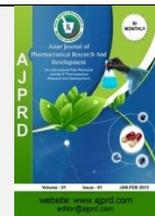


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Review Article

The Impact of Stress on Acne

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ABSTRACT

Introduction: Despite general acknowledgment of a link between stress and acne, few research have been conducted to evaluate this link. The purpose of this study was to discover the link between stress and acne severity.

Method: The research was carried out on adolescent students chosen from Singapore's Choa Chu Kang Secondary School. A total of 94 (59%) of the 160 students invited to participate in the study accepted (43 males and 51 women), and all participants provided parental informed agreement. Mid-year exams at schools were chosen as the stress model for the study. Singaporean children undergo an intensive school examination process. The outcome of such tests has a significant impact on children's long-term employment possibilities. The Perceived Stress Scale (PSS) was utilized in this study to assess acne severity in relation to stress using the global acne grading system (GAGS). The questionnaire also contained some confounding factors related to the severity of acne.

Conclusions: According to the findings of this study, it is concluded that stress has a favorable correlation with acne severity.

Keywords: Acne, acne vulgaris, acne severity, acne grade, stress, stress scale

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INTRODUCTION:

Acne vulgaris is a prevalent skin condition. Eighty-five percent of people between the ages of 12 and 24 have acne ^[1]. It is a multifactorial and complex condition characterized by comedones, papules, pustules, and nodules that originate in the pilosebaceous follicle. Overproduction of sebum, aberrant keratinization of follicular epithelial cells, Propionibacterium acnes colonization, and inflammation are the four key interconnected pathogenic causes of acne ^[2]. Acne is associated with psychological variables in two ways. Emotional stress can aggravate acne, as many acne patients have experienced, and acne sufferers are prone to developing psychological issues such as social phobias, low self-esteem, or melancholy. The link between emotional stress and acne start or worsening is based on multiple cutaneous neurogenic elements that interact with a pathogenic cascade in acne. (a) activating the adrenal

glands to generate more hormones that promote sebum production (b) Delaying the healing process (c) The effect of stress on the hypothalamus and the release of corticotropin-releasing hormone (CRH), which stimulated oil gland sebum production ^[3]. One of the most common obstacles in medical education is stress. It has been shown that academic challenges are a bigger perceived stressor and frequently have a detrimental impact on their academic achievement, physical health, and psychological well-being ^[4]. In a questionnaire poll, 74% of 178 patients and family said worry is an exacerbating factor for acne ^[5]. An interventional study indicated that when patients received biofeedback training, relaxation training, and stress reduction strategies, their acne improved compared to controls ^[6]. Furthermore, multiple investigations have indicated that psychological stress might affect the skin's immunological activity ^[7] and cutaneous barrier function ^[8]. Daily activities have a greater impact on acne during adolescence because physical, intellectual, and emotional

changes occur at this age, resulting in severe psychosocial disturbances^[9]. Acne patients are self-conscious about the recurrence of skin lesions, particularly redness and scarring, and frequently describe feelings of embarrassment, low confidence, depression, stress, and anxiety when applying for jobs, especially if they have tried numerous treatments^[10]. In general, the more severe the acne, the higher the impact on patients' quality of life, the larger the impact on patients' self-esteem and body image, and the greater the risk of anxiety, depression, and suicide^[11]. Acne patients are at a higher risk of acquiring chronic stress, anxiety, and depression^[12]. It is critical for doctors to examine the presence of psychological disorders when treating acne sufferers. As a result, the physician and the patient must develop a deep bond^[13].

MECHANISM OF ACNE FORMATION:

The acne formation initiates with the overactive SG, follicular hyper keratinization, immunological changes, and plugging of the infundibulum facilitating P. acnes, bacteria colonization, and inflammation. Increased sebum that is the major source of nutrients for P. acnes production is an important participating cause of the acne formation. The mechanism of acne formation should be understood for the design and estimation of the formulation for the effective treatment of acne. Hence, the detail pathogenic factors and process of acne formation is elucidated in (Figure 1 and

2.)The various pathogenic factors blamed for the development of acne include the PSU, hyper keratinization and undue sebum production, discharge inflammatory mediators, and inflammatory infiltrates (causes the progress of growing steps resulting in severity). P. acnes bacteria initiate the formation of propionic and acetic acid, thus resulting in the metabolism of sebaceous triglycerides into fatty acids. This results in the irritation of the follicular wall and surrounding dermis. S. epidermidis, an anaerobic microorganism, is another causative microorganism involved in acne pathogenesis and produces fatty acid modifying enzyme that forms cholesterol by the fatty acid esterification in the skin. S. Aureus, gram-positive rod-shaped bacteria, invade the skin and start producing extracellular enzymes such as lipases, proteases, hyaluronidases, and collagenase. These enzymes cause tissue injury and spread the pathogen into the deeper tissues. S. agalactiae, gram-positive coccus bacteria, is also involved in the development of P. acnes. The capsular polysaccharides and the pore-forming toxins of S. agalactiae are the key factors of S. agalactiae. K. pneumoniae, gram-negative bacteria present on the skin flora, causes infection in acne patients undergoing long-term antibiotic therapy. The malicious factors of K. Pneumoniae is capsular polysaccharides, siderophores, and adhesins, this virulence produces seditious acne lesions papules, pustules^[14].

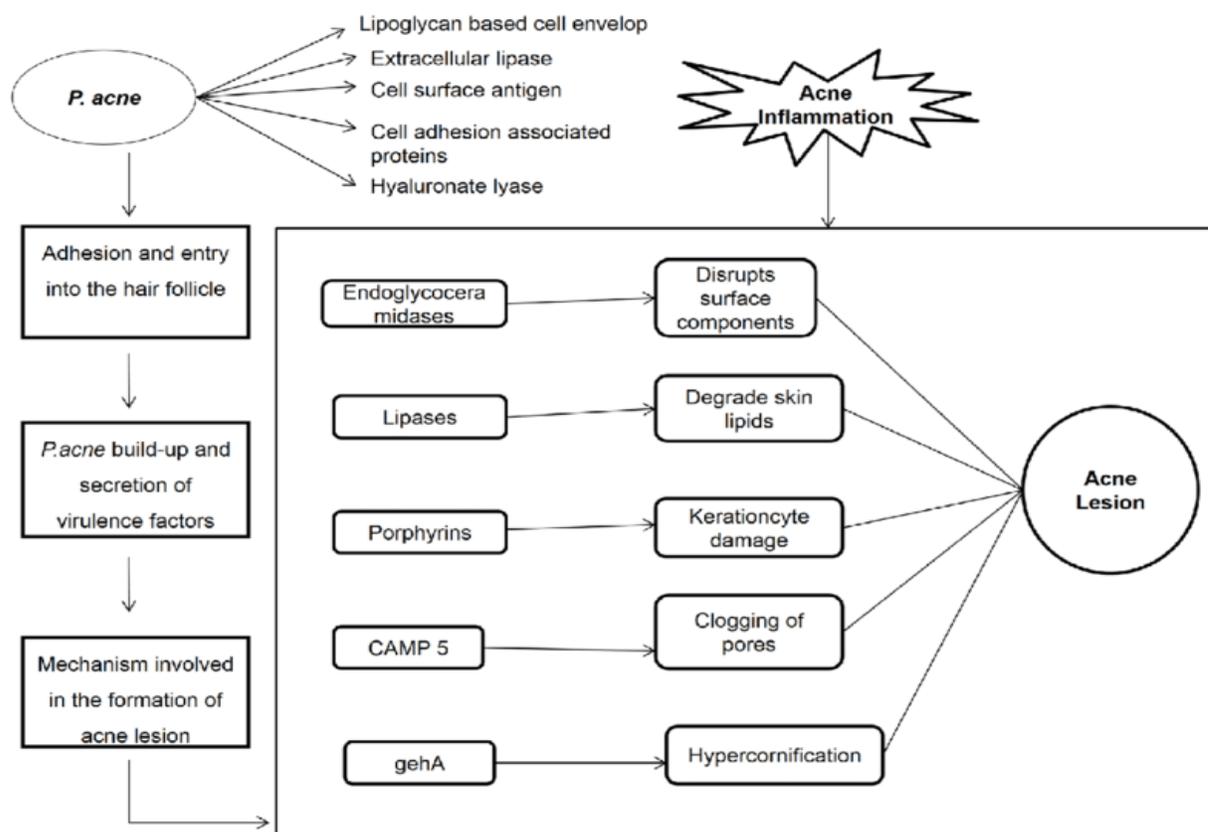


Figure 1: Mechanism of Acne Formation.

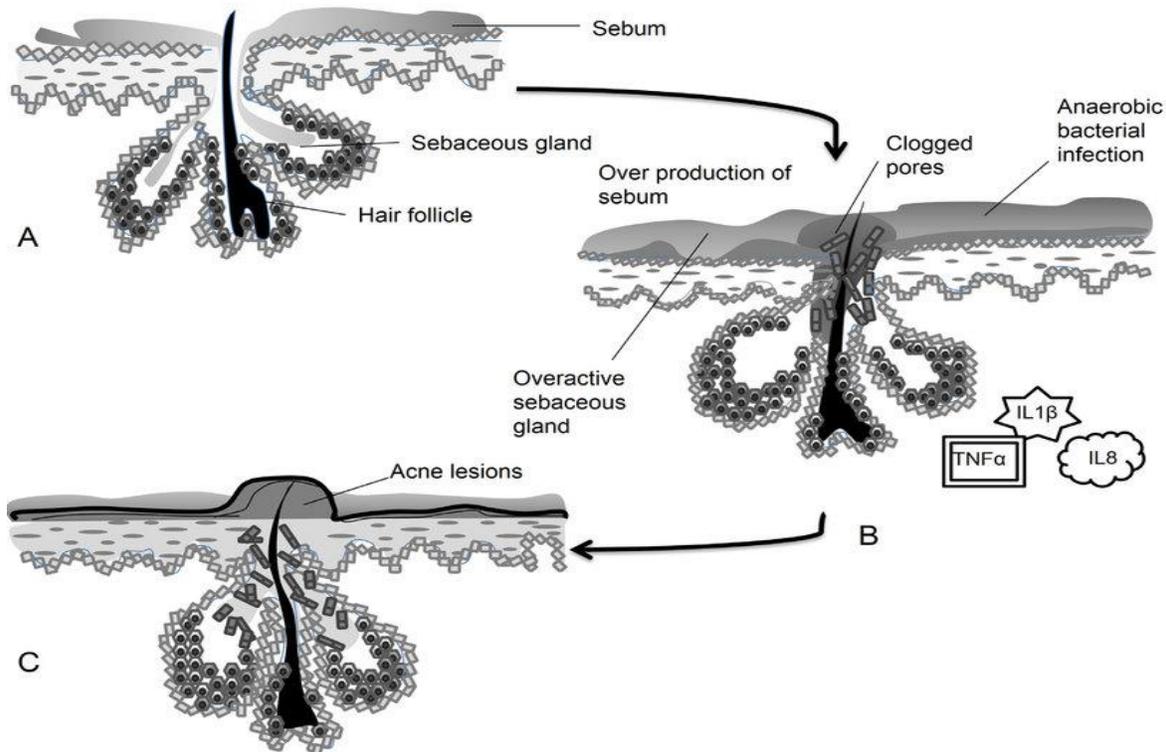
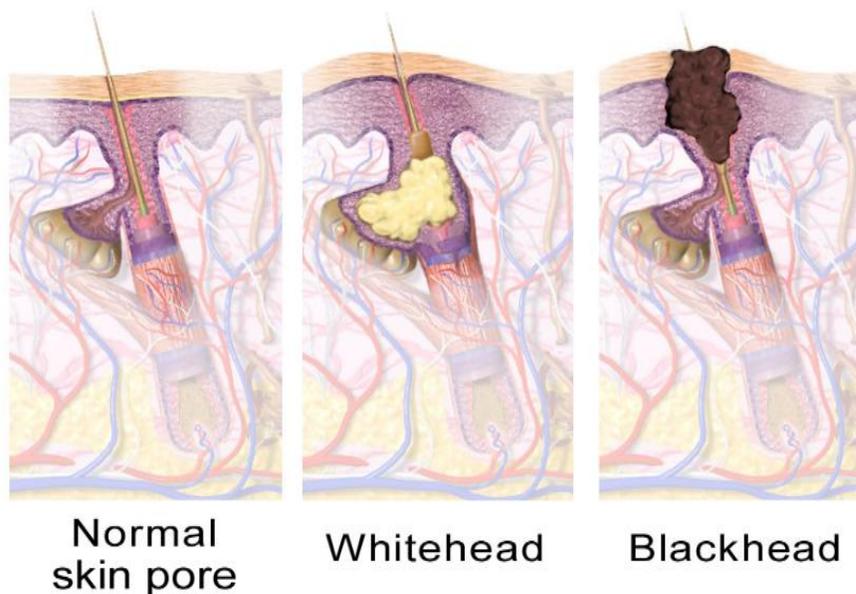


Figure 2: Causative pathogenic factors in acne: (1) Pilosebaceous unit. (2) Mechanism and effects of clogging pore. (3) Inflammatory infiltrates in acne formation

CLASSIFICATION OF ACNE VULGARIS:



Normal skin pore

Whitehead

Blackhead

Acne vulgaris can be categorized as mild, moderate, or severe to determine the most suitable treatment approach. There is no universally agreed-upon scale for evaluating the severity of acne. Mild acne is characterized by the presence of clogged skin follicles (comedones) primarily on the face, with occasional inflammatory lesions. On the other hand, moderate acne involves a higher number of inflammatory papules and pustules compared to mild cases, and these lesions may also appear on the body's trunk.^[15]

METHODOLOGY:

Method 1:

The study included that 160 students being of the age 13 through 19 or immature were selected from Singapore's Choa Chu Kang Secondary School. From this, 94 (59%) were accepted (43 males and 51 women), and all participants provided parental informed agreement. Approval for the study was granted by the research ethics committees of the National Skin Centre and National Health Group Polyclinics, in addition to the Singapore Ministry of Education. The research employed mid-year school exams as the stress model, focusing on the

educational system's rigorous assessments faced by children in Singapore [16]. The outcomes of such tests have a significant impact on children's long-term job possibilities. These tests are known to cause psychological stress in Singaporean youngsters [16]. The study was conducted in two distinct stages. Phase I, referred to as the high stress state, occurred during a two-week period in May, coinciding with the mid-year examinations. Phase II, known as the low stress condition, was carried out between mid-July and early August, which was around two months after the completion of the exams. Measurements were taken in each phase in a controlled environment of 21°C at least 20 minutes of acclimatization. Students were requested to remain in another room with identical temperature and surroundings between measurements. Singapore's humidity levels remain steady throughout the year. All measurements were taken between 12:30 h and 18.00 h in the afternoon. Students were asked to fill out a self-administered questionnaire detailing their health status, medical history, smoking history, acne history, past acne treatments, and the kind of treatment when appropriate. Students were told not to use any topical medications for at least one day before the study testing and not to wash their faces with any soaps or cleansers on the day of the test. All examinees' height and weight were measured, and their body mass index was determined. The Perceived Stress Scale (PSS) was used to determine the level of felt psychological stress. The PSS is a cutting-edge psychological stress test that consists of a 14-item self-questionnaire that assesses the respondent's perception of psychological stress and measures the degree to which the respondent's external situation is self-appraised as stressful [16]. This measure is frequently used in stress research as a psychological tool for measuring stress perception, and it has shown normative results and reliability. Previous research has utilized the PSS to assess self-reported stress in adolescents [17, 18] and college students, including stress related to school exams [19, 20]. The PSS was given to students at two different times: during the examination period (Phase I) and approximately two months afterwards (Phase II), which coincided with the students' summer vacation.

Method 2:

A cross-sectional study was conducted in a tertiary care facility in the north Gujarat region. Patients were recruited through the Dermatology Outpatient Department. Prior approval was obtained from the medical college's Ethical Committee. Dermatologists initially evaluated the patients. The goal of the study was presented to acne vulgaris patients. Patients over the age of 15 who were willing to participate in the study were enrolled in the study. Patients provided formal written consent. Patients were evaluated using semi-structured Performa, which included socio-demographic information such as age, gender, marital status, education, religion, and so on. Dermatologists examined acne severity using The Global Acne Grading System (GAGS), and patients were subsequently tested for stress, anxiety, and depression using the Depression, Anxiety, and Stress Scale- 21 item scale. (DASS 21) The Acne Grading System around the World In 1997, Doshi, Zaheer, and Stiller [43] developed the GAGS (global acne grading system). This technique divides the face, chest, and back into six sections (forehead, each cheek, nose, chin, chest, and back) and assigns a size factor to each. Two factors are awarded to the forehead, right cheek, and left cheek, one factor to the nose and chin, and three factors to the chest and upper back. Each type of lesion is

assigned a severity value: no lesions = 0, comedones = 1, papules = 2, pustules = 3, and nodules = 4. The local score (Local score) is calculated as follows: Local score = Factor Grade (0-4). The global score is the sum of the local ratings, and the global score was used to grade acne severity. A score of 1-18 is regarded mild; 19-30 is considered moderate; 31-38 is considered severe; and >39 is considered very severe. Depression as measured by the Depression, Anxiety, and Stress Scale DASS-21 is a 21-item list. DASS-21 (Depression Anxiety Stress Scale): The DASS21 is divided into three subscales: depression, stress, and anxiety, each with seven questions [44]. The internal consistency of both the English and non-English versions is strong (Cronbach's alpha scores >0.7). The study employed the Hindi version of the scale, which had been translated and verified by Bhupendra Singh et al. The purpose of the questionnaire was taught to patients by a mental social worker, and each patient was given a separate spot to fill out the scale [45]. The emotional states of psychological stress, depression, and anxiety were computed by adding up each DASS-21 question to score how the subject felt in the previous week. The scores for each set of DASS-21 questions, which contain 7 items for the three subscales evaluated on a Likert four point scale (0, 1, 2, and 3) ranging from 0 (Never) to 3 (Almost usually), were calculated independently to generate a score for depression, anxiety, and stress other than depression and anxiety. These four responses for the level of severity or frequency of psychological stresses were analysed using the DASS-21 scoring guidelines, which categorize depression scores as normal (0-4), mild (5-6), moderate (7-10), severe (11-13), and extremely severe (14 and above); anxiety scores as normal (0-3), mild (4- 5), moderate (6-7), severe (8-9) and extremely severe (10 and above). Normal (0-7), mild (8-9), moderate (10-12), severe (13-16), and extremely severe (17 and beyond) stress levels are assigned. Statistical Evaluation All obtained data was logged and entered into Microsoft Excel before being analyzed with IBM Statistical Product and Service Solutions (SPSS) version 20.0. Continuous data was expressed as a mean (standard deviation), and categorical data as a number (percentage). Chi square was employed to analyze the relationship between variables. P 0.05 was regarded as significant.

STRESS MANAGEMENT TECHNIQUE:

Yoga and Mindfulness: As Tools for Emotion Regulation

Yoga is an ancient Eastern practice that dates back over 2000 years. Although its origins and provenance are unknown, the earliest written word 'Yoga Sutra' defines the concept of yoga, focusing on spiritual growth, emotion regulation, and mind regulation. Initially, the emphasis was on breathing awareness and breathing exercises known as 'pranayama' to quiet the mind and body and eventually attain a higher state of consciousness.

Physical movement in the form of postures was included and integrated with yogic breathing 'prana' and components of relaxation as yoga evolved. The basic goal is to improve well-being by increasing physical flexibility, reducing discomfort and unpleasant stimuli, and reducing negative thoughts and emotions. According to the medical literature, the benefits are extensive for both mental and physical health disorders such as anxiety, depression, cardiovascular disease, cancer, and respiratory ailments. It has also been shown to improve

muscular-skeletal disorders and physical symptoms by boosting physical body awareness.

Yoga has become a worldwide phenomenon and is extensively practiced in a variety of styles. In general, all kinds of yoga incorporate some relaxation. Furthermore, some styles emphasize pranayama while others are more physical in character. Vinyasa flow is one such practice that entails moving through a number of yoga postures using the inhale and exhale of the breathing pattern; this leads to the movement becoming contemplative. Pranayama is frequently followed by standing postures linked together with a movement called vinyasa (akin to a sun salutation) that serves to keep the body moving and enhances fitness, flexibility, and helps maintain linkage with the breath. A variety of seated postures, an inversion (such as headstand or shoulder stand), and a final relaxation 'savasana' are also commonly included in the practice.

Mindfulness:

Mindfulness entails being more present in the moment by acknowledging the here and now, often known as "being present," rather than focusing on the past or future^[21]. Being aware of our surrounds and the environment, as well as what we are eating and drinking, and physical sensations such as the sun or wind on our skin, are all examples of being present^[21].

Mindfulness includes acknowledging one's thoughts and body. Every day, humans have hundreds of thoughts, the vast majority of which are unimportant. In certain cases, these thoughts are recurrent and negative, which can lead to increased stress and unpleasant physical sensations including anxiety, nausea, and tension headaches. Being mindful means being aware of our thoughts and whether we are caught up in them rather than being aware of the present moment. Furthermore, awareness of the physical body may be modest on a daily basis; being mindful means improving this awareness by becoming more linked with the sensations in the body. This could be feeling the legs move when walking, or feeling the earth beneath the feet or the natural way the body moves while standing^[24].

Mindfulness has been proved to improve physical and mental wellbeing. The National Institute for Clinical Excellence^[24] presently recommends it as an adjuvant therapy to Cognitive Behavioral Therapy (CBT) for the prevention of recurrent depression.

However, with so many distractions around them, it may be difficult for some people to do this, so they may choose to choose a certain time and place when and where they may sit in a comfortable position to begin to become aware of their breathing and physiological sensations.

Researchers developed the ability to detect stress in laboratory settings using medical-grade devices^[27-30], and smartwatches and smart bands have begun to be employed for stress level detection research^[29-31]. These devices provide users with a high level of comfort and functionality, but their stress detection accuracies are lower than those of medical-grade devices due to low signal quality and the difficulty of acquiring data during severe physical activity. Researchers have demonstrated that as data is collected over a lengthy period of time, detection performance improves^[32]. During movement periods, the signal may be lost (data gap) or artefacts may be

produced. The accuracies of these devices in detecting stress levels for two classes are around 70%^{[29, 30] [33,34]}.

Researchers should recover from the stressed state to the baseline state after identifying people's stress levels. There have been very few studies that integrate automatic stress detection (using physiological data) with recommended acceptable stress management approaches, to the best of our knowledge. The physiological effects of mindfulness were investigated by Ahani et al.^[35]. The Biosemi gadget was used to collect electroencephalogram (EEG) and breathing readings. They used machine learning techniques to distinguish between control (non-meditative state) and meditation states. Karydis et al.^[36] used a wearable EEG measurement device (Muse headband) to identify post-meditation perceptual states. Mason et al.^[37] investigated how yoga affected physiological signals. They measured blood pressure and respiration signals with a PortaPres Digital Plethysmograph. Using these signals, they also demonstrated the beneficial effects of yoga. A further study corroborated the favourable effect of yoga on physiological signals; researchers used a piezoelectric belt and a pulse sensor to detect breathing and heart rate pulse^[21]. They proved the benefits of several yogic breathing patterns in assisting individuals to relax. Several research have also been conducted to demonstrate the usefulness of mobile mindfulness apps using physiological signals that measures the heart rate variability (HRV)^{[20],[38],[39]}, electrodermal activity (EDA), salivary alpha-amylase (sAA), and electroencephalogram (EEG). Other research^[38,39] employed EEG and respiratory signals to validate the efficacy of mobile mindfulness apps.

Embracing the unchangeable: taking control of what you can

When under stress, it's easy to feel helpless, yet remaining passive will not help. There may be things you can't change, but concentrating on what you can do to manage or influence a stressful situation will help to alleviate the unsettling feelings that come with feeling out of control.^[42]

Risk factors that to be avoided:

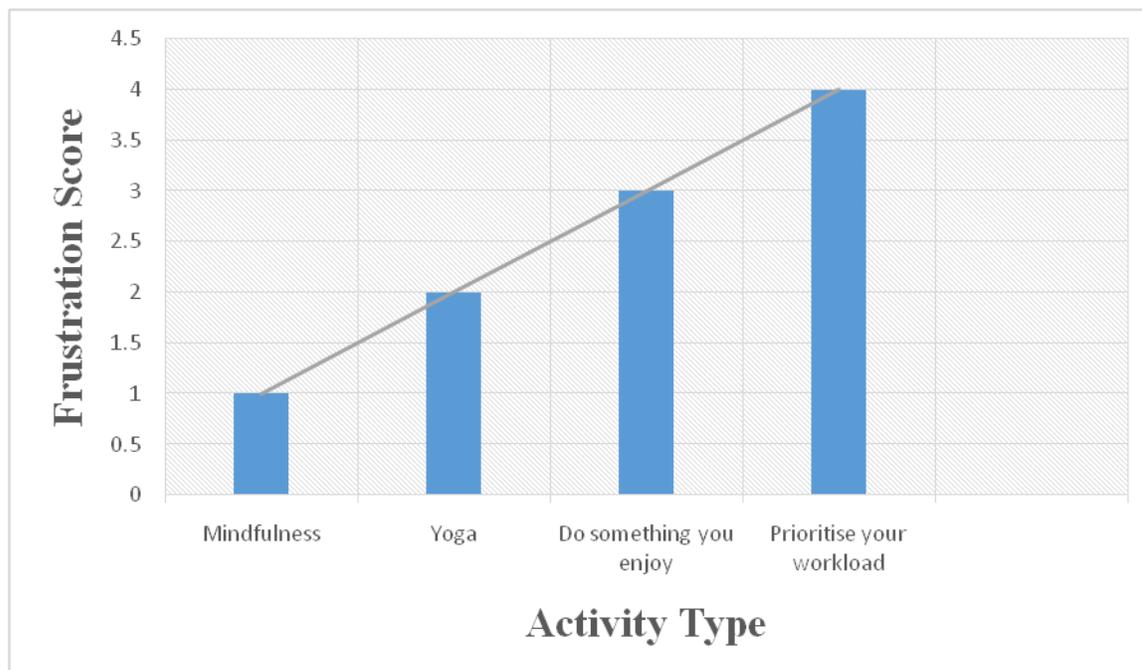
Smoking, binge eating, and excessive drinking are just a few of the unhealthy habits that may creep into our lives during stressful times, and it's remarkable how reliant we can get on these destructive coping techniques to manage stress. Make excellent lifestyle choices that contribute to your overall well-being. Exercise enhances sleep and encourages the body to release endorphins, which are believed to have stress-relieving properties.^[42]

Do something you enjoy:

Making time in our hectic schedules to do the activities we enjoy is essential for having a pleasant attitude. Even if you just have 20 minutes a day to read, practice a musical instrument, or do something else that makes you happy, you must take a break and remember not to abandon your interests.^[42]

Prioritise your workload:

When incoming jobs never seem to slow down, prioritising your workload and scheduling your time is crucial if taking a break or slowing down is not an option. Set realistic goals and finish the most urgent chores first^[42]



Alternative medicine:

According to research, complementary therapies are being explored as potential treatments for acne. However, the evidence supporting their effectiveness is of low quality. Some studies suggest that applying tea tree oil or bee venom topically may reduce the number of skin lesions in individuals with acne. Tea tree oil has shown comparable effectiveness to benzoyl peroxide or salicylic acid, but it can cause allergic contact dermatitis. The anti-acne effects of tea tree oil may be due to its antibacterial action against *C. acnes* and its anti-inflammatory properties. Several other plant-derived therapies, such as basil oil and oligosaccharides from seaweed, have shown positive effects against acne, but there is a lack of well-designed studies investigating their use for this purpose. Acupuncture, herbal medicine, and cupping therapy have insufficient high-quality evidence to support their use for treating acne [43]

DISCUSSION:

The management of acne vulgaris requires a comprehensive approach that encompasses understanding the underlying mechanisms of acne formation, accurate classification of the severity of the condition, and exploring alternative approaches to complement conventional treatments. The understanding of the mechanisms involved in acne formation is essential for developing targeted treatment strategies. Factors such as increased sebum production, hormonal fluctuations, follicular obstruction, and bacterial colonization contribute to the development of acne lesions. By addressing these underlying mechanisms, healthcare professionals can tailor treatment plans to target specific aspects of acne pathogenesis. Accurate classification of acne severity aids in determining the most appropriate treatment approach for each individual. Mild acne, characterized by comedones and occasional inflammatory lesions, may respond well to topical treatments and lifestyle modifications. Moderate acne, with a higher number of inflammatory papules and pustules, may require a combination of topical and systemic therapies. Severe acne, marked by extensive inflammatory lesions, nodules, and

cysts, often necessitates more aggressive treatment approaches, such as oral isotretinoin. The classification system helps guide treatment decisions and allows for personalized care. In addition to conventional treatments, there is growing interest in incorporating alternative medicine approaches into acne management. Practices such as yoga, mindfulness, and emotion regulation techniques may assist individuals in coping with the emotional impact of acne.

By promoting stress reduction, self-acceptance, and emotional well-being, these techniques may complement conventional therapies and potentially improve treatment outcomes. Encouraging individuals to focus on factors within their control, such as maintaining good hygiene practices, adopting a healthy diet, and following a consistent skincare routine, can empower them in their acne management journey. By fostering a positive mindset and self-acceptance, individuals may experience improved self-esteem and overall well-being, which can positively impact the management of their condition. Identifying and avoiding risk factors associated with acne exacerbation is crucial. Practices such as excessive sun exposure, smoking, and consuming a high-glycemic-index diet have been linked to acne flare-ups. Educating patients on the importance of sun protection, smoking cessation, and a balanced diet may aid in reducing the severity and frequency of acne breakouts.

While alternative medicine approaches, such as herbal remedies, have shown some potential in reducing acne lesions, the evidence supporting their effectiveness is limited. Further research is needed to establish the safety and efficacy of these alternative treatments. It is important for individuals to consult with healthcare professionals before incorporating any alternative therapies into their acne management plan.

CONCLUSION:

A holistic approach to managing acne vulgaris involves understanding the underlying mechanisms, accurately

classifying the severity of the condition, and considering alternative approaches alongside conventional treatments. According to this research, it has been determined that there is a positive connection between stress and the severity of acne. By addressing multiple aspects of acne, healthcare professionals can provide comprehensive care that focuses on both physical and emotional well-being. Continued research and collaboration between conventional and alternative medicine practitioners will further advance our understanding and management of this common skin condition.

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