"DETERMINANTS AND CONSEQUENCES OF OBESITY AMONG ADOLESCENTS - A CROSS-SECTIONAL STUDY"

Thesis Submitted to

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For the award of the degree of

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In

the Faculty of Nursing

By

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(Registration No: KLEU/Ph.D.-16-17/ DO1216016)

Under the Guidance of

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2023

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Gratitude is a quality similar to electricity: It must be produced and discharged and used up in order to exist at all.

- ***William Faulkner***

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LIST OF ABBREVIATIONS

Sr. No	Abbreviations	Expanded forms
1.	BMI	Body Mass Index
2.	WHO	World Health Organization
3.	IOTF	International Obesity Task Force
4.	WT	Weight
5.	HT	Height
6.	EST	Ecological Systems Theory
7.	DDPI	Deputy Director of Public Instruction
8.	TV	Television
9.	PUC	Pre-University Course
10.	IEC	Institutional Ethical Committee
11.	BP	Blood Pressure
12.	SBP	Systolic Blood Pressure
13.	DBP	Diastolic Blood Pressure
14.	CI	Confidence Interval
15.	OR	Odds Ratio
16.	RR	Relative Risk

ABSTRACT

Background: The majority of deaths worldwide are caused by noncommunicable illnesses, which disproportionately affect people in low-and middle-income countries. Reduced risk factors, early diagnosis of problems, and prompt treatment can save millions of lives.

Out of sixty-seven million global deaths in 2020, forty-one million were due to non-communicable diseases principally diabetes mellitus, cardiovascular diseases, chronic respiratory diseases, and cancers.

Obesity remains one of the most urgent health problems which is characterized by abnormal or excessive accumulations of body fat that might jeopardize a person's health.

Obesity is not an immediate fatal illness itself; it is a severe risk factor for a number of serious non-communicable illnesses and ailments. The "New World Syndrome" of non-communicable illnesses, of which obesity is the first wave, is thought to be responsible for a significant burden on public health and socioeconomics in developing nations.

Objectives:

Primary objectives

1. to study the determinants of obesity among adolescents in the age group of 10-16 years
2. to study the consequences of obesity among adolescents in the age group of 10-16 years

Secondary objectives

1. to find out the prevalence of overweight and obesity among adolescents

Methodology: A cross-sectional study was conducted among 1050, aged 10–16 years schoolchildren from government and private schools of Belagavi city. Stratified cluster sampling was used to select the samples. Data were collected by administering the predesigned, prevalidated, and pretested questionnaire. Height and weight were measured and Body mass index (BMI) was calculated. Overweight and obesity was classified by WHO/International Obesity Task Force for Asia and India standard of obesity. Chi-square test, and multiple logistic regression analysis using the statistical package for the social science version 22.0. The significance level of all the tests was set at $P \leq 0.05$.

Results: The study results revealed that, prevalence of overweight and obesity among adolescents was 8.57% and 4.38% respectively. Age, family history of diabetes, family history of hypertension, physical activity, number of hours spent with mobile every day, number of hours spent with a TV, frequency of foodstuffs consumed by a child (fried food, bakery items, sweets, and fast foods) were statistically significant with overweight and obesity ($P < 0.05$).

Conclusion: There is a pressing need for cost-effective school-based strategies and appropriate policy changes in developing countries like India to stem the rising tide of overweight and obesity among adolescents.

Keywords: Determinants; Consequences; Obesity; Adolescents; Body mass index

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CHAPTER I

INTRODUCTION

1.1) Background

The majority of deaths worldwide are caused by noncommunicable illnesses, which disproportionately affect people in low- and middle-income countries. Reduced risk factors, early diagnosis of problems, and prompt treatment can save millions of lives.[1]

Out of sixty-seven million global deaths in 2020, forty-one million were due to non-communicable diseases principally diabetes mellitus, cardiovascular diseases, chronic respiratory diseases, and cancers.[2]

Obesity remains one of the most urgent health problems which is characterized by abnormal or excessive accumulations of body fat that might jeopardize a person's health.[3]

Obesity is not an immediate fatal illness itself, it is a severe risk factor for a number of serious non-communicable illnesses and ailments.[4] The "New World Syndrome" of non-communicable illnesses, of which obesity is the first wave, is thought to be responsible for a significant burden on public health and socioeconomics in developing nations.[5]

Adolescents are the young people aged between 10 to 19 years. It is a transitional stage of physical, physiological and psychological development from puberty to legal adulthood. Worldwide more than 1.3 billion are adolescents.[6] About 21% of Indian population is adolescents.[7]

They are the future of the nation, forming a major demographic and economic force. They have specific needs which vary with gender, life circumstances and socio-economic conditions. They face challenges like poverty, lack of access to health care services, unsafe environments etc. It is a period of preparation for undertaking greater responsibilities like familial, social, cultural and economic issues in adulthood. [7]

According to the World Health Organization, overweight and obesity are one of the most significant public health issues facing the world today and are becoming an epidemic.[8]

Obesity is one component of the double burden of malnutrition, and in every region except Africa and Asia, more people are fat than underweight. Overweight and obesity, once thought to be a problem exclusively in high-income countries, are now on the rise in low- and middle-income countries, particularly in metropolitan areas.[9]

Because of significant demographic and socioeconomic change, India is becoming a hotspot for adult, childhood and adolescent obesity epidemics, particularly among urban populations. Although age-standardized rates are modest, India has the world's third highest absolute rate of obesity. Over the years, epidemiological studies have continuously shown an increase in the prevalence of overweight and obesity among teenagers across the subcontinent. In India, 5.3% of boys and 5.2% of girls under the age of 20 were overweight, according to a systematic analysis undertaken as part of the 2013 Global Burden of Disease study. Overall, boys and females in the above-age group had obesity rates of 2.3% and 2.5%, respectively.[10]

Obesity in children and adolescents mostly caused by an increase in calorie-dense diets high in fat and sugar but deficient in protein, vitamins, minerals, and other essential micronutrients.[11] Physical inactivity has increased in recent years, not just

among adults but also among children and adolescents, as a result of an increase in sedentary activities such as watching television and playing video games.[12] Families, schools, friends, childcare facilities, doctors, religious organizations, government agencies, the media, the food and beverage business, and the entertainment sector all have an impact on children's and adolescents' eating and exercise habits.[13]

Obesity has become a major issue among children and teenagers. Obesity in children and adolescents has a wide range of severe health implications and has a profound impact on their physical health, social and emotional well-being, and self-esteem.[14]

The WHO is actively tackling the issue of childhood obesity across the world, in order to examine population-based prevention strategies for childhood obesity. Earlier, it was believed that obesity was a problem affecting only the adult population, but now, researchers have realized the serious dangers that overweight and obesity pose to children's health, including both the short-term dangers of childhood obesity and the long-term dangers as obese kids and teens grow up to become obese adults and experience other health problems.[15]

Obesity etiology is considered to be complicated, with a complex interplay of genetics, hormones, and the environment. The environmental influences are seen in the shape of obesogenic setting in which lifestyle practices have been modified to fit an urbanized style, in contrast to our prior traditional Indian lifestyle. Early waking, exercise or Pranayama followed by healthy meals made from locally produced and freshly cooked ingredients, manual labor for self-work, and a disciplined lifestyle were all important for physical and mental wellness.[16]

Elevated blood pressure in childhood is considered a major concern to public health and is widespread worldwide. Furthermore, high blood pressure continues

throughout early adulthood, contributing to the beginning of cardiovascular disease and, eventually, premature death. As a result, preventing high blood pressure in childhood is an effective method for reducing the related illness load. The proper identification of important risk factors for high blood pressure in childhood is the cornerstone of prevention.[17]

Obesity has been associated to low academic performance in addition to the well-established negative impacts on physical health and death. According to several research, obese people have a lower intelligence quotient and poorer executive function, memory, attention, and motor abilities than their normal weight colleagues. Academic achievement is vital during the school years, and it is also a powerful predictor of occupational and social success in adulthood.[18]

1.2) Need for the study

Children and adolescents in developing nations are more frequently affected by disorders that fall on either the extreme of the undernutrition or overnutrition continuum.[19] In India, there are still many public health and advocacy programs devoted to improving nutrition, but in recent years, overnutrition has also become a significant public health issue.[20]

An international dietary concern, obesity is one of the most pervasive and serious issues impacting children and adolescents.[21] Potential physical and psychological effects of adolescent obesity are linked to an increase in the incidence of childhood obesity. [22, 23]

It has a significant public health impact because, 80% of overweight children become overweight adults. Obesity prevalence has doubled in children and quadrupled in teenagers in the world during the last two decades. This rise in childhood and adolescent obesity has also contributed to an increase in adult obesity or overweight rates. This has serious implications for public health since 80% of overweight kids grow up to be overweight adults.[24]

Additionally, obesity has detrimental effects on long-term success and satisfaction in life. The lifestyle of these individuals may be permanently changed by focused sessions that emphasize good food and exercise practices for kids and their families.[25]

The prevalence of obesity in children and adolescents (ages 2–19) throughout the world has recently undergone significant changes.[23]

Since 1980, the prevalence of overweight and obesity at these ages has increased dramatically in developed nations, from 16.9% (16.1-17.7) of boys and 16.2% (15.5-17.1) of girls in 1980 to 23.8% (22.9-24.7) of boys and 22.6% (21.7-23.6) of girls in 2013.[26]

Children and adolescents in developing nations are becoming more and more likely to be overweight or obese. This prevalence rose from 8.1% (7.7-8.6) in 1980 to 12.9% (12.3-13.5) in 2013 for males and from 8.4% (8.1-8.8) to 13.4% (13.0-13.9) in 2013 for girls.[26]

According to recent WHO global estimates,

- Worldwide obesity has nearly tripled since 1975. According to recent data, in 2016 more than one billion people worldwide were obese, including 650 million adults, 340 million adolescents and 39 million children. 39% of adults aged 18 years and over were overweight in 2016, and 13% were obese. 39 million children under the age of 5 were overweight or obese in 2020.[27]

- Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016. People living with obesity are twice as likely to be hospitalized if tested positive for COVID-19 and the prevalence of overweight and obesity among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The rise has occurred similarly among both boys and girls in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016.[27]

- Prevalence of obesity and overweight among 2-17 years old Indian children, ranged between 3.6 and 24.2%. If current trends continue, the number of overweight or obese infants and young children globally will increase to 250 million by 2030.[28]

Prevalence varies across the country because of changes in lifestyle, particularly food trends and physical activity. Furthermore, urbanization and industrialization are the primary causes of the rise in the prevalence of childhood obesity. Such studies will be important in planning and implementing relevant intervention techniques.

However, there is large body of literatures that describes prevalence of obesity among adolescents, very little has done to study the determinants and associated factors among adolescents in the northern part of Karnataka. In view of these contexts, there is scope to study the determinants and its effects among school going adolescents.

In view of these contexts, the present study was undertaken to study the determinants and its effects among school going adolescents. This type of study will help in developing interventions programs for the school children who will eventually help in prevention of obesity and its consequences.

1.3) Title of the study

Determinants and Consequences of Obesity among Adolescents - A Cross Sectional Study

1.4) Objective

Primary objectives

1. To study the determinants of obesity among adolescents in the age group of 10-16 years
2. To study the consequences of obesity among adolescents in the age group of 10-16 years

Secondary objectives

3. To find out the prevalence of overweight and obesity among adolescents

1.5) Operational Definitions

- **Adolescents**: In the present study adolescents refers to the male and female students in the age group of 10 to16 years studying in government and private schools.
- **Obesity**: In the present study obesity refers to the excess body fat, has accumulated to the extent that it may have a negative effect on health
- **Determinants**: In the present study determinants refers to the factors or variables which determines the condition of obesity.
- Determinants of obesity include

    1. Dietary practices

    2. Physical activities

- **Consequences**: In the present study consequences refers to the health effects or associated factors of obesity in Adolescents at the time of data collection

- Consequences of obesity includes

    1. **Blood Pressure**
    2. **School/ Academic performance**

1.6) Conceptual Framework

The conceptual framework adopted from Davison's ecological model of predictors of children and adolescents overweight connected family, school, and community risk factors and behaviors to overweight

Ecological Systems Theory (EST) conceptualizes human development in terms of an interacting contextual viewpoint. Ecological Systems Theory contends that without consideration of an individual's surroundings or ecological niche, it is hard to comprehend the evolution or change in their characteristics.[29]

An ecological niche includes the contexts in which those settings are positioned as well as the immediate context in which a person is embedded. A child's ecological niche includes both the home and the school, which in turn includes more inclusive social contexts like the community and society at large. A child's particular characteristics, such as gender and age, interact with familial and cultural factors in addition to these more general variables to influence development.[30]

Predictors of Adolescent overweight

According to this theory, adolescents' behavioral patterns like physical activity, dietary practices and sedentary behaviors can place adolescent at risk of overweight, these factors will be referred to as adolescent risk factors.

The impact of adolescents' risk factors on the development of overweight is moderated by their characteristics which include age, gender, BP, and susceptibility to weight gain.

The development of adolescent risk factors is shaped by family characteristics, such as parents' food habits and activity patterns, nutritional knowledge and the relationship between siblings and peers.

As a result of their impact on parenting styles and kids' daily eating and activity behaviors, school environment characteristics like structured periods for activity and the nutritional quality of school lunches, as well as community, demographic, and larger environmental factors like parent work-related demands, ethnic background, and the availability and accessibility of recreational facilities, affect child weight status.

Research relating to the model of adolescent overweight presented in is reviewed below. Specifically, research relating to each of the child risk factors (i.e., dietary practice, physical activity, and sedentary behavior) is reviewed in turn and the influence of (a) Adolescent characteristics (b) parenting styles and family characteristics and (c) community and demographic characteristics, including the schooling system, are considered for each adolescent risk factor. The primary goal of this review is to highlight the necessity of addressing the characteristics of the child and the familial and societal contexts in which the child is embedded in order to understand the process by which childhood overweight develops.

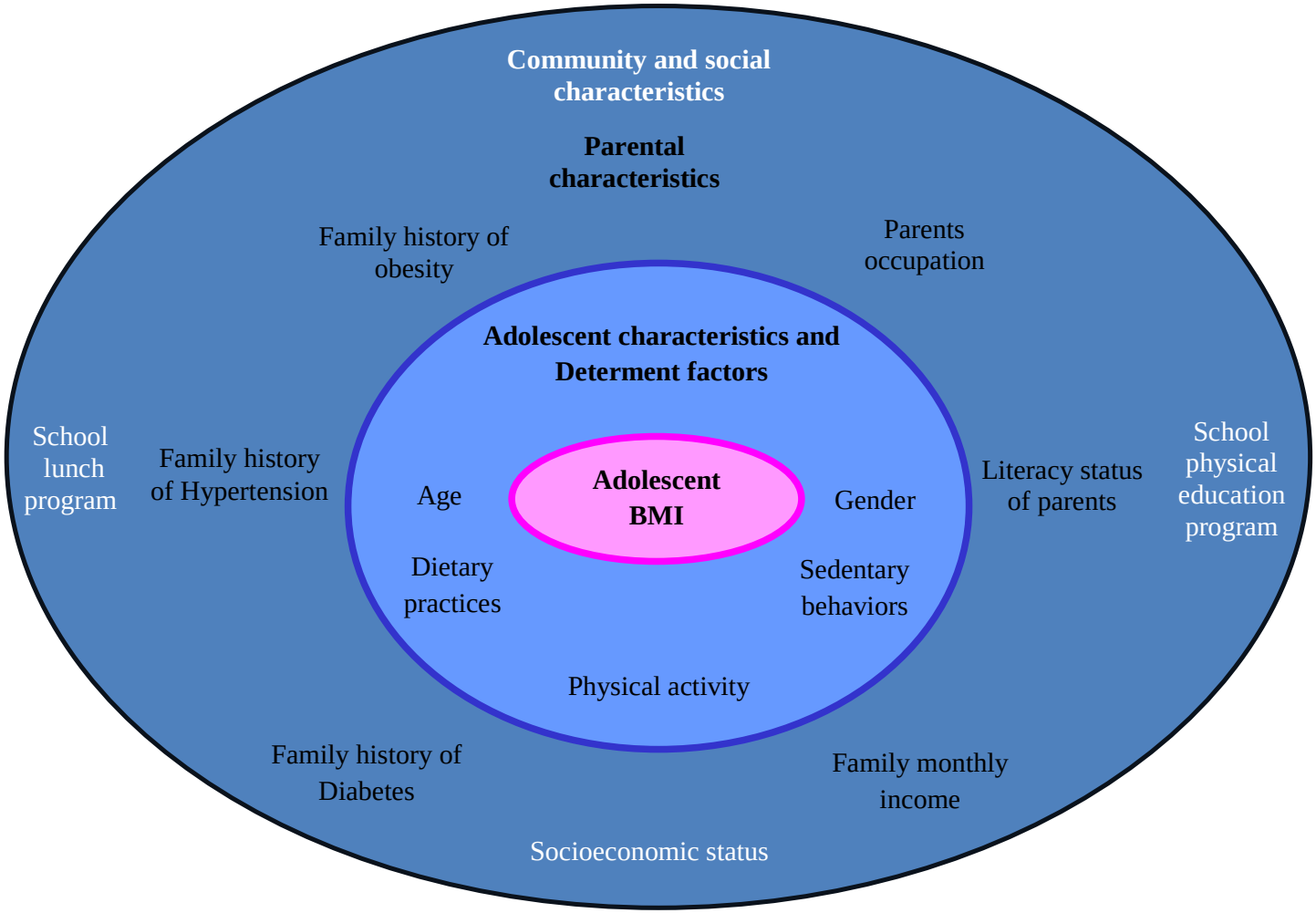


Figure 1: Modified Davison Ecological System Model

CHAPTER II

REVIEW OF LITERATURE

The task of reviewing literature includes identifying, selecting, critically analyzing, and reporting on existing knowledge on the topic of interest. It serves as the foundation for locating facts and new ideas that must be included in the current investigation. It assists the researcher in locating correct data that can be used to support current findings and develop conclusions.

The review of literature is presented under the following headings

i. Literature pertaining to the prevalence and determinants of obesity among adolescents
ii. Studies on consequences of obesity among adolescents

Literature pertaining to the prevalence and determinants of obesity among adolescents

1. A cross-sectional study was carried out to determine the prevalence of overweight and obesity among 300 teenage pupils aged 13 to 16. According to International Obesity, body weight and height were measured, and body mass index was classified based on age- and sex-specific cut-off values. In the current study, 3.3% were obese and 12% were overweight. The frequency of overweight and obesity was higher among the subject's non-exercising family members and those with monthly family incomes over ten thousand per month. Adolescent students in Belgaum City have a significant prevalence of

overweight and obesity, which is statistically linked to decreased physical activity and parental monthly income.[31]

2. A cross-sectional school-based study was done to ascertain the prevalence and evaluate the risk factors for obesity among the 1185 secondary school students. Using self-administered questionnaires, data were gathered. Measurements of height and weight were taken, and the Body Mass Index (BMI) was computed. Children that are overweight or obese are more prevalent overall than average 10.8% and 6.2%, respectively. It was discovered that having a parent who works in business, identifying as Muslim, and going to private schools were all significantly associated with being overweight or obese. Since childhood obesity is the precursor to adult obesity, it is crucial to implement school health initiatives effectively to lessen and control the burden of childhood obesity.[32]
3. In order to gauge the prevalence of obesity and identify the demographic factors affecting it among 440 schoolchildren, a cross-sectional, school-based study was carried out. WHO Standard Age and Sex-Specific Growth For the purpose of defining overweight and obesity, reference chart was employed. 12.27% of the study participants were overweight, and 3.86% were obese. Age and the children's obesity status were shown to be significantly correlated. Overweight and obesity were more common among kids from higher socioeconomic classes. The primary characteristics that influenced the obesity status of the schoolchildren were identified as being higher household wealth, eating habits, parental history of obesity and diabetes, and living in an urban area.[33]
4. A cross-sectional study was conducted among 984 kids aged 10 to 16 from 3 schools, to determine the prevalence of obesity and overweight and to determine the factors influencing teenage obesity. Obesity and overweight were found to

be prevalent, with rates of 4.6% and 11.3%, respectively. It was found to be more in girls than boys. Teenage obesity was found to be significantly influenced by daily activity, junk food consumption, and sleep length of more than 8 hours. Steps must be taken to prevent obesity from the beginning, such as daily exercise, increased physical activity, and a reduction in junk food consumption. More research is needed to determine the factors that influence adolescent obesity.[34]

5. A research study was done to evaluate the prevalence and risk factors for obesity among 13 to 16-year-old high school students in urban region. A pretested semi structured questionnaire was utilized to collect data, and anthropometric measures were taken in accordance with WHO criteria. Overweight and obesity were found to be prevalent in 7.67% and 5.83% of the population, respectively. Obesity was found to be statistically significant with socioeconomic level, junk food intake, watching TV, and playing video/mobile games. Adolescents should be educated about diet and physical exercise, according to the findings of a new study.[35]
6. A cross-sectional study was done to determine the prevalence of health-related risk factors among 559 urban teenage high school pupils. Fruits, vegetables, energy dense liquids, and energy dense snacks/fast foods were consumed by 39%, 37.6%, 42.2%, and 72.5% of the population, respectively. 39.5% of students participated in regular physical activity, while 23.1% spent more than three hours watching television or playing computer games. In the previous 30 days, the prevalence of cigarette smoking, smokeless tobacco, and alcohol use among students was 5.5%, 6.3%, and 5.4%, respectively.[36]
7. A cross-sectional study was undertaken in Bangalore city to investigate the

prevalence, risk factor attitude of parents towards obesity and overweight among 1079 school children aged 6 to 13 years. The parents completed a standardized questionnaire, and the school nurse measured their weight and height. The prevalence was substantially related with birth weight and sport. Sports protect the children from becoming overweight or obese. The parent's attitude towards eating meals with their child and their appraisal of their child's physical activity was protective, whereas the child's attitude towards regulating his or her food was a risk factor for overweight and obesity.[37]

8. A cross-sectional study was undertaken among 215 individuals presenting to the OPD at the primary health center to investigate the prevalence of obesity among teenagers and its association to sociodemographic characteristics. Following the completion of the questionnaire, the parameters of height and weight were measured and recorded. In the majority of instances in the study, 151 students performed physical activity only sometimes, while 26 did not engage any physical activity. Only 17.6% of cases engaged in some form of physical activity on a regular basis. In this study, we discovered that 34.8% of cases were overweight, and 26.9% were obese. Obesity and overweight can be avoided by implementing school-based awareness programs and educating parents about healthy lifestyle management, hence avoiding chronic illness in adulthood.[38]

9. A Cross sectional study of 734 male and female students aged 10 years and older from two private schools in urban was conducted to assess the prevalence of overweight and obesity and its associate factors. Using the WHO body mass index for age charts, anthropometric measures were taken to assess overweight and obesity. The prevalence of overweight and obesity among teenagers was 21.7% and 6.1%, respectively. Age, gender, religion, parental education level,

mother working outside the home, engagement in strenuous physical activities, vegetarian diet, and snacking on junk food were not found to be substantially related to overweight/obesity.[39]

10. A cross-sectional study was conducted in Pondicherry to determine the prevalence of overweight and obesity among 2465 10-18-year-old pupils. The students were labeled "overweight" or "obese" based on the Indian Academy of Pediatrics age- and gender-specific BMI norms. According to the study findings, the prevalence of overweight and obesity in our sample population was 9.7% and 4.3%, respectively. In our study population, the prevalence of overweight and obesity was highest among students attending private schools in the urban region.[40]
11. A cross-sectional study was conducted on 2258 adolescent school children to investigate the incidence of overweight and obesity and its relationship with social and environmental variables. Body mass index was used to classify overweight and obesity, according to the current technique suggested by the Centers for Disease Control and Prevention in 2000. A pre-tested and verified questionnaire was used to obtain data on social and environmental variables. Parental literacy, family income, and child sleep length were all substantially associated with overweight. Overweight was associated with parental education level. Increases in family income and child sleep duration of 7 hours per day also increased children's connection with weight gain, to address the problem of overweight/obesity, interventional strategies should take into account the family, school, and physical environment.[41]

12. The study was conducted to examine the factors impacting overweight and obesity among 1050 school-aged adolescents. To collect nutritional and physical activity data, a planned and pretested semi-structured questionnaire was used. Among 1050 school-aged adolescents, 7.8% were overweight and 2.7% were obese. Early and mild adolescence, male gender, English medium of instruction, and a positive family history of obesity were found to be substantially linked with overweight/obesity in the research sample. Outside food intake, meal skipping habits, and irregular consumption of staple healthy food items were discovered to be significant diet related predictor variables for overweight/obesity. Sedentary activities, fewer outdoor games, and sleep deprivation were also revealed to be significant predictors of overweight/obesity among the physical activity predictors.[42]
13. A school-based, cross-sectional study was done to determine the prevalence of overweight and obesity among children in four schools from the fifth to tenth grades. The chi-square test was used to assess the data. A total of 1828 pupils from four schools were screened. There were 590 girls and 1238 boys among them. Cole et al.'s criteria for overweight and obesity were 11.3% and 3.3%, respectively, while Khadilkar et al.'s criteria were 17.5% and 7.8%.[43]
14. A school-based, cross-sectional study was done to assess the prevalence of obesity and its association with risk factors related to physical activity in children in higher secondary schools from both public and private schools. Based on measurements gathered from 496 high school students, the projected prevalence of overweight was 7%, obesity 3%, and malnutrition 18%. Children who attended a private school had a greater risk of being overweight, but those who walked to school had a lower risk. Students who did housework for 4 hours

or more per week had a lower chance of being overweight, whereas those who did less exercise had a higher risk of being obese (OR 6.61, 95% CI 1.91-22.84).[44]

15. A cross-sectional study was conducted in rural Pune to investigate the incidence of overweight and obesity in children aged 10-15 years. Students from grades V to IX from a rural Pune school had their sociodemographic and anthropometric data collected. Body mass index guidelines from the Indian Academy of Pediatrics were used. Obesity was 3.6% (5% in males and 1.9% in girls) while overweight was 7.1% (12.5% in boys and 8.5% in girls) and of obesity was 3.6% (5% in boys and 1.9% in girls). Overweight and obesity were more common in boys than in girls. The proportion of overweight and obese children increased with higher parental educational status, with the mother's educational status being statistically significant.[45]

16. A cross-sectional study was conducted to determine the prevalence of obesity among adolescents and the many factors that contribute to it. Data was collected from 385 participants using standardized questionnaires and validated and calibrated heliometers and weighted devices. The World Health Organization's body mass index scale was utilized to develop a category for obesity. It was shown that 6.8% of adolescents were fat and 17.1% were overweight. Gender, financial position, dietary habits, chocolate eating habits, mode of transportation to school, sports participants, physical activity, and screen time all have a significant correlation. Adolescents who participated in sports and physical exercise had a healthy BMI. Teens who watched more than 2 hours of screen time were more obese, and these were just a few of the factors that contributed to teenage obesity.[46]

17. A cross-sectional study was conducted on 1900 teenagers aged 10 to 19 years to determine the prevalence of overweight and obesity as well as the associated risk factors. Subjects' body weight and height were measured in order to calculate their body mass index. The International Obesity Task Force (IOTF) categorization was used for the estimation of being overweight and obese. Female gender, bus mode of transportation, not playing games, and having a single sibling were revealed to have an independent association with the prevalence of being overweight in a binary logistic regression analysis.[47]

18. A cross-sectional study was conducted to determine the prevalence of behavioural risk factors for obesity among 1842 adolescents in grades VIII to XII. In the current survey, 40.7% of students ate fruit one or more times per day, while 74.5% ate vegetables one or more times per day. During the preceding week, about 20% of the students had fast food on 4 to 7 days. 30.4% of students watched more than two hours of television every day. Outdoor sports were avoided by about 68% of the girls and 22% of the boys. When the students' physical activity patterns were examined, it was shown that 15.6% were inactive, 43.4% were minimally active, and the remaining 41.0% engaged in health-promoting physical activity. 6.2% of the kids were overweight, while 5.2% were obese.[48]

19. The prevalence and behavioral factors of overweight and obesity in school-aged teenagers were investigated in a study. A total of 660 students from wealthy and impoverished schools were recruited. The World Health Organization's 2007 growth reference was used to define overweight and obesity. Overweight and obesity were prevalent in 9.8% and 4.8% of the population, respectively. Males had a higher prevalence of both overweight and obesity. There was a

statistically significant difference in the prevalence of overweight and obesity between affluent and nonaffluent schools (14.8% and 8.2%, respectively). Increased fast food consumption, low physical activity level, and watching television for more than 2 hours per day were all important drivers of overweight and obesity. Even in small towns, the prevalence of obesity is high. Diet and physical activity have a substantial impact on adolescent children's weight.[49]

20. A cross-sectional study was done on 1110 children and adolescents aged 6-17 years to investigate the prevalence and determinants of overweight and obesity. The researcher interviewed primary kids, while middle and high school students answered a questionnaire about meal frequency, snacking, fruits and vegetables intake, time spent watching television/outdoors, and family history of obesity. Their heights and weights were measured in accordance with World Health Organization guidelines. Overweight and obesity were prevalent in 6.48% of the population. It was 7.05% for females and 5.95% for males. Overweight and obesity were 17.1% more prevalent among children who participated in physical activity less than once every two weeks, as well as in those whose fathers and moms were overweight or obese. Every family with overweight or obese children must be educated on healthy eating and lifestyle choices.[50]

21. A single centric epidemiological study was carried out in to investigate the prevalence of overweight and obesity and the factors that contribute to them. Overweight and obesity were determined by measuring each student's height, weight, waist circumference, and hip circumference. To interview the students, a predesigned and pretested questionnaire was used to elicit information on family characteristics such as the number of family members, the education and

occupation of parents, their usual physical activity, and habit of watching TV and time spent with computer and sleeping, as well as the pattern of dietary intake. Children who spent time watching television or using a computer had a much greater risk of being overweight or obese. The study aims to highlight that childhood obesity is an emerging health problem that needs to be proven by large-scale investigations, and that effective preventative interventions should be devised to stem this epidemic at its inception.[51]

22. The study's goal was to determine the prevalence of overweight and obesity, as well as the factors that contribute to it among children and adolescents in Kolkata. Multivariate regression analyses of body mass index (adjusted for age and gender) revealed that about 18% of total variance in BMI could be explained by monthly family income, participants believing they are obese, excessive junk food consumption, skipping breakfast, excessive salt consumption, and computer hours. Sedentary lifestyles, especially rising fast food preferences, may be to blame for the rise in pediatric and teenage obesity in this demographic.[52]

23. A cross-sectional study was undertaken to assess risk factors for overweight and obesity among 806 school-aged children aged 12 to 15 years, who were chosen using multistage random sampling. Height and weight were assessed using standard methods and BMI was computed. Obesity and overweight were prevalent at 3.97% and 9.80% respectively. Regular consumption of fast foods and carbonated beverages, low levels of physical activity, watching television for more than 2 hours per day, or playing computer games for more than 2 hours per day were all significantly associated with overweight and obesity. Intervention methods focused primarily on boosting physical activity, reducing

consumption of calorie rich foods, and giving psychological support are critical in combating this new rising problem of adolescent obesity.[53]

24. A school-based cross-sectional study of 2963 teenagers in Udupi was done to determine the prevalence of obesity among adolescents in the study region and to investigate the relationship of physical activity and eating habits with obesity. They were interviewed using a pre-tested questionnaire, and then their BMI was measured and classified using World Health Organization guidelines. Overweight was 2.4% and obesity was 1.4%, with greater rates among teenagers from higher socioeconomic backgrounds and those who used motorized transportation. Current levels of obesity and lifestyle variables among teenagers in the research region can greatly predispose them to the risk of noncommunicable diseases, which must be taken into account when developing noncommunicable disease policies.[54]

25. A cross-sectional, community-based study utilizing systematic random sampling was conducted on 811 teenagers of both sexes from a South-West Delhi urban region to investigate the incidence of overweight and obesity and its sociodemographic correlates. To collect information on socio-demographic and anthropometric factors, a pre-designed and pre-tested proforma was employed. Overweight and obesity were prevalent in 15.1% and 7.2% of the population, respectively. According to a logistic regression analysis, the prevalence was considerably greater among subjects enrolled in private schools. Overnutrition is a new health issue in the adolescent population that must be addressed immediately.[55]

26. A cross-sectional study was carried out to determine the prevalence of overweight and obesity, as well as their sociodemographic correlates, using an interview technique, followed by a clinical examination with ethical concern. The study found a link between decreased consumption of vegetable foods and fruits, meals prepared outside the home, alcohol consumption, yoga practice, socioeconomic position, and the development of overweight/obesity in adolescents.[56]

27. A cross-sectional study was carried out to investigate the prevalence and risk factors for overweight and obesity in adolescent school children. A pre-designed and pre-tested proforma was used to collect information. Height, weight, and waist circumference were measured. To diagnose overweight and obesity, the International Obesity Task Force (IOTF) references were employed. Out of 910 study participants, 71 (7.80%) were found to be overweight and 20 (2.20%) were obese. Overweight and obesity were not substantially linked with age, gender, religion, household type, or mode of transportation to school. Obesity in high socioeconomic status (SES), a lack of outdoor games, a lack of physical activity, television (TV) watching for >2 hours, snacking in front of TV, sleeping for 6 hours, consuming >2000 kilo calories per day, junk food consumption, and snacking in between regular meals were significantly associated with overweight and obesity.[57]

28. A cross-sectional study was conducted in 1079 school-aged teenagers to investigate the prevalence of obesity and to examine specific factors that contribute to obesity. Students between the ages of 14 and 16 were given a pre-designed, semi-structured questionnaire to complete under observation. Overweight and obesity were prevalent in 10.2% and 6% of the population,

respectively. There was a substantial relationship between parents' education, occupation, mode of transportation to school, and BMI. Awareness about lifestyle-related disorders widespread among teenagers and parents is an urgent issue.[58]

29. A cross-sectional study was conducted to determine the prevalence of obesity and overweight among school-aged children. After receiving written informed consent from their parents, 1281 children aged 10 to 15 years were investigated using pre-designed, pre-tested, semi-structured Performa. BMI was estimated after anthropometric measurements were performed. Obesity and overweight were prevalent in 2.98% and 8.23% of government school children, respectively. Obesity and overweight were prevalent in 8.83% and 12.13% of private school children, respectively.[59]

30. A study was conducted in Sambalpur to investigate the prevalence of overweight and obesity among schoolchildren aged 10 to 12 years. Face-to-face interviews with a predesigned prestructured questionnaire were used to collect data. Body mass index was calculated using anthropometric measurements such as height and weight. Obesity was prevalent in 11.53% of the study population. Rapid urbanization and industrialization in developing countries alters food patterns and lifestyle. As a result, actions should be taken to combat the risk factors that are generating this rising prevalence of overweight and obesity. One of the most essential initiatives towards reducing morbidity is health education for the next generation.[60]

31. A Cross sectional descriptive study of 680 school going adolescents aged 10-19 years was conducted to assess the factors associated with prevalence of obesity. The multistage random sampling technique was used to enroll participants.

Predesigned and pretested schedule was used to elicit in formation on lifestyle patterns. Approximately 71.5 percent of teenagers used to eat with their families, which was substantially (p=0.0001) related with a low prevalence of obesity. Those who ate fast food on a daily basis were more likely to be overweight. In our study, the key predictors of overweight were eating with family, method of transportation used, and time spent watching television.[61]

32. A cross-sectional study was carried out in eight randomly selected schools in Allahabad District to investigate the prevalence of overweight and obesity, as well as its correlates, among 940 school-aged adolescents. The WHO BMI for age classification was used to assess overweight and obesity. Obesity and overweight were reported to be 6.6% and 1.1%, respectively. High socioeconomic status of parents (OR-2.4, CI-1.3-4.5), not participating in outdoor games (OR-2.2, CI-1.1-4.3), house hold activities (OR-2.6, CI-1.0-6.4), longer duration of television viewing (OR-2.6, CI-1.2-5.2), and frequent consumption of fast foods (OR-1.8, 1.0-3.2) were found to be significant predictors of overweight and obesity.[62]

33. A cross-sectional survey was conducted to investigate the family risk factors for obesity in urban teenagers in north India. A total of 5993 school-aged adolescents (10-19 years old) were recruited for the study. Self-reporting questionnaires was used to collect the data. Each student's anthropometric measurements, such as height and weight, were measured and documented. Obesity was found in 2.4% of the population. Obesity was most prevalent in the 16–19-year-old age group (4.4%). Parental obesity, high literacy, and parental wealth were all connected with adolescent obesity. Adolescent obesity is influenced by parental obesity, family socioeconomic situation, and age.[63]

34. A cross-sectional study was undertaken in ten randomly selected schools in Jaipur city with tuition fees greater than 18000/year to identify several lifestyle risk factors for obesity among school students from rich families aged 10-18 years. After their informed written agreement, 1610 students from classes V to XII were included, and their comprehensive lifestyle history with anthropometric data was documented. 364 (22.61%) of the individuals were obese/overweight. On the binary multivariate logistic regression technique, viewing television during meals, frequency of main meals outside home per month, frequency of snacks outside home per week, and duration of television/computer watching per day were revealed to be significant predictors of overweight/ obesity. According to the current study, childhood overweight/obesity is a rising health problem (22.61%), and lifestyle variables were key risk factors.[64]

Studies on consequences of obesity among adolescents

35. A school-based cross-sectional study of 1959 teenagers aged 11-17 years in northern India was done to assess the prevalence of persistent hypertension and obesity, as well as its risk factors. The prevalence of chronic hypertension was 5.7% in rural areas and 8.4% in urban areas, respectively. Obesity was found in 2.7% and 11.0% of rural and urban schoolchildren, respectively. A high prevalence of chronic hypertension and obesity was discovered among urban schoolchildren and adolescents in a northern Indian state. Adolescent hypertension was linked to being overweight or obese (having a high BMI). To reduce the risk of cardiovascular disease in adulthood, prevention and early identification of juvenile obesity is more important.[65]

36. Community-based cross-sectional research of school-aged teenagers was done to determine the prevalence of high blood pressure and the risk factors associated with it. BP, height, and weight were assessed according to conventional protocols, with Centers for Disease Control and Prevention charts. An oral questionnaire utilized to assess lifestyle risk factors. Elevated blood pressure was found in 24.2% of the 1041 subjects. Obesity, a limited fruit diet, and frequent junk food consumption increased the likelihood of having high blood pressure, but physical activity decreased the odds.[66]

37. A cross-sectional study was conducted on 1281 children aged 10 to 15 years to determine the prevalence of hypertension and its relationship with obesity. BMI was estimated after anthropometric measurements were performed. With the participant seated in a comfortable position, blood pressure was taken in the left arm to the nearest 1 mmHg using electronic equipment (Omron Corporation Tokyo, Japan). Obesity and overweight were prevalent in 5.62% and 9.99% of the population, respectively. Overall, hypertension was found in 6% of the 200 obese and overweight children studied, and prehypertension was found in 4.5%. Anthropometric parameters such as Waist Hip Ratio, MAC, and mean SBP and DBP were considerably higher in obese and overweight children compared to normal weight children.[67]

38. A cross-sectional analytical study was conducted on 1000 adolescents from high schools in a rural area of Kerala to determine the prevalence and predictors of prehypertension and hypertension. Trained team members performed anthropometry and blood pressure measurements. SPSS 21 was used for statistical analysis. The Chi-square test was employed to determine the relationship between category variables. Prehypertension and hypertension were

found in 24.5% (males-30.5%, females-20.3%) and 0.6% (males-0.98%, females-0.34%) of the population, respectively. Male gender (AOR-1.67 95% CI-1.23-2.28), low socioeconomic status (AOR-1.55 95% CI-1.15-2.11), overweight/obese (AOR-5.7 95% CI-2.4-13.6), low fruit consumption (AOR-2.02 95% CI-1.499-2.7), and high soft drink consumption (AOR-2.21 95% CI-1.4446-3.39) were significant risk factors for prehypertension and hypertension.[68]

39. The study was carried out to evaluate the BMI and blood pressure (BP) of 1000 school-aged urban children, as well as the relationship between BMI and BP. Regardless of gender, there was a significant (p0.001) and positive connection between BMI and BP. HT and prehypertension were seen in a greater proportion of fat and overweight trial participants. Obesity management is one of the most critical parts of HT prevention in children.[69]

40. A cross-sectional study of 1060 school children was done to investigate the prevalence of overweight, obesity, and hypertension among children aged 10 to 16 years, as well as the relationship between BMI, age, and blood pressure. A semi-structured questionnaire was designed to collect information about the children's demographics, and for all of the children, weight and height were measured, BMI was calculated, and blood pressure was measured using a sphygmomanometer with the appropriate cuff size for the age. The correlation between BMI and hypertension revealed a strong positive correlation between BMI and systolic BP in both males (r=0.827) and females (r=0.714) and the correlation was found to be statistically significant, whereas the correlation between BMI and diastolic BP in males (r=0.838) and females (r=0.515) was not found to be statistically significant. Because high blood pressure was found

to be highly linked with overweight/obesity in this study, we urge that blood pressure screening be done routinely in children and adolescents.[70]

41. Prospective descriptive research was conducted on 115 children aged 5 to 15 years who attended the Out Patient Clinic to determine the relationship between BMI and blood pressure. Pre-hypertension and hypertension were found in 1% (2 out of 195) of normal children, 0% (0 out of 30) of overweight children, and 60.9% (9 out of 14 obese children). The P value was statistically significant, demonstrating a substantial relationship between BMI and blood pressure.[71]

42. A study was done to examine the relationship between obesity and hypertension in school-aged children aged 12 to 18. BMI was calculated after measuring height and weight. Blood pressure measures were performed in accordance with the American Heart Association's recommendations, and a family history of hypertension was also evaluated. 8.94% of the 682 children were fat, and 20.09% were hypertensive. Obesity is strongly linked to hypertension in children, and both may be risk factors for future cardiovascular disease.[72]

43. A population-based cross-sectional study was done among 979 adolescent pupils (11-19 years) to determine the prevalence and sociodemographic correlates of childhood obesity and increased blood pressure. The study population's anthropometric measurements and blood pressure were recorded. Prevalence of obesity, overweight and hypertension was 2.4%, 14.5% and 5.62%. Obesity was substantially connected with average fast food intake, screen time, and limited outside activity. The burden of overweight/obesity, as well as hypertension with all of its associated risks, was found to be substantial in our research population, necessitating the development of national policies and initiatives to address the risk associated with these non-communicable

illnesses.[73]

44. A study was undertaken to determine the prevalence of obesity and overweight in school-aged children and adolescents in north Karnataka, to investigate obesity-related morbidities such as prehypertension and hypertension, as well as risk factors for long-term hypertension. A total of 2800 youngsters between the ages of 10 and 16 were screened from three schools in the Bijapur district's urban and rural areas. Weight, height, BMI, and blood pressure were recorded. According to this study, the prevalence of hypertension was significantly higher in overweight and obese children than in children with normal BMI. Furthermore, the prevalence of overweight and obesity is higher in urban school children than in rural school children. More large-scale research is needed to investigate obesity and its associated morbidities, such as hypertension in school-aged children and adolescents.[74]

45. A cross-sectional study was undertaken on 600 children aged 6 to 10 years to determine the connection between blood pressure and body mass index. Anthropometric measurements were taken using standardized protocols. There were 341 (56.8%) males and 259 (43.2%) females among the 600 children. Obese children had a 10% and a 21.4% prevalence of hypertension and prehypertension, respectively, compared to 2.1% and 6% in lean children. The link between obesity and hypertension in school-aged children has been demonstrated.[75]

46. A Cross sectional study was undertaken to evaluate the prevalence of hypertension in obese children and find out the correlation of hypertension and obesity among children of private schools. The prevalence of hypertension in Indian youngsters was assessed using cut-off values. Hypertension was found in

28% of the population, with 19.7% being prehypertensive and 52.2% being normal. The study showed positive correlation. The prevalence of hypertension increased with BMI and age in both sexes.[76]

47. A cross-sectional analytical study was undertaken on 700 teenagers aged 10 to 19 years from four secondary schools to assess the relationship between high BMI and hypertension. Trained research assistants took anthropometric measures and blood pressure readings from respondents. There was a strong positive association between BMI and both systolic and diastolic blood pressure (DBP), with BMI explaining approximately 31.5% and 20.2% of the variability in systolic and diastolic blood pressure, respectively, in those with BMI85th percentile (p 0.05). Adolescents with BMI85th percentile for age and gender were more likely to be hypertensive than those with lower BMI, and BMI predicts both SBP and DBP better in those with BMI85th percentile.[77]

48. A study was conducted to investigate the prevalence of HTN/prehypertension (PHTN) among teenagers, as well as the risk factors associated with it. A total of 88,974 teenagers between the ages of 12 and 17 were tested from 49 middle schools in Changsha. All adolescents had their body weight, height, and blood pressure (BP) assessed. HTN and PHTN were defined using Chinese reference data based on gender and age. The prevalence of PHTN and HTN was determined to be 7.2 and 3.1%, respectively. HTN risk ratio (RR) was considerably greater in overweight and obese adolescents after controlling for age, gender, and height. Being overweight or obese significantly elevated the incidence of both HTN and PHTN among adolescents aged 12 to 17 years.[78]

49. A cross-sectional analytical study was carried out to investigate the extent of overweight and its relationship with blood pressure among teenagers aged 9 to

16 years. The prevalence of overweight based on a traditional BMI threshold was 27.5% for males and 20.9% for girls, but this varied depending on the indicators. High systolic blood pressure (HSBP) was found in 12.0% of boys and 9.7% of girls, and it increased with BMI, weight, triceps skin fold thickness (TSFT), and percent body fat. Study suggested that blood pressure monitoring should be a routine element of school children's physical examinations, and that the application of cutoffs connected to metabolic concerns may be necessary for assessing obesity.[79]

50. The current sample of teenagers (n = 160; ages 13 to 16) was collected from ten schools in the Punjab city of Ludhiana. Each subject's height (cm) and weight (kg) were measured, and their Body Mass Index was determined. The subjects were divided into normal-weight and obese categories based on their BMI for age and gender. The obese and normal-weight samples were evenly divided amongst the sexes. All of the selected teens were found to be from the medium and upper-middle socioeconomic classes. BMI and academic performance of girls and boys were found to have a substantial negative association.[80]

51. A study was done on 72,399 South Korean adolescents in grades 7-12 to investigate the association between academic achievement and obesity/overweight. Using multivariate logistic regression analysis, the relationship between academic achievement and body mass index (BMI) was investigated. Overweight/obesity was negatively associated with academic performance in both boys and females. According to the findings of this study, adolescents would benefit from weight management in order to avoid obesity and maybe improve academic performance.[81]

52. A cross-sectional study was done on 424 students to investigate the relationship between body mass index (BMI) and academic achievement. There were 424 students in 14 schools. 24.5% of the population was either overweight or obese. The average age of the pupils was 15.44 years, 74.8% were male, 53.8% were high school students, and 83.7% attended public schools. The average GPA for all subjects was 82.44%, and the average GPA for scientific subjects was 70.91%. There was no correlation between the BMI and school performance, except the physics result where obese students perform worse than the normal weight students.[82]

53. A study was conducted to investigate the relationship between overweight and obesity and secondary school performance. In a sample of 566 secondary pupils in Merida, weight and height were assessed, and the body mass index was determined. According to World Health Organization guidelines, nutritional status was defined as normal weight (-2-+1 SD), overweight (+1- 2 SD), and obese (> + 2 SD). Language, mathematics, and science results were utilized as markers of school achievement. Good performance was considered when the scores were 8 and more than 8, and when scores were less than 8 which were considered poor performance, the connection between the variables was investigated using logistic regression models. Obesity is associated with lower school achievement in girls but not in boys.[83]

Justification

The literatures included in the research has shown the prevalence of overweight and obesity varies from 3.6 to 18.2%. and it was found to be higher in high economic group and more prevalent in urban adolescents. Family history of obesity, working status of mother and less duration of sleeping has a direct relationship on childhood obesity. Low levels of physical activity, watching TV, playing computer games, consumption of bakery items, eating fast food were found to be contributing factors for the development of obesity among adolescents. Blood pressure had shown positive correlation with the obesity and academic performance had shown negative correlation with obesity among adolescents. Prevalence varies across the country because of changes in lifestyle, particularly food trends and physical activity. However, there is large body of literatures that describes prevalence of obesity among adolescents, very little has done to study the determinants and associated factors among adolescents in the northern part of Karnataka. In view of these contexts, there is scope to study the determinants and its effects among school going adolescents.

CHAPTER III

MATERIALS AND METHODS

The research technique describes the method used by the investigator in the study in detail. Methodological research is research that aims to establish or improve procedures for gathering, organizing, and analyzing data.

3.1 Research Approach

The research approach describes how the investigation will be carried out. It assists the researcher in determining what data to collect and how to analyze it. It also recommends various inferences based on the data.

Given the nature of the topic chosen for the current study and the objectives to be achieved, a descriptive approach was deemed appropriate for the current investigation.

3.2 Research Design

A study's research design outlines the fundamental procedures that researchers use to generate reliable and interpretable information.

A cross-sectional research design was chosen for the current study

3.3 Study Population

In the present study the population consists of all Adolescent students who are studying in government and private schools of Belagavi city.

3.4 Sample

A sample is a subset of the population that represents the entire population. As a result, it is a subset of the population's elements. The sample chosen for the present study was Adolescent students aged 10- 16 years from 5^{th} to 10^{th} standard studying in selected government and private schools of Belagavi city.

3.5 Sample Size

As per the published literature, prevalence of obesity in children between the age group of 10 to 16 years was 7% in urban areas. Based on this, sample size was calculated by using the formula

Sample size (n) = $Z^2_{1-\alpha}pq/d^2$

Were,

n is Sample size

$\mathbf{Z_{1-\alpha}}$ - Statistic corresponding to the level of confidence, i.e., 1.96 – 95% CI

p is prevalence (obtained from similar studies)

q is (1-p) absence of positivity

d is Precision (in present study d is 10% of p)

Considering the above formula, the sample size was calculated as **1047** and rounded off **1050**

3.6 Sampling Technique

Stratified Cluster Sampling was used to select the samples.

3.7 Sampling Criteria

Inclusion Criteria

- Adolescent students aged 10- 16 years from 5^{th} to 10^{th} standard studying in selected government and private schools of Belagavi city.
- Students who are present during the data collection

Exclusion Criteria

- Children having chronic illnesses such as severe malnutrition, endocrinal problems and physically handicapped.

3.8 Study Variables

- **Socio-demographic variables**: Demographic characteristics included in the study are Age, Gender, Class, Educational Qualification of Father, Educational Qualification of Mother, Family history of Diabetes, Family history of Hypertension, Family history of obesity

- **Determinants of Overweight and obesity:** In the present study determinants refers to the factors or variables which determines the condition of obesity. Which includes Dietary practices and Physical activity.

- **Consequences of Overweight and obesity:** In the present study consequences refers to the health effects of obesity in Adolescents at the time of data collection. Which includes Blood pressure and Academic performance

3.9 Research Setting

Settings are the more specific places where data collection occurs based on the nature of the research question and the type of information needed to address it. The setting planned for the present study was government and private schools of Belagavi city.

3.10 Ethical clearance

Ethical clearance was obtained from the Institutional Ethics Committee of KLE University, Belagavi on human subjects.

3.11 Development of the tool

Data was collected by administering the predesigned, prevalidated and pretested questionnaire

3.12 Description of the tool

The tool consists of

Section I: **Socio-demographic data.**

Section II: **Items on determinants of obesity.**

Section III: **Items on consequences of obesity.**

Measurements

Height: Height was measured by allowing participants to stand straight without footwear, with heels, buttocks and back touching the wall and arm hanging by side.[84]

Weight: Body weight was measured without shoes, heavy clothing, using standard portable weighing machine with an error of $\pm$ 100gm.[84]

Body Mass Index (BMI) was then calculated using the formula, **Body Mass Index (BMI) =** Weight (Kg)/ Height (meter^2) and BMI classification was done based on WHO/International Obesity Task Force (IOTF) for Asia and India standard of obesity.[85]

Table 1: WHO classification of BMI

Category	BMI range (kg/m2)
Underweight	< 18.5
Normal	18.5- 22.99
Overweight	23-24.9
Obesity	>25

3.13 Validity of the tool

The tool was validated by 7 experts in the field of Pediatric nursing, Meical surgical nursing and Pediatricians

3.14 Reliability

Reliability of an instrument is a degree of consistency with which an instrument measures the attribute it is supposed to measure. Reliability of the tool was done and was found to be 0.80

3.15 Pilot study

Pilot study was done on 110 adolescent students in a government school, Belagavi

3.16 Data collection procedure

- Approval from the Institutional Ethics Committee on human subject was obtained
- A prior permission was taken from the DDPI Belagavi and the list of schools were obtained from DDPI office
- Total 8 schools were selected for data collection by simple random sampling
- A permission was taken from the head of the school, explained the purpose and method of the study.
- All adolescents from 5th to10th standard from the selected schools who were willing to participate were included in the study
- Students were briefed about the study, the consent from their parents and assent were obtained from the students
- Data were collected by administering the pretested questionnaire
- Height, weight, Blood pressure were measured and last year aggregate marks obtained from school authority

3.17 Data analysis

Logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. The odds ratio with 95% CI was presented. $P < 0.05$ was considered an association between an outcome variable and an explanatory variable. Data was analyzed using the statistical software Core System Users Guide SPSS Inc 2014(IBM SPSS Version 22).

Conclusion

The research methodology, research design, variables, study setting, population, sample, sampling strategy, development of the tool, tool description, data collection method and data analysis have all been covered in this chapter.

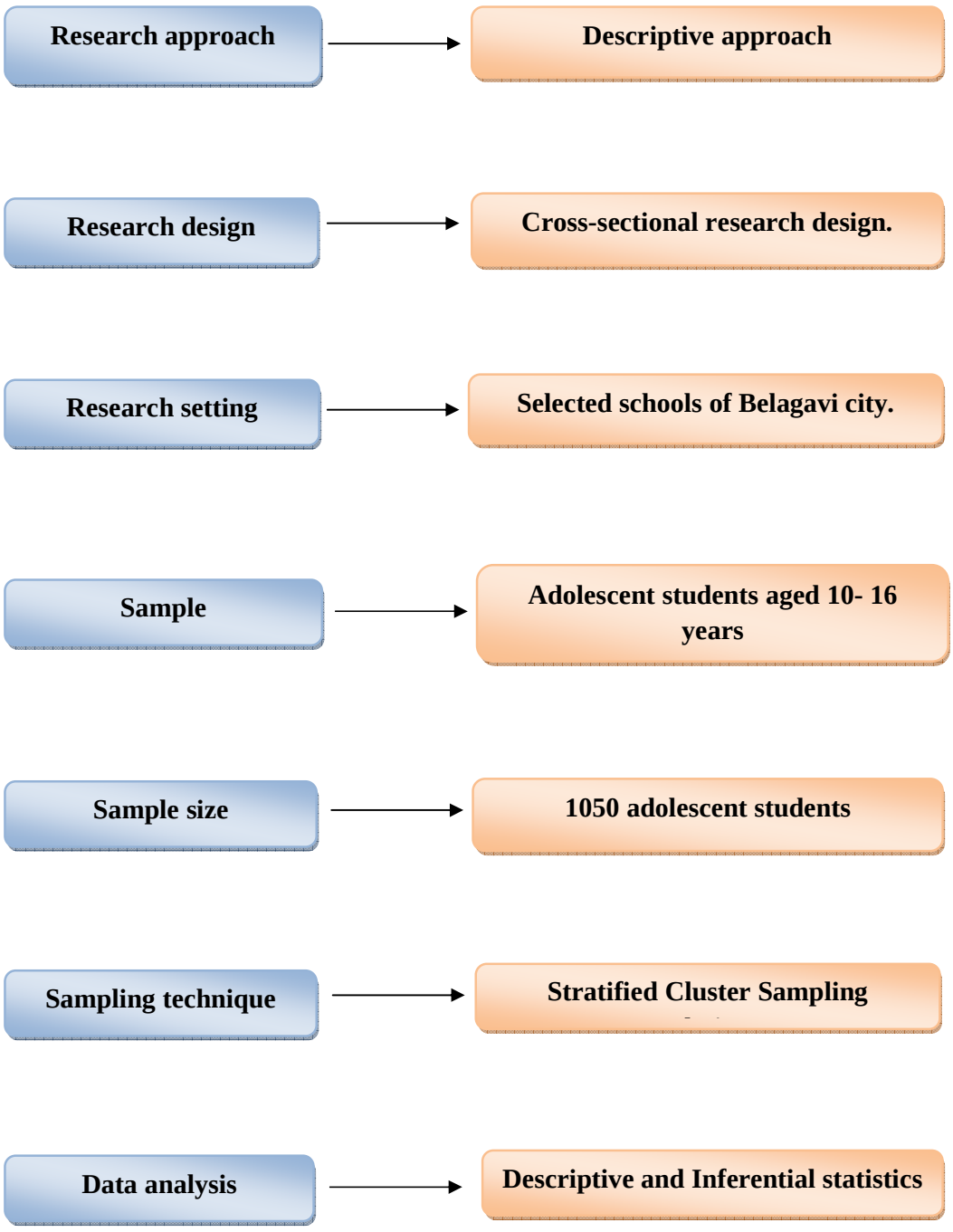


Figure 2: Flow chart of Research methodology

CHAPTER IV

DATA ANALYSIS AND RESULT INTERPRETATION

It is concerned with the process of organizing and synthesizing data from samples in order to explore the determinants and consequences among adolescents, as well as the process of making sense of the results and investigating their implications.

Descriptive analysis was carried out by frequency and proportion for categorical variables. Binary logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. Odds ratio along with 95% CI is presented. P value < 0.05 considered as association between outcome variable and explanatory variable. IBM SPSS version 22 was used for statistical analysis.

The data are presented under the following headings

- **Section I:** Descriptive analysis of demographic variables, determinants and consequences in study population
- **Section II:** Association between demographic variables, determinant factors and consequences with BMI
- **Section III:** Prevalence of Overweight and Obesity among Adolescent students
- **Section IV:** Multiple logistic regression analysis of obesity with study variables
- **Section V:** Correlation between BMI with SBP, DBP and academic performance by Karl Pearson's correlation coefficient

4.1 Section I: Descriptive analysis of demographic variables, determinants and consequences in study population

Section I (a): Distribution of respondents according to demographic profile

Table 2: Distribution of respondents according to demographic profile (n=1050)

Profile	Frequency	Percentages
Gender		
Male	567	54.0
Female	483	46.0
Class		
10th	221	21.05
5th	193	18.38
6th	220	20.95
7th	169	16.10
8th	117	11.14
9th	130	12.38
Education of father		
Primary	4	0.38%
Secondary	117	11.14%
PUC	279	26.57%
Graduate	433	41.24%
Post- Graduate	217	20.67%

Education of mother		
Illiterates	7	0.67%
Primary	25	2.38%
Secondary	198	18.86%
PUC	265	25.24%
Graduate	428	40.76%
Post- Graduate	127	12.10%
Family history of Diabetes		
Yes	216	20.6
No	834	79.4
Family history of HTN		
Yes	157	15.0
No	893	85.0
Any obese person		
Yes	300	28.6
No	750	71.4
Total	**1050**	**100.0**

Table 2 shows that

- Among the study population, 54.00% of them were male, 46.00% of them were female.
- Maximum students (21.05%) were studying in tenth standard, whereas minimum students (11.14%) were from 8^{th} standard
- Among the study population with fathers' education, 41.24% of them completed their graduation, 26.57% of them completed their PUC, 20.67% of them completed their post-graduation
- Among the study population with mothers' education, 40.76% of them completed their graduation, 25.24% of them completed their PUC, 18.86% of them completed their Secondary education, 12.10% of them completed their post-graduation.
- Regarding family history of Diabetes 79.4% of students had family history of Diabetes where as 20.6% of them didn't have family history of diabetes
- About the family history of Hypertension 85% of them had family history of Hypertension where as 15% didn't have family history of Hypertension
- Among the study population 71.4% of adolescents had family history of obesity, where as 28.6% didn't have family history of obesity

Section I(b): Descriptive analysis of physical activity among the study participants

Table 3: Distribution of study participants according to physical activity

(n=1050)

Running / Jogging	**Daily**	**Alternative**	**Once a week**	**Rarely**	**Nil**
Frequency	104	620	156	45	125
Percentages	9.90%	59.05%	14.86%	4.29%	11.90%
Walking					
Frequency	61	264	105	133	487
Percentages	5.81%	25.14%	10.00%	12.67%	46.38%
Swimming					
Frequency	536	306	141	54	13
Percentages	51.05%	29.14%	13.43%	5.14%	1.24%
Skipping					
Frequency	298	442	217	59	34
Percentages	28.38%	42.10%	20.67%	5.62%	3.24%
Outdoor Games					
Frequency	170	193	304	223	160
Percentages	16.20%	18.38%	28.95%	21.23%	15.23%

Table 3 presents that

- Maximum students (59.05%) were involved in running alternatively, whereas 4.29% were involved rarely.
- Majority of (46.38%) participants didn't involve in walking, where as 5.82% of students involved in walking daily
- Maximum (42.10%) respondents involved in skipping alternative days, whereas 3.24% students didn't involve in skipping
- Among study samples majority (28.95%) of students involved in the outdoor games once in a week, whereas only 15.23% students didn't involve in outdoor games

Table 4: Distribution of study samples according to mode of conveyance to school in the study population (n=1050)

Mode of conveyance to school	Frequency	Percentages
Walking	146	13.90%
Cycling	149	14.20%
Bus	386	36.77%
Private Vehicles	167	15.90%
Two-Wheeler	202	19.23%

- Table 4 depicts that among the study population, 13.90% of them were going to school by walk, 14.00% of students were going to school by cycle, 36.77% them were going to school by Bus, 19.23% of them were going to school by Two-Wheeler and 15.90% of them were going by private vehicles.

Table 5: Distribution of study samples according to number of hours watching TV (n=1050)

Number of hours watching TV	Frequency	Percentages
1/2Hr	128	12.19%
1 Hr	265	25.2%
2 Hr	375	35.7%
>2 Hr	93	8.39%

- Table 5 shows that, among the study subjects with number of hours watching TV, 35.7% of them watching for 2 hours, 25.2% of them watching TV for 1 hour, 12.19% of them watching TV for 1/2 hour and 8.39% of students watching TV for more than 2 hours

Table 6: Distribution of study samples according to number of hours using the mobile everyday (n=1050)

Number of hours using the mobile every day	Frequency	Percentages
1/2Hr	293	27.9%
1 Hr.	179	17%
2 Hr	129	12.3%
>2 Hr	133	12.6%

- Table 6 depicts that majority (27.9%) of students spend half an hour time with the mobile every day, where as 12.3% of students spend 2 hours' time with mobile every day, 17% of respondents spend 1 hour time with mobile every day and 12.3% of students spend more than 2 hours' time with mobile every day.

Table 7: Distribution of study samples according to habit of eating food while watching tv (n=1050)

Habit of Eating Food While Watching Tv	Frequency	Percentages
No	331	31.52%
Yes	719	68.48%

- Table 7 shows that, 68.48% of them have habit of eating food while watching TV, where as 31.52% of students didn't have habit of eating food while watching TV

Section I(c): Descriptive analysis of dietary practices among the study participants

Table 8: Distribution of study samples according to dietary practices (n=1050)

Pulses	**Everyday**	**2-3 times a week**	**Occasionally**
Frequency	184	592	274
Percentages	17.52%	56.38%	26.10%
Fried Foods			
Frequency	594	364	92
Percentages	56.57%	34.67%	8.76%
Cereals			
Frequency	279	387	384
Percentages	26.57%	36.86%	36.57%
Vegetables			
Frequency	182	290	578
Percentages	17.33%	27.62%	55.05%
Fruits			
Frequency	389	308	353
Percentages	37.05%	29.33%	33.62%
Bakery Items			
Frequency	375	452	223

Percentages	35.71%	43.05%	21.24%
Sweets			
Frequency	323	410	317
Percentages	30.76%	39.05%	30.19%
Ice Cream			
Frequency	447	320	283
Percentages	42.57%	30.48%	26.95%
Fast Foods			
Frequency	633	212	205
Percentages	60.29%	20.19%	19.52%

Non- Veg	Nil	Everyday	2-3 times a week	Occasionally
Frequency	28	419	516	87
Percentages	2.67%	39.90%	49.14%	8.29%
Beverages				
Frequency	36	265	95	654
Percentages	3.43%	25.24%	9.05%	62.29%

Table 8 depicts that, distribution of study samples according to dietary practices, in terms of

- Pulses, 56.38% of them consuming 2-3 times a week, 26.10% of them consuming occasionally and 17.52% of them consuming every day.
- Fried foods, 56.57% of them having fried fruits every day, 34.67% of students consuming fried foods 2-3 times a week and 8.76% of students consuming occasionally.
- Cereals, 36.86% of them consuming 2-3 times a week, 36.57% of them having cereals occasionally and 26.57% of them consuming cereals every day.
- Vegetables, 55.05% of them consuming vegetables Occasionally, 27.62% of students consuming vegetables 2-3 times a week and 17.33% of students consuming vegetables every day.
- Fruits, 37.05% of them having fruits daily, 33.62% of students consuming fruits occasionally and 29.33% of students consuming fruits 2-3 times a week.
- Bakery items, 43.05% of respondents consumes bakery Items 2-3 times a week, 35.71% of respondents consumes bakery Items every day and 21.24% of respondents consumes bakery Items occasionally.
- Sweets, 39.05% of them consumes sweets 2-3 times a week, 30.76% of students consumes sweets every day and 30.19% of students consumes sweets occasionally.
- Fast foods, 60.29% of them having fast food every day, 20.19% of students consumes fast food 2-3 times a week and 19.52% of students consumes fast food occasionally

- Non veg, 49.14% of students consumes nonveg 2-3 times a week, 39.9.% of students consume non veg every day, 8.29% of students consume non veg occasionally and 2.67% of students do not consume non veg.
- 62.29% of them consume beverages Occasionally, 25.24% of students consume beverages every day, 9.05% of students consume beverages 2-3 times a week and 3.43% of students do not consume beverages.

Section I(d): Descriptive analysis of Blood pressure in the study population

Table 9: Distribution of study participants according to blood pressure (n=1050)

Blood pressure	Frequency	Percentage (%)
Normotensive	782	74.48
Pre hypertensive	265	25.24
Stage 1 hypertension	3	0.29

- Table 9 demonstrates that 25.24% of study participants were categorized into pre hypertensive group and 0.29% of them were categorized into stage 1 hypertension group

Section II: Association between demographic variables, determinant factors and consequences with BMI

Section II(a): Association between demographic variables with BMI

Table 10: Association between demographic profiles with prevalence of obesity

(n=1050)

Profile	UW	%	Normal	%	OW	%	Obese	%	Total	%	Chi-square	p-value
Gender												
Male	369	65.1	124	21.9	53	9.3	21	3.7	567	54.0	4.76	0.1900
Female	295	61.1	126	26.1	37	7.7	25	5.2	483	46.0		
Age												
10	33	91.6	2	5.56	1	2.7	0	0	36	3.42	340.57	0.0001*
11	215	81.7	30	11.4	18	6.8	0	0	263	25.0		
12	112	81.7	8	5.8	17	12.4	0	0	137	13.0		
13	102	68.9	36	24.3	8	5.4	2	1.3	148	14.0		
14	81	69.3	21	17.9	9	7.6	6	5.1	117	11.1		
15	73	69.5	27	25.7	5	4.6	0	0	105	10.0		
16	48	19.6	126	51.6	32	13.3	38	15.8	244	23.2		
Class												
5	159	82.3	20	10.3	14	7.25	0	0	193	18.3	378.60	0.0001*
6	181	82.2	20	9.0	19	8.64	0	0	220	20.9		
7	124	73.3	31	18.3	12	7.1	2	1.18	169	16.0		
8	86	73.5	24	20.5	07	5.9	0	0	117	11.1		
9	87	66.9	29	22.3	8	6.1	6	4.6	130	12.3		
10	27	12.2	126	57.0	30	13.5	38	17.1	221	21.0		
Education father												
Primary	2	50.0	1	25.0	1	25.0	0	0.0	4	0.4	69.5310	0.0001*
Secondary	97	83.6	16	13.8	1	0.9	2	1.7	116	11.0		
PUC	202	72.9	57	20.6	14	5.1	4	1.4	277	26.4		
Degree	229	52.5	131	30.0	45	10.3	31	7.1	436	41.5		
PG	134	61.8	45	20.7	29	13.4	9	4.1	217	20.7		

Education mother												
Illiterates	5	71.4	2	28.6	0	0.0	0	0.0	7	0.7	52.9840	0.0001*
Primary	14	58.3	6	25.0	2	8.3	2	8.3	24	2.3		
Secondary	153	77.7	28	14.2	9	4.6	7	3.6	197	18.8		
PUC	178	66.7	65	24.3	22	8.2	2	0.7	267	25.4		
Degree	233	54.4	126	29.4	39	9.1	30	7.0	428	40.8		
PG	81	63.8	23	18.1	18	14.2	5	3.9	127	12.1		
Family income												
<=10000	16	66.7	7	29.2	0	0.0	1	4.2	24	2.3	89.5670	0.0001*
10001-20000	225	84.3	30	11.2	7	2.6	5	1.9	267	25.4		
20001-30000	171	61.1	77	27.5	23	8.2	9	3.2	280	26.7		
30001-40000	190	51.1	115	30.9	43	11.6	24	6.5	372	35.4		
>=40001	62	57.9	21	19.6	17	15.9	7	6.5	107	10.2		
Family history of Diabetes												
Yes	110	50.9	78	36.1	14	6.5	14	6.5	216	20.6	27.92	0.0001*
No	554	66.4	172	20.6	76	9.1	32	3.8	834	79.4		
Family history of HTN												
Yes	68	43.3	58	36.9	12	7.6	19	12.1	157	15.0	50.2680	0.0001*
No	596	66.7	192	21.5	78	8.7	27	3.0	893	85.0		
Any obese person												
Yes	109	36.3	115	38.3	35	11.7	41	13.7	300	28.6	172.644	0.0001*
No	555	74.0	135	18.0	55	7.3	5	0.7	750	71.4		
Total	664	63.2	250	23.8	90	8.6	46	4.4	1050	100.0		

- Table 10 demonstrates that age, class, education of father, education of mother, family monthly income, family history of Diabetes, family history of Hypertension and family history of obese shows statistically significant with overweight and obesity. (p value <0.05)

Section II(b): Association between Physical activities with BMI

Table 11: Association between Physical activities with prevalence of obesity

(n=1050)

Physical activities	UW	%	Normal	%	OW	%	Obese	%	Total	%	Chi-square	p-value
Running/Jogging												
Nil	55	53.9	25	24.5	21	20.6	1	1.0	102	9.7	46.9540	0.0001*
Daily	388	62.8	143	23.1	47	7.6	40	6.5	618	58.9		
Alternatively	99	61.9	40	25.0	16	10.0	5	3.1	160	15.2		
Once a week	29	61.7	15	31.9	3	6.4	0	0.0	47	4.5		
Rarely	93	75.6	27	22.0	3	2.4	0	0.0	123	11.7		
Walking												
Nil	42	67.7	11	17.7	8	12.9	1	1.6	62	5.9	213.0300	0.0001*
Daily	120	44.9	111	41.6	27	10.1	9	3.4	267	25.4		
Alternatively	45	38.8	23	19.8	29	25.0	19	16.4	116	11.0		
Once a week	76	57.6	34	25.8	18	13.6	4	3.0	132	12.6		
Rarely	381	80.5	71	15.0	8	1.7	13	2.7	473	45.0		
Swimming												
Nil	311	58.2	150	28.1	37	6.9	36	6.7	534	50.9	91.4620	0.0001*
Daily	226	72.9	49	15.8	28	9.0	7	2.3	310	29.5		
Alternatively	95	67.4	35	24.8	8	5.7	3	2.1	141	13.4		
Once a week	29	54.7	7	13.2	17	32.1	0	0.0	53	5.0		
Rarely	3	25.0	9	75.0	0	0.0	0	0.0	12	1.1		
Skipping												
Nil	121	40.6	92	30.9	56	18.8	29	9.7	298	28.4	131.1010	0.0001*
Daily	318	71.9	86	19.5	22	5.0	16	3.6	442	42.1		
Alternatively	165	75.3	44	20.1	9	4.1	1	0.5	219	20.9		
Once a week	40	69.0	17	29.3	1	1.7	0	0.0	58	5.5		
Rarely	20	60.6	11	33.3	2	6.1	0	0.0	33	3.1		

Outdoor games												
Nil	10	83.3	1	8.3	1	8.3	0	0.0	12	1.1	66.4970	0.0001*
Daily	156	71.2	36	16.4	25	11.4	2	0.9	219	20.9		
Alternatively	195	71.4	47	17.2	25	9.2	6	2.2	273	26.0		
Once a week	100	46.7	75	35.0	23	10.7	16	7.5	214	20.4		
Rarely	203	61.1	91	27.4	16	4.8	22	6.6	332	31.6		
Mode of conveyance to school												
Walking	281	74.1	65	17.2	24	6.3	9	2.4	379	36.1	196.9930	0.0001*
Cycling	99	55.9	37	20.9	31	17.5	10	5.6	177	16.9		
Bus	180	80.0	34	15.1	11	4.9	0	0.0	225	21.4		
Private Vehicles	48	55.8	34	39.5	4	4.7	0	0.0	86	8.2		
Two-Wheeler	51	33.8	64	42.4	14	9.3	22	14.6	151	14.4		
Others	5	15.6	16	50.0	6	18.8	5	15.6	32	3.0		
No of hours - watching TV												
Nil	147	74.2	34	17.2	15	7.6	2	1.0	198	18.9	145.2580	0.0001*
1/2hr	109	85.8	12	9.4	4	3.1	2	1.6	127	12.1		
1hr	198	75.3	52	19.8	12	4.6	1	0.4	263	25.0		
2hrs	158	43.2	120	32.8	50	13.7	38	10.4	366	34.9		
>2hrs	52	54.2	32	33.3	9	9.4	3	3.1	96	9.1		
Habit of eating food while watching TV												
No	286	86.4	29	8.8	16	4.8	0	0.0	331	31.5	116.0520	0.0001*
Yes	378	52.6	221	30.7	74	10.3	46	6.4	719	68.5		
No of hours spent with computer everyday												
Nil	469	75.2	93	14.9	56	9.0	6	1.0	624	59.4	292.5950	0.0001*
1/2hr	74	81.3	9	9.9	6	6.6	2	2.2	91	8.7		
1hr	83	57.6	47	32.6	10	6.9	4	2.8	144	13.7		
2hrs	32	27.6	61	52.6	7	6.0	16	13.8	116	11.0		
>2hrs	6	8.0	40	53.3	11	14.7	18	24.0	75	7.1		
No of hours spent with mobile everyday												
Nil	240	75.9	54	17.1	19	6.0	3	0.9	316	30.1	351.6790	0.0001*
1/2hr	248	84.6	30	10.2	12	4.1	3	1.0	293	27.9		
1hr	110	61.5	34	19.0	32	17.9	3	1.7	179	17.0		

2hrs	55	42.6	55	42.6	10	7.8	9	7.0	129	12.3		
>2hrs	11	8.3	77	57.9	17	12.8	28	21.1	133	12.7		
No of hours spent in sleep												
7hrs	177	47.2	123	32.8	33	8.8	42	11.2	375	35.7	111.1810	0.0001*
8hrs	334	69.6	100	20.8	44	9.2	2	0.4	480	45.7		
9hrs	153	78.5	27	13.8	13	6.7	2	1.0	195	18.6		

- Table 11 depicts that running, walking, skipping, swimming, outdoor games, mode of conveyance to the school, number of hours in watching TV, eating of food while watching TV, number of hours spent with computer every day, number of hours spent with mobile every day and number of hours spent in sleep shows statistically significant with prevalence of overweight and obesity

Section II(c): Association between dietary practices with BMI

Table 12: Association between dietary practices with prevalence of obesity (n=1050)

Food-stuffs consumed by child	UW	%	Normal	%	OW	%	Obese	%	Total	%	Chi-square	p-value
Cereals												
Everyday	150	53.8	87	31.2	26	9.3	16	5.7	279	26.6	37.5120	0.0001*
2-3 times a week	229	59.2	105	27.1	39	10.1	14	3.6	387	36.9		
Occasionally	285	74.2	58	15.1	25	6.5	16	4.2	384	36.6		
Pulses												
Everyday	61	33.2	81	44.0	36	19.6	6	3.3	184	17.5	105.9800	0.0001*
2-3 times a week	407	68.8	119	20.1	34	5.7	32	5.4	592	56.4		
Occasionally	196	71.5	50	18.2	20	7.3	8	2.9	274	26.1		
Fried foods												
Everyday	438	73.9	91	15.3	54	9.1	10	1.7	593	56.5	200.2140	0.0001*
2-3 times a week	187	51.2	144	39.5	22	6.0	12	3.3	365	34.8		
Occasionally	39	42.4	15	16.3	14	15.2	24	26.1	92	8.8		
Vegetables												
Everyday	51	28.0	85	46.7	21	11.5	25	13.7	182	17.3	146.3270	0.0001*
2-3 times a week	188	64.8	69	23.8	22	7.6	11	3.8	290	27.6		
Occasionally	425	73.5	96	16.6	47	8.1	10	1.7	578	55.0		
Non- vegetarian												
Everyday	262	59.3	126	28.5	28	6.3	26	5.9	442	42.1	23.2860	0.0010*
2-3 times a week	351	67.2	98	18.8	54	10.3	19	3.6	522	49.7		
Occasionally	51	59.3	26	30.2	8	9.3	1	1.2	86	8.2		
Fruits												
Everyday	222	56.8	102	26.1	55	14.1	12	3.1	391	37.2	66.0360	0.0001*
2-3 times a week	186	58.3	78	24.5	26	8.2	29	9.1	319	30.4		
Occasionally	256	75.3	70	20.6	9	2.6	5	1.5	340	32.4		
Bakery items												
Everyday	255	68.7	59	15.9	33	8.9	24	6.5	371	35.3	72.6780	0.0001*
2-3 times a	316	69.0	102	22.3	33	7.2	7	1.5	458	43.6		

week												
Occasionally	93	42.1	89	40.3	24	10.9	15	6.8	221	21.0		
Sweets												
Everyday	234	72.9	49	15.3	34	10.6	4	1.2	321	30.6	41.8810	0.0001*
2-3 times a week	254	61.1	101	24.3	32	7.7	29	7.0	416	39.6		
Occasionally	176	56.2	100	31.9	24	7.7	13	4.2	313	29.8		
Ice cream												
Everyday	359	81.0	62	14.0	16	3.6	6	1.4	443	42.2	121.7780	0.0001*
2-3 times a week	151	46.0	100	30.5	51	15.5	26	7.9	328	31.2		
Occasionally	154	55.2	88	31.5	23	8.2	14	5.0	279	26.6		
Fast foods												
Everyday	490	79.0	76	12.3	45	7.3	9	1.5	620	59.0	227.3310	0.0001*
2-3 times a week	124	55.9	63	28.4	20	9.0	15	6.8	222	21.1		
Occasionally	50	24.0	111	53.4	25	12.0	22	10.6	208	19.8		
Beverages												
No	23	65.7	11	31.4	1	2.9	0	0.0	35	3.3	41.0220	0.0001*
Everyday	196	74.2	53	20.1	15	5.7	0	0.0	264	25.1		
2-3 times a week	57	55.3	27	26.2	16	15.5	3	2.9	103	9.8		
Occasionally	388	59.9	159	24.5	58	9.0	43	6.6	648	61.7		
Eating outside food												
1-3 times a week	107	46.7	72	31.4	26	11.4	24	10.5	229	21.8	78.8460	0.0001*
> 3 times a week	106	52.5	65	32.2	20	9.9	11	5.4	202	19.2		
Once in a month	423	73.3	106	18.4	38	6.6	10	1.7	577	55.0		
Occasionally	28	66.7	7	16.7	6	14.3	1	2.4	42	4.0		
Total	664	63.2	250	23.8	90	8.6	46	4.4	1050	100.0		

- Table 12 presents that, among study population, the difference in proportion of frequency of consuming cereals, pulses, fried foods, vegetables, non- veg, fruits, bakery items, sweets, Ice cream, fast foods, beverages and eating outside food across BMI was statistically significant (p value <0.001)

Section II(d): Comparison of obesity with mean SBP, DBP and academic performance by one way ANOVA

Table 13: Comparison of obesity with mean SBP, DBP and academic performance (n=1050)

Obesity	SBP		DBP		Academic performance	
	Mean	SD	Mean	SD	Mean	SD
UW	114.95	7.88	79.26	4.89	68.21	7.19
Normal	123.84	10.93	83.26	6.41	66.37	5.76
OW	117.20	12.02	82.01	5.14	67.48	5.07
Obese	130.25	8.98	87.63	4.08	64.20	6.95
Total	117.71	10.08	80.70	5.70	67.58	6.80
F-value	80.29094		59.1699		7.7449	
P-value	0.0001*		0.0001*		0.0001*	

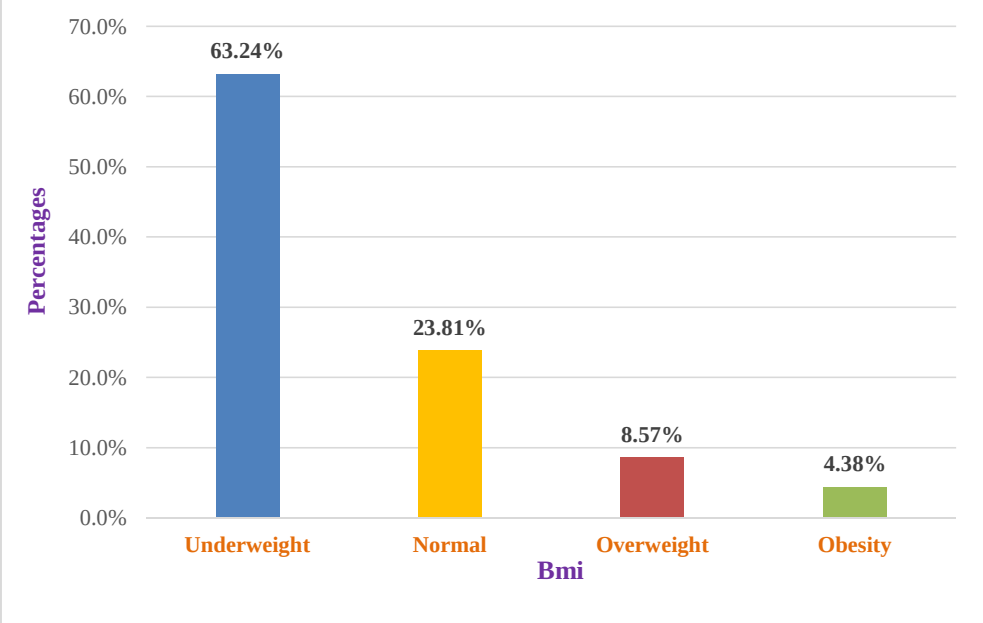
- Table 13 shows that, the mean difference of systolic, diastolic blood pressure and last year aggregate marks across BMI were statistically significant. (P value <0.001)

Section III: Prevalence of Overweight and Obesity among Adolescent students

Table 14: Prevalence of Overweight and Obesity among Adolescents (n=1050)

BMI	No of respondents	% of respondents
Underweight	664	63.24
Normal	250	23.81
Overweight	90	8.57
Obese	46	4.38
Total	1050	100.00

- Table 14 reports that prevalence of overweight and obesity among adolescents were found to be 8.57% and 4.38% respectively



Graphs 1: Bar chart showing BMI in the study population

Section IV: Multiple logistic regression analysis of obesity with study variables

Section IV(a): Multiple logistic regression analysis of prevalence of obesity by demographic profile

Table 15: Multiple logistic regression analysis of prevalence of obesity by demographic profile (n=1050)

Profile	Adjusted OR	95% CI for OR		p-value
		Lower	Upper	
Gender				
Male	0.66	0.47	0.93	0.0180*
Female	Ref.			
Education father				
Primary	0.65	0.04	9.59	0.7550
Secondary	0.10	0.02	0.43	0.0020*
PUC	0.30	0.13	0.70	0.0050*
Graduation	0.74	0.45	1.21	0.2320
PG	Ref.			
Education mother				
Illiterates	-	-	-	-
Primary	3.44	0.74	16.13	0.1160
Secondary	1.69	0.65	4.39	0.2840
PUC	0.90	0.43	1.88	0.7800
Degree	0.74	0.41	1.32	0.3070
PG	Ref.			

Family income				
<=10000	0.18	0.02	1.67	0.1320
10001-20000	0.13	0.05	0.31	0.0001*
20001-30000	0.26	0.14	0.50	0.0001*
30001-40000	0.32	0.20	0.52	0.0001*
>=40001	Ref.			
Family history of Diabetes				
Yes	0.52	0.32	0.84	0.0080*
No	Ref.			
Family history of HTN				
Yes	0.74	0.45	1.22	0.2400
No	Ref.			
Any obese person				
Yes	2.87	1.91	4.31	0.0001*
No	Ref.			

- Table 15 demonstrates that, among the study population in demographic variables age, gender, education of father (secondary and PUC education), family income, family history of diabetes and family history of obese showed statistically significant or associated with overweight and obesity. (p value <0.05)

Section IV(b): Multiple logistic regression analysis of prevalence of obesity by physical activities

Table 16: Multiple logistic regression analysis of prevalence of obesity by Physical activities (n=1050)

Physical activities	Adjusted OR	95% CI for OR		95% CI for OR
		Lower	Upper	
Running/Jogging				
Nil	Ref.			
Daily	0.95	0.29	3.05	0.9280
Alternatively	0.85	0.24	2.97	0.7960
Once a week	0.11	0.02	0.83	0.0320*
Rarely	0.02	0.00	0.14	0.0001*
Walking				
Nil	Ref.			
Daily	0.29	0.09	0.90	0.0310*
Alternatively	7.30	2.05	25.96	0.0020*
Once a week	0.38	0.11	1.34	0.1330
Rarely	0.13	0.04	0.42	0.0010*
Swimming				
Nil	Ref.			
Daily	0.94	0.45	1.96	0.8740
Alternatively	0.86	0.28	2.68	0.8010
Once a week	2.18	0.57	8.27	0.2530
Rarely	0.00	0.00	.	0.9980
Skipping				
Nil	Ref.			
Daily	0.45	0.21	0.95	0.0360
Alternatively	0.07	0.02	0.21	0.0001*
Once a week	0.03	0.00	0.36	0.0060*
Rarely	9.71	0.76	124.67	0.0810
Outdoor games				
Nil	Ref.			
Daily	4.17	0.27	64.16	0.3060
Alternatively	0.65	0.05	8.79	0.7440
Once a week	0.31	0.02	4.78	0.4020
Rarely	0.20	0.01	2.93	0.2410
Mode of conveyance to the school				
Walking	Ref.			
Cycling	0.87	0.36	2.11	0.7550
Bus	0.33	0.12	0.90	0.0310*
Private Vehicles	0.11	0.03	0.50	0.0040*
Two-Wheeler	2.23	0.84	5.96	0.1080
Others	2.52	0.66	9.63	0.1770

No of hours - watching TV daily				
Nil	Ref.			
1/2hr	0.17	0.04	0.65	0.0090*
1hr	0.12	0.04	0.42	0.0010*
2hrs	0.41	0.15	1.13	0.0850
>2hrs	0.28	0.08	0.98	0.0460*
Habit of eating food while watching food				
No	Ref.			
Yes	9.70	2.96	31.74	0.0001*
No of hours spent with computer everyday				
Nil	Ref.			
1/2hr	0.67	0.21	2.10	0.4910
1hr	1.06	0.44	2.57	0.9000
2hrs	0.26	0.09	0.78	0.0160*
>2hrs	0.35	0.11	1.07	0.0660
No of hours spent with mobile everyday				
Nil	Ref.			
1/2hr	2.63	0.82	8.47	0.1050
1hr	4.96	1.67	14.73	0.0040*
2hrs	0.48	0.14	1.57	0.2220
>2hrs	1.37	0.40	4.72	0.6190
No of hours spent in sleep				
7hrs	Ref.			
8hrs	0.34	0.16	0.73	0.0060*
9hrs	0.71	0.28	1.77	0.4580

- Table 16 reports that, among the study participants in physical activities running (once a week and rarely), walking (daily and alternatively), skipping (once a week and alternatively), mode of conveyance to the school (bus and private vehicle), number of hours watching TV (1/2 hour, 1hour and >2 hours), habit of watching TV while having food, number of hours spent with computer every day (2 hours), number of hours spent with mobile everyday(1 hour), number of hours spent in sleep everyday (8 hours) showed statistically significant or associated with overweight and obesity. (p value <0.05)

Section IV(c): Multiple logistic regression analysis of prevalence of obesity by Food-stuffs consumed by child

Table 17: Multiple logistic regression analysis of prevalence of obesity by Food-stuffs consumed by child (n=1050)

Food-stuffs consumed by child	Adjusted OR	95% CI for OR		p-value
		Lower	Upper	
Cereals				
Everyday	0.62	0.26	1.46	0.2730
2-3 times a week	0.43	0.22	0.81	0.0100*
Occasionally	Ref.			
Pulses				
Everyday	0.23	0.10	0.56	0.0010*
2-3 times a week	0.47	0.24	0.95	0.0350*
Occasionally	Ref.			
Fried foods				
Everyday	0.09	0.05	0.19	0.0001*
2-3 times a week	0.04	0.02	0.08	0.0001*
Occasionally	Ref.			
Vegetables				
Everyday	1.02	0.46	2.28	0.9600
2-3 times a week	0.33	0.14	0.79	0.0130*
Occasionally	Ref.			
Non- veg				
Everyday	1.98	0.75	5.23	0.1680
2-3 times a week	1.73	0.61	4.89	0.2990
Occasionally	Ref.			
Fruits				
Everyday	18.22	6.76	49.13	0.0001*
2-3 times a week	6.87	3.20	14.74	0.0001*
Occasionally	Ref.			

Bakery items				
Everyday	1.35	0.57	3.18	0.5000
2-3 times a week	1.89	0.76	4.68	0.1700
Occasionally	Ref.			
Sweets				
Everyday	7.33	2.29	23.47	0.0010
2-3 times a week	3.06	1.12	8.41	0.0300
Occasionally	Ref.			
Ice cream				
Everyday	0.08	0.03	0.22	0.0001*
2-3 times a week	1.12	0.49	2.52	0.7930
Occasionally	Ref.			
Fast foods				
Everyday	0.42	0.16	1.08	0.0730
2-3 times a week	0.32	0.13	0.78	0.0120*
Occasionally	Ref.			
Beverages				
No	0.31	0.03	3.22	0.3260
Everyday	0.24	0.11	0.51	0.0001*
2-3 times a week	1.81	0.82	3.99	0.1400
Occasionally	Ref.			
Eating outside food				
1-3 times a week	0.94	0.39	2.31	0.9000
> 3 times a week	1.17	0.45	3.07	0.7510
Once in a month	0.43	0.18	1.02	0.0500*
Occasionally	Ref.			

- Table 17 shows that, among the study respondents in food stuffs consumed by the child cereals (2-3 times a week), pulses, fried foods, vegetables (2-3 times a week), fruits, sweets, ice cream, fast food (2-3 times a week), beverages (everyday), eating outside food showed statistically significant or associated with overweight and obesity. (p value <0.05)

Section IV(d): Logistic regression analysis of overweight/obesity with consequences in study population

Table 18: Logistic regression analysis of overweight/obesity with consequences in study population (n=1050)

Factor	Odds ratio	95 % CI of odds ratio	P value
Systolic blood pressure	1.092	1.053-1.133	<0.001
Diastolic blood pressure	1.238	1.138-1.347	<0.001
Lat year aggregate marks (%)	0.939	0.881-1.00	<0.001

- Table 18 shows the regression analysis of overweight and obesity with consequences factor. Systolic blood pressure, diastolic blood pressure and academic performance shows statistically significant or associated with overweight and obesity. (p value <0.05)

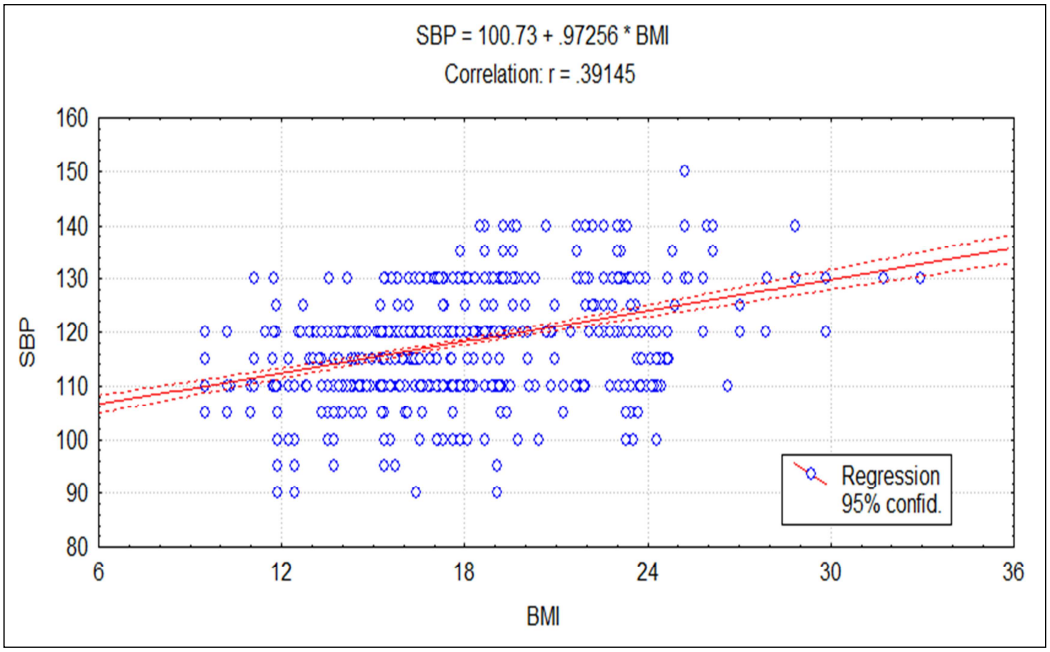
Section V: Correlation between BMI with SBP, DBP and academic performance by Karl Pearson's correlation coefficient

Table 19: Correlation between BMI with SBP, DBP and academic performance by Karl Pearson's correlation coefficient (n=1050)

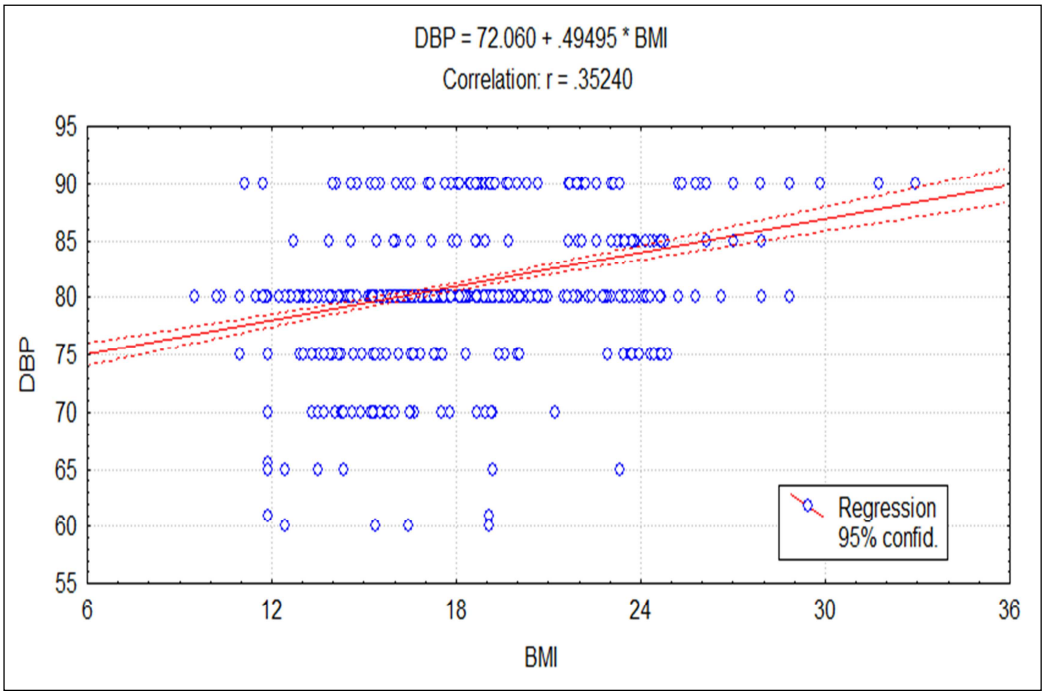
Variables	Correlation between BMI with		
	Correlation coefficient r-value	t-value	p-value
SBP	0.3914	13.5058	0.0001*
DBP	0.3524	11.9551	0.0001*
Academic performance	-0.1534	-4.9279	0.0001*

*p<0.05 indicates significant correlation

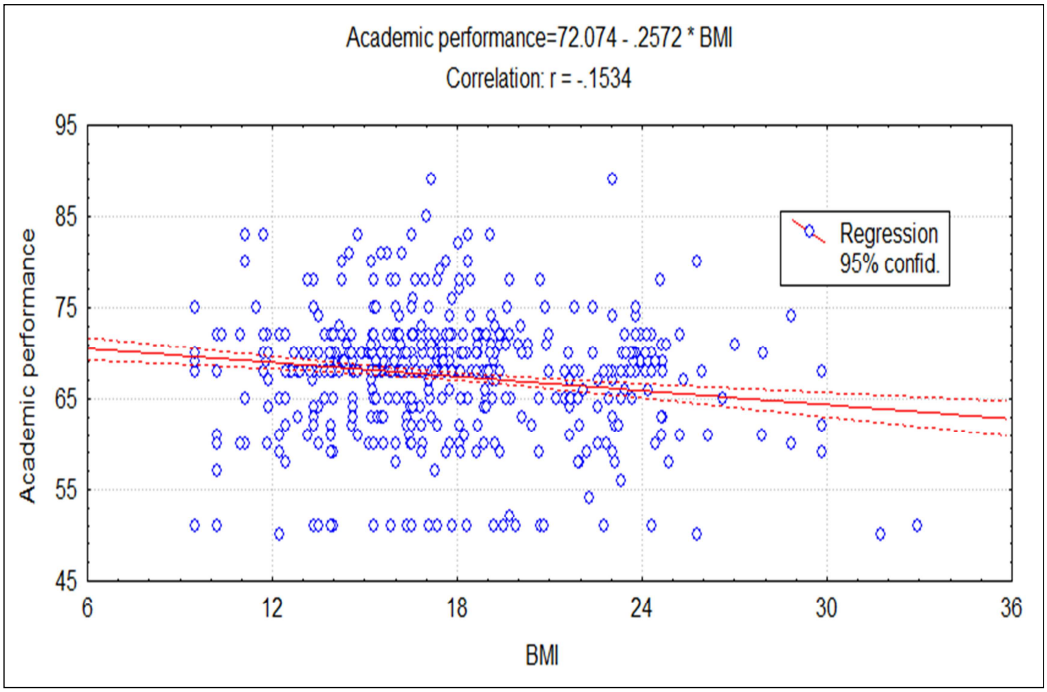
- Table 19 shows that there is positive and moderate correlation between SBP and DBP with BMI and negative weak correlation between Academic performance



Graphs 2: Scatter diagram showing the correlation between BMI and SBP



Graphs 3: Scatter diagram showing the correlation between BMI and DBP



Graphs 4: Scatter diagram showing the correlation between BMI and academic performance

CHAPTER V

DISCUSSION

This chapter presents the major findings of the study, discussion, conclusions, and suggestions in brief. Discussions are either supported or contested by the literature or critical analysis.[86] Findings of the study were discussed under the following headings

1. Findings related to descriptive analysis of demographic variables and determinant factors in study population
2. Findings related to Association between demographic variables, determinant factors and consequences with BMI
3. Prevalence of Overweight and Obesity among Adolescent students

Findings related to descriptive analysis of demographic variables and determinant factors in study population

Demographic variables

The present study findings demonstrates that 54.00% of them were male, 46.00% of them were female, Maximum students 21.05% were studying in 10th standard, 60.00% of them belongs to nuclear family and 40.00% of them belongs to Joint family. A similar study conducted by Seema S et al[87] revealed that 55.00% were male and 44.00% were female. 71.7% were belonged to nuclear family. Another similar research done by Goyal K et al[88] showed that among 5664 students 57% of them were boys and 43% were girls.

Physical activities

Present study revealed that Maximum 59.05%students were involved in running alternatively, whereas 4.29% were involved rarely. Majority (46.38%) participants didn't involve in walking. Maximum 42.10% of respondents involved in skipping alternative days. Majority 28.95% of students involved in the outdoor games once in a week. A similar study done by Seema S et al[87] showed that majority of the students involved in physical activities sometimes.

In this study 13.90% of them were going to school by walk, 36.77% them were going to school by Bus, 19.23% of them were going to school by Two-Wheeler and 15.90% of them were going by private vehicles. A contradictory result seen in the study conducted by Sinha KV et al[89] where maximum (45.3%) students' mode of transport to the school was bicycle.

Current study results related to number of hours watching TV per day depicts that maximum (35.7%) participants were involved in watching TV for 1 to 2 hours, a similar result showed in the research done by Sinha KV et al.[89] Another similar study done by Bhattacharya PK et al[90] revealed that maximum 42% of students involved in watching TV for 2 hours.

Present study demonstrates that majority of the students 27.9% spend half an hour time with the mobile every day. A related study conducted by Mekonnen T et al[91] showed that 77.6% students spent their half an hour to one hour time with mobile every day.

Dietary practices

In present study 43.05% of them consume Bakery Items every day, 39.05% of them eat Sweets every day, 42.57% of them eat ice cream 2-3 times a week, 60.29% of them have fast food 2-3 times a week, 62.29% of them drink beverages Occasionally. A similar study carried out by Karki A et al[92] demonstrates that 47.1% of samples consumes hot chips, fries 1-2 times per week and 41.7% of them eat snacks, sweets, chocolate, ice cream 1-2 times per week. Maximum 83.1% students drink soft drinks which was contradictory result to present. Amit Kumar N et al[93] mentioned in their study that maximum 88.3% of students were non-vegetarian which was similar to our study findings.

Findings related to Association between demographic variables, determinant factors and consequences with BMI

Association of demographic variables with obesity

In the present study it showed that gender across BMI was not statistically significant, a similar study done by Verma KC et al[94] reported no significant association of obesity with gender.

In accordance of findings with this study, parents' education showed significant association with obesity, a contradictory result seen in the research conducted by Verma KC et al[94] where there was no significant association of obesity with education of subjects.

A study by Nagaraj S et al[95] reported that Family income was statistically significant with obesity this result was similar to our findings.

Our study found family history of obese was statistically associated with obesity and not significant association with diabetes. Likewise, a study among adolescent in Bengaluru by Pedapudi AD et al[96] reported that students who reported a history of obesity in their family more likely to be obese as compared with other students who didn't show the history and not statistically associated with the family history of diabetes and hypertension

Association of Physical activity with obesity

In the study population, the difference in proportion of physical activity (Running / Jogging, Walking, Swimming, Skipping, Outdoor Games) across BMI was statistically significant with obesity similar to a study done by Ameer SR et al[97] revealed that physical exercise was statistically significant associated with obesity. Students who physically inactive were prone to be obese than who were physically active.

Significant association was found with mode of conveyance to the school in our study which was observed in the research done by Seema S et al[87] where mode of transport to school was associated with obesity.

In study population, the difference in proportion of those who watching TV (Half-an hour, one hour, two hours) across BMI was statistically significant and the difference in proportion of those who watching TV for >2 hours across BMI was not statistically significant. A similar study done by Gayatri D et al[98] showed that obesity is mainly seen in the students who spend more time in watching TV.

A study done by Jain B et al[99] depicts that eating junk in-between meal had significantly association with obesity which showed a comparable result with our study

A study by Samuel IB et al[100] showed that there was no statistically significant difference between handset use time with obesity which was contrast to our study findings where our study findings showed statistical association with obesity

Association of Dietary practices with obesity

A study done by Nair GLR et al[101] revealed that no significant association was obtained related to consumption of bakery items with obesity which was contrast our study findings.

There was no statistically significant association was found regarding consumption of non-veg in our research this result was supported by the study conducted by Ameer SR et al. [97] On the contrary study conducted by Banjade B et al[102] revealed there was statistically significant association was found with obesity

Consumption of fast food was statistically associated with obesity in our study. Supportive results were observed in study done by Banjade B et al[102]

The present study demonstrates that eating ice cream was significant association with obesity among adolescents. The result was supported with study by Ramulu PR et al[103] were eating ice cream outside at weekend showed positively associated.

The present study demonstrates that consuming sweets, carbonated drinks were significant association with obesity among adolescents. The result was

supported with study by Jain B et al[99] showed that those who were consuming chocolates, sweets and carbonated drinks were significantly obese

In study population, the difference in proportion of frequency of eating food outside across BMI was statistically significant in the present study. The result was supported with study done by Kumari DJ et al[104] were eating at fast food restaurant was statistically significant with obesity.

Association of Blood pressure with obesity

The present study revealed that the mean difference of systolic blood pressure and diastolic blood pressure across BMI was statistically significant. (P value <0.001). A similar study conducted by Bardol RV et al[105] showed that prevalence of hypertension was found to be more significant in overweight children as compared with normal children. Another study done by Zhao W et al[106] revealed Blood pressure was significant association with obesity.

A study carried out by Dulskiene V et al[107] presented that significant association was found between obesity and prehypertension and hypertension, this result was supported with our findings.

In the present study mean difference of systolic blood pressure and diastolic blood pressure with BMI was statistically significant. Similar findings were found in study done by Mohan B et al[108] revealed that hypertension was positively associated with obesity.

Association of academic performance with obesity

In the present study the mean difference of last year aggregate across BMI was statistically significant. A similar study by Salzar Rendon JC et al[109] revealed that Obesity is associated with lower school achievement in girls but not in boys.

A contrast result was seen in the study done by Alswat KA et al[110] revealed that there was no correlation between the BMI and school performance

Prevalence of Overweight and Obesity among Adolescent students

The current study showed that prevalence of overweight and obesity among adolescents was 8.57% and 4.38% respectively. Vishnu PR et al[111] reported a similar overall prevalence (14%) among adolescents. Another similar study by Goyal et al[112] observed overall prevalence (12%) of obesity among adolescents. A study bone by Kotian MS et al[113] among adolescent students revealed that prevalence of combined overweight and obesity was 14%. Other research studies conducted in India revealed a greater prevalence of overweight and obesity.[89,113]

CHAPTER VI

CONCLUSION

Despite the fact that undernutrition remains a key factor to childhood morbidity and death throughout the developing world, rates of youth overweight and obesity have been steadily increasing over the last 2-3 decades. Childhood obesity has emerged as a major global health issue that is unevenly distributed across and within areas. Over the last three decades, the severity and prevalence of pediatric obesity have increased considerably. Obesity is no longer just an issue in high-income countries, it is rapidly spreading to low and low-middle-income countries, particularly in metropolitan areas.

In the present study it was observed that the prevalence of overweight and obesity was 8.57% and 4.38% respectively among adolescents. The major contributing factors Family history of Hypertension, Family history of obese, students' physical activity, mode of transport to school, no of hours spent in watching TV every day, no of hours spent with mobile every day, habit of eating food while watching Tv, eating snacks between meals, dietary habits like consuming bakery items, sweets, fast food, fired food more than 2-3 times in a week. Gender, and consumption of beverages were found not a risk factors for the development of obesity among adolescents. Blood pressure and academic performance showed positive correlation with obesity.

Therefore, our research findings suggest to fight this expanding hazard to adolescent health in India, there is an urgent need for comprehensive public health

interventions such as growth monitoring, nutrition education, and the promotion of physical education and exercise programs in schools and communities.

Parents can help by providing healthy meals and snacks, daily physical activity, and nutrition education can all assist to avoid adolescent obesity. Healthy meals and snacks nourish growing bodies while also modelling healthy eating habits and attitudes.

Because children spend the majority of their active hours in schools, schools must provide ample healthy food and drink, as well as healthy and wholesome snacks, and the setting must be favorable to sufficient physical exercise.

Nursing implications

The findings of present study have implications in the field of nursing education, nursing practice, nursing administration and nursing research

a. Nursing education

- Students should be trained on the management and prevention of obesity in children and adolescents using the findings of this study
- Adolescents, parents, and instructors can access a variety of instructional materials and newsletters.
- Organize various conference, workshop on management and prevention of childhood obesity
- The curriculum should prioritize health education and place a greater emphasis on educating the public about obesity management and prevention in teenagers.

b. Nursing practice

- Health education can be imparted in the hospital through various methods like lectures, pamphlets, information booklet, self-instruction module etc
- It is the role of nursing personnel to identify concerns in patients and offer the appropriate treatment to resolve obesity-related disorders.
- Community based awareness and many campaigns have to conduct to prevent the obesity

c. Nursing administration

- Periodical arrangement of in-service education program, continuing education programs for the staff nurses regarding the management and preventive measures of obesity
- Protocol should be made in the adolescent clinic regarding the management and preventive measures of obesity

d. Nursing research

- Findings of current study will help to conduct another teaching program using some teaching programs regarding the management and preventive measures of obesity
- Research explains new technologies and assessments to initiate different measures to help adolescents and their families to prevent obesity

CHAPTER VII

SUMMARY

A cross sectional research was undertaken on determinants and consequences of obesity among adolescents in Belagavi city

Objectives

Primary objectives

1. To study the determinants of obesity among adolescents in the age group of 10-16 years

2. To study the consequences of obesity among adolescents in the age group of 10-16 years

Secondary objectives

1. To find out the prevalence of overweight and obesity among adolescents

Materials and Methods

Ethical Clearance was obtained from KLE University Ethics Committee on Human Subjects. A cross-sectional study was conducted among 1050 schoolchildren from different schools in Belagavi. Adolescent students aged 10–16 years from 5th to 10th standard studying were selected from government and private schools of Belagavi city. Stratified cluster sampling was used to select the samples. The randomly selected students were instructed to gather in a separate room and were

briefed about the study. Assent was obtained from the students, and consent papers were handed to them for their parents to sign.

Data were collected by administering the predesigned, prevalidated, and pretested questionnaire. After filling out the questionnaire, height and weight were measured. Body mass index (BMI) was then calculated using the formula BMI = weight (kg)/height(m2) and BMI classification was done based on the WHO/International Obesity Task Force for Asia and India standard of obesity.

Logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. The odds ratio with 95% CI was presented. $P < 0.05$ was considered an association between an outcome variable and an explanatory variable. Data was analyzed using the statistical software Core System Users Guide SPSS Inc 2014(IBM SPSS Version 22).

Distribution of respondents according to demographic profile

- Among the study population, 54.00% of them were male, 46.00% of them were female.
- Maximum students 21.05% were studying in tenth standard, whereas minimum students were from 8^{th} standard
- Among the study population, 60.00% of them belongs to nuclear family and 40.00% of them belongs to Joint family.
- 28.57% of students had family history of obese person.
- Among the study population with fathers' education, 41.24% of them were Pre-university, 26.57% of them were Secondary, 20.67% of them were Graduate and with mothers' education, 40.76% of them were Pre-university,

25.24% of them were Secondary, 18.86% of them were Primary, 12.10% of them were Graduate.

- Among the study population 20.57% of them had family history of diabetes and 14.95% % of them had family history of hypertension.

Distribution of study participants according to physical activity

- Maximum (59.05%) students were involved in running alternatively, whereas 4.29% were involved rarely. Majority 46.38% participants didn't involve in walking. Maximum 42.10% of respondents involved in skipping alternative days. Majority 28.95% of students involved in the outdoor games once in a week
- Among the study population, 13.90% of them were going to school by walk, 36.77% them were going to school by Bus, 19.23% of them were going to school by Two-Wheeler and 15.90% of them were going by private vehicles.
- Among the study subjects with Number of hours watching TV, 35.7% of them watching for 2 hours, 25.2% of them watching for 2 hours, of them watching for 2 hours, of them watching for 2 hours
- Majority of the students 27.9% spend half an hour time with the mobile every day
- 68.48% of them had habit of eating food while watching TV

Distribution of study samples according to dietary practices

- In study population with food stuffs consumed by children, in terms of pulses 56.38% of them having 2-3 times a week, 56.57% of them having fried fruits every day, 36.86% 56.57% of them having cereals 2-3 times a week, 55.05% of them having vegetables Occasionally, 37.05% of them having fruits 2-3

times a week, 43.05% of them having Bakery Items every day, 39.05% of them having Sweets every day, 42.57% of them having ice cream 2-3 times a week, 60.29% of them having fast food 2-3 times a week, 62.29% of them having beverages occasionally.

Distribution of study participants according to blood pressure

- 25.24% of study participants were categorized into pre hypertensive group and 0.29% of them were categorized into stage 1 hypertension group

Prevalence of Overweight and Obesity among Adolescent students

- Prevalence of overweight and obesity among adolescents were found to be 8.57% and 4.38% respectively

Association between demographic variables, determinant factors and consequences with BMI

- Age, class, education of father, education of mother, family monthly income, family history of Diabetes, family history of Hypertension and family history of obese shows statistically significant with overweight and obesity. (p value <0.05)
- Students' physical activity, mode of transport to school, no of hours spent in watching TV every day, no of hours spent with mobile every day, habit of eating food while watching Tv, eating snacks between meals, dietary habits (Bakery items, sweets, fast food, fired food, vegetables, fruits) shows statistically significant with overweight and obesity. (p value <0.05). Gender, involved in household activates and consumption of beverages shows not significant with BMI Category

- The mean difference of systolic and diastolic blood pressure across BMI were statistically significant. The mean difference of last year aggregate across BMI was statistically significant.

Logistic regression analysis of obesity with demographic profile, determinants and consequences among adolescents

- Among the study population in demographic variables age, gender, education of father (secondary and PUC education), family income, family history of diabetes and family history of obese showed statistically significant or associated with overweight and obesity. Among the study participants in physical activities running (once a week and rarely), walking (daily and alternatively), skipping (once a week and alternatively), mode of conveyance to the school (bus and private vehicle), number of hours watching TV (1/2 hour, 1hour and >2 hours), habit of watching TV while having food, number of hours spent with computer every day (2 hours), number of hours spent with mobile everyday(1 hour), number of hours spent in sleep everyday (8 hours) showed statistically significant or associated with overweight and obesity. Frequency of food-stuffs consumed by child cereals (2-3 times a week), pulses, fried foods, vegetables (2-3 times a week), fruits, sweets, ice cream, fast food (2-3 times a week), beverages (everyday), eating outside food showed statistically significant or associated with overweight and obesity. (p value <0.05)
- Systolic and diastolic blood pressure, and last year aggregate marks showed statistically significant or associated with overweight and obesity. (p value <0.05)

CHAPTER VIII

RECOMMENDATIONS

- A similar study can be conduct using longitudinal research design
- Prevalence and determinants of obesity study can be done in rural setting
- A comparative study can be done in the rural and urban population
- An intervention study can be conduct in the schools
- The questionnaire used in this study can be further validated and modified in similar studies.
- The identified factors should be taken into consideration in the development of obesity prevention strategies by policy-makers, mass-media, health professionals and teachers targeting more effectively on both Adolescents and their parents' needs.
- There is a pressing need for cost-effective school-based strategies and appropriate policy changes in developing countries like India to stem the rising tide of overweight and obesity among adolescents.
- To improve nutrition, schools can include healthier food offerings in the cafeteria and eliminate marketing of unhealthy foods. To improve activity, schools can develop safe walking and biking routes to school, and can promote active recess time.
- Parents and guardians should try to be good role models for their kids-eating healthfully, staying active, minimizing screen time, and living healthy lifestyles that Adolescents can internalize as they grow.
- Teachers also need to undergo a special training on the same topic

- Community awareness program need to be conducted alerting the need for their cooperation in preventing and minimizing obesity among school students.

LIMITATIONS

- The study is limited to 10 to 16 years among adolescents
- The study is limited only to government and private schools of Belagavi city
- The study is limited to the urban population.

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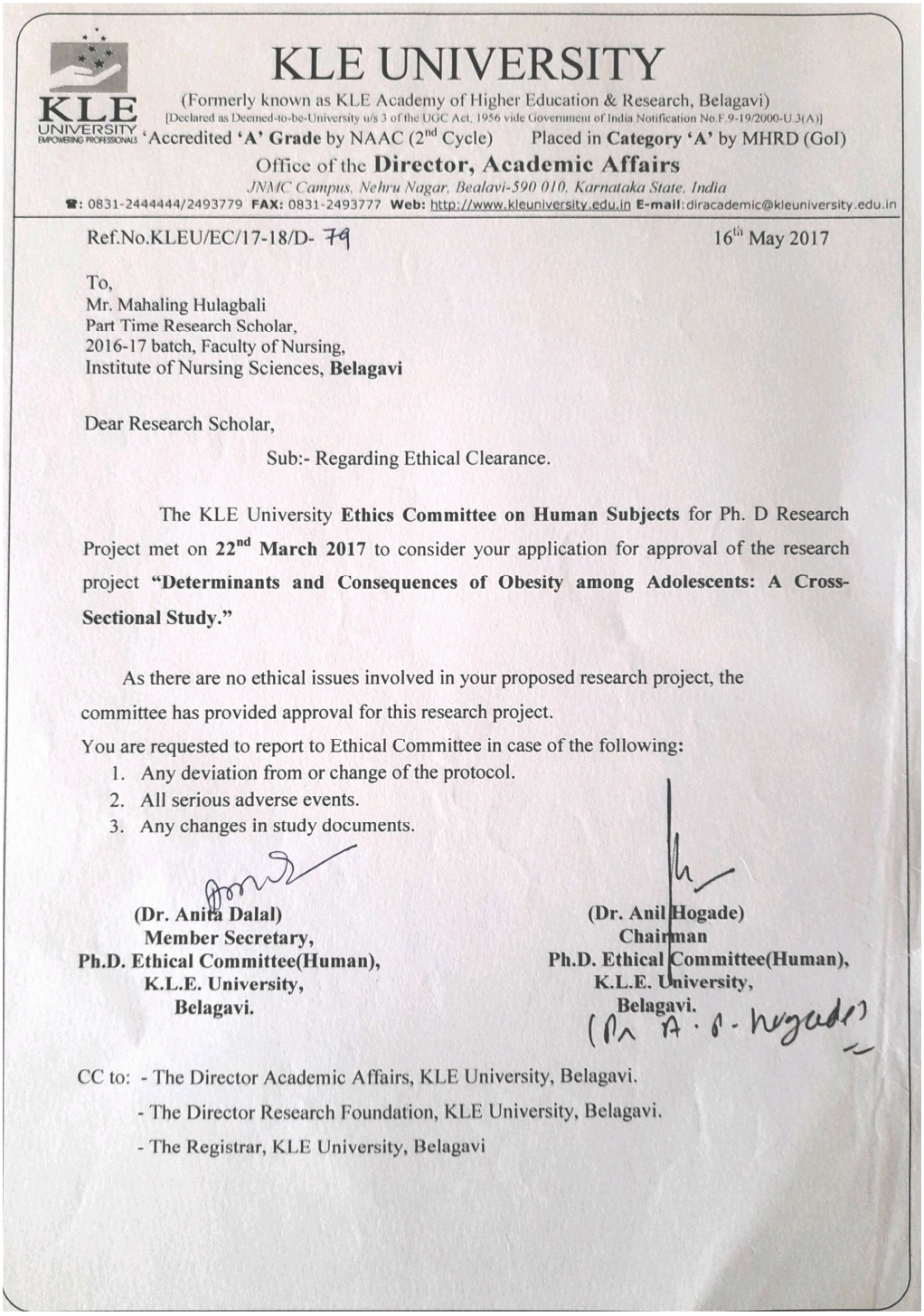
ANNEXURE I

ETHICAL CLEARANCE LETTER



KLE UNIVERSITY

(Formerly known as KLE Academy of Higher Education & Research, Belagavi)
[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India Notification No.F.9-19/2000-U.3(A)]
'Accredited **'A' Grade** by NAAC (2nd Cycle) Placed in **Category 'A'** by MHRD (GoI)

Office of the **Director, Academic Affairs**
JNMC Campus, Nehru Nagar, Belavi-590 010, Karnataka State, India
☎: 0831-2444444/2493779 **FAX:** 0831-2493777 **Web:** http://www.kleuniversity.edu.in **E-mail**:diracademic@kleuniversity.edu.in

Ref.No.KLEU/EC/17-18/D- 79 16th May 2017

To,
Mr. Mahaling Hulagbali
Part Time Research Scholar,
2016-17 batch, Faculty of Nursing,
Institute of Nursing Sciences, **Belagavi**

Dear Research Scholar,

Sub:- Regarding Ethical Clearance.

The KLE University **Ethics Committee on Human Subjects** for Ph. D Research Project met on **22nd March 2017** to consider your application for approval of the research project **"Determinants and Consequences of Obesity among Adolescents: A Cross-Sectional Study."**

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),
K.L.E. University,
Belagavi.

(Dr. Anil Hogade)
Chairman
Ph.D. Ethical Committee(Human),
K.L.E. University,
Belagavi.

CC to: - The Director Academic Affairs, KLE University, Belagavi.
- The Director Research Foundation, KLE University, Belagavi.
- The Registrar, KLE University, Belagavi

ANNEXURE II

PERMISSION LETTER

From
Mr. Mahaling Hulagbali (Ph.D research scholar)
Asst. Professor Dept. of Pediatric Nursing
KAHER, Institute of Nursing Sciences
Nehru Nagar, Belagavi-590010

To
The DDPI Officer
Belagavi.

Through the principal

Sub: Permission to conduct Research study in primary & secondary schools of Belagavi city.

Respected sir

I undersigned Mr. Mahaling Hulagbali Ph.D Research Scholar in KLE Academy of Higher Education & Research Belagavi, would like to request you to permit me to conduct Research study titled **Determinants and Consequences of Obesity among Adolescents** in primary & secondary schools of Belagavi city.

Kindly permit me to conduct research for the same and do the needful.

Thanking you in anticipation

Date:
Place: Belagavi

Yours faithfully

(Mr. Mahaling Hulagbali)

KAHER INSTITUTE OF NURSING SCIENCES BELAGAVI

Dean & Principal
KAHER Institute of Nursing Sciences
Belagavi

ANNEXURE III

PERMISSION LETTER FROM DDPI OFFICER

ಜಿಲ್ಲಾ ಪಂಚಾಯತ, ಬೆಳಗಾವಿ.

ಉಪನಿರ್ದೇಶಕರ ಕಾರ್ಯಾಲಯ, ಸಾರ್ವಜನಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ, ಬೆಳಗಾವಿ(ದ).

ಸಂಖ್ಯೆ: ಇ9/ಕೆ.ಎಲ್.ಇ/ರಿಸರ್ಚ/1735/2017-18 1547 ದಿನಾಂಕ: 08-01-2018

To,
Mr.Mahaling Hulagbali (Ph.D research sgholar)
Asst. Professor Dept. Of Pediatric Nursing
KAHER, Institute of Nursing Sciences
Nehru Nagar, Belagavi-590010

ವಿಷಯ: ಬೆಳಗಾವಿ ನಗರದಲ್ಲಿ ಶಾಲೆಗಳಲ್ಲಿ ರಿಸರ್ಚ ಮಾಡುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: ತಮ್ಮ ಕಛೇರಿಯ ಪತ್ರ ದಿನಾಂಕ:16-12-2017.

****

ಮೇಲಿನ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ Mr.Mahaling Hulagbali (Ph.D research sgholar) ಕೆ.ಎಲ್.ಇ ಅಕ್ಯಾಡಮಿ ಆಫ್ ಹ್ಯೆಯರ್ ಎಜ್ಯುಕೇಶನ್ & ರಿಸರ್ಚ ಬೆಳಗಾವಿ ನಗರದಲ್ಲಿನ ಶಾಲೆಗಳಲ್ಲಿ Determinants And Consequences of Obesity of among Adolescents ರಿಸರ್ಚ ಮಾಡುವ ಕುರಿತು ಶಾಲೆಗೆ ಬೋಧನೆಗೆ ತೊಂದರೆಯಾಗದಂತೆ ಅಧ್ಯಯನ ಕೈಗೊಳ್ಳಲು ಅನುಮತಿಸಿದೆ.

ಉಪನಿರ್ದೇಶಕರು(ಆಡಳಿತ),
ಸಾರ್ವಜನಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ,
ಬೆಳಗಾವಿ(ದ).

ANNEXURE IV

INFORMED CONSENT FORM AND CHILD ASSENT

Informed Consent Form for Parents of Adolescents Participating In the Research Titled "Determinants and Consequences of Obesity among Adolescents – A Cross Sectional Study"

Research Scholar: Mr. Mahaling Hulagbali

Supervisor: Prof (Dr.) Sangeeta Kharde

Introduction:

We are requesting you to agree to participate your child in the study entitled Determinants and consequences of obesity among adolescents conducted by Mahaling Hulagbali, Ph.D Research scholar at KLE University Belagavi, under the guidance of Dr. Sngeeta Kharde, Professor and HOD, dept. of Obstetrics and gynaecology nursing, KLE Institute of Nursing Sciences, Belagavi

Explanation of the procedure:

In this study your child will have to answer some prepared questions about general health information, socio- demographic details and then your child height, weight and blood pressure will be recorded. Child will be continued to fill out the questionnaires regarding dietary practices, physical activities, mode of transport to the school, sleeping pattern and academic performance in the school. This entire procedure will take 20-30 minutes.

Possible Benefits:

There will be no immediate and direct benefit to your child, but your child's participation is likely to help in studying the determining factors and effects of obesity among adolescents and this type of study will help in developing the intervention programs for school children which will eventually help in reducing and prevention of Diabetes, hypertension and many more obesity related diseases

Possible Risks:

The tools employed for conducting the study is safe and as such are not likely to cause any harm to your child

Confidentiality:

Your child's identity will not be revealed and all the information will be collected coded so that no one will know your identity.

Withdrawal:

Participation in study is voluntary. If you don't wish that your child should participate in the study you can refuse, which will not impact the child in relation to school matters.

Cost of participation:

The cost of the study will be borne by the researcher. There will be no additional cost to your child for participating in this study.

Payment of participation:

There will be no incentives to your child for participating this study.

CHILD ASSENT

In this research study you will have to answer some prepared questions related to your social, demographical aspects, reasons and effects of obesity. The time taken to answer these questions will be 20 to 30 minutes. It is your choice that you can stop participating in the study at any time.

Questions: If you have any questions related to this study you can contact:

Mr.Mahaling Hulagbali
Ph.D Research scholar,
KLEU's Institute of Nursing Sciences,
Nehru Nagar, Belagavi-590010
Mobile No – 9986226960
Email id- mahalingmh@gmail.com

OR

Prof (Dr.) Sangeeta Kharde
HOD, Dept. of OBG Nursing
KLEU's Institute of Nursing Sciences,
Nehru Nagar, Belagavi-590010
Mobile No – 9481322656

Legal rights:

By signing this consent form you are not waiving any of your legal rights.

Publication rights:

The results of the study will be used for publication however the identity of the participants will be kept confidential.

CONSENT STATEMENT

I have read the information or it has been read to me in the languages I can understand. I have had the opportunity to ask any questions at any time. I consent voluntarily for my child to participate in the study.

1. Name of the parent ----------

   Signature/ thumb impression of the parent ----------

   Date: Place:

2. Signature of the investigator (Person obtaining consent) ----------

   Name: ----------

   Date: Place:

3. Signature of the witness: ----------

   Name: ----------

   Date: Place:

INFORMED CONSENT FORM AND CHILD ASSENT

ಸಂಶೋಧನೆಯಲ್ಲಿ ಭಾಗವಹಿಸುವ ಹದಿಹರೆಯದವರ ಪೋಷಕರಿಗೆ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಸಮ್ಮತಿ ನಮೂನೆ "ಹದಿಹರೆಯದವರಲ್ಲಿ ಸ್ಥೂಲಕಾಯತೆಯ ನಿರ್ಧಾರಕಗಳು ಮತ್ತು ಪರಿಣಾಮಗಳು - ಒಂದು ಅಡ್ಡ ವಿಭಾಗದ ಅಧ್ಯಯನ"
ಸಂಶೋಧನಾ ವಿದ್ಯಾರ್ಥಿನಿ: ಶ್ರೀ ಮಹಾಲಿಂಗ ಹುಲಗಬಾಳಿ
ಮೇಲ್ವಿಚಾರಕರು: ಪ್ರೊ (ಡಾ.) ಸಂಗೀತಾ ಖರ್ಡೆ

<u>ಪರಿಚಯ:</u>

ಕೆಎಲ್ಇ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಬೆಳಗಾವಿಯಲ್ಲಿ ಪಿಎಚ್ಡಿ ಸಂಶೋಧನಾ ವಿದ್ಯಾರ್ಥಿನಿ ಮಹಾಲಿಂಗ್ ಹುಲಗಬಾಳಿ ಅವರು ನಡೆಸಿದ ಡಿಟರ್ಮಿನಂಟ್‌ಗಳು ಮತ್ತು ಹದಿಹರೆಯದವರಲ್ಲಿ ಸ್ಥೂಲಕಾಯತೆಯ ಪರಿಣಾಮಗಳು ಎಂಬ ಶೀರ್ಷಿಕೆಯ ಅಧ್ಯಯನದಲ್ಲಿ ಡಾ. ಸಂಗೀತಾ ಖರ್ಡೆ, ಪ್ರಾಧ್ಯಾಪಕಿ ಮತ್ತು ಎಚ್ಒಡಿ ಅವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ನಿಮ್ಮ ಮಗುವನ್ನು ಭಾಗವಹಿಸಲು ನಾವು ನಿಮ್ಮನ್ನು ವಿನಂತಿಸುತ್ತಿದ್ದೇವೆ. . ಪ್ರಸೂತಿ ಮತ್ತು ಸ್ತ್ರೀರೋಗ ಶುಶ್ರೂಷೆ, KLE ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ನರ್ಸಿಂಗ್ ಸೈನ್ಸಸ್, ಬೆಳಗಾವಿ

<u>ಕಾರ್ಯವಿಧಾನದ ವಿವರಣೆ:</u>

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಮಗುವು ಸಾಮಾನ್ಯ ಆರೋಗ್ಯ ಮಾಹಿತಿ, ಸಾಮಾಜಿಕ-ಜನಸಂಖ್ಯಾ ವಿವರಗಳ ಕುರಿತು ಕೆಲವು ಸಿದ್ಧಪಡಿಸಿದ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಬೇಕಾಗುತ್ತದೆ ಮತ್ತು ನಂತರ ನಿಮ್ಮ ಮಗುವಿನ ಎತ್ತರ, ತೂಕ ಮತ್ತು ರಕ್ತದೊತ್ತಡವನ್ನು ದಾಖಲಿಸಲಾಗುತ್ತದೆ. ಆಹಾರದ ಅಭ್ಯಾಸಗಳು, ದೈಹಿಕ ಚಟುವಟಿಕೆಗಳು, ಶಾಲೆಗೆ ಸಾರಿಗೆ ವಿಧಾನ, ಮಲಗುವ ಮಾದರಿ ಮತ್ತು ಶಾಲೆಯಲ್ಲಿನ ಶೈಕ್ಷಣಿಕ ಕಾರ್ಯಕ್ಷಮತೆಯ ಬಗ್ಗೆ ಪ್ರಶ್ನಾವಳಿಗಳನ್ನು ಭರ್ತಿ ಮಾಡುವುದನ್ನು ಮಗುವಿಗೆ ಮುಂದುವರಿಸಲಾಗುತ್ತದೆ. ಈ ಸಂಪೂರ್ಣ ವಿಧಾನವು 20-30 ನಿಮಿಷಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತದೆ.

ಸಂಭವನೀಯ ಪ್ರಯೋಜನಗಳು:

ನಿಮ್ಮ ಮಗುವಿಗೆ ಯಾವುದೇ ತಕ್ಷಣದ ಮತ್ತು ನೇರ ಪ್ರಯೋಜನವಾಗುವುದಿಲ್ಲ, ಆದರೆ ನಿಮ್ಮ ಮಗುವಿನ ಭಾಗವಹಿಸುವಿಕೆಯು ಹದಿಹರೆಯದವರಲ್ಲಿ ಸ್ಥೂಲಕಾಯತೆಯನ್ನು ನಿರ್ಧರಿಸುವ ಅಂಶಗಳು ಮತ್ತು ಪರಿಣಾಮಗಳನ್ನು ಅಧ್ಯಯನ ಮಾಡಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ ಮತ್ತು ಈ ರೀತಿಯ ಅಧ್ಯಯನವು ಶಾಲಾ ಮಕ್ಕಳಿಗೆ ಮಧ್ಯಸ್ಥಿಕೆ ಕಾರ್ಯಕ್ರಮಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಮಧುಮೇಹ, ಅಧಿಕ ರಕ್ತದೊತ್ತಡ ಮತ್ತು ಸ್ಥೂಲಕಾಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಅನೇಕ ಕಾಯಿಲೆಗಳನ್ನು ಕಡಿಮೆ ಮಾಡುವುದು ಮತ್ತು ತಡೆಗಟ್ಟುವಲ್ಲಿ

ಸಂಭವನೀಯ ಅಪಾಯಗಳು:

ಅಧ್ಯಯನವನ್ನು ನಡೆಸಲು ಬಳಸುವ ಉಪಕರಣಗಳು ಸುರಕ್ಷಿತವಾಗಿರುತ್ತವೆ ಮತ್ತು ನಿಮ್ಮ ಮಗುವಿಗೆ ಯಾವುದೇ ಹಾನಿ ಉಂಟುಮಾಡುವ ಸಾಧ್ಯತೆಯಿಲ್ಲ

ಗೌಪ್ಯತೆ:

ನಿಮ್ಮ ಮಗುವಿನ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ ಮತ್ತು ನಿಮ್ಮ ಗುರುತು ಯಾರಿಗೂ ತಿಳಿಯದಂತೆ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಕೋಡ್ ಮಾಡಲಾಗುತ್ತದೆ.

ಹಿಂತೆಗೆದುಕೊಳ್ಳುವಿಕೆ:

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆಯು ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ. ನಿಮ್ಮ ಮಗು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಬೇಕೆಂದು ನೀವು ಬಯಸದಿದ್ದರೆ ನೀವು ನಿರಾಕರಿಸಬಹುದು, ಇದು ಶಾಲೆಯ ವಿಷಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಮಗುವಿನ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರುವುದಿಲ್ಲ.

ಭಾಗವಹಿಸುವಿಕೆಯ ವೆಚ್ಚ:

ಅಧ್ಯಯನದ ವೆಚ್ಚವನ್ನು ಸಂಶೋಧಕರು ಭರಿಸುತ್ತಾರೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಿಮ್ಮ ಮಗುವಿಗೆ ಯಾವುದೇ ಹೆಚ್ಚುವರಿ ವೆಚ್ಚ ಇರುವುದಿಲ್ಲ.

ಭಾಗವಹಿಸುವಿಕೆಯ ಪಾವತಿ:

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಿಮ್ಮ ಮಗುವಿಗೆ ಯಾವುದೇ ಪ್ರೋತ್ಸಾಹ ಇರುವುದಿಲ್ಲ.

ಮಕ್ಕಳ ಒಪ್ಪಿಗೆ

ಈ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಸಾಮಾಜಿಕ, ಜನಸಂಖ್ಯಾ ಅಂಶಗಳು, ಕಾರಣಗಳು ಮತ್ತು ಸ್ಥೂಲಕಾಯದ ಪರಿಣಾಮಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಕೆಲವು ಸಿದ್ಧಪಡಿಸಿದ ಪ್ರಶ್ನೆಗಳಿಗೆ ನೀವು ಉತ್ತರಿಸಬೇಕಾಗುತ್ತದೆ. ಈ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಲು ತೆಗೆದುಕೊಳ್ಳುವ ಸಮಯ 20 ರಿಂದ 30 ನಿಮಿಷಗಳು. ನೀವು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದನ್ನು ನಿಲ್ಲಿಸಬಹುದು ಎಂಬುದು ನಿಮ್ಮ ಆಯ್ಕೆಯಾಗಿದೆ.

ಪ್ರಶ್ನೆಗಳು: ಈ ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳನ್ನು ಹೊಂದಿದ್ದರೆ ನೀವು ಸಂಪರ್ಕಿಸಬಹುದು:

ಶ್ರೀ.ಮಹಾಲಿಂಗ್ ಹುಲಗಬಳಿ

ಪಿಎಚ್‌ಡಿ ಸಂಶೋಧನಾ ವಿದ್ಯಾರ್ಥಿ,

KLEU ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ನರ್ಸಿಂಗ್ ಸೈನ್ಸಸ್,

ನೆಹರು ನಗರ, ಬೆಳಗಾವಿ-590010

ಮೊಬೈಲ್ ಸಂಖ್ಯೆ - 9986226960

ಇಮೇಲ್ ಐಡಿ- mahalingmh@gmail.com

ಅಥವಾ

ಪ್ರೊ (ಡಾ.) ಸಂಗೀತಾ ಖರ್ಡೆ

HOD, OBG ನರ್ಸಿಂಗ್ ವಿಭಾಗ

KLEU ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ನರ್ಸಿಂಗ್ ಸೈನ್ಸಸ್,

ನೆಹರು ನಗರ, ಬೆಳಗಾವಿ-590010

ಮೊಬೈಲ್ ಸಂಖ್ಯೆ - 9481322656

ಕಾನೂನು ಹಕ್ಕುಗಳು:

ಈ ಸಮ್ಮತಿಯ ನಮೂನೆಗೆ ಸಹಿ ಮಾಡುವ ಮೂಲಕ ನಿಮ್ಮ ಯಾವುದೇ ಕಾನೂನು ಹಕ್ಕುಗಳನ್ನು ನೀವು ಬಿಟ್ಟುಕೊಡುವುದಿಲ್ಲ.

ಪ್ರಕಟಣೆಯ ಹಕ್ಕುಗಳು:

ಅಧ್ಯಯನದ ಫಲಿತಾಂಶಗಳನ್ನು ಪ್ರಕಟಣೆಗಾಗಿ ಬಳಸಲಾಗುತ್ತದೆ ಆದರೆ ಭಾಗವಹಿಸುವವರ ಗುರುತನ್ನು ಗೌಪ್ಯವಾಗಿ ಇರಿಸಲಾಗುತ್ತದೆ.

ಸಮ್ಮತಿ ಹೇಳಿಕೆ

ನಾನು ಮಾಹಿತಿಯನ್ನು ಓದಿದ್ದೇನೆ ಅಥವಾ ನನಗೆ ಅರ್ಥವಾಗುವ ಭಾಷೆಗಳಲ್ಲಿ ಅದನ್ನು ನನಗೆ ಓದಲಾಗಿದೆ. ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ. ನನ್ನ ಮಗು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಸಮ್ಮತಿಸುತ್ತೇನೆ.

1. ಪೋಷಕರ ಹೆಸರು ----------

ಪೋಷಕರ ಸಹಿ/ಹೆಬ್ಬೆರಳಿನ ಗುರುತು ----------

ದಿನಾಂಕ: ಸ್ಥಳ:

2. ತನಿಖಾಧಿಕಾರಿಯ ಸಹಿ (ಸಮ್ಮತಿಯನ್ನು ಪಡೆಯುವ ವ್ಯಕ್ತಿ) ----------

ಹೆಸರು :----------

ದಿನಾಂಕ: ಸ್ಥಳ:

3. ಸಾಕ್ಷಿಯ ಸಹಿ: ----------

ಹೆಸರು :----------

ದಿನಾಂಕ: ಸ್ಥಳ:

ANNEXURE V

DATA COLLECTION PROFORMA

Study title: Determinants and consequences of obesity among adolescents- A cross sectional study

Investigator: Mr. Mahaling Hulagbali

(Note: All the personal information provided during the study will be kept confidential)

I. IDENTIFICATION DATA

1. Code No: _____
2. Age: _____
3. Gender: _____
4. Class studying at present: _____

II. FAMILY HISTORY

1. Occupation: Father _____

   Mother _____

2. Literacy :

   Status: Illiterate/ Primary/ Secondary/ Pre university/Graduate/ Post Graduate

   Father_____

   Mother _____

3. Monthly Family income: _____Rs
4. Type of family: Nuclear/ Joint/ Extended
5. Family history of diabetes, hypertension. Yes/ No
6. Any obese person in your family: Yes/ No

III. PERSONAL HISTORY

1. Physical activities:

	D Daily	Al Alternatively	O Once a week	R Rarely	Ni Nil
R Running / Jogging					
W Walking					
S Swimming					
Sk Skipping					
O Outdoor games					

2. Mode of conveyance to the school : walking/ cycling/ bus/ private vehicles/ two wheeler/ others
3. Does the school have play ground: Yes/ No
4. How many physical education classes in a week:
5. No of hours spent in watching TV everyday:
6. Do you have habit of eating food while watching TV: Yes/ No
7. No of hours spent with computer everyday (Playing games/ chatting etc):
8. No of hours spent with mobile everyday:
9. Habits: smoking/ tobacco chewing/ alcohol consumption/ nil/ any others specify
10. No of hours spent in sleep:
11. Involve in household activities: Yes/ No

IV. DIET AND APPETITE HISTORY

1. How would you describe your appetite : Good/ Average/ Poor
2. Do you eat snacks between meals: Yes/ No
3. School provides lunch: Yes/ No

V. FOOD-STUFFS CONSUMED BY CHILD

	F FOOD-STUFFS	Everyday	2-3 times a week	Occasionally
1	Cereals Rice, idli, uppitetc			
2	Pulses Dal, soya, groundnut etc			
3	Fri Fried foods Puri,vada, kachorietc			
4	Vegetables			
5	Non- vegetarian Chicken, fish, meat, egg etc			
6	Fruits			
7	Bakery items Cake, pasterys, chocolates etc			
8	Sweets			
9	Ice cream			
10	Fast foods Pizza, burgers etc			
11	Beverages Tea, coffee, milk, soft drinks etc			

VI. How often do you eat outside(hotels/ restaurants): 1-3 times a week/ > 3 times a week/ once in a month/ occasionally/ nil

VII. ANTHROPOMETRY MEASURMENT

Height _____cm

Weight _____ kg

BODY MASS INDEX (BMI KG/M^2)

CONSEQUENCES

I. Blood Pressure: _____mm of Hg

II. Last year aggregate marks :

ANNEXURE VI

CERTIFICATES

NPTEL Online Certification

(Funded by the Ministry of HRD, Govt. of India)

This certificate is awarded to

MAHALING HULAGBALI

for successfully completing the course

Health Research Fundamentals

(NIE-ICMR e-Certificate course: NIeCer 101)

with a score of **65** %

Online Assignments	19/25	*Proctored Exam*	45.75/75

Total number of candidates certified: **593**

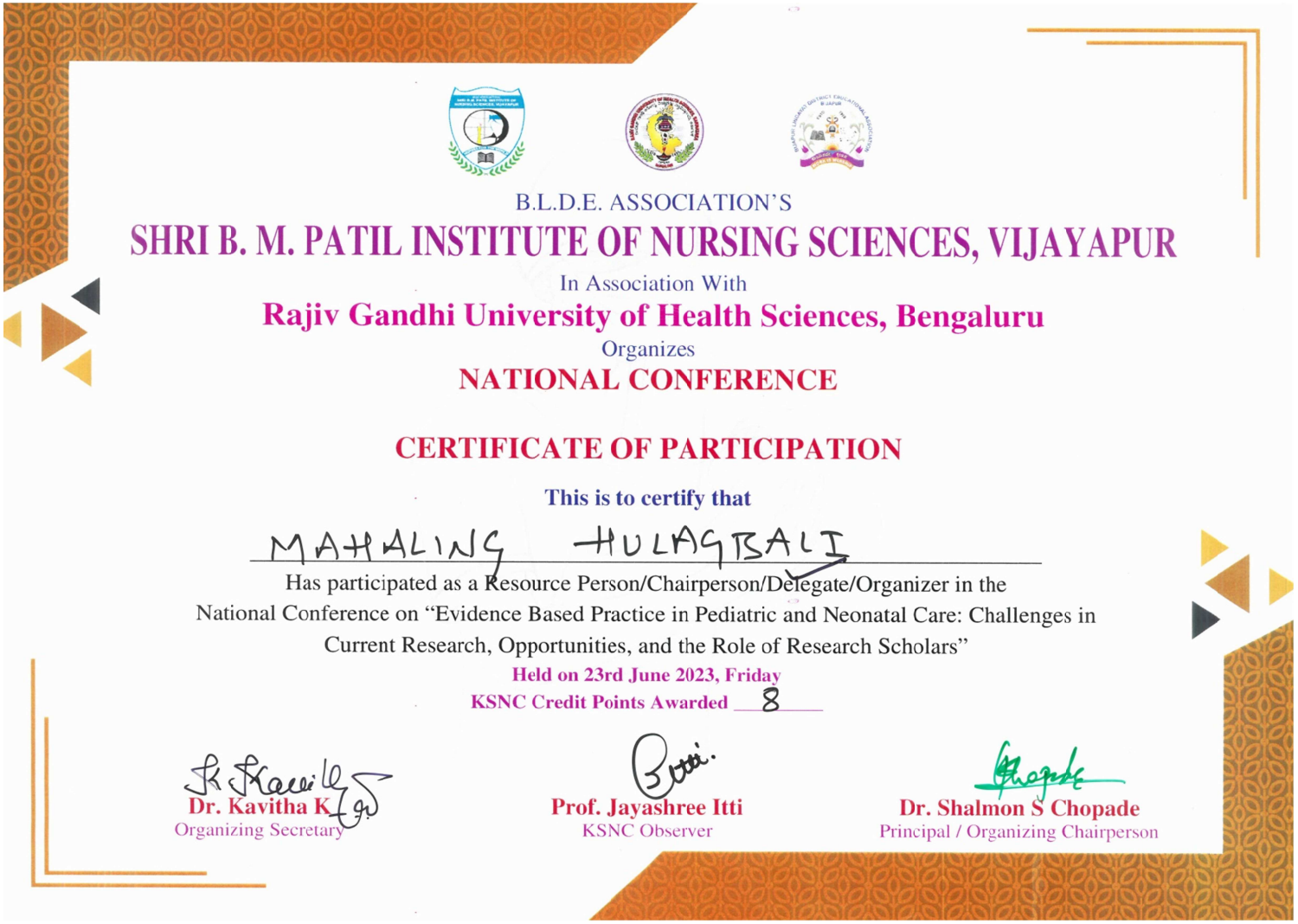
Dr. Manoj Murhekar
Scientist G & Director In-charge
National Institute of Epidemiology Chennai

Dr. Soumya Swaminathan
Secretary to Govt. of India, Dept. of Health Research &
Director-General, Indian Council of Medical Research

Prof. Andrew Thanga
NPTEL Coordinator
IIT Madras

ICMR-National Institute of Epidemiology

Roll No: NPTEL17HS1426190023FN
To validate and check scores: http://nptel.ac.



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SHRI B. M. PATIL INSTITUTE OF NURSING SCIENCES, VIJAYAPUR

In Association With

Rajiv Gandhi University of Health Sciences, Bengaluru

Organizes

NATIONAL CONFERENCE

CERTIFICATE OF PARTICIPATION

This is to certify that

MAHALING HULAGBALI

Has participated as a Resource Person/Chairperson/Delegate/Organizer in the National Conference on "Evidence Based Practice in Pediatric and Neonatal Care: Challenges in Current Research, Opportunities, and the Role of Research Scholars"

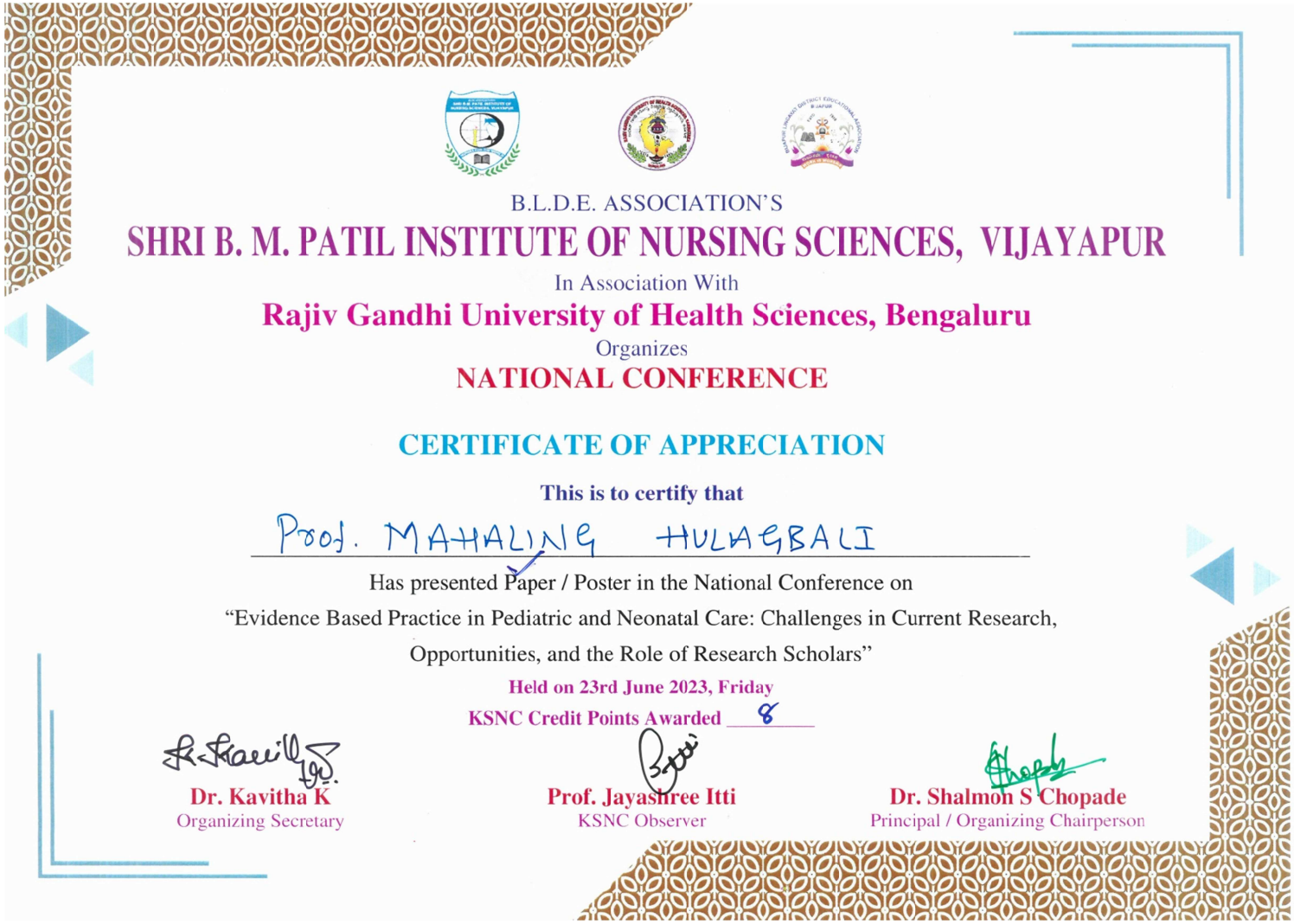
Held on 23rd June 2023, Friday

KSNC Credit Points Awarded 8

Dr. Kavitha K
Organizing Secretary

Prof. Jayashree Itti
KSNC Observer

Dr. Shalmon S Chopade
Principal / Organizing Chairperson



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In Association With

Rajiv Gandhi University of Health Sciences, Bengaluru

Organizes

NATIONAL CONFERENCE

CERTIFICATE OF APPRECIATION

This is to certify that

Prof. MAHALING HULAGBALI

Has presented Paper / Poster in the National Conference on

"Evidence Based Practice in Pediatric and Neonatal Care: Challenges in Current Research, Opportunities, and the Role of Research Scholars"

Held on 23rd June 2023, Friday

KSNC Credit Points Awarded 8

Dr. Kavitha K
Organizing Secretary

Prof. Jayashree Itti
KSNC Observer

Dr. Shalmon S Chopade
Principal / Organizing Chairperson

Prevention of obesity among Adolescents

What is obesity ?

"A condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired." (WHO)

Who are adolescents?

- A period of human growth and development that occurs after childhood and before adulthood
- Includes those persons between 10 and 19 years of age (WHO 2014)

Why is obesity increasing ?

- Increased calorie consumption and junk foods.
- Sedentary life style: Watching TV for more than 2 hrs, Playing games in computer and mobiles, Using Mobile while having food.
- Genetic predisposition.
- Physical inactivity.

Effects of obesity

- Poor self esteem
- Type 2 diabetes
- Hypertension
- Depression
- Sleep apnoea

Prevention :

- Involve in physical activity. Children ages 6 to 17 should have at least 60 minutes of medium physical activity most days of the week
- Reduce screen time
- Consumption healthy foods and drinks. These include fat-free or low-fat milk, fresh fruit, and vegetables. Avoid drinks or snacks that are high in sugar and fat.
- Promote good sleep with a consistent bedtime routine. Teens ages 13 to 18 need 8 to 10 hours.
- Avoid stress

ANNEXURE VII

PUBLICATIONS

HulagbaliMahaling et al., IJSRR 2019, 8(1), 317-323

Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Prevalence of Obesity among Adolescents in Belagavi – A Pilot Project

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ABSTRACT

Non communicable diseases are the leading global causes of death, and strike hardest at the worlds low and middle income population. Obesity is a condition in which excess body fat has accumulated to the extent that it may have a negative effect on health to measure the prevalence of obesity among adolescent students (aged 10-16 years) in Belgravia.

In a descriptive cross-sectional study, 90 adolescent students aged 10 to 16 years were examined from private high school selected by Stratified Cluster Sampling technique Height and weight were measured in all participants and the body mass index (BMI) of each individual was calculated. Body mass index classes were calculated according to the International Obesity Task Force standards.

Out of the 95 adolescent students, 69(72.63%) were boys and 26 (27.37%) were girls. The prevalence of overweight, and obesity was 9.47%, and 4.42%, respectively.

An increasing prevalence of overweight/obesity was seen in urban adolescents. Hence, it is an urgent need for immediate and targeted preventive measures.

KEYWORDS: Adolescents, overweight/obesity, prevalence

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Ph. No. 08660566008

INTRODUCTION

Non communicable diseases are the leading global causes of death, and strike hardest at the worlds low and middle income population. They can be significantly reduced and millions of lives can be saved through the reduction of their risk factors, early detection of complications and timely treatment.[1]

Out of 57 million global deaths in 2008, 36 million (63%) were due to NCDs principally cardiovascular diseases, DM, cancers and chronic respiratory diseases.[2]

Obesity is a medical conditionin which excess body fat has accumulated to the extent that it may have a negative effect on health.[5]

Obesity is one of the most widespread and major problems affecting children and adolescents and is a global nutritional concern. An increased prevalence is found in many countries where the major nutritional disorder previously was malnutrition.[18]An increase in the prevalence of childhood obesity is associated with potential medical and psychosocial complications of obesity in adolescence [19, 20]

Recent WHO global estimates showed that

- In 2014, more than 1.9 billion adults aged 18 years and older were overweight and obese, 39% of adults aged 18 years and over (38% of men and 40% of women) were overweight and obese,
- The worldwide prevalence of obesity more than doubled between 1980 and 2014. [23]
- In India prevalence of overweight and obesity among adolescents aged between 10-19 years was found to be 11% and 5.75 respectively and is varies within country. [24]

If current trends continue the number of overweight or obese young children and adolescents globally will increase to 70million by 2025. [24]

MATERIALS AND METHODS

The study was conducted in a private high school of Belgravia city. Ninty five students, aged 10-16 years were selected through stratified sampling technique.

A prior consent for the study was taken from DDPI, Belagavi, school administration and from the parents. At the time of initiating the study each participants were informed about the study protocol and written assent was obtained.

Weight and height were taken using a standard procedure Body weight was measured to the nearest 100 grams using calibrated portable scales. Height was measured to the nearest centimeter with the subject in full standing position, using a calibrated measuring rod. All measurements were taken with minimal clothing and without shoes.

Inclusion criteria

1. Adolescent students aged 10- 16 years from 5th to 10th standard studying in selected government and private schools of Belagavi city.
2. Students who are willing to participate in the study.

Exclusion criteria

1. Schools having exclusively boys or girls(Non-coeducational schools)
2. Children having chronic illnesses such as severe malnutrition, endocrinal problems and physically handicapped.

RESULTS

A Cross sectional study consisting of 95 Adolescents is undertaken to study the prevalence of obesity. The maximum number of adolescents in the present study belonged to the 14 years age group (33.68%). Males constituted 72.63% of the subjects studied and females constituted 27.37% of the study group. Majority of family income 37 (38.95%) were <=10000. There was family history of hypertension in 4.21%, Diabetes mellitus in 8.42%, and obesity in 15.79% of the total adolescents studied. The prevalence of obesity in adolescents was found to be 8.42% andthere was no significant association with demographic variables

Section I-Socio-demographic data

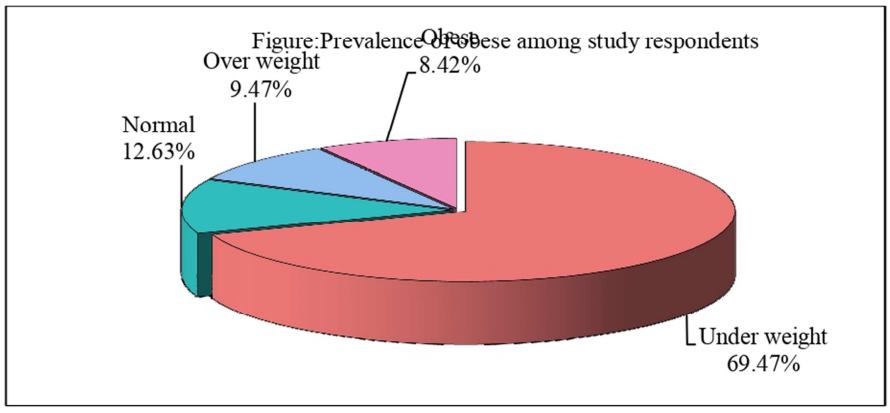
Table 1: Socio-demographic characteristics wise distribution of study respondents

Characteristics	No of respondents	% of respondents
Age in yrs		
13	18	18.95
14	32	33.68
15	26	27.37
16	19	20.00
Gender		
Boys	69	72.63
Girls	26	27.37
Class of study		
7	21	22.11
8	27	28.42
9	33	34.74
10	14	14.74
Father education		
Primary	23	24.21
Secondary	39	41.05
Graduate	33	34.74
Mother education		
Illiterate	5	5.26
Primary	36	37.89
Secondary	37	38.95
Graduate	17	17.89
Family income		
<=10000	37	38.95
10001-15000	26	27.37

15001-20000	17	17.89
>=20001	15	15.79
Types of family		
Nuclear	65	68.42
Joint	30	31.58
Family History		
No	83	87.37
Diabetic	8	8.42
Hypertension	4	4.21
Obese person in your family		
No	80	84.21
Yes	15	15.79
Total	**95**	**100.00**

Table 2: Prevalence of obese among study respondents

Category	No of respondents	Prevalence
Under weight	66	69.47
Normal	12	12.63
Over weight	9	9.47
Obese	8	8.42
Total	**95**	**100.00**



Pie graph showed the prevalence of obesity among adolescents

Table 3: Association between Socio-demographic characteristics with prevalence of obesity

Characteristics	UW	%	Normal	%	OW	%	Obese	%	Total	Chi-square	p-value
Age in yrs											
13	13	72.22	0	0.00	2	11.11	3	16.67	18	9.7220	0.3730
14	22	68.75	5	15.63	2	6.25	3	9.38	32		
15	20	76.92	4	15.38	1	3.85	1	3.85	26		
16	11	57.89	3	15.79	4	21.05	1	5.26	19		
Gender											
Boys	47	68.12	8	11.59	7	10.14	7	10.14	69	1.2910	0.7310
Girls	19	73.08	4	15.38	2	7.69	1	3.85	26		
Class of study											
7	17	80.95	2	9.52	0	0.00	2	9.52	21	12.6800	0.1780
8	19	70.37	1	3.70	5	18.52	2	7.41	27		
9	23	69.70	6	18.18	1	3.03	3	9.09	33		
10	7	50.00	3	21.43	3	21.43	1	7.14	14		
Father education											
2	15	65.22	3	13.04	2	8.70	3	13.04	23	3.6430	0.7250
3	30	76.92	5	12.82	3	7.69	1	2.56	39		
4	21	63.64	4	12.12	4	12.12	4	12.12	33		
Mother education											
1	1	20.00	2	40.00	0	0.00	2	40.00	5	16.5550	0.0500*
2	26	72.22	3	8.33	5	13.89	2	5.56	36		
3	29	78.38	3	8.11	2	5.41	3	8.11	37		
4	10	58.82	4	23.53	2	11.76	1	5.88	17		
Family income											
<=10000	28	75.68	3	8.11	2	5.41	4	10.81	37	5.4500	0.7930
10001-15000	19	73.08	4	15.38	2	7.69	1	3.85	26		
15001-20000	10	58.82	3	17.65	3	17.65	1	5.88	17		
>=20001	9	60.00	2	13.33	2	13.33	2	13.33	15		
Types of family											
Nuclear	43	66.15	8	12.31	6	9.23	8	12.31	65	4.0490	0.2560
Joint	23	76.67	4	13.33	3	10.00	0	0.00	30		
Family History											
No	55	66.27	12	14.46	9	10.84	7	8.43	83	4.5650	0.6010
Diabetic	7	87.50	0	0.00	0	0.00	1	12.50	8		
Hypertension	4	100.00	0	0.00	0	0.00	0	0.00	4		
Obese person in your family											
No	57	71.25	11	13.75	8	10.00	4	5.00	80	7.9220	0.0480*
Yes	9	60.00	1	6.67	1	6.67	4	26.67	15		
Total	66	69.47	12	12.63	9	9.47	8	8.42	95		

DISCUSSION

The overall prevalence of overweight and obesity was found to be 8.42% among adolescents (aged 10-16 years) from the present study. Goyal *et al.*[9] reported a similar prevalence (12%) of overweight and obesity among adolescents (aged 12-18 years). It was also reported in the same study that the prevalence of overweight was high among adolescent children who belonged to higher socioeconomic class compared to those who belonged to the lower socioeconomic class. Laxmaiah *et al.*, in a similar study conducted among adolescents in the age group of 12-17 years, reported prevalence as low as 7% during the year 2007.[10]It was observed by George *et al.*[11] in a study done in Kerala among rural adolescent children in the age group of 13-18 years that the rates of prevalence of overweight and obesity were 16% and 7%, respectively. The results of the studies discussed above show a higher prevalence when compared to our study. A higher prevalence of about 15.8% was also reported from another study by Ramachandran *et al.* [12] among urban adolescent school children.

CONCLUSION

The prevalence rate of obesity was8.42%., in our study population. The study results show that overweight and obesity is predominant among adolescent students belonging to the private school in Belagavi city.

ACKNOWLEDGMENT

The authors would like to acknowledge the support of all the students who participated in the study and the head of the institutions for permitting the study.

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Original Article

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Determinants of overweight and obesity among adolescent students in North Karnataka

Mahaling Mallikarjun Hulagbali, Sangeeta N Kharde[1]

Abstract:

INTRODUCTION: Globally, childhood and adolescent obesity prevalence has reached alarming levels with grave public health consequences. It is believed that a sedentary lifestyle and the consumption of calorie-dense and low-nutritional-value foods are two of the most significant etiological factors contributing to the rising prevalence of childhood and adolescent obesity in developing countries.

OBJECTIVE: The main objective was to study the contributing factors (determinants) of obesity among adolescent students.

MATERIALS AND METHODS: A cross-sectional study was conducted from January 2019 to October 2019 among 1050 schoolchildren from different schools in Belagavi. The results used for comparison were based on descriptive statistics, Chi-square test, and multiple logistic regression analysis using the statistical package for the social science version 22.0. The significance level of all the tests was set at $P \leq 0.05$.

RESULTS: The study results revealed that age, family history of diabetes, family history of hypertension, physical activity (running, swimming), number of hours spent with mobile every day, number of hours spent with a computer every day, frequency of foodstuffs consumed by a child (fried food, bakery items, sweets, and fast foods) were statistically significant or associated with overweight and obesity ($P < 0.05$).

CONCLUSION: The study concluded that high-socioeconomic status, physical inactivity, frequency of consumption of fast food, inactive outdoor games, and poor nutritional knowledge were significantly associated with overweight and obesity. Therefore, there is a pressing need for cost-effective school-based strategies and appropriate policy changes in developing countries like India to stem the rising tide of overweight and obesity among adolescents.

Keywords:

Childhood, determinants, obesity, overweight

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Received: 01 June 2022, **Revised:** 16 October 2022, **Accepted:** 27 October 2022, **Published:** 17 June 2023

Introduction

India is becoming an epicenter of epidemics of adult and childhood obesity, particularly among urban populations, due to rapid demographic and socioeconomic transition. Although age-standardized rates are low, India has the third-highest rate of obesity in the world in absolute terms. Epidemiological studies have consistently documented an increase in the prevalence of overweight and obesity among adolescents in the subcontinent over the years. According to a systematic analysis conducted as part of the 2013 Global Burden of Disease study, 5.3% of males and 5.2% of females under the age of 20 years were overweight in India. Overall, males and females in the above-age category had a prevalence of obesity of 2.3% and 2.5%, respectively.[1]

Adolescents are young people aged between 10 and 19 years. It is a transitional stage of physical, physiological, and psychological development from puberty

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to legal adulthood. Worldwide more than 1.2 billion are adolescents. About 21% of the Indian population is adolescent. They are the future of the nation, forming a major demographic and economic force.[2]

The World Health Organization (WHO) has classified obesity as one of the top 10 global health risks and one of the top five in developed countries. Globally, approximately 22 million children aged 5 years are overweight according to the WHO standards and data from 79 developing countries, including several industrialized countries.[3]

Numerous factors including genetic, social, and environmental, act through mediators of energy metabolism and physical activity, and contribute to weight gain. The increasing prevalence of obesity in genetically stable populations suggests that dietary, lifestyle, and environmental determinants may hold the key to understanding obesity epidemics.[4]

Childhood obesity is largely caused by an increase in the consumption of calorie-dense foods that are high in fat and sugar but low in protein, vitamins, minerals, and other beneficial micronutrients.[5] Physical inactivity has been increasing in recent years, not only among adults but also among children and adolescents, owing to the increased use of sedentary activities such as watching television and playing video games.[6] Families, schools, peers, childcare facilities, doctors, religious institutions, government agencies, the media, the food, and beverage industry, and the entertainment industry all impact the eating and exercising habits of children and adolescents.[7]

There has been a trend toward increasing the prevalence of overweight and obesity among developing countries. The data on the prevalence of childhood obesity in India, which is also undergoing an epidemiological transition, are scanty. In view of this, the study was undertaken to study the determinants of obesity among adolescent students.

Materials and Methods

Ethical Clearance was obtained from KLE University Ethics Committee on Human Subjects with Ref no KLEU/EC/17-18/D-79 dated 16.05.2017. A cross-sectional study was conducted among 1050 schoolchildren from different schools in Belagavi. Adolescent students aged 10–16 years from 5th to 10th standard studying were selected from government and private schools of Belagavi city. Stratified cluster sampling was used to select the samples. A sampling frame was prepared by enlisting the student names using the attendance registers of all the classes in 5th–10th standard classes and from each class according to the strength of the class students were selected as samples. The randomly selected students were asked to assemble in a separate room and were briefed about the study, assent was taken from the students and the consent forms were distributed to them to be signed by their parents. The data were collected from students whose parents provided consent. Students who are willing to participate in the study were included in the study, children with chronic illnesses such as severe malnutrition, endocrinal problems, and physically handicapped were excluded from the study. The sample size was calculated using the formula sample size (n) = $Z^2_{1-\alpha}$ pq/d^2. Where

n – Sample size

$Z_{1-\alpha}$ – Statistic corresponding to the level of confidence, i.e., 1.96%–95% confidence interval (CI)

p is prevalence (obtained from similar studies)

q is (1 – p) the absence of positivity

d – Precision (in the present study d is 10% of p)

Considering the formula, the sample size was calculated as 1047 and rounded off as 1050.

Data were collected by administering the predesigned, prevalidated, and pretested questionnaire. After filling out the questionnaire, height and weight were measured. Height was measured by allowing participants to stand straight without footwear, with heels, buttocks, and back touching the wall, and arm hanging by the side. Weight was measured without any shoes, heavy clothing, and using the standard portable weighing machine with an error of ± 100 g. Body mass index (BMI) was then calculated using the formula BMI = weight (kg)/height (m^2) and BMI classification was done based on the WHO/International Obesity Task Force for Asia and India standard of obesity.

Logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. The odds ratio with 95% CI was presented. $P < 0.05$ was considered an association between an outcome variable and an explanatory variable. Data was analyzed using the statistical software Core System Users Guide SPSS Inc 2014(IBM SPSS Version 22).

Results

Table 1 depicts the education status of parents of the study population and reveals that among fathers 41.24% of them were preuniversity, 26.57% of them were

secondary, and 20.67% of them were graduate, and among mothers, 40.76% of them were preuniversity, 25.24% of them were secondary, 18.86% of them were primary, and 12.10% of them were graduate.

Table 2 depicts that among the study population, 59.05% of them alternatively doing running/jogging, 25.14% of them alternatively doing walking, 51.05% of them daily walking, 42.10% of them daily involved in skipping, and 24.48% of them involving outdoor games activity.

Table 3 depicts the study population in terms of pulses, with 56.38% of them having 2-3 times a week, 56.57% of them having fried fruits every day, 36.86% having cereals 2-3 times a week, and 55.05% having vegetables.

Table 1: Descriptive analysis of education among parents of the study population (*n*=1050)

	Frequency (%)
Education (father)	
Primary	4 (0.38)
Secondary	117 (11.14)
Preuniversity	279 (26.57)
Graduate	433 (41.24)
Postgraduate	217 (20.67)
Education (mother)	
Illiterate	7 (0.67)
Primary	25 (2.38)
Secondary	198 (18.86)
Preuniversity	265 (25.24)
Graduate	428 (40.76)
Postgraduate	127 (12.10)

Occasionally, 37.05% of them have fruits 2-3 times a week, 43.05% have bakery items every day, 39.05% have sweets every day, 42.57% have ice cream 2-3 times a week, 60.29% have fast food 2-3 times a week, and 62.29% have beverages occasionally.

Table 4 reveals that family history of diabetes, hypertension, obesity, and physical activity (running and swimming), number of hours spent with mobile and computer every day, and frequency of foodstuffs consumed by the child (pulses, fried food, vegetables, fruits, bakery items, sweets, and fast foods) shows statistically significant or associated with overweight and obesity ($P < 0.05$).

Discussion

Various studies have been conducted in India to assess the prevalence of overweight/obese school-going children, but the determinants of obesity among adolescents in North Karnataka were unclear. In our study, parent education level did not significantly correlate with elevated BMI among the students. This finding was similar to other studies.[8,9]

Several studies have proven that age and family history of diabetes, hypertension, and obesity were the major determinants contributing to obesity[10,11] which is similar to our study findings.

Some of the determinants of overweight and obesity found in our study were low physical activity, TV

Table 2: Descriptive analysis of physical activity in the study population (*n*=1050)

	Frequency (%)				
	Daily	Alternatively	Once a week	Rarely	Nil
Running/jogging	104 (9.90)	620 (59.05)	156 (14.86)	45 (4.29)	125 (11.90)
Walking	61 (5.81)	264 (25.14)	105 (10.00)	133 (12.67)	487 (46.38)
Swimming	536 (51.05)	306 (29.14)	141 (13.43)	54 (5.14)	13 (1.24)
Skipping	298 (28.38)	442 (42.10)	217 (20.67)	59 (5.62)	34 (3.24)
Outdoor games	12 (1.14)	193 (18.38)	257 (24.48)	223 (21.24)	365 (34.76)

Table 3: Descriptive analysis of foodstuffs consumed by children in the study population (n=1050)

	Frequency (%)		
	Every day	2-3 times a week	Occasionally
Pulses	184 (17.52)	592 (56.38)	274 (26.10)
Fried foods	594 (56.57)	364 (34.67)	92 (8.76)
Cereals	279 (26.57)	387 (36.86)	384 (36.57)
Vegetables	182 (17.33)	290 (27.62)	578 (55.05)
Fruits	389 (37.05)	308 (29.33)	353 (33.62)
Bakery items	375 (35.71)	452 (43.05)	223 (21.24)
Sweets	323 (30.76)	410 (39.05)	317 (30.19)
Ice cream	447 (42.57)	320 (30.48)	283 (26.95)
Fast foods	633 (60.29)	212 (20.19)	205 (19.52)
	Nil	Every day	2-3 times a week	Occasionally
Nonvegetarian	28 (2.67)	419 (39.90)	516 (49.14)	87 (8.29)
Beverages	36 (3.43)	265 (25.24)	95 (9.05)	654 (62.29)

Table 4: Logitic regression analysis of overweight and obesity with determinant factors

Factor	Odds ratio	95% CI of odds ratio	*P*
Family history of diabetes (base line=No)			
Yes	0.421	0.180-0.983	0.046
Family history of hypertension (base line=No)			
Yes	0.219	0.094-0.509	<0.001
Family history of obese (base line=No)			
Yes	0.078	0.028-0.215	<0.001
Physical activity			
Running (base line=Daily)			
Alternatively	17.872	2.301-138.819	0.006
Once a week	6.562	0.696-61.853	0.100
Rarely	NA	NA	NA
Nil	NA	NA	NA
Walking (base line=Daily)			
Alternatively	2.667	0.292-24.345	0.385
Once a week	5.241	0.606-45.351	0.132
Rarely	1.778	0.171-18.534	0.630
Nil	13.00	1.360-124.297	0.026
Swimming (base line=Daily)			
Alternatively	0.257	0.100-0.662	0.005
Once a week	0.385	0.095-1.569	0.183
Rarely	0	0	0.999
Skipping (base line=Daily)			
Alternatively	1.404	0.641-3.078	0.396
Once a week	0.215	0.026-1.777	0.154
Rarely	0	0	0.999
Nil	0	0	0.999
Number of hours spent with mobile every day (baseline ≥2 h last)			
½ h	0.152	0.037-0.616	0.008
1 h	0.071	0.025-0.202	<0.001
2 h	0.546	0.185-1.615	0.274
Number of hours spent with the computer every day (baseline ≥2 h last)			
½ h	0.204	0.035-1.193	0.078
1 h	0.093	0.034-0.252	<0.001
2 h	1.397	0.437-4.467	0.573
Number of hours - watching TV every day (baseline ≥2 h last)			
½ h	1.500	0.176-12.775	0.711
1 h	0.333	0.057-1.955	0.224
2 h	2.280	0.578-9.00	0.239
Do you eat snacks between meals (baseline=No)			
Yes	0.392	0.113-1.362	0.141
Foodstuffs consumed by the child			
Cereals (baseline=Every day)			
2-3 times a week	0.583	0.244-1.395	0.226
Occasionally	1.040	0.430-2.518	0.931
Pulses (baseline=Every day)			
2-3 times a week	5.647	2.098-15.197	0.001
Occasionally	2.400	0.729-7.899	0.150
Fried foods (baseline=Every day)			
2-3 times a week	2.945	1.111-7.806	0.030
Occasionally	9.257	3.604-23.775	<0.001
Vegetables (baseline=Every day)			
2-3 times a week	0.420	0.166-1.062	0.067
Occasionally	0.179	0.073-0.438	<0.001
Fruits (baseline=Every day)			
2-3 times a week	5.112	2.255-11.591	<0.001
Occasionally	2.546	0.723-8.968	0.146

Contd...

Table 4: Contd...

Factor	Odds ratio	95% CI of odds ratio	P
Bakery items (baseline=Every day)			
2-3 times a week	0.292	0.111-0.770	0.013
Occasionally	0.859	0.374-1.975	0.721
Sweets (baseline=Every day)			
2-3 times a week	7.703	2.436-24.363	0.001
Occasionally	4.604	1.337-15.854	0.016
Ice cream (baseline=Every day)			
2-3 times a week	1.359	0.476-3.887	0.567
Occasionally	1.623	0.514-5.125	0.409
Fast foods (baseline=Every day)			
2-3 times a week	3.750	1.407-9.992	0.008
Occasionally	4.400	1.759-11.005	0.002

CI: Confidence interval

watching/computer games, and junk foods. A similar association was also seen in a study done by Prasad *et al.*[12]

It has been observed that a high intake of fried foods and sugary beverages is significantly associated with a high BMI and obesity in children. In addition, diets consisting primarily of junk foods are generally deficient in nutrients.[13,14] Consequently, a high intake of junk foods can contribute to the "double burden of malnutrition," undernutrition, and overnutrition that simultaneously affects the Indian population.[15]

As socioeconomic status increases the prevalence of obesity increases. Similar results were obtained in many other studies.[16]

Watching TV was found to be significantly associated with increase in the prevalence of overweight and obesity and was found to relate to physical inactivity and snacking during this time.[17]

Playing outdoor games for at least an hour per day was related to significantly decreased risk of overweight and obesity. A similar study was conducted by Vasconcellos *et al*. and suggested that Physical activity intervention may improve physical fitness and risk factors for cardiovascular disease in adolescents who are overweight or obese.[18]

Due to a cross-sectional study, cause-and-effect relationship cannot be established. The use of international reference standards to classify BMI in an Indian context may be one of the limitations of the study.

Conclusion

The prevalence of overweight and obesity was found to be high among adolescent students. The major determinants were physical activity, number of hours spent with mobile every day, frequency of foodstuffs consumed by the child (bakery items, sweets, and fast foods), and showed statistically significant with overweight and obesity. Therefore, it is necessary to organize school-based, family-oriented obesity prevention programs to reduce the future burden of obesity-associated chronic diseases.

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Conflicts of interest

There are no conflicts of interest.

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ANNEXURE VIII

DATA COLLECTION PHOTOS