acharya, Ed.; 1st ed.). Choukhambha Krishanadas Academy.
- Taking Care of Your Voice | NIDCD. (n.d.). Retrieved April 5, 2022, from <https://www.nidcd.nih.gov/health/taking-care-your-voice>
- Tanita | BC-1000 PLUS Body Composition Scale. (n.d.). Retrieved April 5, 2022, from <https://tanita.com/products/bc-1000plus?Color=White>
- Vagbhata. (2005). *Ashtangahrdaya* (Paradakara H S Sastri, Ed.; Reprint). Chowkhamba Surbharati Prakashan.
- Vagbhata. (2008a). *Ashtanga Hridaya: Vol. I* (T Sreekumar, Ed.; II). Harisree.
- Vagbhata. (2008b). *Ashtanga Hridaya: Vol. I* (T Sreekumar, Ed.; II). Harisree.
- Wallace, R. K. (2020). *Ayurgenomics and Modern Medicine*. *Medicina*, 56(12), 1-7. <https://doi.org/10.3390/MEDICINA56120661>

Sumith Kumar M /Afr.J.Bio.Sc. 6(8) (2024)

ISSN: 2663-2187

<https://doi.org/10.33472/AFJBS.6.8.2024.1950-1959>



Ayurvedic Perspective on Metabolically Healthy Obesity: Understanding Staulya and Medho Sara

**Sumith Kumar M ^{1*}, Pradeep Grampurohit ², Sunil S. Jalalpure³,
Masood Ahmed Tahashilda⁴**

1. PhD Scholar, KLE Academy of higher education and research, Belagavi, Karnataka – 590010 &
Associate Professor, Guru Gorakshnath Institute of Medical Sciences, Mahayogi Gorakshnath University,
Gorakhpur.

2. Professor, KLE Shri BMK Ayurveda Mahavidyalaya, Belagavi, Karnataka.

3. Principal and Professor, College of Pharmacy, KLE Academy of higher education and research,
Belagavi, Karnataka

4. KLE'S BASIC SCIENCE RESEARCH CENTER, Belagavi

*Corresponding Author

*Email: drsumith@gmail.com

Article History
Volume 6, Issue 8, 2024
Received: 26 Mar 2024
Accepted : 29 Apr 2024
doi: 10.33472/AFJBS.6.8.2024. 1950-1959

ABSTRACT

Obesity is a condition characterised by the excessive or abnormal deposition of fat or adipose tissue in the body which leads to complicated health issues connected with several harmful impacts on well-being, including an increased risk of various medical diseases and considerable cost burdens on healthcare systems and society. This study analyses the Ayurvedic concepts of Staulya and Medho Sara about Metabolically Healthy Obesity (MHO) and Metabolically Unhealthy Obesity (MUO). Medho Sara, characterized by excellence in adipose tissue, correlates closely with the notion of MHO, where persons with obesity do not exhibit conventional cardiometabolic concerns. In contrast, Staulya, indicating pathological obesity, correlates more with MUO, defined by metabolic abnormalities and elevated risks of type 2 diabetes and cardiovascular illnesses.

The research intends to illustrate how comprehending Medho Sara and Staulya can aid in the early identification of high-risk patients for metabolic imbalances and cardiovascular illnesses. By merging traditional Ayurvedic wisdom with modern medical viewpoints, this study hopes to bring fresh insights into the holistic management of obesity. Clinical and laboratory examinations were undertaken on individuals with obesity to differentiate between Medho Sara and Staulya phenotypes based on numerous factors such as BMI, blood pressure, glucose levels, lipid profiles, and markers of insulin resistance.

The data demonstrated a prevalence of 30.1% for the Medho Sara phenotype among people with obesity, showing major disparities in clinical and biochemical parameters between the two phenotypes. Medho Sara residents were considerably younger, had lower BMI and waist circumference compared to Staulya individuals. Additionally, biomarkers associated with insulin resistance differed considerably across the two groups, with higher adiponectin levels in Medho Sara and lower uric acid levels compared to Staulya.

This study adds unique insights into the varied metabolic profiles within obesity via the lens of Ayurvedic principles, underlining the significance of tailored approaches for controlling obesity-related illnesses based on specific phenotypic traits. The merging of ancient knowledge with modern scientific understanding offers a viable option for furthering obesity research and improving individual health outcomes.

Keywords: Obesity, Metabolically Healthy Obesity (MHO), Metabolically Unhealthy Obesity (MUO), Medho Sara, Staulya, Insulin resistance

Introduction

Obesity is a condition characterised by the excessive or abnormal deposition of fat or adipose tissue in the body which leads to complicated and multifaceted health issues that is related to a wide range of negative effects on an individual's well-being. According to a historical review, obesity is highly connected to over 50 medical disorders, with evidence from Mendelian randomization studies indicating causality(1).

Some of the primary health repercussions of obesity include a higher risk of at least 18 co-morbidities, such as metabolic diseases and catastrophic health consequences(2). Additionally, obesity can contribute to psychological deficits, social stigma, and prejudice, affecting numerous elements of an individual's life(2). Furthermore, obesity is associated with an enhanced risk of diseases such as diabetes, heart disease, some malignancies, high blood pressure, high cholesterol, and breathing problems(3). The economic consequence of being overweight and obese, including direct medical expenditures and increased absenteeism, has also been well-documented(4). Therefore, understanding and addressing obesity is crucial for improving individual health and reducing the economic impact on healthcare systems and society as a whole.(5).

Ayurveda provides an inimitable way of understanding a person with a higher BMI in the form of *Staulya* and *Medho Sara*, the term *Medho Sara* (Excellence of adipose tissue) is constituted by two components i.e. *Meda* & *Sara* which means *Vishuddhatara Medho Dhatu* (Excellence of adipose tissues), which signifies the characteristics of a *Dhatu* (Tissue) physiologically in respect of its quantity, quality and functions. On the other hand, *Staulya* (Obesity) has been explained to indicate the pathological nature of Adipose tissue.

Medho Sara has high similarity to the current understanding of Metabolically healthy obesity (MHO) which is a notion drawn from clinical data that a subgroup of patients with high BMI does not exhibit overt cardiometabolic problems(6). It is characterised by the lack of metabolic abnormalities such as type 2 diabetes, glucose intolerance, dyslipidemia, hypertension, and inflammation, which are risk factors for cardiovascular diseases (CVD) (7).

Although there is no standardized definition of MHO, some proposed criteria include(6):

- Systolic blood pressure (SBP) ≤ 130 mmHg; diastolic blood pressure ≤ 85 mmHg
- Fasting blood glucose ≤ 6.1 mmol/l (≤ 100 mg/dl)
- Fasted serum triglycerides ≤ 1.7 mmol/l (≤ 150 mg/dl)
- HDL cholesterol serum concentrations > 1.0 (> 40 mg/dl) (in men) or > 1.3 mmol/l (> 50 mg/dl) (in women)

MHO has been associated with superior adipose tissue function, insulin sensitivity, and cardiorespiratory fitness compared to unhealthy obesity. Studies have shown that Individuals with MHO may have a lower risk of type 2 diabetes and CVDs, while the risk is still higher compared to healthy lean individuals(6).

The description of *Staulya* mentioned in *Ayurveda* can be more correlated to the definition of Metabolically unhealthy obesity (MUO) which is characterized by the presence of metabolic abnormalities, such as atherogenic dyslipidemia, insulin resistance, prediabetes and metabolic syndrome, which are most important four risk factors for type 2 diabetes and CVD (8).

Sumith Kumar M / Afr.J.Bio.Sc. 6(8) (2024)

This concept has implications for the study of persons with high BMI in the purview of *Medho Sara* and *Staulya* for the early identification of high-risk individuals or subgroups for prevention and treatment strategies

Aims and Objectives

The study aims to achieve the following objectives:

- To Explore the Ayurvedic ideas of *Medho Sara* and *Staulya* and their association with Metabolically Healthy Obesity (MHO) and Metabolically Unhealthy Obesity (MUO).
- Determine how knowing *Medho Sara* and *Staulya* can benefit in early detection of high-risk patients for metabolic imbalances and cardiovascular illnesses.

By addressing these aims and objectives, the study seeks to give new insights into the holistic management of obesity through an integrated approach integrating traditional Ayurvedic wisdom with modern medical viewpoints.

Materials and Methods

Individuals attending Utsaha OPD of KAHER Sri BMK Ayurveda Mahavidhyalaya, Belagavi with body mass index (BMI) >25 were approached to participate in the study.

The Data was collected through a structured questionnaire for assessing the basic characteristics mentioned for *Medho Sara* and *Staulya* as per Ayurveda classics.

Anthropometric and clinical assessments of *Medho Sara* and *Staulya* were performed as per the approved SOP guidelines.

Height was measured while standing without shoes to the nearest 0.1 cm using a calibrated stadiometer (Seca 213, Germany). weight was measured in light clothing without shoes and socks to the nearest 0.1 kg (Seca 803, Germany). BMI was calculated as weight in kilograms (kg) divided by the square of height in meters (m²). Waist circumference was measured twice to the nearest 0.1 cm over the skin midpoint between the tenth rib and the iliac crest at the end of a normal exhalation, using an inelastic measuring tape (Seca 201, Germany)

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured twice on the right arm using a digital sphygmomanometer (Omron HEM 7120) after 5 minutes of rest in a seated position with the arm supported at the heart level

Biochemical measurements

Blood investigations were conducted according to the principles of Good Clinical Practice that has its principles as reported in the Declaration of Helsinki. Experienced nurses and medical professionals conducted the venipuncture. Venous blood samples were promptly refrigerated and processed within 2 hours of collection at the Hospital Laboratory, Aliquots of serum/plasma were stored at -20°C for short-term storage or -80°C for long-term storage before examination in the Medical Research central laboratory. Fasting plasma glucose, total cholesterol, triglycerides, high-density lipoprotein-cholesterol, low-density lipoprotein-cholesterol, high-sensitivity C-reactive protein, adiponectin, and uric acid and were measured using an automated analyzer.

Selection of study participants and Definitions of measures

1. Participants having a BMI of > 25.0 were included in the study and classified as overweight and obese based on their BMI suggested by the world obesity federation.

Sumith Kumar M /Afr.J.Bio.Sc. 6(8) (2024)

2. Categorisation of the participants into Medho Sara and Staulya was done based on the classical description of Medho Sara and Staulya in Ayurveda Classics.(9)
3. Metabolic health classification was made as metabolically healthy or unhealthy based on a set of criteria,
 - Body Mass Index (BMI) ≥ 25 kg/m²
 - Fasted serum triglycerides ≤ 1.7 mmol/l (≤ 150 mg/dl)
 - HDL cholesterol serum concentrations >1.0 (>40 mg/dl) (in men) or >1.3 mmol/l (>50 mg/dl) (in women)
 - Systolic blood pressure (SBP) ≤ 130 mmHg; diastolic blood pressure ≤ 85 mmHg
 - Fasting blood glucose ≤ 6.1 mmol/l (≤ 100 mg/dl)
4. Age and gender: Participants belonging to an age group of 18 to 45 years with both male and female gender ranges to ensure a representative sample.
5. Participants were selected from different geographical sites to account for probable variations in diet, lifestyle and environmental factors.
6. A convenient sampling method representing the target population adequately was used to select 193 participants who fall under the inclusion criteria.

Statistical Analysis

The normality test for continuous data was analysed using the Kolmogorov-Smirnov test. Continuous variables were presented as mean (standard deviation) for normally distributed and median (25th percentile, 75th percentile) for non-normally distributed variables, and the differences between *Medho Sara* and *Staulya* were compared using an independent t-test and Mann-Whitney test respectively. Categorical variables were provided as frequency and proportion and comparisons between groups were done using the chi-square test. All analyses were performed using IBM SPSS 26.0 and statistical significance was defined at 2-sided $P < 0.05$.

Observations and Results

Overall, 305 participants gave consent to participate in the study and blood taking for the same. Out of these, 193 people with overweight and obese (BMI > 25) were examined for *Medho Sara* and *Staulya* phenotypes and obesity-related clinical and biochemical characteristics, using a convenient sampling technique.

The frequency of *Medho Sara* among adults with obesity was 30.1% (95% CI 23.7 – 37.1%) and the remaining 69.9% falls under *Staulya* phenotype.

The values factors used to define participants as either *Medho Sara* or *Staulya* like subjective parameters of *Ayata upachaya* (Improper growth), *Swedadhikya* (Excess sweating), *Daurgandhya* (Foul smell), *Ayasa Swasa* (Dyspnoea on exertion), *Nidradhikya* (Excessive sleep), *Snigdha Varna* (lustre), *Snigdha Kesha* (Hair), *Snigdha Pureesha* (Stool) and objective parameters like systolic BP, Diastolic BP, Fasting blood glucose test, HDL-cholesterol and Triglycerides were highly statistically significant between the two groups except for analysis based on BMI, which was significant at a p-value < 0.01 (Table 1).

TABLE 1 Comparison of parameters used as criteria to define *Medho Sara* and *Staulya* phenotypes

Parameters	<i>Medho Sara</i> n = 58	<i>Staulya</i> n = 135	p-value	n = 193
------------	-----------------------------	---------------------------	---------	---------

BMI	28.4 (3.3)	30.0 (3.9)	< 0.01	29.5 (3.8)
Systolic BP (mm Hg), mean (SD)	118 (9)	128 (11)	< 0.001	122 (11)
Diastolic BP (mm Hg), mean (SD)	84 (7)	93 (9)	< 0.001	86 (10)
Fasting blood glucose test (mmol/L), mean (SD)	5.13 (0.36)	5.37 (0.48)	< 0.001	5.30 (0.46)
HDL-cholesterol (mmol/L), mean (SD)	1.25 (0.16)	1.09 (0.21)	< 0.001	1.14 (0.21)
Triglycerides (mmol/L), mean (SD)	0.96 (0.31)	1.19 (0.50)	< 0.001	1.12 (0.46)

Among those with *Staulya* phenotype 52 (65.2%) exhibited only one among the four important risk factors for type 2 diabetes and CVD, 22 (28.1%) showed 2 risk factors, 6 (5.9%) had 3 risk factors and no one was found to have all four risk factors for type 2 diabetes and CVD. High blood pressure (SBP or DBP > 90th percentile) was the most represented risk factor (51.9%) across *Staulya* phenotypes and was considerably greater in males than in females (60.0% vs 41.7%, p-value = 0.03). Instead, high triglycerides (TG > 1.7 mmol/L) were the least detected risk factor among the *Staulya* phenotypic.

Medho Sara and *Staulya*, related clinical and laboratory parameters were presented in Table 2. *Medho Sara* phenotype was considerably younger [21.9 (2.2) vs 22.6 (2.1) years, p-value = 0.03], had considerably lower BMI [28.4 (3.3) vs 30.0 (3.9) kg/m², p-value < 0.01] and had significantly lower waist circumference [86.6 (8.5) vs 91.3 (9.8), p-value < 0.01] as compared with *Staulya* phenotype. The prevalence of physical markers of insulin resistance including acanthosis nigricans (areas of dark, thick velvety skin in body folds and creases) was more common among *Staulya* than in *Medho Sara* (p-value = 0.03). Serum adiponectin was substantially greater (p-value < 0.01) in *Medho Sara* as compared to *Staulya* participants with values of 7.1 (2.4) versus 5.5 (2.1) µg/mL respectively.

In addition, serum uric acid was significantly lower in *Medho Sara* as compared to *Staulya* [364.7 (65.1) vs 389.5 (65.8) µmol/L, p-value = 0.04].

TABLE 2: *Medho Sara* and *Staulya*, related clinical and laboratory parameters

Parameters	<i>Medho Sara</i> n = 58	<i>Staulya</i> n = 135	p-value	n = 193
Waist circumference (cm), mean (SD)	86.6 (8.5)	91.3 (9.8)	< 0.01	89.9 (9.6)
Body fat percentage, mean (SD)	42.3 (5.1)	42.3 (4.9)	0.97	42.3 (4.9)
Fasting insulin (µU/mL), median (q25, q75)	14.8 (10.2, 23.6)	17.0 (11.0, 24.7)	0.24	16.7 (10.7, 24.6)
HOMA-IR, median (q25, q75)	3.4 (2.3, 5.3)	4.0 (2.7, 5.6)	0.22	3.9 (2.4, 5.6)
Insulin Resistance, n (%)	28 (48.3)	78 (57.8)	0.16	106 (54.9)
HbA1c (%), mean (SD)	5.2 (0.3)	5.2 (0.3)	0.43	5.2 (0.3)
Acanthosis nigricans, n (%)	28 (49.1)	87 (65.4)	0.03	115 (60.5)
Total cholesterol (mmol/L), mean (SD)	4.67 (0.57)	4.45 (0.86)	0.05	4.52 (0.79)
LDL-cholesterol (mmol/L), mean (SD)	3.20 (0.73)	3.18 (0.87)	0.92	3.19 (0.83)
Uric acid (µmol/L), mean (SD)	364.7 (65.1)	389.5 (65.8)	0.04	382.3 (66.3)
Adiponectin (µg/mL), mean (SD)	7.1 (2.4)	5.5 (2.1)	< 0.01	5.9 (2.3)
Leptin (ng/mL), mean (SD)	24.8 (11.1)	25.7 (11.5)	0.73	25.5 (11.3)
Interleukin-6 (pg/mL), median (q25, q75)	1.7 (1.2, 3.1)	2.3 (1.6, 3.4)	0.09	2.1 (1.5, 3.3)

Discussion on Observation and Results

Study Findings looked into the prevalence of *Medho Sara* and *Staulya* phenotypes among persons with obesity, giving insight into their clinical and biochemical aspects. The findings gave new insights into the distinctions between these phenotypes and their connection with various risk factors and biomarkers.

The study revealed a frequency of 30.1% for the *Medho Sara* phenotype among people with obesity, showing a high occurrence of this phenotype within the group under examination and it was more common among younger age groups. This underscores the necessity of recognising and discriminating between these phenotypes in the context of obesity-related treatment plans and research. Compared to *Staulya*, *Medho Sara* individuals had significantly lower BMI, lower waist circumference, lower serum uric acid and higher serum adiponectin levels. Furthermore, *Medho Sara* phenotype was found to be more common in women than in men, and this may be attributed to differences in lifestyle, hormone levels and body fat distribution(10,11)

Among individuals with the *Staulya* phenotype, the distribution of risk factors varied, with high blood pressure being the most prominent risk factor. Interestingly, this risk factor demonstrated a gender gap, with a larger prevalence in Males compared to Females. Conversely, elevated triglycerides were less typically observed among individuals with the *Staulya* phenotype, indicating the heterogeneity in risk factor profiles within this group.

A study of clinical and biochemical markers between the *Medho Sara* and *Staulya* phenotypes found substantial differences. The *Medho Sara* phenotype was noticeably younger, had a lower BMI, and had reduced waist circumference compared to the *Staulya* phenotype. These findings underline the different metabolic features associated with each condition.

The study also highlighted changes in biomarkers linked with insulin resistance between the two phenotypes, Acanthosis nigricans, a physical indication of insulin resistance, was more common in persons with the *Staulya* phenotype, there is evidence indicating that acanthosis nigricans is a marker of glucose metabolism derangement and was linked with insulin resistance in obesity(12). The hyperinsulinemic-euglycemic clamp is widely regarded as the preferred method for detecting insulin resistance. However, due to its intricate nature and invasiveness, the most commonly used approach for evaluating insulin resistance is the calculation of HOMA-IR. Our study findings indicate that *Medho Sara* phenotype demonstrates a lower HOMA-IR score in comparison to individuals displaying the *Staulya* phenotype(13–16). It is important to highlight that 50% of the participants in our study exhibited insulin resistance. This implies that, in addition to obesity itself, variations in the genetic susceptibility of each individual to develop insulin resistance may also contribute. However, it is important to note that this is not the focus of this article.

Moreover, blood adiponectin levels were considerably greater in people with the *Medho Sara* phenotype, indicating potential metabolic differences between the two groups.

Notably, blood uric acid levels were much lower in those with the *Medho Sara* phenotype compared to those with the *Staulya* phenotype. This observation contributes to the detailed understanding of metabolic differences between different phenotypic groupings and may have

Sumith Kumar M / *Afr.J.Bio.Sc.* 6(8) (2024)

consequences for developing treatment protocols or subsequent studies on obesity-related comorbidities.

The prevalence of *Medho Sara* in individuals of high BMI may be a transient phenotype, and it is essential to consider long-term follow-up, especially covering elderly people, in understanding the conversions between *Staulya* and *Medho Sara*. There is an inconsistent risk profile among obese individuals, suggesting the existence of a subgroup of obesity that is metabolically healthy.

It is essential to evaluate the combinations of environmental factors, genetic vulnerability, and the mechanisms encouraging weight increase and protecting a higher body weight in comprehending the variances between *Staulya* and *Medho Sara*.

Additionally, the incidence of *Staulya* and *Medho Sara* may vary based on the particular criteria used to describe these characteristics, and there are uncertainties in a reliable international comparison of obesity phenotype prevalence. Possible factors contributing to *Medho Sara* may be because these individuals have lower amounts of visceral and liver fat, which are associated with better metabolic health and can be understood from whole-genome transcriptome studies which have found distinct gene expression profiles linked with MHO(17), providing insights into the protective molecular processes in *Medho Sara*.

Our study revealed that individuals with the *Medho Sara* phenotype exhibited significantly lower BMI and waist circumference compared to those with the *Staulya* phenotype. However, it is important to note that these two measures of adiposity did not serve as predictors for the *Medho Sara* phenotype within the population under investigation. This finding suggests that there may be additional underlying factors that contribute to the MHO phenotype, even though obesity is a risk factor for metabolic morbidities(18). In addition, greater BMI found among *Medho Sara* in our study may be related to larger skeletal muscle mass and fat mass. Indeed, BMI has been described as a poor predictor of adiposity due to the inability to discriminate between body fat mass and lean tissue mass(19). These characteristics combined lead to the distinctive metabolic profile of *Medho Sara* individuals, demonstrating the intricate interplay of genetic, molecular, environmental, and lifestyle factors in the emergence and upkeep of metabolic health in the setting of obesity

Limitations of the study

Despite the remarkable outcomes in this study, some limitations need to be addressed. current studies on *Medho Sara* and *Staulya* had a small sample size, which limits the generalizability of the findings. As this was a cross-sectional study with no follow-ups, which limits the ability to assess the long-term health outcomes of *Staulya* phenotype of obesity.

Conclusion

In conclusion, the study on the *Medho Sara* and *Staulya* phenotypes among patients with obesity has exposed considerable differences in clinical and biochemical characteristics of these morphologies and this understanding may help in the early identification of high-risk people or subgroups for prevention and treatment methods. This can also lead to developing individualised interventions tailored to the individual's metabolic health state, thereby improving their entire health and minimising the financial impact on healthcare systems as well as society in general. Hence this study has potential implications for clinical practice and public health policies.

1. Lam BCC, Lim AYL, Chan SL, Yum MPS, Koh NSY, Finkelstein EA. The impact of obesity: a narrative review. *Singapore Med J* [Internet]. 2023 Mar 1 [cited 2024 Jan 27];64(3):163. Available from: [/pmc/articles/PMC10071857/](https://pubmed.ncbi.nlm.nih.gov/40071857/)
2. Djalalinia S, Qorbani M, Peykari N, Kelishadi R. Health impacts of Obesity. *Pak J Med Sci* [Internet]. 2015 Jan 1 [cited 2024 Jan 23];31(1):239. Available from: [/pmc/articles/PMC4386197/](https://pubmed.ncbi.nlm.nih.gov/2586197/)
3. Health Risks | Obesity Prevention Source | Harvard T.H. Chan School of Public Health [Internet]. [cited 2024 Jan 27]. Available from: <https://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/health-effects/>
4. Ward ZJ, Bleich SN, Long MW, Gortmaker SL. Association of body mass index with health care expenditures in the United States by age and sex. *PLoS One* [Internet]. 2022 Mar 1 [cited 2024 Jan 27];16(3 March). Available from: <https://www.cdc.gov/obesity/basics/consequences.html>
5. Why BMI is inaccurate and misleading [Internet]. [cited 2024 Mar 8]. Available from: <https://www.medicalnewstoday.com/articles/265215#Waist-to-height-ratio-better-than-BMI>
6. Blüher M. Metabolically Healthy Obesity. *Endocr Rev* [Internet]. 2020 Jun 1 [cited 2024 Jan 28];41(3):405–20. Available from: <https://doi.org/10.1210/endrev/bnaa004>
7. April-Sanders AK, Rodriguez CJ. Metabolically Healthy Obesity Redefined. *JAMA Netw Open* [Internet]. 2021 May 3 [cited 2024 Jan 28];4(5):e218860–e218860. Available from: <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2779690>
8. Smith GI, Mittendorfer B, Klein S. Metabolically healthy obesity: facts and fantasies. *J Clin Invest* [Internet]. 2019 Oct 1 [cited 2024 Jan 28];129(10):3978–89. Available from: <https://doi.org/10.1172/JCI129186>.
9. Acharya J T. Charaka samhita by Agnivesa with Ayurveda deepika teeka of Chakrapanidatta. Reprint ed. Varanasi: Chaukhambha Orientalia; 2011. 277–279 p.
10. Isasi CR, Parrinello CM, Ayala GX, Delamater AM, Perreira KM, Daviglus ML, et al. Sex Differences in Cardiometabolic Risk Factors among Hispanic/Latino Youth. *J Pediatr* [Internet]. 2016 Sep 1 [cited 2024 Mar 20];176:121-127.e1. Available from: <https://pubmed.ncbi.nlm.nih.gov/27344220/>
11. Aldhoon-Hainerová I, Zamrazilová H, Hill M, Hainer V. Insulin sensitivity and its relation to hormones in adolescent boys and girls. *Metabolism* [Internet]. 2017 Feb 1 [cited 2024 Mar 20];67:90–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/28081782/>
12. Maguolo A, Maffei C. Acanthosis nigricans in childhood: A cutaneous marker that should not be underestimated, especially in obese children. *Acta Paediatr* [Internet]. 2020 Mar 1 [cited 2024 Mar 20];109(3):481–7. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/apa.15031>

Sumith Kumar M / *Afr.J.Bio.Sc.* 6(8) (2024)

13. Khokhar A, Chin V, Perez-Colon S, Farook T, Bansal S, Kochummen E, et al. Differences between Metabolically Healthy vs Unhealthy Obese Children and Adolescents. *J Natl Med Assoc.* 2017 Sep 1;109(3):203–10.
14. Ooi DSQ, Ong SG, Lee OMH, Chan YH, Lim YY, Ho CWL, et al. Prevalence and predictors of metabolically healthy obesity in severely obese Asian children. *Pediatric Research* 2022 92:5 [Internet]. 2022 Feb 7 [cited 2024 Mar 20];92(5):1374–80. Available from: <https://www.nature.com/articles/s41390-022-01941-z>
15. Vinciguerra F, Tumminia A, Baratta R, Ferro A, Alaimo S, Hagnäs M, et al. Prevalence and Clinical Characteristics of Children and Adolescents with Metabolically Healthy Obesity: Role of Insulin Sensitivity. *Life* 2020, Vol 10, Page 127 [Internet]. 2020 Jul 28 [cited 2024 Mar 20];10(8):127. Available from: <https://www.mdpi.com/2075-1729/10/8/127/htm>
16. Genovesi S, Antolini L, Orlando A, Gilardini L, Bertoli S, Giussani M, et al. Cardiovascular Risk Factors Associated With the Metabolically Healthy Obese (MHO) Phenotype Compared to the Metabolically Unhealthy Obese (MUO) Phenotype in Children. *Front Endocrinol (Lausanne)* [Internet]. 2020 Feb 7 [cited 2024 Mar 20];11:513485. Available from: www.frontiersin.org
17. Zoghi G, Shahbazi R, Mahmoodi M, Nejatizadeh A, Kheirandish M. Prevalence of metabolically unhealthy obesity, overweight, and normal weight and the associated risk factors in a southern coastal region, Iran (the PERSIAN cohort study): a cross-sectional study. *BMC Public Health* [Internet]. 2021 Dec 1 [cited 2024 Mar 2];21(1):1–8. Available from: <https://bmcpublihealth.biomedcentral.com/articles/10.1186/s12889-021-12107-7>
18. Serbis A, Giapros V, Paschou SA, Siomou E. Children with metabolically healthy obesity have a worse metabolic profile compared to normal-weight peers: a cross-sectional study. *Endocrine* [Internet]. 2021 Sep 1 [cited 2024 Mar 21];73(3):580–7. Available from: <https://link.springer.com/article/10.1007/s12020-021-02762-6>
19. Vanderwall C, Randall Clark R, Eickhoff J, Carrel AL. BMI is a poor predictor of adiposity in young overweight and obese children. *BMC Pediatr* [Internet]. 2017 Jun 2 [cited 2024 Mar 2];17(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/28577356/>

E. OTHERS**1. Change of Guide letter**
KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH
 (Formerly known as KLE University)

 (Deemed-to-be-University established u/s 3 of the UGC Act, 1956)
 Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
JNMC Campus, Nehru Nagar, Belagavi-590 010, Karnataka State, India
 Web: <http://www.kledeemeduniversity.edu.in> E-mail: info@kledeemeduniversity.edu.in

☎: 0831-2444444

FAX: 0831-2493777

Web: <http://www.kledeemeduniversity.edu.in>E-mail: info@kledeemeduniversity.edu.in

Ref. No. KAHER/AA/21-22/D- 200721002

19th July 2021**ORDER**

Sub: Change of Research Supervisor / (Guide) for Dr. Sumit Kumar M, Part Time Ph.D. Scholar, 2017-18 Batch.

With reference to the above, as **Dr. B. S. Prasad** is resigned from his job, your request for change in the Research Supervisor (Guide) from Dr. B.S.Prasad, Shri. BMK Ayurveda Mahavidyalaya, Belagavi has been accepted. **Dr. Pradeep Grampurohit**, Professor of Panchakarma, Shri. BMK Ayurveda Mahavidyalaya, Belagavi has been approved as new guide by the competent authority of the KAHER.

The other terms and conditions including research topic, submission of thesis / dissertation, etc. approved by the KAHER for the Ph. D. Program shall remain unaltered.



(Signature)
(Dr. Roopa M. Bellad)
 Director, Academic Affairs

To,
Dr. Sumit Kumar M,
 Part-Time Ph.D. Scholar,
 2017-18 Batch
 Shri. BMK Ayurveda Mahavidyalaya,
Belagavi

CC to:

1. The Registrar, KAHER, Belagavi.
2. The Controller of Examination, KAHER, Belagavi.
3. The Principal, Shri. BMK Ayurveda Mahavidyalaya, KAHER, Belagavi
4. Dr.B. S. Prasad, Former Principal, Shri. BMK Ayurveda Mahavidyalaya, Belagavi – Former Guide
5. Dr. Pradeep Grampurohit, Prof. of Panchakarma, Shri. BMK Ayurveda Mahavidyalaya, Belagavi-Guide
6. Dr. Sunil S Jalalpure, Principal, College of Pharmacy, KAHER, Belagavi-Co-guide

2. Change from Part-time to Full-time PhD



KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH

(Formerly known as KLE University)

(Deemed-to-be-University established u/s 3 of the UGC Act, 1956)

Accredited 'A+' Grade by NAAC (3rd Cycle) Placed in Category 'A' by MHRD (GoI)

JNMC Campus, Nehru Nagar, Belagavi-590 010, Karnataka State, India

☎: 0831-2444444

FAX: 0831-2493777

Web: <http://www.kledeemeduniversity.edu.in>

E-mail: info@kledeemeduniversity.edu.in

Ref. KAHER/AA/D- 214

15th June 2022

To,
Dr. Sumithkumar M
Full-Time -2017-18 Batch
Faculty of Ayurveda
KAHER, Belagavi

Sub.: Change in category from Part-Time to Full time research Scholar.

Ref.: Representation letter from the Scholar through Dean, Principal & Guide.

Dear Scholar,

This is to inform you that your change in category from part-time to full-time has been accepted by the competent authorities of the KAHER.

You are hereby informed that you will be applicable to the full-time rules and regulations and pay the full-time fees in the forthcoming years till the completion of your Ph.D. tenure.

The other terms and conditions including research topic, submission of thesis / dissertation, etc. approved by the KAHER for the Ph. D. Program shall remain unaltered.




(Dr. Roopa M. Bellad)
Director, Academic Affairs

CC to:

1. The Special Officer to Hon. Vice-Chancellor, KAHER, Belagavi
2. The Registrar, KAHER, Belagavi.
3. The Dean, Faculty of Ayurveda, Shri. BMK Ayurveda MAhavidyalaya, Belagavi.
4. The Principal, Shri. BMK Ayurveda MAhavidyalaya, Belagavi.
5. The Controller of Examination KAHER, Belagavi.
6. Dr. Pradeep L. Grampurohit, Prof. & Head of Panchakarma, Shri. BMK Ayurveda Mahavidyalaya, KAHER Belagavi- Guide

3. Permission for Blood Investigation at KLE Ayurveda Hospital, Medical Laboratory

From,
Dr. Sumith Kumar M
 Assistant Professor
 KLE's Shri BMK Ayurveda Mahavidyalaya
 Belagavi - 590003

To,
The Medical Superintendent
 KLE Ayurveda Hospital
 Belagavi - 590003

Sub: Seeking Approval to conduct blood investigation concerned with my PhD studies at KLE Ayurveda Hospital, Medical laboratory.

Respected Sir,

As I am doing my PhD Studies on "Bio-Chemical changes in Individuals of High BMI with special reference to MEDO SARA (excellence of adipose tissue) and STAULYA (obesity)" from KAHER, Belagavi, in relation to this I want to perform blood investigation namely Hemogram, Lipid profile (Triglycerides, Cholesterol, HDL-C, LDL-C), Blood glucose, Insulin, Creatinine and Alkaline phosphatase at the medical laboratory of at KLE Ayurveda Hospital Belagavi.

Hence, I request your good office to grant me permission to perform the same and the expenditure arise for the conduction of the above-mentioned tests will be borne by me. I will provide all necessary Reagents & Reagents for the above mentioned tests and allow me to utilise the laboratory facilities.

Yours Sincerely

[Signature]
 Dr. Sumith Kumar M

5-8-21
 05/08/2021
 Belagavi

*permitted
 copy to
 1) Dr. Keshav for medical
 2) Mr. Anjanna
 3) Mr. Sumith Kumar
 office file
 4)*

KLE University's Ayurved Hospital Shahapur, Belagavi.
Inward No. 17
Date: 05/08/21

4. Best paper presentation award from GAF 2021 on study topic



5. Paper presentation Certificate



6. Elisa Kit purchase request



SHRI B M KANKANAWADI AYURVED MAHAVIDYALAYA

Post Graduate Studies & Research Centre

(Approved by Central Council of Indian Medicine, New Delhi & M/o AYUSH, GoI)

A Constituent Unit of

KLE ACADEMY OF HIGHER EDUCATION & RESEARCH

(DEEMED-TO-BE-UNIVERSITY)

(Re-Accredited 'A' Grade by NAAC (2nd Cycle) || Placed under Category 'A' by MHRD GoI)



First AYUSH Institution having NAAC & NABH Accreditation

Ref: BMK/2021-22-1-608



Dt: 9/8/2021

TO WHOMSOEVER IT MAY CONCERN

Dr. Sumithkumar M., Assistant Professor, department of Basic Principles of our institute, have placed Purchase Order on M/s KRISHGEN BIOYSTEMS for the supply of the below kits for the use his Ph.D. research studies.

Item Code	Description	Pack Size	Quantity
KBH1550	Human Adiponectin, ADP GENLISA™ ELISA	ELISA 96 wells	1
KBH1559	Human Leptin, LEP GENLISA™ ELISA	ELISA 96 wells	1
KBH0010	Human Insulin GENLISA™ ELISA	ELISA 96 wells	1
KB1145	GENLISA™ Human TNF-alpha (Tumor Necrosis Factor Alpha) ELISA	ELISA 96 wells	1
KB1068	GENLISA™ Human IL-6 ELISA	ELISA 96 wells	1

We confirm these kits to be used by us for research use only and not for diagnostic purposes.




PRINCIPAL
 Shri B. M. Kankanawadi
 Ayurved Mahavidyalaya
 A Constituent Unit of KAH
 Shahapur, BELAGAVI-03.

IMPARTING AYURVEDA EDUCATION SINCE 1933

Shahapur, Belagavi - 590 003, Karnataka, INDIA

Ph. No. : +91 831 2486286, Fax : +91 831 2424157 Website : www.kleayurworld.edu.in Email : bmkprincipal.kaher@kleayurworld.edu.in

7. Elisa Kits received from Krishgen Biosystems





8. Blood collection

