"EVALUATIVE STUDY OF ACNE VULGARIS AND IT'S IMPACT ON DERMATOLOGICAL LIFE QUALITY INDEX IN YOUNG ADULTS IN A TERTIARY CARE CENTRE, A ONE YEAR CROSS SECTIONAL STUDY."

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LIST OF ABBREVIATIONS USED

DLQI	-	Dermatological life quality index
QOL	-	Quality of life
DHT	-	Dihydrotestosterone
DHEAS	-	Dehydroepiandrosterone sulphate
SHBG	-	Sex hormone binding globulin
ACTH	-	Adrenocorticotrophic hormone
GH	-	Growth hormone
MSH	-	Melanocyte stimulating hormone
P. acnes	-	Propionibacterium acne
RNA	-	Ribonucleic acid
PPAR	-	Peroxisome proliferator activated receptor
FGFR	-	Fibroblast growth factor receptor
IL	-	Interleukin
DTH	-	Delayed type hypersensitivity
TLR	-	Toll like receptor
HSP	-	Heat shock protein
CD	-	Cluster differentiation
TNF	-	Tumor necrosis factor
PAMP	-	Pathogen associated molecular pattern
C3	-	Complement 3
IgG	-	Immunoglobulin G
IGF	-	Insulin like growth factor
UVA	-	Ultraviolet A
PUVA	-	Psoralen plus ultraviolet A

EGF	-	Epidermal growth factor
GAGS	-	Global acne grading system
PCOS	-	Polycystic ovarian syndrome
USG	-	Ultra sonography
HRQL	-	Health related quality of life

ABSTRACT

Background and objectives: Acne vulgaris is a common and chronic dermatological disorder of pilosebaceous follicles of face and upper trunk mainly affecting young adults and adolescents. Clinically, it is characterized by polymorphic lesions like, comedones, papules, pustules, nodules and cysts. Scarring is one of the dreaded complication as it scars both skin and mind. The patients experience psychological burdens like depression, anxiety, low self esteem.

The objectives of this study are, to evaluate dermatological life quality index (DLQI) in young adult patients suffering from acne vulgaris and to determine correlation between acne severity and DLQI.

Material and methods: The present study is a one year cross-sectional study from January 2016 to December 2016. Total 100 patients were included in study. Patients in age group of 18-30 years attending dermatology out patient department with all grades of acne vulgaris were included. Demographic data was recorded. Diagnosis was established by detailed history and clinical examination. Patients were asked to fill Dermatological life quality index questionnaire. Grading of acne vulgaris was done by simple grading system proposed by Indian authors. Correlation between severity of acne vulgaris and DLQI was done using Spearman's rank correlation method.

Results: Amongst 100 patients studied, largest number of patients had grade 2 of acne vulgaris. Significant association between severity of acne with increasing age and female gender was observed. Also severity of acne was associated with history of manual picking of lesions. Maximum number of patients had DLQI ranging from 6

to 11, suggesting moderate effect on quality of life. A positive and significant relationship was observed between Grades of acne and DLQI (Spearman R =0.2326, p=0.01989) at 5% level of significance. It was found that, the higher the grades of acne, the higher is the effect of DLQI.

Conclusion: A positive and significant relationship was observed between grades of acne and DLQI, meaning higher the grades of acne higher is the effect of DLQI.

Key words: Acne Vulgaris and Dermatological life quality index

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INTRODUCTION

Acne vulgaris is a chronic inflammatory disorder of pilosebaceous duct, clinically characterized by polymorphic lesions consisting of comedones, papules, pustules, nodules and cysts. It affects up to 80% of adolescents and young adults. While neither life threatening nor physically debilitating, acne can affect social and psychological functioning.[1] The patients experience psychological burdens like depression, anxiety, low self esteem.

Sulzberger and Zaidems in their article stated that, "There is no single disease which can cause more psychic trauma, more maladjustment between parent and children, more general insecurity and feelings of inferiority and greater sums of psychic suffering than does acne vulgaris." [2]

Quality of life is a general term which encompasses feeling of joy and satisfaction with life. WHO defines Quality of Life (QOL) as "The individual's perception of their position in the context of culture and value systems in which they live and in relation to their goals, expectations, standards and concerns." [3]

It provides insight into debilitating effects of acne, that patients don't address themselves.

Several general health related quality of life measures and acne specific quality of life questionnaires have been developed. General health related quality of life measures compare effect of different conditions on patient's life. These include Dermatological life quality index (DLQI), Skindex, Skindex-29, Skindex-16. Finlay

and Khan developed widely used DLQI for use in research studies and routine clinical practice to assess quality of life.

There are less number of studies conducted in India in relation to assessment of impact of acne vulgaris on quality of life. The purpose of this study was to determine impact of acne vulgaris on quality of life and psychology of patients, so as to provide early psychological intervention as an adjunct to dermatological treatment for good outcomes.

OBJECTIVES

Primary objective:

To evaluate dermatological life quality index (DLQI) in young adult patients suffering from acne vulgaris.

Secondary objective:

To determine correlation between acne severity and DLQI.

REVIEW OF LITERATURE

HISTORICAL ASPECTS

Acne vulgaris is known since ancient times and has a long history. The roots of acne can be traced back to ancient civilizations that is Egyptians, Greeks, Romans.

In Ebers Papyrus, the word 'aku-t' was coated. The word was later translated as boils, blains, sores, pustules or any inflammatory swelling.[4]

Ancient Egyptians were of opinion that acne is caused by telling lies.

Description of acne was given by Byzantine Physician 'Aetius Amidenus' in Greek. The word acne appears to originate from Greek word, 'Akme.' **Aristotle** was the first person to use Greek word 'Ionthoi', which means, 'The first growth of beard, in regards to its appearance during puberty.

Ancient Roman literature mentioned about treatment of acne. In Rome, around 4^{th} century AD, acne victims were advised to wipe their pimples with a cloth while watching a falling star with myth that lesions of acne would then automatically fall from body.

Pliny and Celsus used the word 'Varus' to describe acne further. **Aetius** coined the word 'Acne' for first time after confirming word acme as a misprint. **Fuchs** (1840) used word acne vulgaris for first time.[5]

Description of sebaceous glands was given by **Rubban Tabari** in treatise Firdous al Hikamah meaning (Paradise of wisdom). In Arabian language dermatological condition clinically resembling acne vulgaris was labelled as 'Busoore labaniya'. In a text, 'Cannon of Medicine' **Avicenna** gave detailed description of clinical presentation and etiopathogenesis of acne.

In Elizabethan era, appearance of woman was of prime importance. As pale complexion was an indicator of wealth, women began using layers of Venetian Ceruse, a thick, white lead based paint. This paint was a breeding ground for acne. For management of these acne people at that time used to use mercury make ups. This further led to development of sulfur containing preparations.

In (1638), **Riolanus** noted association between acne and disordered menstruation. **Ionston** (1648) described relation between virility and repression with acne. **Plenck** (1738) thought that acne could be cured by marriage. He related occurrence of acne in young people to copious secretion of semen and rich diet. **Bateman** (1813) attributed black points in acne to small worms. **Alibert** (1837) stressed that acne sufferers lived in constant anxiety. **Simon** (1842) discovered Demodex folliculorum. He thought of Demodex as etiological factor in acne vulgaris. **Virchow** (1863) described pathological events occurring in skin in acne vulgaris and he regarded acne as an irritative process set up around hair follicle due to retention of secretions. Hebra agreed with Riolanus and attributed acne to disordered menstruation. He also related occurrence of acne to seborrhea. He could not find effective remedy for acne. **Unna** described follicular hyperkeratosis as prime histological feature of acne.

Bacillus causing acne was discovered at end of 19th century. **Blair, Lewis and Goodhead** (1970) attributed black color of acne to melanin. **Zelickson and Motta** found in their studies that black color is due densely packed horny cells in infundibulum.[6]

HISTORICAL ASPECTS IN TREATMENT OF ACNE VULGARIS

In 17th century acne vulgaris was treated with urine which they claimed to be a cleanser and helpful in prevention of acne as well for fair complexion. Ancient Egyptians treated acne with honey and animal origin preparations. **Aulus Cornelius Celsus**, a Roman encyclopaedist coated the treatment of acne with mixture of sulfur in mineral baths.

In 1920, **Jack Breitbart** of the Revlon Corporation discovered benzoyl peroxide for the treatment of acne. Breitbart found that this product was more effective and smelled better than the sulfur treatments of the past. In 1930, laxatives were in use for treatment of acne[7]. In 1950s Tetracycline was first time given for acne as it was noticed that acne was caused by bacteria. In 1960s, the topical treatment, Retin-A was developed for cure of acne. In 1980s, a novel drug Accutane (Isotretinoin) for acne appeared in the markets of America and was found extremely effective but was associated with severe side effects that is., stroke, seizure, myocardial infarction and hair loss. Women were advised contraception for up to six months after discontinuation of the therapy.

In 1990, laser therapy evolved to treat acne and is now widely used remedy as it clears the recent as well as old scars left by acne. In 2000, the

blue/red therapy was developed along with laser therapy for treatment of acne[7]. Microneedling with dermaroller has now emerged as a novel treatment modality for the treatment of acne scars. **Orentreich** was first to describe subcision or dermal needling in 1995 for scars. **Fernandes,** in 2006, introduced percutaneous collagen induction therapy with the dermaroller[8]. In 2007, a vaccine against inflammatory acne has been tested in mice, yet to be tested in humans.[9]

ANATOMY OF PILOSEBACEOUS UNIT:-

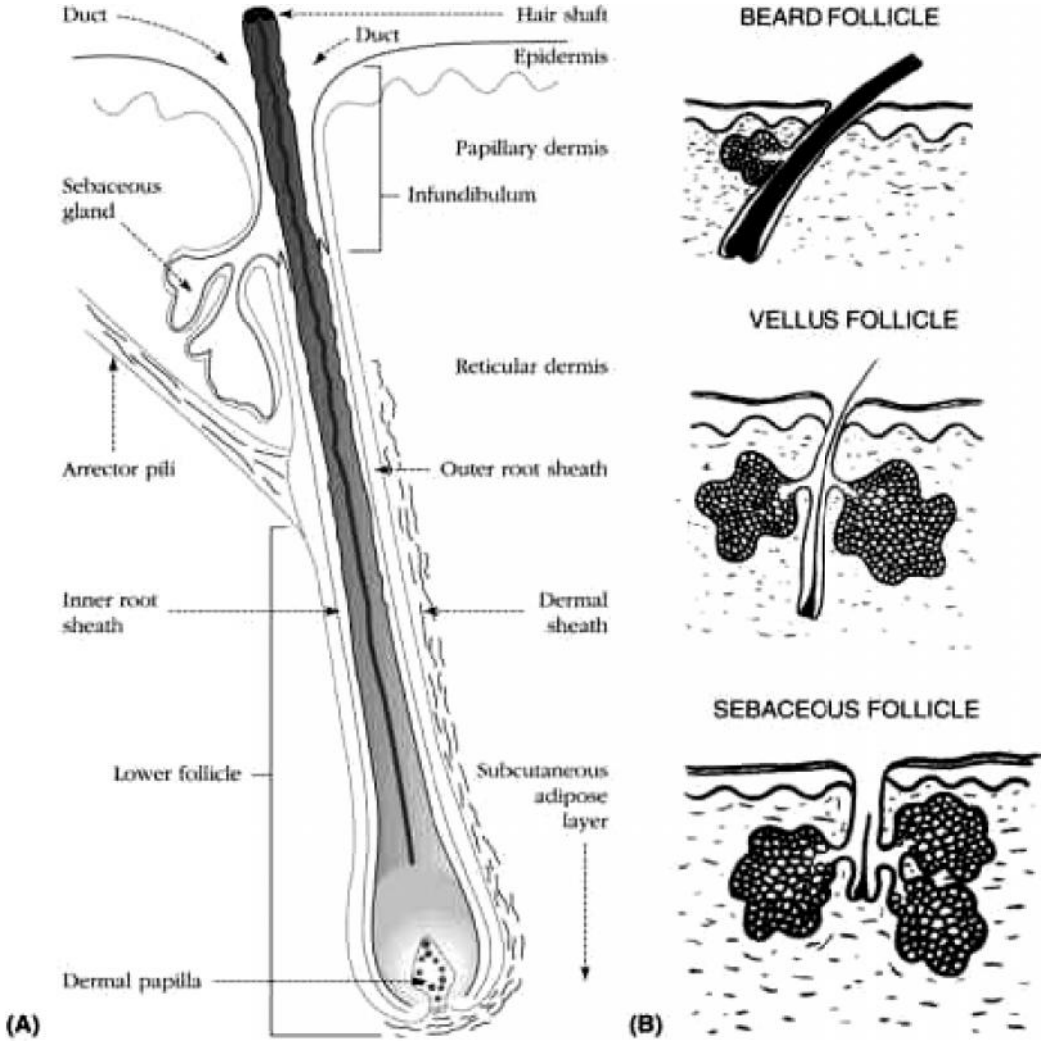
The skin is the largest organ in body, with surface area of 2 m^2 accounting for 16-20% of total body weight. The layers of skin include epidermis, dermis and sub cutaneous tissue. The accessory structures of skin are hair, nails and large variety of glands like eccrine, apocrine , sebaceous glands and sensory receptors. Hair follicles along with associated sebaceous glands form a pilosebaceous unit. [10]

The lining of pilosebaceous duct is keratinized epithelium. Sebum, epithelial cells and bacteria are discharged through the pilosebaceous canal. Ostium is opening of the pilosebaceous unit on surface of skin. Infundibulum is the part of pilary canal which extends from level of the ostium to the opening of sebaceous duct in pilary canal. Acroinfundibulum is upper one fifth of infundibulum, while infrainfundibulum is lower four fifth below pilosebaceous duct.[11] Acroinfundibulum and infrainfundibulum are structurally and functionally different. Infrainfundibulum has a role in formation of comedo.[12]

There are three types of follicles that are present over face.

- Beard follicle
- Vellus follicle
- Sebaceous follicle

It is the sebaceous follicle, with large pores that plays a role in acne. The dynamics within follicle is responsible for obstruction. It is the distribution of sebaceous follicles on face and trunk that determines the localization of lesions of acne.



DISTRIBUTION OF SEBACEOUS GLANDS:-

Sebaceous glands are present all over skin except over palms and soles. Maximum concentration of sebaceous glands is found over scalp forehead, nose and upper part of back. They are largest and most numerous over scalp. There are 400-900 glands/sq. cm over scalp, forehead, cheeks, chin[13]. Rest of the body, they are found in concentration less than 100/sq. cm.

Sebaceous glands in some areas may directly open on to the surface of skin as over eyelids where they are called Meibomian glands and over prepuce where they are called Tyson's glands. Free sebaceous glands are present in areola, called Montgomery tubercles. Ectopic sites for sebaceous glands are, tongue, cervix, margin of upper lip (Fordyce's spots).

DEVELOPMENT OF SEBACEOUS GLANDS:-

Rudiments of sebaceous glands appear in 12^{th} week of intrauterine life on posterior surface of hair pegs. Around 13^{th} to 15^{th} week, glands are clearly distinguishable. The glycogen which is present initially is lost in 17^{th} week and large lipid drops are visible in centre. At point of follicular origin central cells degenerate to form lumen. The surrounding cells form sebaceous duct after keratinization.

Glands are functional from the time of formation itself. Function and development of glands in prenatal period is regulated by maternal androgens.

The gland reaches peak of its activity after third trimester. Sebaceous glands are active in neonatal period and then involute and remain quiescent till puberty.

STRUCTURE OF SEBACEOUS GLAND:-

Sebaceous glands are unilobular or multilobular structures They consist of acini connected to a common excretory duct. The lining is stratified squamous epithelium. Sebaceous glands contain lipid producing sebocytes and keratinocytes that line the sebaceous duct. The periphery of the sebaceous gland is a basal cell layer and has small, cuboidal, nucleated, highly mitotic sebocytes, rich in RNA. As cells progress toward the middle of the gland they accumulate lipid droplets as they terminally differentiate and lack all other cellular organelles. Surrounding the glands are connective tissue capsules that are composed of collagen fibres that provide physical support.[14]

PHYSIOLOGY OF SEBACEOUS GLANDS:-

The sebaceous glands exude lipids by disintegration of entire cells and this process is known as *holocrine secretion*. The life span of a sebocyte from cell division to holocrine secretion is around 21–25 days.[15] Because of this constant state of renewal and secretion of the sebaceous gland, individual cells within the same gland are engaged in different metabolic activities dependent upon their state of differentiation.[16]

SEBUM:-

The sebum is formed after disintegration of lipid containing cells in sebaceous glands. It is a complex mixture of lipids that varies from species to species. Human sebum produced is very difficult to analyze as skin surface lipids contain other lipids from keratinizing epidermis, apocrine and eccrine glands along with sebum. There are exogenous sources of skin surface lipids

like, cosmetics, ointments used in topical therapy and soaps. If surface lipid is collected from skin areas rich in sebaceous glands then lipid composition approaches to pure sebum.

Major lipids in sebum	Concentration (%)
Triglycerides	57.5
Wax esters	26
Squalene	12
Cholesteryl esters	3
Cholesterol	1.5

Epidermis contributes to triglycerides, cholesterol, Cholesteryl esters and also phospholipids.[13]

Functions of sebum

- Antifungal action due to products of hydrolysis
- Antibacterial action due to presence of certain free fatty acids
- Secretion of vitamin E to protect skin surface lipids
- Role in regulation of per cutaneous absorption
- Role in barrier function
- Precursor of vitamin D[17]

STEROID METABOLISM IN SEBACEOUS GLANDS:-

The development and secretary activity of sebaceous gland are under control of androgens. The main circulating androgen that is testosterone is synthesized by testes. Adrenal gland is main source of dehydroepiandrosterone sulphate (DHEAS) and is quantitatively the major circulating adrenal androgens. The adrenal gland also produces androstenedione and delta-5 androstenedione, latter being one of the important circulating androgen in women. The ovary synthesizes testosterone, androstenedione.

Testosterone is bound to sex hormone binding globulin (SHBG) and thus high level of SHBG signifies low level of free hormone.[18]

Acne vulgaris is a disorder dependent on androgens mainly and sebaceous glands are specific androgen targets.

The activity of sebaceous glands is regulated by androgens of gonadal or adrenal origin.

The biological activity of testosterone on the skin is mainly induced by its conversion to 5-alfa-DHT by the enzyme 5-alfa-reductase.[19] Testosterone and 5-alfa-DHT stimulate 5-alfa-reductase mRNA and 5-alfa-reductase enzyme activity and thus exert their effects through binding to androgen receptors identified in the keratinocytes of the basal layer of the sebaceous gland and the outer root sheath of the hair follicle and not the keratinocytes elsewhere.[20] Seborrhea in acne thus can be due to increased production of 5-alfa-DHT. 3-beta hydroxysteroid dehydrogenase is evenly distributed throughout sebaceous

gland substance while 17-beta hydroxysteroid dehydrogenase is present in periphery of gland.

3-beta pathway is involved in breakdown of androgens while 17-beta hydroxysteroid dehydrogenase is involved in androgen production. Thus their localization in sebaceous gland is related to pathogenesis of acne, either due to overproduction of androgens or disturbed ratio of excretion : synthesis of androgens.

5-alfa-DHT is reduced to 3-alfa and 3-beta, 17-beta-androstenediols and these substances are excreted in abnormally high quantities in women suffering from acne and hirsutism. These are the end points of cellular androgen metabolism.

HORMONAL CONTROL OF SEBUM PRODUCTION AND SECRETION:

1. **Androgens-**

The adrenal cortex develops during first trimester of pregnancy. It is active in steroid metabolism. It plays important role in development of fetal sebaceous glands into adult ones. The level of sebum excretion at birth is similar to that in adults.[21] After some definite time after birth, glands involute due withdrawal of maternal androgens and quantity of sebum reduces. At puberty there is vast enlargement of gland and increase in sebum output.

2. **Progesterone-**

The effect of progesterone on sebaceous gland activity is matter of dispute. Progesterone production may produce acne.[22] Specially when given to

elderly women it increases sebum synthesis.[23] No such effect could be there in young women.[24] Progesterone is a competitive inhibitor of 5-alfa-reductase and might reduce sebaceous gland activity but in humans its sebosuppressive effect is minimal.[25]

3. Estrogens-

Estrogens depress sebaceous activity in pharmacological doses. Estrogens may act by reducing endogenous androgen production.[26] It has a central action. It acts by inhibiting release of ACTH and gonadotrophins from anterior lobe of pituitary gland thus further inhibit androgen release.[27]

MSH has no role in control of sebaceous gland activity. GH may have a sebotrophic effect.[27] Progesterone containing contraceptive pills produce no effect on sebum secretion rate. Rate of sebum secretion reduces with intake of more estrogen containing contraceptive pills.[28]

ACNE VULGARIS:

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous units mainly affecting adolescents and young adults characterized by increased sebum production and formation of open and closed comedones, erythematous papules and pustules and in more severe cases nodules, deep pustules and pseudocysts. Scarring is a major complication of acne. It scars both skin and mind.

INCIDENCE:-

The disease is quite common to extent it has been often called physiological. Rarely it may be present at birth and in mild form can be seen in neonatal period called, neonatal acne. A peak in prevalence and severity occurs between age of 14 and 17 years in females, when 40% are affected, while 16 and 19 years of age in males, when 35% are affected.[29] Acne develops earlier in females than in males that may reflect the earlier onset of puberty.[30]

Studies show that acne are slightly more predominant in males with more severe involvement. In females acne may persist till third decade of life.[31]

Kligman stated that true prevalence of acne is 100% in boys and girls and no one goes without even few comedones and papules in their adolescence. Cunliff and Gould found that clinical acne was not confined to adolescents. At 40-49 years of age 3% of men and 5% of women still had

acne and also at 50-59 years of age 6% of men and 8% of women had acne.[32] Age at which spontaneous regression of acne occurs is not fixed and very little is known about it. It has been stated that resolution of acne lesions may be related to specific changes in acne prone hyper secreting glands.[33]

Racial studies:-

Racial studies give idea about the genetic and environmental factors. White Americans have more evident and more severe acne. Incidence of acne is said to be low in people with their diet rich in fish while incidence increases with diet rich in saturated fats.[34] Spanish people tend to develop

more commonly cystic acne. African Americans have more commonly pomade acne, stemming from use of hair pomades.[35]

Genetic factors in acne:-

Acne is not an inherited condition but there may be an inherited predisposition to development of acne. The genes documented in causation of acne are, gene for cytochrome P-450-1A1 and gene for steroid 21-hydroxylase.

Positive family history may be found in around 40% of acne subjects and correlates with severity of disease. If both parents have acne then 3 of 4 children will have acne while if only one parent has acne then 1 of 4 children will have acne.[35]

Ballanger et al. (2006) found that more severe form of acne will be seen in patients with history of acne on maternal side and on both maternal plus paternal side than with history on paternal side only.[36]

It is not clear which etiological factors in acne are inherited. It may be an exaggerated response of pilosebaceous unit to normal levels of circulating androgens. Alternatively it may be genetically mediated elevation of circulating androgens.[37]

To conclude sebum excretion is under genetic control and development of lesions may be modified by environmental factors.

ETIOPATHOGENESIS OF ACNE:-

Acne vulgaris is a multifactorial disease. The clinical expression depends on interaction of multiple factors.

Following are the factors involved in pathogenesis of acne.

1. Sebaceous gland hyperplasia with seborrhea.
2. Abnormal end organ response to the circulating androgens and their increased levels.
3. Comedogenesis: Ductal hyper cornification
4. Propionibacterium acnes colonization in follicular duct.
5. Inflammation [38]

Sebaceous gland hyperplasia and seborrhea—

At around 7 to 8 years of age, sebaceous gland starts to enlarge under the influence of androgens resulting in increase in sebum secretion. [38] Androgens regulate sebaceous gland function by binding to nuclear androgen receptors (ARs). [39] Immunohistochemistry has demonstrated that sebaceous glands have the highest AR density in skin.[40]

Mechanisms for high sebum production include—

- Increased androgen production
- Increased availability of free androgen due to reduction in sex hormone binding globulin (SHBG)
- An amplified target response mediated through conversion of testosterone to more active dihydrotestosterone
- An increased capacity of the intracellular receptor to bind androgens.

There are three factors which are important in development of acne –

1. Sebum excretion rate
2. Composition of surface lipids
3. Resistance to outflow of sebum.[41]

Cove et al found no significant relation between the size of bacterial population and sebaceous gland secretion.[42]

The patients with acne have higher levels of squalene and wax esters while low levels of fatty acids. There are certain free fatty acids which occur more frequently.[43]

Components of sebum—triglycerides and lipoperoxide may play a role in pathogenesis of acne. Lipoperoxides produce pro-inflammatory cytokines and activate the peroxisome proliferator- activated receptors (PPAR) pathway, which causes increase in sebum.[44]

The reduction in pilosebaceous duct orifice may increase resistance to outflow of sebum. This further may be exacerbated by tropical and humid climate as that causes keratin hydration at the orifice.[45]

Abnormal end organ response to the circulating androgens and their increased levels--

The patients with acne vulgaris have high circulating levels of androgens and so should receive endocrinologic evaluation. [38]

Darley and coworkers found increased levels of testosterone or low SHBG either alone or together in 60 % of female patients. 45 % of patients

had hyper prolactinaemia.[46] Grinsberg et al (1980) have shown increased levels of dehydroepiandrosterone in women with acne, hirsutism, menstrual irregularity.[47] While Sheehan et al (1988) did not find any correlation between acne and other markers of hyperandrogenism.[48]

Comedogenesis: Ductal hypercornification—

Patients of acne show ductal hypercornification.

There exists correlation between severity of acne and number and size of follicular casts. Hypercornification is retention of hyper proliferating ductal keratinocytes.

The stimuli for hypercornification could be excess of androgen, decreased level of linoleic acid in sebum, Interleukin 1. IL-1 receptor antagonists inhibit microcomedo formation providing support for the cytokine's role in acne pathogenesis.[49] Fibroblast growth factor receptor (FGFR)-2 signaling pathway may be involved in hyperkeratinization. The FGFR-2 pathway is androgen dependent. The proposed role in acne includes, an increased production of IL-1 α and 5-α reductase.[50]

In patients with acne keratinocytes proliferate excessively and are shed as cluster. These abnormally desquamated corneocytes become densely packed along with monofilaments and lipid droplets inside follicle, thus leading to micro comedone formation.

Two important events occurring in formation of comedones include,

1. Decrease in dehiscence of horny cells that which stick together and form a solid mass. The underlaying cause for this may be reduced keratinosomes in follicular wall leading to reduced lysis of intercellular cementing substance.
2. Hyperproliferation of follicular epithelium.

   The horny cells stick together and form mass which distends the lumen of follicle, thus forming a micro comedone, a microscopic lesion invisible to naked eye . This grows to size of 1 mm, thus becomes visible and is called closed comedone. There occurs further expansion of the horny mass and due to pressure, lining epithelium becomes thinned out. The closed comedones either rupture inciting inflammation or may transform into open comedones. Later horny mass protrudes the orifice of open comedone and tip of it darkens. Shrunken sebaceous glands may continue to secrete sebum throughout life of comedo.[51]

Propionibacterium acnes colonization in follicular duct--

Acne vulgaris is not infectious. There are three organisms that are isolated on surface of the skin and follicular duct from patients of acne.

1. Propionibacterium acnes
2. Staphylococcus epidermidis
3. Malassezia furfur

There are three main subgroups of Propionibacteria

- Propionibacterium acnes
- Propionibacterium granulosum
- Propionibacterium avidum

Among these P. acnes and P. granulosum are most important. The other organisms like Staphylococcus epidermidis, Malassezia furfur as live in association with P. acnes, there seems some control of these organisms on growth of P. acnes.[33] The propionibacteria add to inflammatory processes via a number of mechanisms. Stress related proteins increase as a result of the trapped bacteria such as HSP60 and HSP70.[52]

Damage to the basement membrane may occur, causing leakage of comedonal contents into the dermis, thereby triggering the adaptive immune response to ductal antigens. The infiltrate around early inflamed lesions consists predominantly of CD4+ T cells and macrophages consistent with a delayed-type hypersensitivity (DTH) reaction.[53] This DTH response may be against an autoantigen or a persistent microbial pathogen. Propionibacteria increase the response to the autoantigen by acting as a mitogen.[54] P. acnes cell walls or a component would act as the PAMP (pathogen associated molecular patterns) and activate TLR-2 on keratinocytes thereby inducing NF-κB and switching on the production of pro-inflammatory cytokines including IL-1α.

The microenvironment within the pilosebaceous unit produced by the bacteria is more important than their absolute numbers for the development of acne lesions. In vitro, oxygen tension, pH and nutrient supply markedly affect

the growth of P. acnes, and the bacterial production of active substances such as lipases, proteases, hyaluronate lyase, phosphatase and smooth muscle contracting substances.[55,56] In vivo, the pH of blackheads may be between 3.6 and 6.7. [57] The pH of blackheads and oxygen tension may affect the growth of bacteria.

Inflammation--

Jeremy et al. confirmed from their study that inflammation in acne occurs prior to hyperproliferation of the follicular wall.[53] Inflammation in acne is dominated by CD4+ T helper cells and a macrophage infiltrate. Ductal corneocytes produce interleukins (IL-1 and IL-2) and Tumor necrosis factor (TNF) which have role in inflammation. Cell wall fraction of P. acne is strong chemo attractant, thus causing infiltration of polymorph nuclear and mononuclear cells at site. Direct immunofluorescence studies have demonstrated that in early inflamed and non-inflamed lesions there occurs activation of alternate as well as classical complement pathway.

Dahl and McGibbon suggested the role of complement in pathogenesis of acne based on their observation of presence of C3 in walls of dermal vessels of lesional skin.[58] Closed comedones have more tendency for developing inflammatory lesion.[59] P . acne also activates the toll like receptor-2 on monocytes and neutrophils which causes production of multiple cytokines like IL-8, IL-12 and TNF. Development of inflammatory acne in some individuals is explained by hypersensitivity to P. acnes.[35]

Non- inflammatory lesions may stimulate alternate pathway of complement activation and thus leading to conversion of non-inflamed lesions to inflammatory lesions.[59] The total IgG levels are raised in severe acne. This can be mostly due a response to cell wall component of P. acnes and Staphylococci and Pityrosporum ovale.[60]

Response of the host to P. acne is important. The level of antibodies to P. acne is raised. This antibody stimulates release of lysosomal hydrolases from polymorphonuclear cells. As lesions progress, type 3 and type 4 immunological reactions increase. There is also increase in leukocyte migration inhibition in acne patients. Thus importance of host's immunological responses in production of inflammatory lesions can be explained.[17]

FACTORS AFFECTING ACNE:--

1. **Menstruation and acne--**

Menstruation is known to affect acne. Acne may flare up 5-6 days prior to menstruation. Williams and Cunliff, used surface microscopy to measure the size of pilosebaceous duct orifices during menstrual cycle. They found that duct exit was significantly smaller between 15^{th} and 20^{th} day of cycle, leading to obstruction to flow of sebum and thus exacerbating acne. Changes in structure of keratin was thought to be a cause for reduction in size of exit of duct. But the exact cause for it is unkown.[61] Polycystic ovarian disease is commonly associated with acne. This can be detected by ultrasonography. The presence of ovarian cyst has no correlation with severity of acne.[62]

2. Dietary factors--

The relationship between diet and acne is controversial. It was thought before 1960s that there exists relationship between diet and acne specially with respect to food items like chocolate, fats, iodides which were blamed. With subsequent studies these were thought to be myths. **Adebamowo et al**, (2005) found that acne is associated with intake of milk, particularly skim milk, sherbet, instant breakfast drink and cottage cheese. It has been postulated that milk increases levels of insulin like growth factor (IGF-1) levels and thus increases comedogenecity. IGF-1 stimulates androgen synthesis in ovarian and testicular tissues. It inhibits synthesis of sex hormone binding globulin. The testosterone precursors like, androstenedione and dehydro-epiandrosterone sulfate and 5α reduced steroids (5α-androstenedione and 5α-pregnanedione), in milk are responsible for comedogenecity. IGF-1 and androgens as increase sebum production are implicated in acne.[63]

Severe calorie deprivation or dietary manipulation may modify sebaceous gland function. Low calorie diet causes a rapid increase in sebum secretion.[27]

Role of vitamin A, zinc, antioxidants, omega-3 fatty acids and dietary fiber in acne is not clear.[63] Iodides have been blamed for aggravating acne, but with poor evidence. There is no evidence that fluorides added to toothpastes and drinking water having role in acne.[64]

3. Environmental factors--

Acne is more common in industrialized cities and mining areas due to genetic, dietary and weather differences and is rare in rural areas. Hot and

humid weather in tropics may precipitate acne by increasing hydration of stratum corneum, called 'tropical acne'. This type of acne is commonly seen on back, especially in soldiers in tropics with backpacks.[65] Workers in kitchen and laundries due to increased heat may develop occupational acne. Sunlight is beneficial to acne although psoralens and UVA (PUVA) therapy may sometimes induce or aggravate acne.[66]

4. Psychological factors—

According to **Kenyon** stress alone is not responsible for acne. But acne itself induces a lot of stress. Picking of lesions which is commonly seen in young women can aggravate appearance of acne leading to acne excoriee.[33]

In periods of stress free fatty acid level may be increased. Many acne patients experience shame, anxiety, embarrassment, lack of confidence and impaired social relationships and thus unemployment.

Koo et al, observed that, psychiatric morbidities associated with acne include,

1) Impaired self image
2) Social impairment
3) Depression
4) Anger and anxiety.[2]

5. Friction and pressure--

Friction and pressure from helmets, and tight collars can induce comedones and papules.[67]

6. Facials (facial massage)--

Facials are regularly undertaken by women in urban areas for rejuvenation, suppleness of skin, tightening of skin, and for delaying the onset of wrinkles. It was observed that facials caused acneiform eruptions in 33.1 % of subjects in a study in India.[68]

7. Drug-induced acne--

Known causative drugs are halogenated compounds, progestogens, oral contraceptive pill (sometimes it helps acne), corticosteroids, isoniazid, and lithium. A new class of therapeutic agents – EGF-receptor antagonists (gefitinib, erlotinib, cetuximab) – have been recognized to cause acneiform eruptions.[69]

8. Pregnancy and acne—

Effect of pregnancy on acne is unpredictable and pre-existing acne may aggravate or remit during pregnancy.

CLINICAL FEATURES OF ACNE :-

Acne vulgaris is the easiest skin condition to diagnose clinically because of its distinctive anatomic distribution, age of occurrence, and polymorphic appearance of lesions in which the comedones (blackheads especially) are the pathognomonic feature. Acne patients usually present with greasy skin due to seborrhea. There exists direct correlation between acne and seborrhea. Despite of this, not all patients with seborrhea have acne, example of this being Parkinsonism and Acromegaly.[70]

Face is involved in 99% , back in 60% and chest in 15% of acne sufferers.[71] Itching is a rarely associated with acne, but if evident may be due to the release of histamine like compounds from P. acnes.[72]

Lesions of acne :-

Comedones- These are the initial non-inflammatory lesions seen in acne patients. They may be either open or closed comedones.

Open comedones :- Are called blackheads. They are of approximately 0.1 to 3 mm size. They are slightly raised above the surface and have dark color in centre due to follicular plugging of keratin, lipid, melanin and bacteria.

On expression of these lesions with comedone extractor, greyish white material is extruded. The black color in centre was thought to be due to melanin deposited due to oxidation of surface lipids.

Closed comedones:- Are called whiteheads. They represent a pilosebaceous duct which is distended with inspissated duct material. Orifice of this duct is barely visible to naked eye. Clinically these appear as pale white, slightly elevated papules. Out of these around 75% develop inflammatory lesions and only 25% resolve. Some lesions may show black centre with a white halo and are called, Intermediate non inflamed lesions or 'Blight head'.[64]

Secondary comedones:- These occur as a result of rupture or epithelisation of primary comedones. They are polyporous, also called double or triple comedones or fistulous comedones. They are seen typically in acne conglobata.

Comedo nevus:- It is a developmental defect of hair follicles. The associated sebaceous gland may be normal, hyperplastic or hypoplastic. Commonly involves scalp, face, trunk.

Solar comedones:- Seen commonly in elderly, periorbital area. Solar damage to supporting dermis causes pilosebaceous duct to get easily distended.

Macrocomedones:- They are larger than 1 mm.

Sandpaper comedones:- Large number of small sized closed comedones seen on forehead.

Submarine comedones:- They are large and deep comedones.

Papules:- These are the superficial lesions less than 5 mm in diameter arising from comedones. 50% of these arise from microcomedones, 25% from open and rest 25% from closed comedones.

Pustules:- They are of 2 types.

Superficial - Formed as a result of obstruction and inflammation in upper part of pilosebaceous canal. It is not tender. It lasts for few days.

Deep - Lesion extends to dermis as well. It arises from papule or nodule and may persist for up to 7 days. It may resolve in 2-6 weeks.

Nodules:- These are deep seated lesions, which extend over large areas.

They are often very tender, chronic and resistant to treatment. More commonly are seen in males.

Cysts:- These are rare to occur. They cause a lot of disfigurement. They may be unilocular or multilocular. 'Cysts' in acne are not true cysts because they are not lined by an epithelium.[73]

Scarring in acne:- Follows the lesions which extend into deeper dermis.

Some patients are particularly more prone for scarring.

Two types of tissue responses can be seen with scarring

1. Increased collagen formation- Leading to hypertrophic scars and keloids.
2. Loss of tissue- Leading to ice-pick scars, depressed fibrotic scars, atrophic macules and perifollicular elastolysis.

Post-inflammatory hyperpigmentation, is seen most frequently in pigmented skin. It can be prevented by starting treatment early.

HISTOPATHOLOGY OF ACNE:-

Comedone : A comedo contains keratinized cells, sebum, organisms. As xylene used processing, removes lipids routinely prepared sections show only keratinized cells. Follicular infundibulum is dilated and wall is thinned. In both open and closed comedones minor inflammation with mononuclear cell infiltration can be present in vessels around papillary dermis.[74]

Papules : They are characterized by predominantly lymphocytic infiltrate which is perifollicular. There may be small areas of follicular wall degeneration.[74] Comedo begins in infrainfundibular part of follicle, where there occurs change in keratinization pattern of entire epithelial lining.

The granular layer becomes more prominent and horny cells become more distinct. Instead of sloughing horny cells pack together forming a dense eosinophilic horn. Lamellar granules are reduced in intercellular spaces of cornified layer in comedo. Cells of stratum granulosum and corneum contain multiple lipid inclusions.[75]

Pustule: Attenuation of follicular wall may lead to rupture, and release of contents into superficial dermis may lead to inflammation. Inflammation is mediated by neutrophils initially and later on by histiocytes and giant cells.[74]

Nodule: There occurs release of follicular contents deep into dermis causing neutrophilic and granulomatous inflammation throughout dermis.[74]

Cystic acne : Extensive inflammation leads to dermal necrosis with abscess formation.[74]

VARIANTS OF ACNE :-

There are different types of acne and these include,

1. **Neonatal and infantile acne :** In around 20% of newborns mild acne is present. The cause appears to be stimulation of sebaceous glands due to maternal androgens. There may be a role of neonatal adrenal glands as they are highly active.[65] Lesions disappear by 1 to 3 months by which sebaceous gland involution starts. In this variant of acne scarring is absent. Infantile acne starts to appear in later months that is by third to sixth month. The cause is thought to be precocious secretion of androgens by gonads. In these patients family history is present commonly. Incidence is more in male children. According to one study, it has been found that if

there is history of infantile acne, these patients develop greater severity of acne with higher incidence in their teenage years.[76]

2. **Acne Mallorca or Aestivalis:** It is a type of acne that occurs in spring or summer. It occurs due to heavy exposure to ultraviolet rays.
3. **Acne mechanica or frictional acne:** Observed after repetitive physical trauma to the skin such as rubbing. It may occur due to clothing (belts and straps) or sports equipment (football helmets and shoulder pads) and occlusion of the skin with adhesive tape. Obstruction of the pilosebaceous gland resulting in comedo formation, is main etiology.

   Clinically it presents as a well-defined, lichenified, hyperpigmented plaque interspersed with comedones.
4. **Acne excoriee:** Occurs mainly in young women who are picking constantly at their skin. Mild acne may be present and is accompanied by extensive excoriations, leaving crusted erosions that may undergo scarring. This may suggest underlying depression, anxiety, obsessive compulsive disorder, or a personality disorder.
5. **Acne conglobata:** Meaning of word c*onglobate* is, shaped in a rounded mass or ball. Thus it being a mixture of comedones, papules, pustules, nodules, abscesses, and scars. This is a severe form of nodular acne and is commonly seen in teenage males.
6. **Acne fulminans :** Also called acute febrile ulcerative acne. This is the most severe form of nodular acne. It is associated with sudden onset of tender oozing plaques with haemorrhagic crusts and systemic signs and symptoms like, arthralgia, myalgia, hepatosplenomegaly.

7. **Occupational acne:** These are acneiform eruptions caused by certain chemical compounds and may be called chloracne when caused by dioxins. Contact with cutting oils, waxes and coal tar may cause oil acne.
8. **Cosmetic acne:** Cosmetics containing lanolin, petrolatum, lauryl alcohol and oleic acid may be comedogenic.[33]
9. **Mc Donald's acne:** It is a type of acne seen in teenagers working in Mc Donald's restaurant due to repeated exposure to oil vapour during cooking.
10. **Drug induced acne:** Many drugs can cause acneiform eruptions. Clinically these are characterized by monomorphic lesions of sudden onset temporally related to drug with absence of comedones, mainly on trunk.[17] Drugs include, systemic corticosteroids, anabolic steroids, ACTH, isoniazid, rifampicin, phenytoin, lithium, disulfiram and thiouracil.
11. **Pyoderma faciale:** It is exacerbated purulent acne that involves face mainly. Seen in women between age of 20-40 years, associated with sudden onset development of highly inflammatory lesions.

CLASSIFICATION OF ACNE VULGARIS:-

There are many methods for classification of acne based on severity of the disease. Uniform classification system is lacking. Methods of measuring the severity of acne vulgaris include simple grading based on clinical examination, lesion counting and those requiring complicated instruments such as photography, fluorescent photography, polarized light photography, video microscopy and measurement of sebum production. Most commonly used methods are, grading and lesion counting.[77]

Table-1: Comparison between grading and lesion counting[77]

Grading	Lesion counting
Involves observing the dominant lesions, and evaluating the extent of involvement	Involves recording the number of each type of acne lesion and thus determining the overall severity
Subjective method	Objective method
Simple and quick	Time consuming
Less accurate	More accurate
Effect of treatment on individual lesions cannot be estimated	Effect of treatment on individual lesions can be estimated
Used in clinical settings	Used in clinical trials

Individual methods:

Carmen Thomas of Philadelphia was the first person to use a scoring system for acne vulgaris. She used lesion counting as a method in her office notes, starting in the 1930s. Several systems for grading the severity of acne exist currently.

- In 1956, Pillsbury, Shelley and Kligman proposed the earliest known grading system. The grading includes the following: [77]

Grade-1: Comedones and occasional small cysts confined to the face.

Grade-2: Comedones with occasional pustules and small cysts confined to the face.

Grade-3: Many comedones and small and large inflammatory papules and pustules, more extensive but confined to the face.

Grade-4: Many comedones and deep lesions tending to 'coalesce and canalize, and involving the face and the upper aspects of the trunk.

- In 1958, James and Tisserand in their review of acne therapy, recommended an alternative grading scheme.[31]

Grade-1: Simple non-inflammatory acne – comedones and a few papules.

Grade-2: Comedones, papules and few pustules

Grade-3: Large inflammatory papules, pustules and a few cysts, a more severe form involving the face, neck and upper portions of the trunk.

Grade-4: More severe, with cysts becoming confluent.

- In 1971, Frank recommended a numbering system based on type of predominant lesion present and severity of the acne lesions.[78]
- In 1977, Michaelsson evaluated their acne treatment results by counting each type of lesion and multiplying the count with the respective severity index. Sum of these indices was taken as severity index.[78]
- In 1977, Doshi, Zaheer and Stiller recommended a global acne grading system (GAGS). This system divides the face, chest and back into six areas and assigns a factor to each area on the basis of size.[77]

Location	Factor
Forehead	02
Right cheek	02
Left cheek	02
Nose	01
Chin	01
Chest and upper back	03

Note: Each type of lesion is given a value depending on severity; No lesion =0; Comedones=1, papules=2, pustules=3 and nodules-=4.

The score for each area (local score) is then calculated using the formula: Local score= Factor X grade (0-4). The global score is the sum of local scores, and acne severity was graded using the global score. A score of 1-18 is considered mild, 19- 30 moderate; 31-38 severe and >39 very severe.

- In Cook et al used photography to grade acne on scale of 0 to 8. The photographs of patients were taken and their acne scored on grades of 0,2,4, and 8. While grading comparison was made with a reference card.
- In 1982, Allen and Smith used photography technique. They added a palpation criteria to the photographs and improved the assessment of acne.The grading scale given for comedones was from 0 to 8. This method was found to be superior to lesion counting.

- In 1984, Burke and Cunliff reported their assessment technique. This was subjective and based on inspection and palpation of skin. It is called Leeds technique. The scale is subdivided into 0.25 units from 0 to 2 that is 0.25, 0.5, 0.75, 1, 1.25, 1.5, 1.75 and 2. Grades of 0.25 to 0.75 represent physiological acne or acne minor while 1 and above indicate clinical acne or acne major. Above grade 2, the acne is subdivided into 0.5 divisions.[79,80]
- In 2008, Hayashi et al used standard photographs and lesions counting and classified acne into four groups. They classified acne based on the number of inflammatory eruptions on half of the face as 0-5 mild, 6-20 moderate, 21-50 severe and more than 50 very severe.

Acne vulgaris was graded by Indian authors with a simple grading system, that classifies acne vulgaris into four grades as follows:[77]

Grade-1: Comedones and occasional papules

Grade-2: Papules, comedones and few pustules

Grade-3: Predominant pustules, nodules and abscesses

Grade-4: Mainly cysts, abscesses with widespread scarring.

DIFFERENTIAL DIAGNOSIS :-

Acne vulgaris is rarely misdiagnosed. The differential diagnosis includes,

Rosacea : Occurs in older age group (30-50). It lacks comedones, cysts, scars and nodules. Characteristically erythema and telangiectasia may occur on butterfly area

of face. There may be history of photosensitivity and ocular involvement in rosacea patients.

Milia : Commonly confused with white heads. Usually are seen on infra orbital area.

Gram negative folliculitis : This may occur as a complication of acne therapy due to long term use of antibiotics. It is caused by Proteus group of anaerobic bacteria.

Perioral dermatitis : More frequently occurs in females due to abuse of fluorinated topical steroids for long time. It is clinically characterized by itchy papules and plaques around mouth sparing vermillion border.

Pityrosporum folliculitis : These are mildly itchy lesions present on trunk. They consist of papules and pustules on erythematous base around follicle.

Molluscum contagiosum : It is pox viral infection clinically characterized by pearly white dome shaped papules with central umbilication. Can be mistaken for closed comedones.

Folliculitis : Staphylococcal folliculitis can mistaken for closed comedones. Material from swab for culture sensitivity can be helpful in diagnosis.

Others : Plane warts, pseudofolliculitis barbae, tuberous sclerosis, acne varioliformis, acneiform eruptions of Behcet's disease.

SYNDROMES ASSOCIATED WITH ACNE:-

1. **Polycystic Ovary syndrome (PCOS or Stein Leventhal syndrome) -** Commonly seen in young girls. Patients present clinically with irregular menses, obesity, androgenic alopecia, hirsutism, and acne. Positive family history may be present and USG abdomen shows multiple cysts in ovaries. It is associated with an increased risk of diabetes mellitus and endometrial carcinoma.[81]
2. **HAIR-AN Syndrome -** Hyperandrogenism, acne, insulin resistance and acanthosis nigricans are components of HAIR-AN syndrome. It is a subset of PCOS. This syndrome is currently described as a fifth variant with poly endrocrinopathy.
3. **Apert syndrome -** It's components are synostoses of cranium, vertebrae, hands, feet and acneiform eruption. Underlying problem is an abnormal sensitivity to normal circulating level of androgens.
4. **PAPA syndrome -** It is variant of acne with systemic symptoms, is characterized by sterile pyogenic arthritis, pyoderma gangrenosum, and acne. Patients with PAPA syndrome may give history of sterile cutaneous abscesses, inflammatory bowel disease, and pancytopenia following administration of sulfa containing medications.[82]
5. **SAPHO syndrome** - It consists of synovitis, acne, pustulosis, hyperostosis, and osteitis. There are reports of successful treatments with NSAIDS, sulfasalazine, and infliximab.[83]
6. **PASH syndrome -** It consists of pyogenic arthritis, acne, suppurativa Hidradenitis.

7. **SAHA syndrome -** Components are Seborrhea, acne, hirsutism, alopecia. This syndrome is associated with PCOS, cystic mastitis, obesity and infertility.

THERAPY FOR ACNE VULGARIS:-

Acne management aims to relieve symptoms, clearance of existing lesions, limit disease activity so preventing new lesions and scarring, and avoid negative impact on quality of life. The choice of treatment is determined by severity of acne, extent of disease mainly and can be modified according to duration of disease, response to treatment, predisposition to scarring, post inflammatory erythema and pigmentation and cost of treatment.

Topical therapy:-

Cleansing: It is believed that acne is related to poor hygiene. To remove keratinous plugs and reduce associated seborrhea, it is recommended that regular face wash should be done. Vigorous cleansing and rubbing of face can aggravate inflammatory phase of acne.

Exfoliants: Oldest therapy for acne is elemental sulfur. It has a keratolytic anti-bacterial and anti-oxidant property. But sulfur has paradoxical role in acne. It promotes formation of new comedones though it hastens resolution of papulopustules. Resorcinol is also an exfoliant that causes irritation and consequent peeling of skin. Salicylic acid in propylene glycol (5%) is also a keratolytic agent, but not used so commonly now a days and is replaced by Benzoyl peroxide.

Benzoyl Peroxide: It is effective bactericidal agent. It releases free oxygen radicals that cause oxidation of bacterial proteins of sebaceous gland. It is available as 2.5, 5, 10% as gel formulation. It mainly reduces comedones.

Side effects are bleaching of clothes and hair and contact sensitivity.

Topical antibiotics: They have bacteriostatic effect and reduce inflammation. *Clindamycin phosphate* Available as 1% gel. It decreases both ductal and surface counts of P. acnes. As pseudo membranous enterocolitis may occur in some patients using it, it should be stopped as soon as intestinal symptoms develop.

Erythromycin - It acts by reducing free fatty acids in follicular duct and is available as 1.5% , 2% solution and 2% ointment. It can be combined with benzoyl peroxide gel.[84]

Tetracycline hydrochloride - It may cause temporary yellow staining of teeth and is as effective as erythromycin.

Topical retinoids: Mechanisms of action include,

1. Inhibition of formation of microcomedones and reduction in their number.
2. Reduction in number of mature comedones.
3. Promotion of normal desquamation of follicular epithelium.
4. Anti-inflammatory action
5. Enhance penetration of other drugs

Retinoic acid (Tretinoin) - Synthetic Vitamin A analogue for topical use. It is available as gel and cream in concentration of 0.025%, 0.05% and 0.1%. It has

side effects like, erythema, irritation, and photosensitivity and hence advised to be applied at night.

Adapalene - It is a third generation retinoid which is available as cream, gel and solution in 0.1% concentration.

Tazarotene - It is available in strengths of 0.05 and 0.1% as gel or cream.

Azelaic acid: It is derived from Pityrosporum ovale. It is dicarboxylic acid derivative. It inhibits growth of P. acnes and also reduces keratohylin granules.It was used initially for hyperpigmentation following acne lesions.[33]

Zinc sulfate: 2% zinc sulfate solution has been used in acne with little success.[85]

Metronidazole: Available as 2% gel. It has been found to be better than 5% benzoyl peroxide in this concentration in a clinical trial.[86]

Aluminium chloride hexahydrate: It has an antibacterial and antiperspirant activity. It can be used in acne where sweating is an aggravating factor.

Dapsone: It is available as 5% gel. It has rapid onset of action and is safe, effective, well tolerated. It inhibits leukocyte trafficking and also generation of inflammatory mediators by leukocytes. It may cause local irritation, erythema and dryness of skin.[87]

Systemic therapy:-

It is indicated in grade 2, 3 and 4 of acne and includes the three major groups drugs, antibiotics, hormones and retinoids.

Oral antibiotics:

Antibiotics penetrate the follicle and also sebaceous gland and decrease colonization by P.acnes and also have an anti-inflammatory effect.

1. **Tetracycline:** The usual dose is 500 mg twice a day continued until a significant decrease in acne lesions occurs. The dose can later be decreased to 250 mg, twice a day or discontinued. The main disadvantage of this antibiotic is that it has be taken on an empty stomach to be the most effective. Pregnancy and children are contraindications.[88]
2. **Doxycycline:** The starting dosage of doxycycline is 50 to 100 mg twice daily.[88]
3. **Erythromycin:** The dosage of erythromycin varies with the type used, but it is typically given as 250-500 mg twice a day. It may cause stomach upset and nausea. It can be used in pregnant women.
4. **Minocycline:** The starting dose is 50 to 100 mg twice a day. Major side effects of minocycline are dizziness, nausea, vomiting, skin pigmentation changes, and tooth discoloration.
5. **Clindamycin:** The usual starting dose is 75 to 150 mg twice a day.
6. **Azithromycin**: Azithromycin has been recently added to therapy of acne vulgaris. Several regimens of Azithromycin include, **Kapida et al** have proposed oral thrice weekly each day, dosage of 500mg while, **Parsad et al** recommended 500mg once a day for four days per month. Fernandez-Obregon have recommended 250mg orally three times a week. All these regimens are of 12 week duration.[89]

Hormonal therapy:

Mainly recommended for females as in males it may lead to feminization. Several hormonal regimens for reducing sebaceous production exist.

Indications of hormonal therapy-

1. SAHA syndrome
2. PCOS (Polycystic ovarian syndrome)
3. HAIRAN syndrome
4. Adult onset acne
5. Refractory acne
6. Nodulocystic acne where isotretinoin is contraindicated.[90]

a) Estrogens: Suppress Ovarian androgens.

Ethinyl estradiol alone or in combination with progesterone can be given. Most common combination is ethinyl estradiol 35microgm plus cyproterone acetate 2 mg.

b) Anti androgens: Acts mainly at the peripheral level.

Spironolactone; 50-100mg

Flutamide; 250mg bid.

Contra-indications for hormonal therapy-

1. Personal or family history of thromboembolism.

It should be used with caution and justification in cases of breast or uterine malignancies, depression, hypertension or presence of internal medical disorders.[90]

Side effects of hormonal therapy-

1. Menstrual abnormality
2. Melasma
3. Fluid retention.

Low dose glucocorticoids cause suppression of adrenal androgens thus leading to reduction in sebaceous secretion. In severe forms of acne vulgaris like Nodulocystic acne, acne fulminans, and acne conglobata and acne flares induced by other systemic therapies steroids can be given orally in low dose.

Systemic retinoids:

Isotretinoin is the one among acne treatments as it targets all pathophysiological factors in acne. Usual dose is 0.5 to 1 mg/kg/day. It is given for period of 4-5 months. It's effect continues for around 2 months even after stopping of drug. It has a sebostatic effect. It decreases size of sebaceous gland. It has a potent comedolytic action. It normalizes ductal hyperkeratinization. It suppresses P. acne by reducing its nutrient supply. It has anti-inflammatory action as it decreases chemotaxis of polymorphonuclear cells.

Indications for isotretinoin therapy-

1. Nodulocystic acne
2. Adult acne
3. Acne conglobata
4. Androgenic acne
5. Acne fulminans
6. Refractory acne.
7. Mild to moderate acne with imminent scarring.

Cutaneous side effect—

1. Cheilitis
2. Facial erythema
3. Photosenstivity
4. Xerosis
5. Dry nose
6. Alopecia
7. Irritant dermatitis

Most of the side effects are reversible on discontinuation of drug.

Systemic side effects-

1. Teratogenicity
2. Derangement of lipid profile
3. Arthralgia
4. Myalgia
5. Vertebral hyperostosis
6. Benign intracranial hypertension
7. Depression and suicidal tendencies.

Other adjunctive treatments include,

1. **Chemical peeling -** Salicylic acid, a beta-hydroxy acid is excellent keratolytic agent and causes solubalization of intercellular cement, reducing corneocytes adhesion. It controls seborrhea and it has comedolytic action. It is contraindicated in pregnancy and lactation. It may cause transient hyperpigmentation and superficial crusting, edema,

transient purpura in lower eyelid area, Hypopigmentation, transient dryness which resolve quickly.[91] Glycolic acid, a alpha-hydroxy acid, is mainly used to treat post acne pigmentation. Erythema and exfoliation are the side effects.

2. **Acne surgery—**Comedone extraction can be done as simple office procedure for comedonal acne.
3. **Intralesional steroid injection--** Intralesional steroids like triamcinolone acitonide 5-10 mg/ml can be given for cystic acne.
4. **Laser therapy for acne scars**— Intense Pulse Light (IPL) laser acts by heating dermis and thus stimulating neocollagenosis. It helps in red hypertrophic scars. It is used for superficial U scars. Ablative laser resurfacing is also an effective technique, but risk of edema, hyperpigmentation, erythema and scarring is more. 585 nm flashlamp-pumped pulsed dye laser can be used for treatment of hypertrophic acne scars.
5. **Microdermabrasion--** This technique involves use of micromarbles of aluminum oxide on scars. Six to seven sessions at around 2 week interval are needed. In one session, twenty passes are made on each area until superficial bleeding. This may be useful for superficial U scars.[92]
6. **Iontophoresis**-- Iontophoresis has been tried for atrophic acne scars and main advantage of it being its non-invasiveness.[93]

Quality of life assessment In Dermatology Patients:

What is quality of life?

Quality of life is a broad term without any precise definition. It depends on number of factors like, support from the friends and relatives, ability to work and interest in ones occupations, accommodation appropriate to expectations and of course, health and disabilities whether congenital or recently acquired disorder.[94]

Quality of life and acne Vulgaris :-

Relationship between dermatological disorders and mind has been known since 1981 when Brocq and Jacquet first described 'neurodermatitis.'[95] Prevalence of emotional disorders among dermatological patients is 25% for outpatients and 45% for inpatients suggesting complex relationship between skin diseases and psychological functioning of patient.[96] Patients with acne have been found to have great psychological and emotional impact of their condition comparable to disorders like psoriasis, vitiligo.

Why try to measure quality of life?

QOL in dermatology is measured mainly for clinical, research audit and for financial and political purposes.

All practitioners use a view of how much the skin disease is affecting their patients while taking treatment decisions, but patients may measure Quality Of Life in a different way from their doctors.[94] When there is data to infer the scores, more precise measurement of Quality Of Life might be helpful in

taking treatment decisions, for example where costly therapy is being initiated. The use of straightforward Quality Of Life, measures is usually welcomed by patients who wish to communicate their concerns.

Methods of measurement of quality of life:-

The techniques that are used to measure QOL, are questionnaire based. These measures either cover all the ways in which patient's living can be affected by any disease, or are more specific to diseases of systems or individual diseases. The details asked about and the question base vary widely. In dermatology several general health questionnaires have been used and also disease specific and speciality specific questionnaires have been created.

Generic QOL measures

1. **Short Form 36 (SF-36)**

It is widely used health survey and contains 36-items, 8 domains of health status are checked by self reporting health status questionnaire- (1) physical activities; (2) usual physical role activities; (3) social activities; (4) bodily pain; (5) usual emotional role activities; (6) general mental health; (7) vitality; (8) general health perceptions. A score ranges from 0 to 100. The higher values indicate superior HRQL.[97] The SF-36 may be the best considered measure for comparing Quality of Life differences across diverse diseases.

2. **Subjective Well Being Scale (SWLS)**

This is a tool consisting of 5-varibles intended to measure global life satisfaction. It is validated and correlated with other method of subjective well-

being (SWB). This was made to gauge contentment with the respondent's life, without assessing contentment with definite life event.[97]

3. Nottingham Health Profile

The Nottingham health profile contains 38 statements combined to form six scales reflecting health problems, such as physical mobility and pain, and severe other statements about areas of daily life affected most often by health. A weighting formula is applied to the tick box answers.[98]

4. General health questionnaire

GHQ is a self administered screening questionnaire. There are 60, 30, 28 , 12 item versions in it; out of which 12 and 28 item versions are used for skin conditions. The 28 item version has got 4 subscales addressing somatic symptoms, anxiety and insomnia, social dysfunction and severe depression[98].

5. Sickness Impact Profile assessment

It is a broadly based assessment of performance of daily activities. One hundred thirty- six individuals statements relating to daily activities can be agreed or disagreed by patients. These are grouped into 7 main categories and 5 subcategories which address to physical, psychosocial, sleep and rest, eating, work, home management, recreation and pastimes.[98]

Acne specific quality of life indices:-

1. **Cardiff Acne disability index (ADI)-** It is a short five item questionnaire derived from the longer Acne Disability Index . It is mainly used for teenagers and young adults with acne. It is self

explanatory and can be simply given to patients who are asked to complete it. It is usually completed in one minute.

2. **Acne specific Quality Of Life Questionnaire-** It was the first validated disease specific questionnaire. It contains 19 questions organized into 4 domains that is, self perception, role social, role emotional and acne symptoms. It is mainly used for facial acne. For all of these domains, higher scores indicate better HRQoL. The total score varies from zero to 114 and is distributed as,

   0-30 Self perception

   0-24 Role social

   0-30 Role emotional

   0-30 acne symptoms.

3. **Acne quality of life index-** It is a brief and easily administered and interpreted measure of acne related quality of life and can be used in clinical and research work. It is a 21 item questionnaire.[99]

4. **Dermatology- Specific Quality of Life Instrument for Acne-** It includes parameters like, acne symptoms, psychological well being, social functioning, performance at work or school and self perceptions in acne patients.

Dermatology Life Quality Index (DLQI):-

The Dermatology Life Quality Index is a condensed self-reported questionnaire to gauge HRQoL over the previous week in patients with skin diseases. It consists of 10 variables covering symptoms and feelings (item 1 and 2), daily activities (items 3 and 4), leisure (items 5 and 6), work and school (item

7), personal relationships (items 8 and 9) and treatment (item 10). Each item is scored on a 4 point scale, with higher scores representing greater impairment in HRQoL.

INSTRUCTIONS FOR USAGE:

DERMATOLOGY LIFE QUALITY INDEX (DLQI)

The DLQI questionnaire is designed for use in adults, i.e. > 16 years. It is self descriptive and can be simply given to the patient who is requested to fill it without the need for detailed explanation.

Scoring

The scoring of each question is as follows:

1) Very much- scored 3
2) A lot- scored 2
3) A little- scored 1
4) Not at all- scored 0
5) Not relevant- scored 0
6) Question unanswered- scored 0
7) Question 7(prevented work or study) scored 3

The DLQI is calculated by adding the score of each question, score ranges between 0-30. The higher the score, the more is the impairment of quality of life. The DLQI can also be expressed as a percentage of the highest probable score of 30.

Meaning of DLQI score:

0-1 = no effect at all on patients life

2-5 = small effect on patients life

6-10 = moderate effect on patients life

11-20 = Very large effect on patients life

21-30 = Extremely large effect on patients life

The DLQI can be analyzed under following 6 headings:

	Questions	**Maximum score**
Symptoms/feelings	1 and 2	6
Daily activities	3 and 4	6
Leisure	5 and 6	6
Work/School	7	3
Personal relationships	8 and 9	6
Treatment	10	3

Interpretation of incorrectly completed questionnaires:-

1. There is a very high success rate of precise conclusion of the DLQI. Nevertheless, occasionally subjects do make mistakes.
2. If one question is left unanswered this is scored 0 and the scores are added and expressed as usual out of a maximum of 30.
3. If two or more questions are left unanswered the questionnaire is not scored.

4. If question 7 is answered 'yes' the score is given as 3. If question 7 is answered 'no' or 'not relevant' but then either 'a lot' or 'a little' is marked this then score is given as 2 or 1.
5. If two or more answer options are ticked, the response option with the maximum score should be recorded.
6. If there is a response between two tick boxes, the lesser of the two score options should be recorded.

The DLQI can be measured by calculating the score for each of its 6 sub-scales (see above). If the answer to one question in a sub-scale is missing, that sub-scale should not be scored.

The DLQI scale is attached with the Proforma. (Annexure II)

MATERIAL AND METHODS

This was a cross-sectional hospital based study. Out of total 25748 patients attending dermatology outpatient department in a tertiary care centre, during study period of one year that is from January 2016 to December 2016, 1287 patients were diagnosed clinically as acne vulgaris. Incidence of acne vulgaris was 5%.

Among these 100 cases were selected for present study according to a formula, sample size= z^2pq/d^2 [p=prevalence (83%), q= 100-p, d= error was 8, z for 95% confidence interval=1.96~2]. The patients suffering from all grades of acne vulgaris between age group of 18 to 30 years were included for study.

The patients having any other chronic skin diseases and disabling medical disorders were excluded from study.

All patients included in this study after obtaining written informed consent in Marathi/English/Hindi/Kannada filled a questionnaire called, Dermatological life quality index (DLQI). DLQI is a validated reliable questionnaire containing 10 questions and covering 6 dimensions, such as, symptoms and feelings, daily activities, leisure, work and school, personal relationships and treatment. Each question is scored as “very much” (score 3), “a lot” (score 2), “a little” (score 1), and “not at all” (score 0). Final DLQI Score was calculated for all patients.

Detailed history was taken for all patients pertaining to socio demographic data, presenting complaints, duration of acne, etc. Thorough physical

examination was done for all patients. Cutaneous examination was done on all patients and the following were noted:

1. Site of lesion (face, chest, back or arms),
2. Type of lesion
3. Grade of acne,
4. Post acne hyperpigmentation (present/absent),
5. Post acne scars (present/absent)

Acne vulgaris was graded into 4 grades based on a grading system proposed by Indian authors.[77]

Acne vulgaris was graded as:

Grade I: Comedones, occasional papules

Grade II: Papules, comedones, few pustules

Grade III: Predominant pustules, nodules, abscesses

Grade IV: Mainly cysts, abscesses, widespread scarring.

DLQI score interpretation is done as follows:

- 0–1 no effect on patient's life
- 2–5 small effect on patient's life
- 6–10 moderate effect on patient's life
- 11–20 very large effect on patient's life
- 21–30 extremely large effect on patient's life.

Correlation between final DLQI score and grades of acne was done by using spearman's rank correlation method.

OBSERVATIONS AND RESULTS

Out of total 25748 patients between age of 18-30 years, who attended dermatology outpatient department during study period, 1287 cases of acne vulgaris were diagnosed. Incidence of acne was 5% . Among these, 100 cases were selected for study, using formula z^2pq/d^2.

Table No. 2: Age incidence

	No. of patients	Percentage
< or = 20	47	47.00
21-23	21	21.00
>or =24	32	32.00

The maximum number of patients were seen in age group of 20 or less than 20 years (47%).

Graph No. 1: Age Incidence

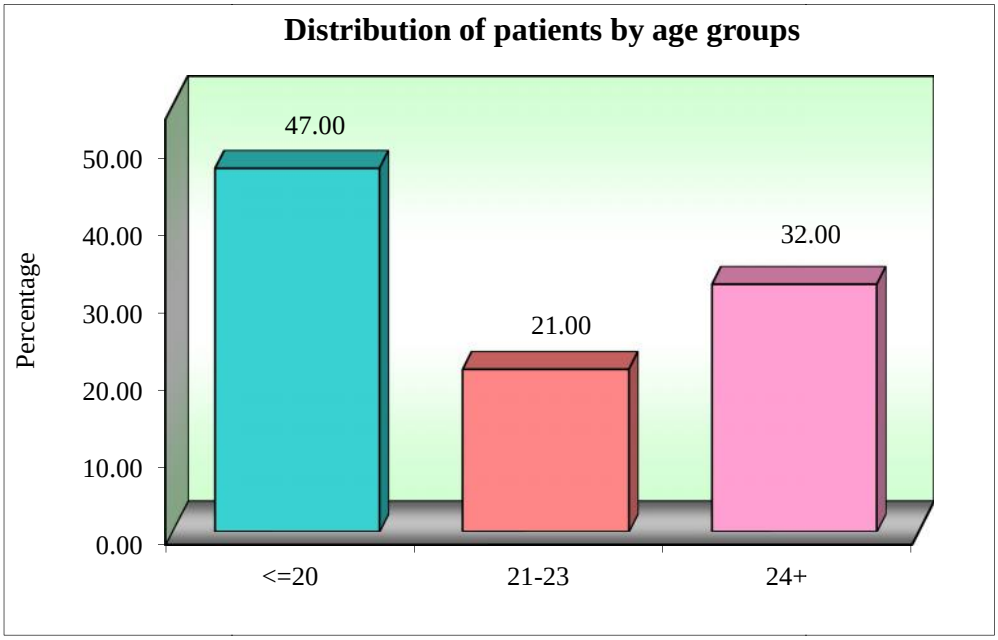


Table No.3: Sex incidence

Sex	No. of patients	Percentage
Males	48	48.00
Females	52	52.00

Out of total 100 patients, 48 patients were males (48%) and 52 were females (52%). The incidence of acne was higher in females than in males, with female: male ratio 1.0833:1.

Graph No. 2: Sex incidence

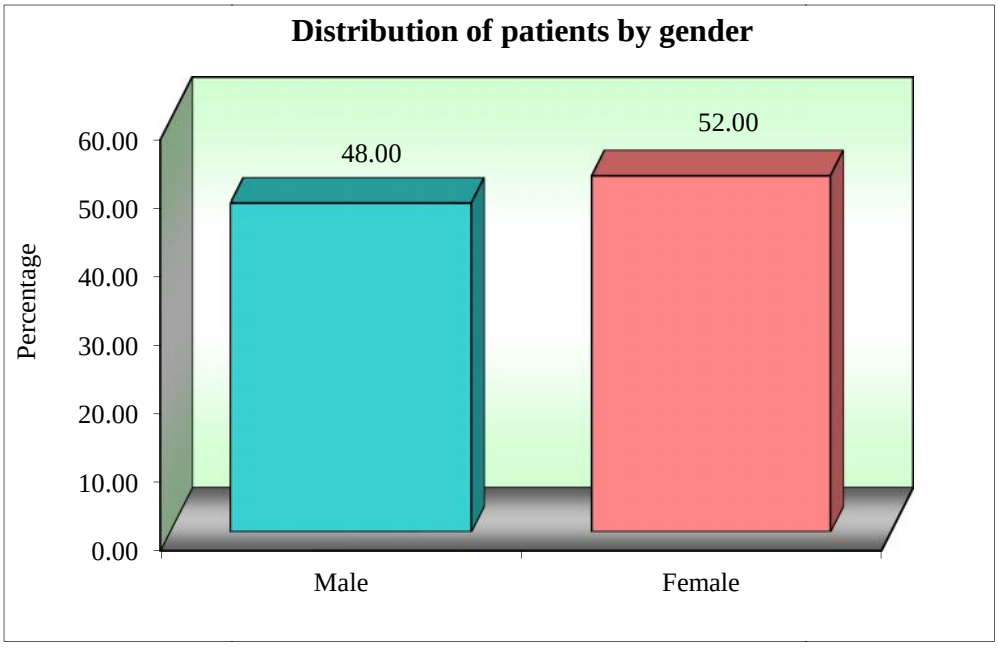


Table No. 4: Marital status

Marital status	No. of patients	Percentage
Married	13	13.00
Unmarried	87	87.00

Among 100 patients, 13 were married (13%) and Maximum that is 87 were being unmarried (87%).

Table No.5 : Marital status and mean DLQI

Factors	Mean	SD	F/t test	p-value
Marital status				
Married	7.77	3.44	-1.9601	0.0500*
Unmarried	11.11	5.99		

Mean DLQI value of 7.77 in married population suggests less impact on quality of life in married people as compared to unmarried people.

Graph No.3: Marital status

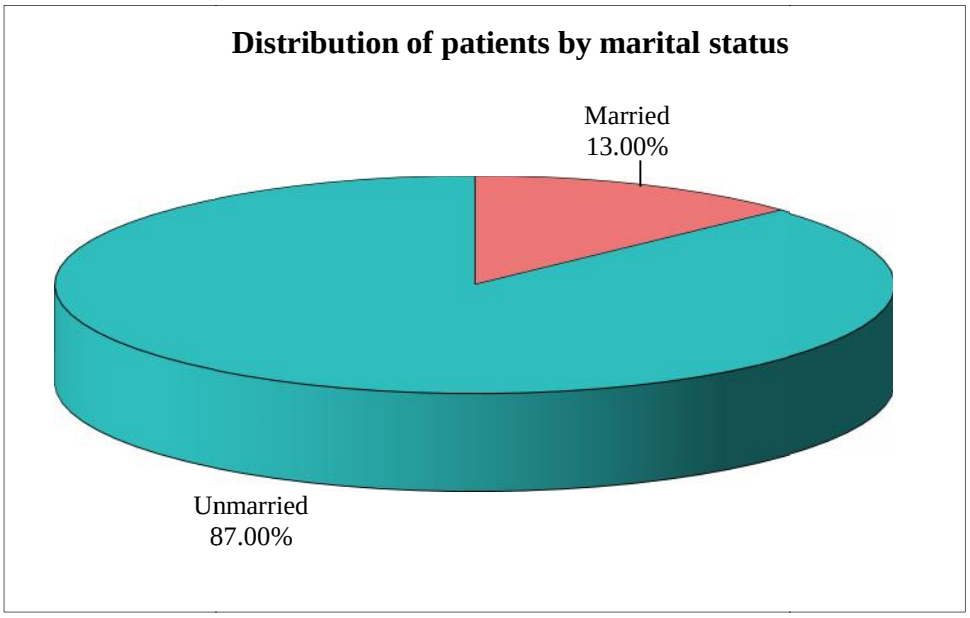


Table No. 6: Occupation

Occupation	No. of patients	Percentage
Students	59	59.00
Service	21	21.00
Housewife	7	7.00
Others	13	13.00

Out of total 100 patients maximum number of patients were students (59%). Remaining were servicemen (21%), housewives (7%) and others (13%).

Graph No. 4: Occupation

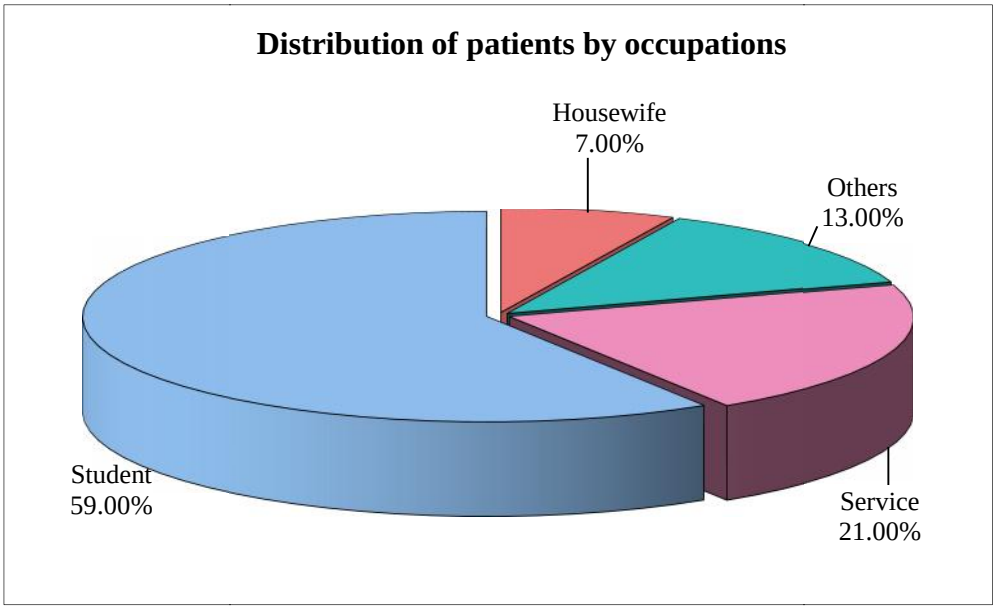


Table No.7: Location

Location	No. of patients	Percentage
Urban	46	46
Rural	54	54

In 100 patients studied, 46 were from urban (46%) and 54 were from rural area (54%).

Incidence being higher in rural area than urban.

Graph No.5: Location

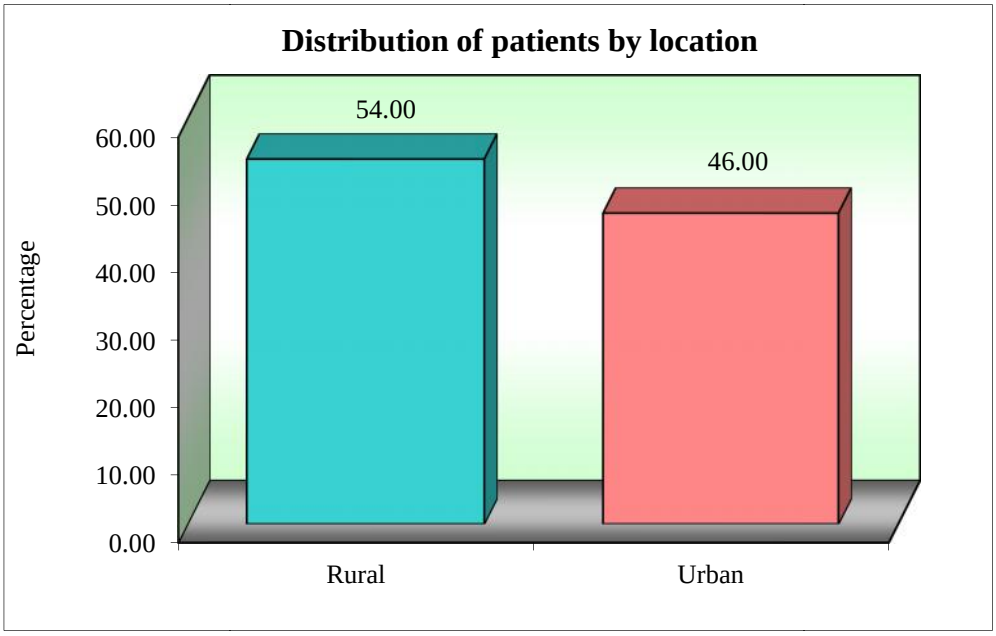


Table No.8 : Duration of acne

Duration of acne	No. of patients	Percentage
<=1yr	47	47.00
1.1-2yrs	36	36.00
2.1+yrs	17	17.00

The maximum number of patients that is 47 had acne of less than or equal to 1 year duration (47%).

Graph No.6: Duration of acne

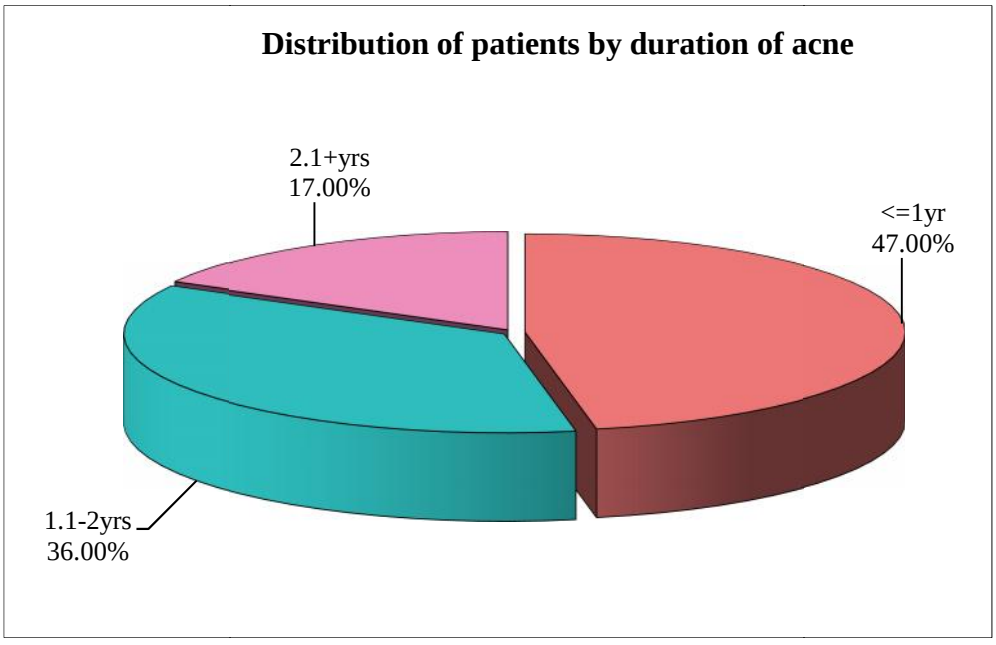


Table No.9 : Distribution of lesions of acne.

Site	No. of patients	percentage
Face	85	85.00
Face and back	8	8
Face and chest	0	0
Face and arms	1	1
Face, chest and back	5	5
Face, chest and arms	0	0
Face, back and arms	1	1
Face, back, chest, arms	0	0

Face was most common site of acne vulgaris.

Graph No.7: Distribution of lesions of acne.

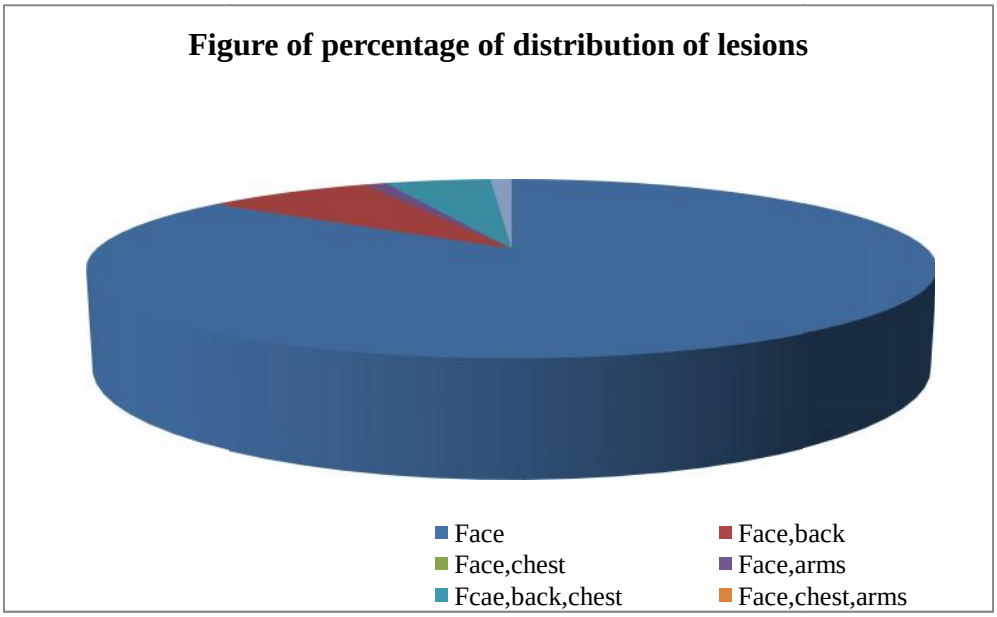


Table No. 10 : History of steroid use

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
History of steroid use											
Yes	0	0.00	7	50.00	5	35.71	2	14.29	14	1.7400	0.6280
No	7	8.14	47	54.65	24	27.91	8	9.30	86		

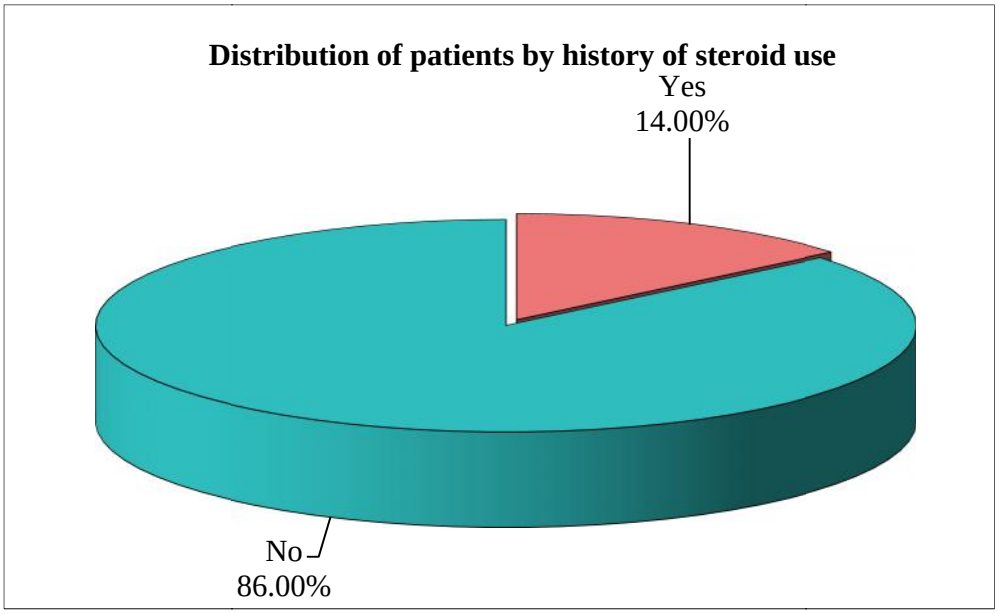
Among 100 patients 14% used topical steroid containing preparations.

Table No. 11 : Mean DLQI score and steroid use

Factors	Mean	SD	F/t test	p-value
History of steroid use				
Yes	14.21	6.49	2.5142	0.0136*
No	10.1	5.53		

Significant difference in mean DLQI score of patients using topical steroid and those not using steroid was observed with p value of 0.0136 at 5% level of significance.

Graph No. 8: History of steroid use



Among 100 patients, 35% patients had received anti-acne treatment in the form of topical retinoids and or benzyol peroxide and or clindamycin or systemic treatment oral azithromycin and or oral retinoids or ayurvedic treatment.

Table No. 12 : Food habits

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
Food habits											
Vegetarian	4	10.53	22	57.89	9	23.68	3	7.89	38	2.1300	0.5460
Non-vegetarian	3	4.84	32	51.61	20	32.26	7	11.29	62		

Among 100 patients 62 patients were having non-vegetarian food habits.

Table No. 13 : History of oily skin

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
Oily skin											
Present	1	14.29	3	42.86	3	42.86	0	0.00	7	1.995	0.5730
Absent	6	6.45	51	54.84	26	27.96	10	10.75	93		
Total	7	7.00	54	54.00	29	29.00	10	10.00	100		

Among 100 patients, 7% patients complained of oily skin.

Table No.14 : Grade wise distribution of acne

Grades of ACNE	No. of patients	Percentage of patients
Grade 1	7	7.00
Grade 2	54	54.00
Grade 3	29	29.00
Grade 4	10	10.00

Out of total 100 patients, 54 that is maximum patients had grade 2 of acne vulgaris (54%). Least number of patients that is 7 had grade 1 of acne (7%).

Graph No.9 : Grade wise distribution of acne

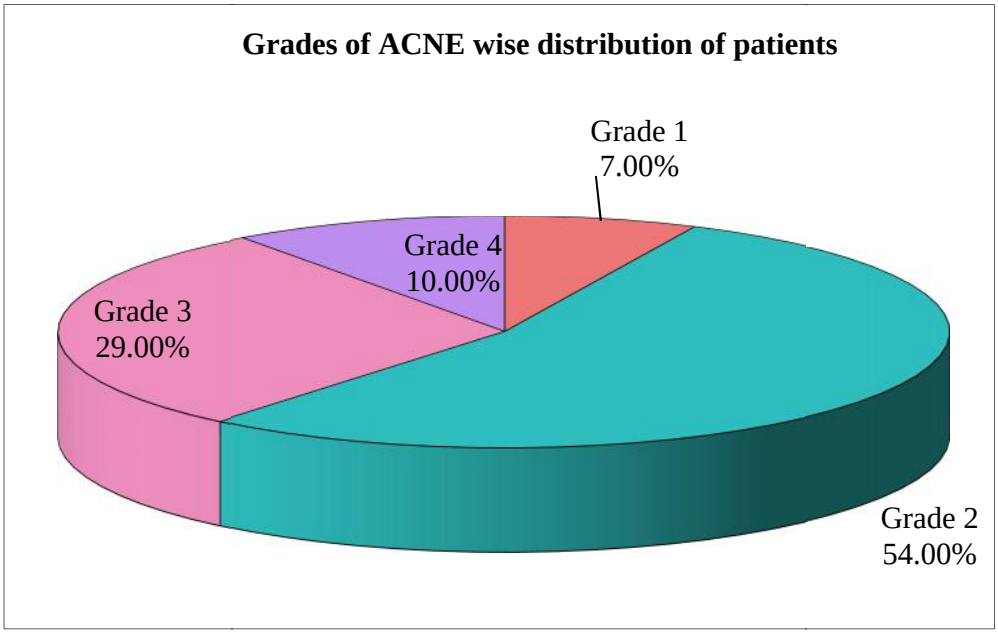


Table No. 15 : DLQI effect wise distribution

Grades of DLQI	No of patients	% of patients
Small effect	21	21.00
Moderate effect	38	38.00
Very large effect	33	33.00
Extremely large effect	8	8.00
Total	100	100.00

Maximum number of patients that is 38% had moderate effect on quality of life followed by very large effect on life quality in 33% of patients and least that is 8% with extremely large effect on life quality.

Graph No.10 : DLQI effect wise distribution

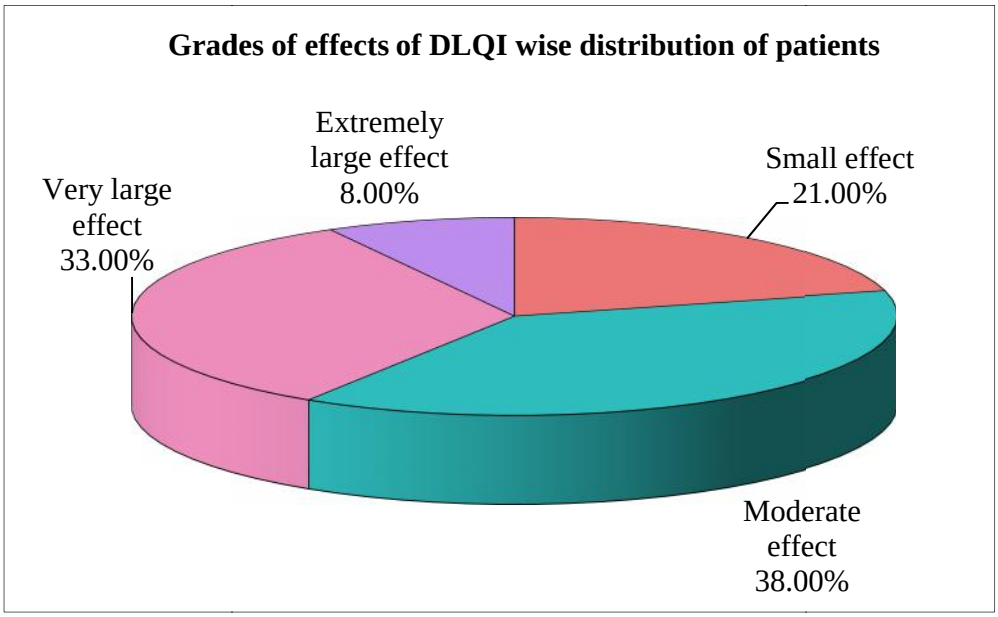


Table No. 16 : Association between grades of acne and age

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
Age groups											
<=20	3	6.38	18	38.30	20	42.55	6	12.77	47	15.0040	0.0200*
21-23	1	4.76	12	57.14	7	33.33	1	4.76	21		
24+	3	9.38	24	75.00	2	6.25	3	9.38	32		

Maximum number of patients with acne fall in less than 20 years of age and in this group maximum number of patients that is 20 have grade 3 acne (42.55%) followed by 18 with grade 2 acne (38.30%) and least number of patients that is 3 in this group have grade 1 acne (6.38%). By applying chi-square test for variables, value is 15.004. P value at 95% confidence interval is 0.020, which being less than 0.05, there exists **significant association between age and grades of acne.**

Table No. 17 Association between grades of acne and gender.

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
Gender											
Male	1	2.08	23	47.92	16	33.33	8	16.67	48	8.5210	0.0360*
Female	6	11.54	31	59.62	13	25.00	2	3.85	52		

Incidence of acne is greater in females (52) than males (48). Maximum number of female patients fall in grade 2 that is 31 (59.62%) and grade 3 that is 13 (25%). The p value is 0.0360 and thus this shows significant association with female gender and grades of acne. This suggested more severity of acne in females.

Table No. 18 Association between grades of acne and manual picking

Factors	Grade 1	%	Grade 2	%	Grade 3	%	Grade 4	%	Total	Chi-square	p-value
Manual Picking											
Yes	2	4.44	18	40.00	17	37.78	8	17.78	45	10.8560	0.0130*
No	5	9.09	36	65.45	12	21.82	2	3.64	55		

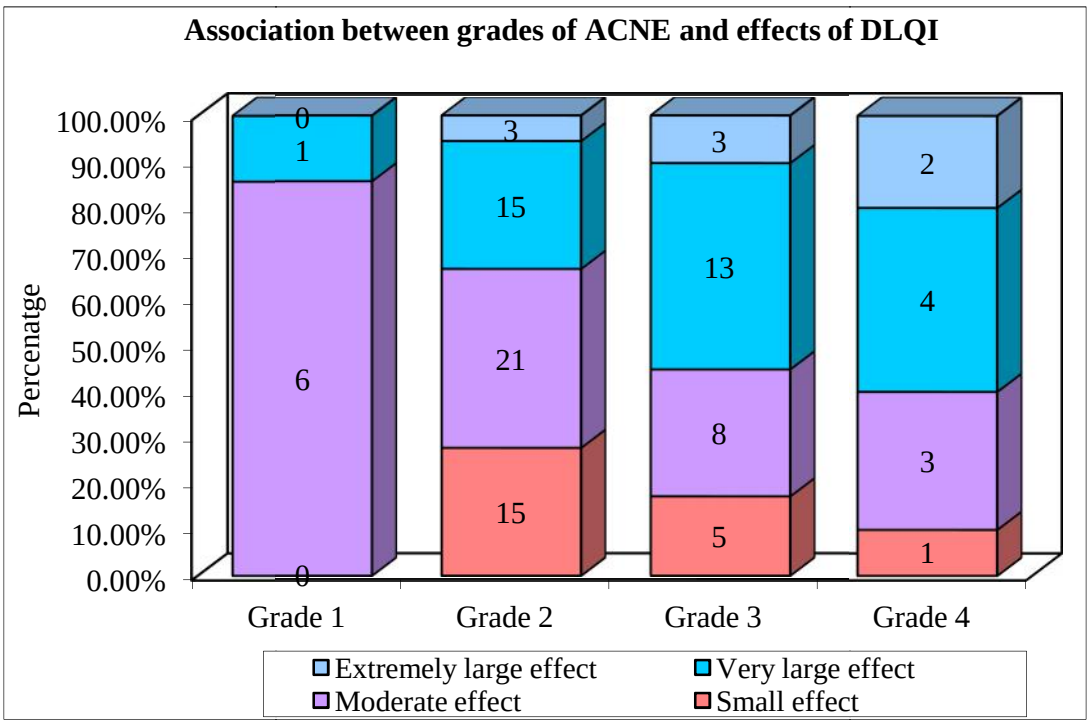
There exists significant association between grades of acne and manual picking of acne lesions. As grade of acne increases, percentage of patients with history of manual picking increases. p value of 0.0130 suggests this significant association at 95% confidence interval.

Table No. 19 Association between grades of ACNE and effects of DLQI

Grades of ACNE	Small effect	Moderate effect	Very large effect	Extremely large effect	Total
Grade 1	0	6	1	0	7
Grade 2	15	21	15	3	54
Grade 3	5	8	13	3	29
Grade 4	1	3	4	2	10
Total	21	38	33	8	100
Chi-square=14.1539 p=0.1170					

Maximum number of patients that is 54 had Grade 2 of acne vulgaris (54%). Minimum number of patients that is 7 had grade 1 of acne (7%). Maximum number of patients that is 38 had moderate effect on life quality (38%), while least number of patients that is 8 had extremely large effect on life quality.

Graph No. 11 Association between grades of acne and effects of DLQI



Graph No. 12 Association between grades of acne and effects of DLQI

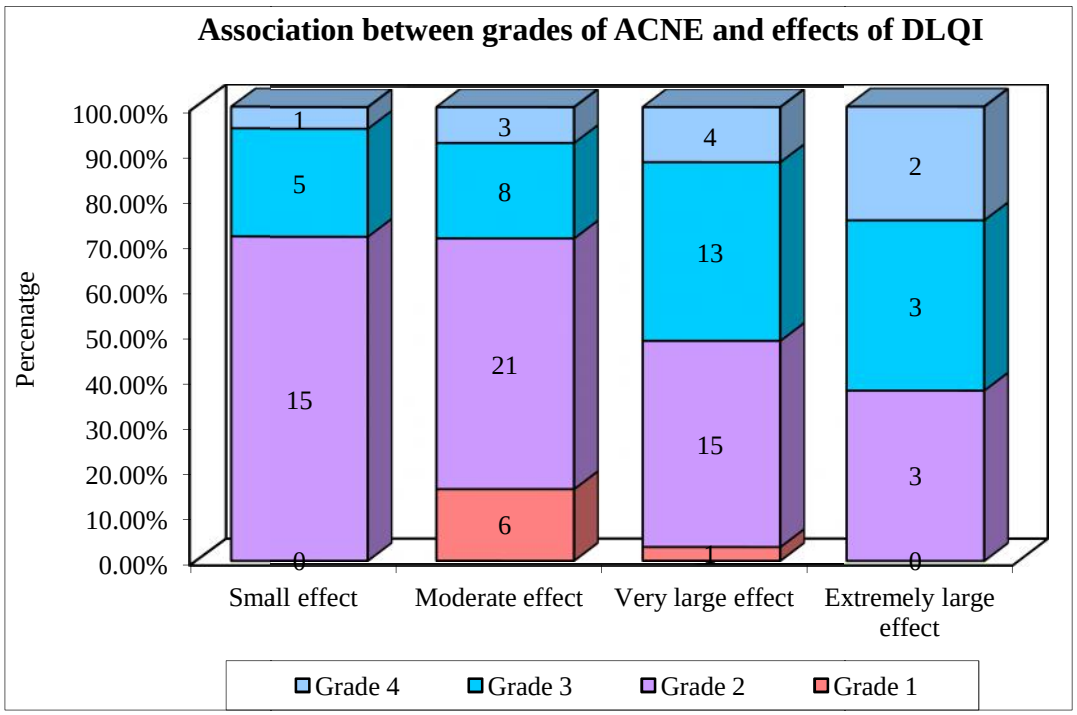


Table No. 20 Correlation between grades of ACNE and effects of DLQI by Spearman's rank correlation method

	Grades of effects of DLQI			
	N	Spearman R	t-value	p-level
Grades of ACNE	100	0.2326	2.3677	0.0199*

*p<0.05

A positive and significant relationship was observed between Grades of acne and DLQI (Spearman R =0.2326, p=0.01989) at 5% level of significance. It means that, the higher the grades of acne, the higher is the effect of DLQI. In another words, the grades of acne and DLQI are dependent on each other.

DISCUSSION

This is a first study in this part of India determining the impact of acne vulgaris on dermatological life quality index. This study included total 100 patients attending outpatient department. Amongst these 100, 48 patients were males and 52 were females.

47 patients were in age group of 18-20 years, 21 patients were in age group of 21-23 years and 32 were 24 years and above. Among 100 patients, 13 patients were married.

Maximum number of patients that is 59 were students. 46 patients were from urban area and 54 from rural area. Face was the most common site of acne vulgaris. Maximum number of patients that is 54 had grade 2 of acne vulgaris. Largest number of patients had DLQI ranging from 6 to 11, suggesting moderate effect on quality of life.

A positive and significant relationship was observed between Grades of acne and DLQI (Spearman R =0.2326, p=0.01989) at 5% level of significance. It was found that, the higher the grades of acne, the higher is the effect of DLQI.

Age incidence:

In a study done in Tamilnadu, India, 114 patients above age of 15 years were included in study. The mean age was 19.39 years. Furthermore, maximum patients (64%) were among 15–20 years.[100] According to a study done by Aayush Gupta et al, which consisted of 100 patients, between the ages of 14–45, mean age was 22.49 ± 5.381 years.[101]

The study done by Haritha Samanthula et al revealed that majority (53.2%) of the participants belonged to the age group 16-20 years.[102] Most of the studies [103,104,105,106] have included an age group between 13 and 18 years and some [107,108] studies from 11 years and some [109,110] from 17 years. In our study maximum number of patients were falling in age group of 18-20 years in pre-defined age range of 18 to 30 years. Significant association between age and grades of acne was found in our study. The severity of acne increases as age advances. But there was no association found between advancing age and effect of DLQI in this study.

Sex Incidence:

In a study done by Hazarika N, Rajaprabha R K et al which included 114 cases, number of females patients (64) were outnumbering males (50).[100] Similar finding was reported by Durai and Nair, which included 140 individuals of which 85 were females and 55 were males.[111] In our study out of 100 patients, 52 were females and 48 were males. The higher number of females may be because females are more conscious of their appearance than the males. There was significant association found between severity of acne and female gender. No gender difference in DLQI scores was noted in our study, indicating both genders were concerned about their appearance and self reported acne.

This was in contrast to some studies, where females had higher DLQI scores.[112,113,114]

Duration of acne:

Samanthula and Kodali found that 60.04% had acne for more than 1 year[102]. In a study done by Neirita Hazarika, Radha K Rajaprabha (42%) had acne for less than 6 months meaning patients presented early for treatment.[100] In our study 47 % patients had acne of duration less than 1 year meaning patients presented early for treatment. There was no association between duration of acne and quality of life.

Family history:

Acne vulgaris is not an inherited condition, though has an inherited predisposition.

Involvement of cytochrome P-450-1A1 and gene for steroid 21-hydroxylase has been Documented.[115] Positive family history may be obtained in 40% of patients and correlates with more severe disease.[116] In our study out of 100 patients 3% patients had positive family history, 2 had history in parents and one with history in sibling.

This indicates heredity seems to have role in acne but this is not the only factor. In a study done by Durai and Nair, out of 140 patients positive family history was observed in 21.4% of patients.[111]

Occupation :

No significant correlation was found between effect of DLQI scores and employment probably because, maximum number of patients in our study were students (59%).This finding was similar to study done in Greece.[112]

Distribution of population:

In our study 46 patients were from urban area and 54 were from rural area. Most of the patients in our study were students. No association was found between patients from urban population and effect on life quality. This finding was contradictory to study done by Ismail K H who reported significant association between factors quality of life and urban population.

This may be due to fact that in our study less number of urban patients were recorded, as many of them being students who must have migrated to urban areas with native from rural areas.

Marital status:

Study done by Durai and Nair showed significant association between marital status and CADI scores.[111] Their study included 127 unmarried and 13 married patients and low CADI score was significant in both married (15.4%) and unmarried (52%). Our study similarly included more number of unmarried population (87%) and mean DLQI value was less for married population than unmarried population, suggesting that there was less effect on quality of life In married population than unmarried population.

History of topical steroid use:

In our study 14 patients among 100 gave history of use of topical steroid containing preparation. Significant difference in mean DLQI score of patients using topical steroid and those not using steroid was observed with p value of 0.0136 at 5% level of significance, indicating effect of this factor on DLQI. Similar other studies did not include this factor.

Distribution of lesions of acne vulgaris:

In study done by Hazarika N and Rajaprabha R K, facial acne alone constituted 61.4% cases and site of acne did not influence DLQI scores[100]. Durai and Nair also observed facial acne (99.3%) to be the commonest in their study and there was no significant association with the QoL either alone or with facial and truncal acne together[111].

Similarly in our study also most common site of acne was face alone (85%).

Grades of acne:

In a study done by Hazarika N and Rajaprabha R K on 114 patients the highest prevalence of grade II acne (67.5%) was encountered followed by Grade I and III (14.9% each). [100] In this study the grading system used for severity of acne was the one proposed by Indian authors similar to the one used in our study[77]. Our study also showed out of 100 maximum (54%) cases of grade 2 acne vulgaris.

While according to other study done by Durai and Nair, out of total 140 patients, most of them (66, 47.1%) had grade 1 acne.[111] The grading system used by Durai and Nair was similar to the one used in our study. [77] This finding was contradictory to our study, the reason may be variability in geographic distribution of population and educational status.

In study done in Sarawak, Malaysia, by Felix Boon-Bin Yap, 173 patients were included and severity of acne was calculated using Global Acne

Grading System (GAGS), according to which, mild acne was seen in 96 (55.5%) patients, moderate acne in 54 (31.2%) and severe in 23 (13.3%).[117]

DLQI scores and correlation with grades of acne :

In study done by Hazarika N and Rajaprabha R K, quality of life was assessed with calculation of DLQI. Ninety-one percentage patients had elevated DLQI scores, with mild effect (score 2–5) being the most common (33.3%). None of the patients had DLQI score >20 (extremely large effect).[100] Nine out of 17 cases with grade 3 acne and all grade 4 acne had a very large effect on patient's life. This showed significant impairment of QoL in acne patients. Worsening of QoL was observed with severity of acne.[100]

Study done by Durai and Nair revealed the most common DLQI score in the range of 2-5 (small effect) in 47 (33.6%) patients. There was significant correlation between the grade and QoL scores ($P = 0.0003$, $P < 0.0001$,Spearman r correlation coefficient) and the scores worsened with increasing severity.[111]

In our study, (38%) had moderate effect on quality of life followed by (33%) with very large effect and 8% with extremely large effect on life quality. Out of 33 patients having very large effect life quality, 17 patients were falling in higher grades of acne that is grade 3 and 4. Out of total 10 patients of grade 4 acne, 4 had very large effect and 2 had extremely large effect on life quality. In our study, positive and significant relationship was observed between grades of acne and DLQI (Spearman R =0.2326, p=0.01989) at 5% level of significance, which was similar to finding of study abovementioned study done by Durai and Nair and Hazarika N and Rajaprabha R K. Studies

done in Iraq, Turkey, and France showed worsening QoL with increasing grade of acne. [112] No association between acne severity and QoL was reported in some studies.[118,119]

The differences seen in various studies highlight the racial influences, population characteristics, study settings, and questionnaire design. The varied pattern of impact of acne on the QoL helps us in understanding the ways in which the individual may be affected. QoL worsens with the severity of acne and is also based on the individuals perception.

CONCLUSION

Among 100 cases studied, maximum cases of acne vulgaris were in age group of 18- 20 years (47%). Male: female ratio was 0.923:1. A slight female preponderance was noted. Maximum number of patients were students (59). The maximum number of patients had acne of less than or equal to 1 year duration. Most common site of acne was face. 35% patients had received oral or topical anti-acne treatment. Maximum patients had grade 2 of acne vulgaris.

Maximum number of patients had moderate effect on quality of life. Significant association between age and grades of acne was found. Females were found to have severe grades of acne. History of manual picking was associated with severe acne. Unmarried people had more impact on quality of life. A positive and significant relationship was observed between grades of acne and DLQI, meaning higher the grades of acne higher is the effect of DLQI. Thus grades of acne and DLQI are dependent on each other.

The assessment of impact of acne on the quality of life is essential, to detect those patients who are at increased risk of being negatively affected so as to treat them in a more integrated manner.

SUMMARY

Among 100 cases studied, maximum cases of acne vulgaris were in age group of 18- 20 years (47%). Among the studied population, 48 were males and 52 were females, with male:female ratio of 0.923:1. A slight female preponderance was noted. Among 100, 13 patients were married. Maximum number of patients were students (59). 46 patients were from urban area and 54 from rural area. 3% patients had positive family history, indicating that hereditary predisposition may be one of the factor responsible for acne but not the only factor causing acne. The maximum number of patients had acne of less than or equal to 1 year duration (47%), with minimum duration being 7 days to maximum being 10 years. This suggested that most of the patients presented to OPD early for treatment. Most common site of acne was face. 85% patients had only facial acne while the other body sites involved were upper back, chest and arms. Among 100 patients, 35% patients had received anti-acne treatment in the form of topical retinoids and or benzyol peroxide and or clindamycin or systemic treatment oral azithromycin and or oral retinoids or ayurvedic treatment. 14% patients used topical steroid containing preparation. Among 100 patients 62 patients were having mixed food habits. 7% patients complained of oily skin. Out of total 100 patients, maximum patients had grade 2 of acne vulgaris (54%). Least number of patients had grade 1 of acne (7%). Maximum number of patients had moderate effect (38%) on quality of life followed by very large effect (33%) and (8%) had extremely large effect on life quality. Significant association between age and grades of acne was found in study with p value of 0.020 at 95% confidence interval. Also p value of

0.0360 showed significant association between female gender and grades of acne. As severity of acne increases, percentage of patients giving history of manual picking of acne lesions increases and p value of 0.0130 suggests this significant association. Significant difference in mean DLQI score of patients using topical steroid and those not using steroid was observed with p value of 0.0136 at 5% level of significance. Mean DLQI value of 7.77 in married population compared to 11.11 in unmarried population suggested less impact on quality of life in married people as compared to unmarried people.A positive and significant relationship was observed between Grades of acne and DLQI with p value of 0.01989 at 5% level of significance.

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ANNEXURE – I - INFORMED CONSENT FORM

I.D.NO. | | | |

"EVALUATIVE STUDY OF ACNE VULGARIS AND IT'S IMPACT ON DERMATOLOGICAL LIFE QUALITY INDEX IN YOUNG ADULTS IN A TERTIARY CARE CENTRE", A ONE YEAR CROSS SECTIONAL STUDY"

The study is conducted by Dr. _____, Post graduate student in M.D Dermatology under guidance of Dr. _____, Professor of Dermatology, J N Medical College, Belagavi.

Respected Sir, we invite you to participate in our study as, you are eligible for the same. During the study you will be asked some questions in detail regarding your present complaints.

Purpose of the study:

Individuals with Acne Vulgaris may feel self-conscious about their appearance and have a poor self-image that stems from fear of public rejection and psychosexual concerns. The purpose of this study is to evaluate the Quality of Life in patients suffering from all grades of Acne Vulgaris and assess the impact of severity of acne vulgaris on quality of life. You are being asked to participate in this research because you have been diagnosed to have acne vulgaris. All patients attending the outpatient department, who are diagnosed to have this disease, will be requested to participate in this study during the period of one year.

Procedure and treatment:

If you choose to participate, you will be asked to give a detailed history of your disease, undergo a dermatological and physical examination and answer the questions which will be handed to you in the form of preformed questionnaire.

Risks and benefits:

The result of you taking part in this research would help health care providers towards a better understanding of this disease, and thus we will be able to provide improved patient care. There is no risk associated with the study.

Alternatives:

If you decide not to participate in this study, you will still be receiving the usual standard care for your disease.

Privacy and confidentiality:

Your privacy will be respected and all information collected about you during the course of this study will be kept confidential. Your identity will remain undisclosed.

Financial incentives:

You shall not be receiving any payment or any financial incentives for participating in this study.

Authorization to publish results:

The results of this study may be published for scientific purpose or presented to a scientific group. Your identity, however, will be maintained confidential at all times.

Voluntary participation:

Your participation in this study is voluntary. Your decision whether or not to participate will neither affect the care of your current disease, nor your future relations with the doctor or the hospital. . In the event if you suffer any physical injury as the result of your participation in this study, you may contact Dr. _____ Telephone No._____ or Dr. _____, Telephone No._____.

Statement of Consent:

I.D.NO: | | | |

I, Mr _____ Volunteer and consent to participate in this study. I have read the consent document or it has been read to me in my vernacular language. I accept to participate in the study. All the information regarding this study is provided to me and I have understood the same. I have been given the opportunity to ask questions and obtain appropriate answers.

Participant's name:

Signature or left thumb print of participant:
Witness name:

Signature of witness:

Signature of the investigator:

Date:

If the participants are Minors (under 18), the parents sign the form, rather than the participants.

ANNEXURE-II

ACNE VULGARIS PROFORMA

Date:

Name: Age/Sex:

OPD No: Occupation:

Education: Address:

Chief Complaints:

Onset:

Duration:

Past History:

Family History:

Personal History:

Diet:

Appetite: Sleep:

Bowel and bladder habits:

Treatment History:

History of manual picking-

General Physical Examination:

Pulse rate: Blood Pressure:

Temperature: Weight:

Oedema, pallor, icterus, clubbing:

Lymphadenopathy:

Cutaneous Examination:

No. of lesions:

Site of lesions:

Type of lesions :

Comedones	Nodules
Papules	Cysts
Pustules	Scars

Oral mucosa:

Hair:

Nails:

Associated dermatological lesions:

Systemic Examination:

C.V.S :

R.S :

G.I.T :

C.N.S :

Grading of acne vulgaris (According to acne vulgaris grading severity scale.)

D.L.Q.I:

Clinical Diagnosis:

DERMATOLOGY LIFE QUALITY INDEX

The aim of this questionnaire is to measure how much your skin problem has affected your life OVER THE LAST WEEK. Please tick ☑ one box for each question.

1.	Over the last week, how **itchy**, **sore**, **painful** or **stinging** has your skin been?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	
2.	Over the last week, how **embarrassed** or **self conscious** have you been because of your skin?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	
3.	Over the last week, how much has your skin interfered with you going **shopping** or looking after your **home** or **garden**?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
4.	Over the last week, how much has your skin influenced the **clothes** you wear?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
5.	Over the last week, how much has your skin affected any **social** or **leisure** activities?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
6.	Over the last week, how much has your skin made it difficult for you to do any **sport**?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
7.	Over the last week, has your skin prevented you from **working** or **studying**?	Yes No	☐ ☐	Not relevant ☐
	If "No", over the last week how much has your skin been a problem at **work** or **studying**?	A lot A little Not at all	☐ ☐ ☐	
8.	Over the last week, how much has your skin created problems with your **partner** or any of your **close friends** or **relatives**?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
9.	Over the last week, how much has your skin caused any **sexual difficulties**?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐
10.	Over the last week, how much of a problem has the **treatment** for your skin been, for example by making your home messy, or by taking up time?	Very much A lot A little Not at all	☐ ☐ ☐ ☐	Not relevant ☐

Please check you have answered EVERY question. Thank you.

Page 1 of 1

ANNEXURE III – PHOTOGRAPHS

Photograph 1: Grade 1 acne vulgaris with DLQI=7

Photograph 2: Grade 1 acne vulgaris with DLQI= 9

Photograph 3: Grade 2 acne vulgaris with DLQI=4

Photograph 4: Grade 2 acne vulgaris with DLQI=8

Photograph 5: Grade 2 acne vulgaris with DLQI= 18

Photograph 6: Grade 2 acne vulgaris with DLQI= 23

Photograph 7: Grade 3 acne vulgaris with DLQI= 12

Photograph 8: Grade 3 acne vulgaris with DLQI= 17

Photograph 9: Grade 3 acne vulgaris with DLQI= 16

Photograph 10: Grade 4 acne vulgaris with DLQI= 14

Photograph 11: Grade 4 acne vulgaris with DLQI= 18

Photograph 12: Grade 4 acne vulgaris with DLQI= 26

Sr. No	AGE	SEX	MARRITAL STATUS	OCCUPATION	AREA	DURATION OF ACNE	HISTORY OF ANTIACNE TREATMENT	HISTORY OF STEROID USE	DIET	FAMILY HISTORY	MANUAL PICKING	OILY SKIN	DISTRIBUTION OF LESIONS	TYPE OF LESIONS	GRADE OF ACNE	DLQI	INTERPRETATION OF DLQI
1	20	F		Student	Ru	2 months			V			present	face	com	Grade 1	12	Very large effect on life quality
2	18	M		Student	Urb	2 years		Yes, topical	N		Yes		face,upper back	com,pap,pus,scars	Grade 3	13	Very large effect on life quality
3	24	M		Nursing staff	Urb	7 months		Yes, topical	N				face	pap and box scars	Grade 2	4	Small effect on life quality
4	24	F		Student	Ru	10 years			V		Yes		face	pap,com,scars(rolling,box)	Grade 2	5	Small effect on life quality
5	22	F		Tailor	Ru	1 month		Yes, topical	N			Present	face	com,pap	Grade 2	18	Very large effect on life quality
6	21	M		Student	Urb	2 years			N				face	com,pap,pus	Grade 2	4	Small effect on life quality
7	23	F		Technician	Ru	4 months		Yes, topical	V	H/o in mother		present	face	com,pap,pus,scars	Grade 3	16	Very large effect on life quality
8	28	F	Married	Doctor	Urb	2 months	ayurvedic, topical		V		Yes		face	pap,pus,nod,cys,scars	Grade 4	6	Moderate effect on life quality
9	26	M		Service	Ru	2 months			V				face	com,pap	Grade 2	3	Small effect on life quality
10	22	M		Student	Ru	1 month		Yes, topical	V				face	com,pap	Grade 2	8	Moderate effect on life quality
11	24	F		Student	Ru	15 days			V				face	com,pap	Grade 2	13	Very large effect on life quality
12	23	F	Married	Housewife	Ru	4 months			V		Yes		face,chest,upper back	com,pap,pus,scars	Grade 3	9	Moderate effect on life quality
13	22	F		Student	Ru	2 years	ayurvedic, topical		V		Yes		face	Pap, scars	Grade 2	11	Very large effect on life quality
14	19	M		Student	Ru	1 year	ayurvedic, topical		N				face	com,pap,pus	Grade 2	6	Moderate effect on life quality
15	22	F		Student	Urb	6 years	topical clindamycin		N		Yes		face	pap,pus,nod,scars	Grade 3	5	Small effect on life quality
16	20	M		Student	Ru	2 years	topical clindamycin		V		Yes		face	com,pap,pus,scars,nod	Grade 4	6	Moderate effect on life quality
17	21	F		Student	Urb	5 years			V				face	com,pap	Grade 2	5	Small effect on life quality
18	26	F	Married	Housewife	Ru	2 years			N				face	pap,pus	Grade 2	6	Moderate effect on life quality
19	18	M		Student	Urb	2 months			N			present	face, upper back	com,pap	Grade 2	2	Small effect on life quality
20	20	F		Student	Urb	2 months		Yes, topical	N		Yes		face	com,pap,pus,scars	Grade 3	12	Very large effect on life quality
21	19	M		Student	Urb	2 years	ayurvedic, topical		N				face	pap,pus,nod,cys	Grade 3	5	Small effect on life quality
22	27	F	Married	Housewife	Urb	2 years			V		Yes		face	com,pap,scars	Grade 1	7	Moderate effect on life quality
23	22	F		Student	Urb	1 year	topical clindamycin		V		Yes		face	com,pap,pus,scars	Grade 2	23	Extremely large effect on life quality
24	18	M		Student	Ru	6 months	ayurvedic, topical and oral		N		Yes		face	pap,cys,scars,nod	Grade 4	18	Very large effect on life quality
25	20	M		Student	Urb	3 years	ayurvedic, topical		N		Yes		face, upper back	com,pap,pus,scars,nod	Grade 4	6	Moderate effect on life quality
26	23	F		Service	Ru	15 days	ayurvedic, topical		N				face	com,pap,pus	Grade 3	14	Very large effect on life quality
27	25	F		Doctor	Urb	1 and 1/2 year	ayurvedic, topical	Yes, topical	N	H/o in sister			face	com,pap	Grade 2	7	Moderate effect on life quality
28	27	F	Married	Housewife	Urb	2 months			V				face	com	Grade 1	9	Moderate effect on life quality
29	24	F	Married	Sweeper	Ru	1 year	topical clindamycin		N		Yes		face	com,pap,pus,scars	Grade 2	8	Moderate effect on life quality
30	18	M		Student	Ru	3 years	ayurvedic, topical		V		Yes		face	com,pap,scars	Grade 3	4	Small effect on life quality
31	19	M		Student	Ru	2 years			N				face	com,pap	Grade 2	3	Small effect on life quality
32	20	M		Student	Urb	6 years			N		Yes		face	Pap, scars	Grade 2	8	Moderate effect on life quality
33	22	F		Student	Urb	8 years	Topical retinoid and BP, TCA peel		N				face,upper back, chest	Pap	Grade 2	9	Moderate effect on life quality
34	19	F		Student	Urb	5 years	Topical retinoid		N		Yes		face	Pap,scars	Grade 2	11	Very large effect on life quality
35	21	M		Student	Ru	2 and 1/2 years	oral istretinoin	Yes, topical	N		Yes		face, upper back,chest	com,pap,pus,scars,nod,cys	Grade 4	26	Extremely large effect on life quality
36	19	M		Student	Ru	3 years			V				face	pap, pus, nod	Grade 3	7	Moderate effect on life quality
37	26	F		Service	Urb	1 year	topical clindamycin and BP, oral azithromycin		V				face	com,pap	Grade 2	8	Moderate effect on life quality
38	23	M		Service	Urb	2 years	Laser for acne scars		N		Yes		face	Pap, scars	Grade 2	7	Moderate effect on life quality
39	26	F		Student	Urb	6 months			V		Yes		face	com,pap,scars	Grade 2	2	Small effect on life quality
40	24	M		Student	Ru	1 year		Yes, topical	N				face	com,pap	Grade 2	14	Very large effect on life quality
41	25	M		Driver	Ru	2 years			N		Yes		face	com,pap,scars	Grade 2	4	Small effect on life quality
42	25	F		Service	Urb	1 year			N		Yes		face	com,pap,scars	Grade 1	10	Moderate effect on life quality
43	25	F		Teacher	Urb	1 year			N				face	Pap	Grade 2	18	Very large effect on life quality
44	26	F		Housewife	Urb	1 year		Yes, topical	V				face, arms	com,pap	Grade 2	25	Extremely large effect on life quality
45	18	M		Student	Ru	4 months			N		Yes		face	com,pap,pus,scars	Grade 3	15	Very large effect on life quality
46	21	M		Student	Ru	1 and 1/2 month			N		Yes		face,upper back,chest	com,pap,scars	Grade 3	10	Moderate effect on life quality
47	20	M		Student	Ru	3 years			N		Yes		face	com,pap,scars	Grade 2	19	Very large effect on life quality
48	18	M		Student	Urb	5 years			N		Yes		face	com,pap,pus,scars	Grade 3	19	Very large effect on life quality
49	24	F		Service	Urb	4 years	oral azithromycin,topical BP,clindamycin		N		Yes		face	com,pap,scars	Grade 2	7	Moderate effect on life quality
50	19	F		Student	Urb	1 year			N				face,upper back	com	Grade 1	9	Moderate effect on life quality
51	24	F		Student	Urb	1 month			N				face	com,pap	Grade 2	4	Small effect on life quality
52	18	M		Student	Ru	1 year			N				face	com,pap	Grade 3	6	Moderate effect on life quality

Sr. No	AGE	SEX	MARRITAL STATUS	OCCUPATION	AREA	DURATION OF ACNE	HISTORY OF ANTIACNE TREATMENT	HISTORY OF STEROID USE	DIET	FAMILY HISTORY	MANUAL PICKING	OILY SKIN	DISTRIBUTION OF LESIONS	TYPE OF LESIONS	GRADE OF ACNE	DLQI	INTERPRETATION OF DLQI
53	20	M		Student	Ru	4 years	Topical BP		N		Yes		face	pap,pus,scars	Grade 3	22	Extremely large effect on life quality
54	27	F		Teacher	Ru	2 years	ayurvedic treatment		N				face	com,pap,pus,nod	Grade 4	15	Very large effect on life quality
55	27	M		Service	Urb	2 years	oral isotretinoin, topical azaelic acid		N		Yes		face	pap,pus,nod,cys,scars	Garde 4	14	Very large effect on life quality
56	18	F		Student	Urb	4 years		Yes, topical	V				face	com,pap	Grade 2	21	Extremely large effect on life quality
57	20	F		Student	Ru	1 year			N		Yes		face	com,pap,scars	Grade 2	6	Moderate effect on life quality
58	19	M		Student	Urb	1 month	Topical retinoid		N				face	com,pap,pus	Grade 2	8	Moderate effect on life quality
59	20	F		Student	Urb	6 years	Topical BP,Adapalene, oral retinoid		N		Yes		face	com,pap,scars	Grade 2	10	Moderate effect on life quality
60	22	F		Service	Ru	1 month		Yes, topical	N				face	com,pap,pus	Grade 3	10	Moderate effect on life quality
61	28	F		Service	Ru	4 years	Topical BP, oral retinoid		N				face	com,pap,pus	Grade 3	10	Moderate effect on life quality
62	20	F		Student	Ru	6 years	ayurvedic and homeopathic treatment		N		Yes		face	com,pap,pus,scars	Grade 3	16	Very large effect on life quality
63	18	F		Student	Urb	1 year			N				face	com,pap,pus	Grade 3	5	Small effect on life quality
64	20	M		Student	Ru	4 years	Unknown topical		N				face	com,pap,pus	Grade 3	17	Very large effect on life quality
65	18	F		Student	Urb	3 years			N				face	com,pap	Grade 2	17	Very large effect on life quality
66	18	M		Student	Ru	2 years			N				face	com,pap	Grade 2	14	Very large effect on life quality
67	19	F		Student	Urb	1 year			N				face	com,pap	Grade 2	9	Moderate effect on life quality
68	18	M		Student	Urb	7 days			N				face,upper back	pap, pus	Grade 2	7	Moderate effect on life quality
69	20	F		Service	Ru	4 months	Topical clinda, adapalene		N		Yes		face	com,pap,pus,scars	Grade 3	20	Very large effect on life quality
70	20	M		Sweeper	Ru	4 years	topical clinda,oral doxy	Yes, topical	N		Yes		face	pap,pus,nod,cys,scars	Garde 4	14	Very large effect on life quality
71	28	M	Married	Service	Ru	6 months		Yes, topical	N		Yes		face	pap,pus,scars	Grade 3	11	Very large effect on life quality
72	20	F		Student	Urb	1 month			V				face	com,pap,pus	Grade 3	5	Small effect on life quality
73	18	M		Student	Urb	5 months			N				face	com,pap,pus	Grade 3	15	Very large effect on life quality
74	26	F	Married	Service	Urb	10 years	Topical retinoid		N		Yes		fae	pap,pus,scars	Grade 2	15	Very large effect on life quality
75	22	M		Student	Ru	3 years			V		Yes		face	pap,scars	Grade 2	8	Moderate effect on life quality
76	24	F		Service	Ru	2 months	oral azithromycin,topical BP,clindamycin		V				face	com,pap,pus	Grade 2	12	Very large effect on life quality
77	19	M		Student	Ru	1 and 1/2 year			N				face	com,pap	Grade 1	10	Moderate effect on life quality
78	19	F		Student	Ru	1 year			V		Yes		face	com,pap,pus,scars	Grade 3	9	Moderate effect on life quality
79	19	M		Student	Urb	5 years			V		Yes		face,upper back	pap, pus,nod,scars	Grade 4	21	Extremely large effect on life quality
80	25	M		Service	Urb	1 month			V				face	com,pap	Grade 2	11	Very large effect on life quality
81	20	M		Student	Ru	3 years			V		Yes		face	com,pap,pus,scars	Grade 3	23	Extremely large effect on life quality
82	24	M		Driver	Ru	2 years			V		Yes		face,chest,upper back	pap,pus,scars	Grade 2	5	Small effect on life quality
83	18	M		Student	Ru	4 years			N		Yes		face,upper back	com,pap,pus,scars	Grade 3	10	Moderate effect on life quality
84	25	F	Married	Housewife	Ru	6 months			V			present	face	com,pap	Grade 2	4	Small effect on life quality
85	25	M		Service	Ru	2 years	oral isotretinoin,oral doxy		N		Yes		face,upper back	com,pap,scars	Grade 2	17	Very large effect on life quality
86	28	F	Married	Service	Urb	10 years	topical retinoid		N		Yes		face	pap,scars	Grade 2	3	Small effect on life quality
87	18	M		Student	Ru	1 year			N				face	com,pap,pus,nod,cys	Grade 4	5	Small effect on life quality
88	28	F	Married	Service	Urb	1 year			V				face	com,pap	Grade 2	12	Very large effect on life quality
89	20	M		Student	Ru	6 months			V				face	com,pap	Grade 2	4	Small effect on life quality
90	20	M		Student	Ru	2 months			V				face	com,pap,pus	Grade 3	19	Very large effect on life quality
91	22	F	Married	Housewife	Ru	1 year			V				face	com,pap,pus	Grade 2	7	Moderate effect on life quality
92	23	M	Married	Service	Ru	2 years			V				face	com,pap,pus	Grade 2	4	Small effect on life quality
93	24	M		Lawyer	Urb	2 years			N				face	com,pap	Grade 2	9	Moderate effect on life quality
94	22	F		Service	Urb	1 year			V				face	com,pap	Grade 1	7	Moderate effect on life quality
95	23	F		Service	Urb	2 years			N				face	com,pap,pus	Grade 2	7	Moderate effect on life quality
96	20	F		Teacher	Urb	6 months	topical retinoid		V				face	com,pap	Grade 2	9	Moderate effect on life quality
97	19	F		Student	Ru	1 year			V				face	com,pap	Grade 2	14	Very large effect on life quality
98	23	M		Service	Ru	6 months	topical BP		N	H/o in father	Yes	present	face	com,pap,pus,scars	Grade 3	20	Very large effect on life quality
99	20	F		Student	Ru	2 years			V		Yes	present	face,upper back,arms	com,pap,pus,scars	Grade 3	21	Extremely large effect on life quality
100	19	M		Student	Ru	7 months			N				face	com,pap	Grade 2	10	Moderate effect on life quality

ANNEXURE-V

KEY TO MASTER CHART

M = Male

F = Female

V = Vegetarian

N = Non-vegetarian

Urb = Urban

Ru = Rural

Com = Comedone

Pap = Papule

Pus = Pustule

Nod = Nodule

Cys = Cyst