

**RISK FACTOR ASSESSMENT FOR ACNE VULGARIS IN HUMAN AND IMPLICATIONS FOR PUBLIC HEALTH INTERVENTIONS IN NORTH CENTRAL INDIA: A SURVEY-BASED STUDY**

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**ABSTRACT**

**Objective:** The aim of the present study is to deal with the population based field study regarding factors that might play essential role in occurrence or epidemiology of Acne vulgaris in north central India.

**Methods:** This cross-sectional study was a population based field study. Populations were assessed for influence of various factors on acne prevalence. The study was carried out from April 2016 to October 2016 in north central India. For this survey, questionnaires were designed to cover all the required information regarding the incidence of acne that includes factors such as gender, age, skin type, complexion, season of the incidence, and dietary habit.

**Results:** Acne vulgaris appears to be influenced by gender, age, seasonal variations, breakout area, complexion, skin types, and dietary habits. Further, the influence of dietary habit on acne, particularly the consumption of dairy products or high-carbon diet has also been evaluated. Apart from depicting the vulnerable range of age ( $p=0.003288$ ), sensitivity on various skin types ( $P=0.00039$ ) and complexion ( $P=0.001355$ ) on the basis of gender; this field study on acne vulgaris, also reveals that the season has inordinate role in acne pervasiveness ( $P=0.115731$ ).

**Conclusion:** This study is helpful in categorizing the risk factors and manifesting the afflictions of acne in population thus, contributing health-care planning.

**Keywords:** Acne, Prevalence, Risk factors, Post management.

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**INTRODUCTION**

Various superficial infectious agents are responsible for human skin problems. In this row, acne vulgaris is one of the most common chronic diseases of the pilosebaceous unit. It affects almost 85% of adolescents when they undergo maximum physical, psychological, and social changes [1]. This problem is neither life-threatening nor physically incapacitating, but generally procures the image of face. Moreover, it can affect the metabolic functioning and erode self-esteem of susceptible individuals [2]. Moving toward the factors influencing acne, female patients tend to develop acne earlier with high persistency than males whereas male suffers with the severe form of acne vulgaris [3-8]. Therefore, it is the demanding need of the present scenario to focus on the wide range of an epidemiological survey on acne vulgaris. Population-based data of epidemiologic survey are significant in computing tools to identify the risk factors, treatments, and expenses of health services. However, community sampling records are considered as an effective method of dermatological investigations of acne cases, in spite of this, it is rare [9].

The aim of the present study is to reveal the multifactorial prevalence of acne vulgaris and various demographic features along with its probable factors that affect the frequency to some extent. To the best of our knowledge, no similar studies have been reported from the north central part of India till date.

**METHODS**

This cross-sectional study was a population-based field study intending to discern the factors that influence the prevalence of acne in adolescents. The study carried out from April 2016 to October 2016 in the north central part of India. For this survey, questionnaires were

designed to cover all the required information regarding the occurrence of acne that includes factors such as gender, age, skin type, complexion, season of the occurrence, dietary habit etc [10].

The schools, colleges, universities as well as local residential colonies including slum areas were taken under consideration. We seek permission for the survey from principals of all the selected institutions. The assortments of the area were made in such a way so as to represent all the socioeconomic groups. We demonstrated the candidates in school, colleges, and in communities the required information about acne and about the survey by lectures and presentations and administer the questionnaires. This study was approved by the hospital research.

**Grading of questionnaire responses**

The grading of questionnaire was designed as such so that all the possible factors influencing the acne prevalence were considered. The different socioeconomic groups were included to conclude the effect of sanitation, dietary habit, candidates that approach different medical help and to share candidate's personal household remedies experience that can help in further studies. The major factors were as follows:

**Gender and age**

The gender-based analyses were done by grouping male and female individuals. This is an important factor as there are considerable variations in the prevalence due to variations in hormones. On the basis of gender, most of the other factors were evaluated. To address both the gender equality, we seek coeducation and segregated institutes. Candidates were asked to assess their age, divided into groups (6-12, 12-18, 18-24, 24-30, and 30-36) and their gender, i.e., male or female as well as to evaluate the severity of their acne infection.

### Severity

Candidates were classified according to their infection in the three following categories: Mild, moderate, and severe. We pre-demonstrated the candidates how to examine their infection severity. They were asked to mention their severity infection frequency on an average has been of great concern in the epidemiologic analysis.

### Seasonal variations

Seasonal variations in disease frequency have been of great interest in the epidemiologic investigation, the seasonality of disease and mortality has been observed for centuries. Therefore, the effects of climatic changes (humidity, sunlight, cold, and temperature) on the skin were also aimed to be assessed in the questionnaires with the heads of summer, winter, autumn, spring, and all seasons. Since the candidates have variable sensitivity to the varying seasons; we seek to investigate the seasons, in which the individual candidate has suffered the most.

### Complexion

The complexions were assessed as fair, moderate, and dark. Although the effects of complexion are hardly reported yet, we have taken it under consideration, which proves worthy.

### Skin type

It was mentioned under following heads, i.e., oily, dry, normal, and complex. The skin types play a noteworthy role to influence acne frequency and severity. As the oily content (sebum) promotes anaerobic bacteria growth.

### Marital status

We have taken this factor as married or unmarried, but it is found to have no association with acne severity.

### Breakout area

To mention their area of the breakout, the candidates were provided with four responses, i.e., face, back, chest, and forehead.

### Dietary habits

To study the relationship between the dietary habit and frequency of acne disease. The dietary habit were assessed using weekly food diary, including high glycemic diet, dairy products, fatty, spicy diet, and chocolate consumption. The frequency of consumption of dairy products was taken as regulated (organized) factors, and the grade of severity of acne disease or its absence was taken as efficacious characteristic. The dietary habit was assessed under the heads of high glycemic diet, dairy products, spicy food (junk food) fatty food, and chocolate. The quantity and quality of glycemic index (GI) defined by glycemic load (GL). The GL was calculated from the weekly food diaries by given formula.

GL = GI for food items × its carbohydrates in grams (g/100)

Moreover, the GI values were taken from the international table of GI [11] the GI was estimated using similar food of known GI.

### Household remedies

For assembling individual's personal experience or their knowledge of acne curatives, we had set a separate column for the household remedies.

### Study areas

Areas were selected by simple random method taking into account to represent all the socioeconomic and age groups. These are schools, universities, and local residential areas including the slum area so as to include different ethnic groups and cultural practices and hygiene.

### Subject selections

Totally, 1500 subjects were under assessment from the different areas out of which, 648 were male, and 852 were female within the age range of 6 year old to 36 years. Questionnaires were distributed to all the candidates and verbally interpreted in simple language or folk language so as to avoid any kind of misunderstanding and to enable accurate response by the participants.

### Statistical analysis

Further, data were collected based on the frequencies of occurrence and statically analyzed with a Pearson's Chi-square test to assign significant differences between the groups where the significance level was set at  $P < 0.05$ . The odds ratio was calculated in adjusted logistic regression models.

### RESULTS

The 1500 respondents were surveyed in between the age range of 6-36 years. Total 39% respondents were found affected, with 41.6% male candidates out of whom 29.6% were cases whereas 58.3% were female with 45.7% cases. The results clearly reflected that females were more affected than males (Table 1 and Fig. 1b).

Our observation reveals the prevalence of acne which is directly proportional to the age of 14-24/25 (Table 1 and Fig. 1a). However, acne occurrence is indirectly proportional to the age above than 25. There, we observed the rare cases of acne in the age of 6-12 years of female candidates although percentage is very low (0.13%). Although in each group of age, females have higher prevalence than males. The age variations are statistically significant ( $P=0.00329$ ) (Table 1).

Coming to the next parameter, the skin type was proved to be another effective factor. It was under the heads of oily, dry, normal, and complex skin type. Oily skin showed higher sensitivity toward the infection 42.9% in female and 17% in male out of total, i.e., 60.3% (Fig.2). Dry skins are also prone to infection but comparatively lesser percentage is reported, i.e., 20.8% in female and 14.01% in male from 34.8% as a total (Fig. 1b). Whereas, normal and complex skin types have negligible sensitivity which is highly significant ( $P=0.00039$ ) (Table 1 and Fig. 1c).

Further, the impact of complexion on acne prevalence is also noteworthy. Moderate is more at risk than the fair and dark complexions (68.3%, 24%, and 17%, respectively) which is also proved by p value, i.e., 0.00135 (Table 1 and Fig. 1d). However, seasonal variation is reported as one of the most valuable factors, in which summers (61.3%) are most infectious (Fig. 1e and 2a-i severe

**Table 1: Acne prevalence among the genders, based on various factors**

Factor	Range	Male	Female	P=0.05
Age	6-12	0	2	0.00329
	12-18	43	79	
	18-24	72	124	
	24-30	60	130	
	30-36	10	65	
Skin type	Oily	102	251	0.00039
	Dry	82	122	
	Normal	0	5	
	Complex	1	22	
Face complexion	Fair	33	50	0.00135
	Moderate	120	280	
	Dark	30	70	
	Season	Summer	100	
Winter	6	10		
Monsoon	15	20		
Autumn	17	18		
All	47	93		

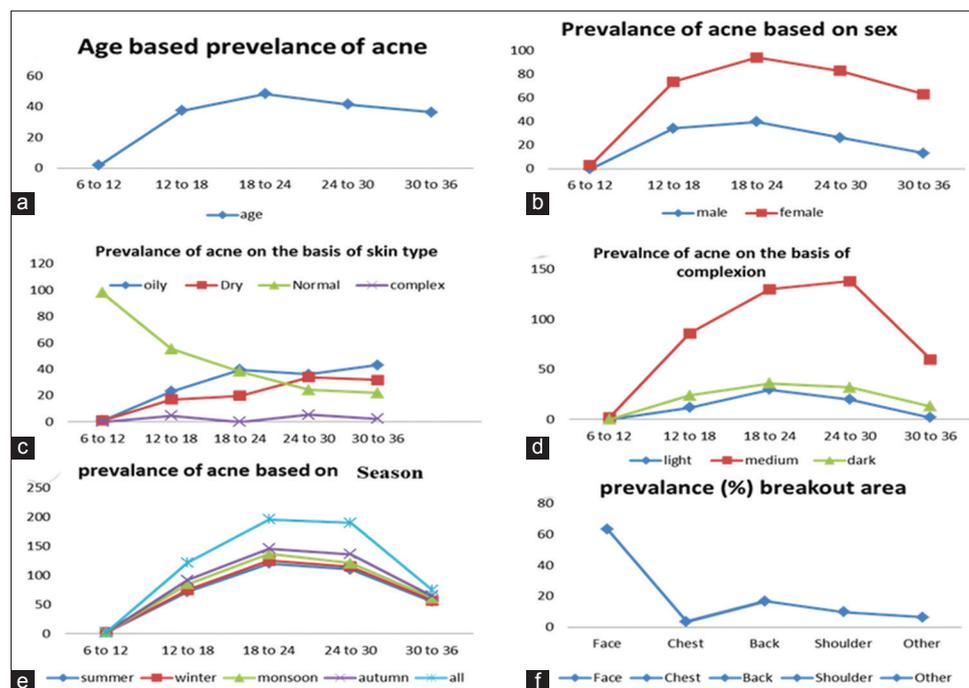


Fig. 1: Prevalence of acne: (a) Based on age, (b) based on sex, (c) based on skin type, (d) based on breakout area, (e) based on seasonal variation, (f) based on complexion



Fig. 2: (a-i) Images representing severity of acne persiveness during summer season on the face of moderate complexion and oily skin type

condition in summer) while other seasons, i.e., monsoon, autumn, and winter are less susceptible, respectively. The seasonal variation has significance of  $P=0.035$  (Table 1). The face considers a having highest breakout area (Figs. 1f and 2a-i).

The marital status has found to be insignificant in acne perseverance. Regarding dietary habit, it was established from the data that consumption of high glycemic index diet and high glycemic load (GL) exacerbates risk of acne occurrence. Respondents with high GL daily dietary habits (i.e., consumption of 100 g of carbohydrates daily), make up 56.8% of total infected respondent, while consumptions with 2-3 times a week (i.e., consumption of 100 g of carbohydrates only 2-3 times/days/week) show 43.2%, and there are no reports on rare consumption of carbohydrates. It is clear from the data that high GI diet computing high GL reflects its influence on promotion of acne. However, the consumption of dairy products and milk shows the risk of acne prevalence significantly higher among the respondent with daily consumption (52.6%) than 2-3 times a week (29.3%) and

weekly (18.1%). Data reveal a direct correlation between the dairy product consumption and risk of occurrence of acne [12] although the examinees consuming fatty and spicy foods show comparatively low-risk competent than dairy products. Apart from this, consumption of chocolate reveals contrary effects (Fig. 3) [13,14].

Further interrogations during the survey, the personal experience of household remedies from respondent were assembled. Among the infected examinees, 64.8% seek household treatments, and 27.1% seek medical care, which may include allopathic, homeopathic, Ayurvedic, and Unani disciplinary. Moreover, 8.1% respondents seek no treatments. All the information regarding household natural remedies were assessed and considered for the future prospects that may prove assistive for our study. Some of the information is listed in Table 2.

DISCUSSION

An individual can suffer from acne more easily and frequently than any other disease [4]. Our community-based study reveals that acne is commonly occurring problem in the age of puberty and shows extensive emotional impact and ultimately declines one's self-esteem. The present investigation shows the prevalence of acne in population, i.e., 39%. There are many similar studies which have been reported globally till date such as in Turkey [25], Syria [26], Ankober Ethiopia [27], Northern Ethiopia [28], Taiwan [29], Australia [8], South India [3,30], Saudi Arab [31], Iran [1], Portugal [32], Malaysia [4], Greece [33], Brazil [34], Glasgow [35], Mexico [36], France [11] etc., (Table 3 and Fig. 4).

The present findings demonstrate similarities with the reports of Bogino et al. (2014) in Northern Ethiopia (19.4%) [28], Perkins et al. (2012) in Taiwan (4.7%) [29], Stathakis et al. (1997) [46] and Killkenny et al. (1998) [8] in Australia (10%) and 36.1%, respectively. Moreover, other global findings like that of Al-Ameer and Al-Akloby (2002) in Saudi Arabia 19.6% [31], France 7.2% (1996) [11], Mexico 2.5% (1972) [36], Brazil 2.7% (2014) [34], and Singapore 3% (2007) [41] of community-based survey shows 11.2% and 19.6% of prevalence. The present findings show 39% of prevalence in north central India [46,47].

However, our investigation shows lower number of cases than various other studies 91.3% [33], 86% [2], 64% [43] of occurrence suggest that

Table 2: Some of the most frequently used household remedies

Constituents	Procedure	Effects
<i>C. arietinum</i> , <i>C. longa</i> , milk	Cicer powder, curcuma longa in 3:1 ratio blend with milk, applies paste 10-15 minutes	Reduce blemish, balance facial oil, clear pore [15]
<i>C. verum</i> , honey	1:3 ratio <i>C. verum</i> , honey apply 10-15 minutes	It combat bacterial growth improves outbreak [17]
<i>O. sanctum</i>	Finely crushed leaves applied for 15-20 minutes	Antibacterial, reduce blemish, balance oil [19]
<i>Azadirachta indica</i>	Finely crushed leaves applied for 15-20 min	Antibacterial, antioxidant [16]
<i>C. papaya</i>	Paste of papaya applies for 15-20 minutes	Reduce acne and scar, promotes growth of new healthy cells [20]
<i>C. sinensis</i>	Orange peel grind with water up to paste apply for 20-25 minutes	Reduce swelling an inflammation [21]
<i>Musa</i> spp.	Banana peel directly rubs in circular motion, for 30 minutes	Anti-inflammatory, reduce redness, and swelling [22]
<i>A. vera</i>	Apply aloe gel directly on face	Antiseptic, oil balance [23]
<i>Mentha</i> spp.	Crushed leaves juice, apply for 5-10 minutes	Exfoliate skin, astringent activity, reduce blemish [21]
<i>S. tuberosum</i>	Potato juice, rub for few minute	Antioxidant, reduce blemish [18]
<i>A. sativum</i>	Garlic extract and water in 1:1 ratio for 2-3 minutes	Strong antibacterial, maintain circulatory and digestive system [24]

*O. sanctum*: *Ocimum sanctum*, *A. sativum*: *Allium sativum*, *S. tuberosum*: *Solanum tuberosum*, *A. vera*: *Aloe vera*, *C. sinensis*: *Citrus sinensis*, *C. papaya*: *Carica papaya*, *C. verum*: *Cinnamomum verum*, *C. arietinum*: *Cicer arietinum*, *C. longa*: *Curcuma longa*

Table 3: Prevalence of acne vulgaris in adolescent age; global review

Country	Study population	Prevalence (%)	Reference
Mexico	10,000	2.5	Maldonado et al., 1977 [36]
Glasgow	2014	72	Rademaker et al., 1989 [35]
France	923	7.2	Daniel et al., 1996 [11]
Peru	1857	44.1	Freyre et al., 1998 [12]
Australia	666	83.1	Killkenny et al., 1998 [8]
Turkey	2652	23.1	Atkan et al., 2000 [25]
U K	317	49.8	Smithard et al., 2001 [37]
Saudi	220	19.6	Al-Ameer et al., 2002 [31]
Hong Kong	522	91.3	Yeung et al., 2002 [38]
New Zealand	9570	67.3	Purvis et al., 2004 [39]
Portugal	1290	82.1	Amado et al., 2006 [32]
Singapore	1045	87.9	Tan et al., 2007 [41]
Belgium	594	94.9	Nijsten et al., 2009 [42]
Turkey	563	64	Uslu et al., 2007 [43]
South India	28917	1.068	Adityan et al., 2009 [3]
Iran	1002	93.2	Ghods et al., 2009 [1]
Nigeria	539	90.7	Husain et al., 2009 [44]
Malaysia	409	67.5	Hanisah et al., 2009 [4]
Taiwan	-	4.7	Perkins et al., 2012 [29]
Greece	1531	51.2	Tasoula et al., 2012 [33]
Ankober Ethiopia	-	7.7	Doni et al., 2013 [27]
South India	623	53.2	Samanthula et al., 2013 [30]
Northern Ethiopia	402	19.4	Bogino et al., 2014 [28]
Syria	-	34.7	Waqar et al., 2014 [26]
Brazil	52	96	Bagatin et al., 2014 [31]
Northern India	1500	39	This study

the selected region is lesser prone to acne. Although, it is reflected by community-based studies that Australia has the least prevalence of acne than Asians [48].

This study clearly reveals in the form of graphs, and tables which depicts prevalence frequency of acne is directly proportional to the age, from 20-36 (Fig. 1a), supported by the findings of Aktan et al. [25], Hanisah et al. [4] and Rademaker et al. [35] Moreover, females are more infected (45.7%) than the males (29.6%) (Fig. 1b and Table 1) which was also reported by Tallab [49] and Al-Ameer [31]. It might be due to hormonal changes, which are supposed to facilitate the initiation of premenstrual acne [50]. It is interesting that the season has an inordinate role in the initiation of acne (Fig. 1c). Summer and monsoon are found highly accountable. However, maximum cases are reported from summer season than monsoon, winter, and autumn (Table 1 and Fig. 1e) [31]. Further, seasonal variations regarding severity in acne pathogenesis are also considerable. This finding is contradicted with the traditional

believes that acne improves in summer and aggravate in winter [51]. Probably, because low temperature and humidity adversely affect the epidermal stratum, that ultimately reduces the hydration level of corneum stratum. Hence, reduces the extensibility and resistance to fissuring [52].

On the other hand, sunlight intensity in the noon of midsummer is 130 times more than midwinter [53], and it was thought that UV rays are beneficial to acne. Therefore, sun-bath sustains the restoration of inflammatory lesions by increasing blood circulation [54,55]. Apart from all, the study regarding seasonal variation, result of our study is against the conventional beliefs, supported by Indian survey reports that acne intensifies during summer (Fig. 1e and Table 1) [3,4].

The pilosebaceous unit rich areas are most susceptible site of acne vulgaris, i.e., face (Fig. 1f and Table 1). In the present study, face is reported by 100% of cases, validating face as a core playground of acne

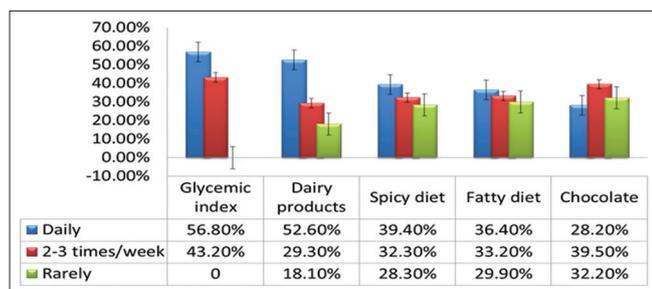


Fig. 3: Graphical illustration of effect of dietary habit on prevalence of Acne vulgaris

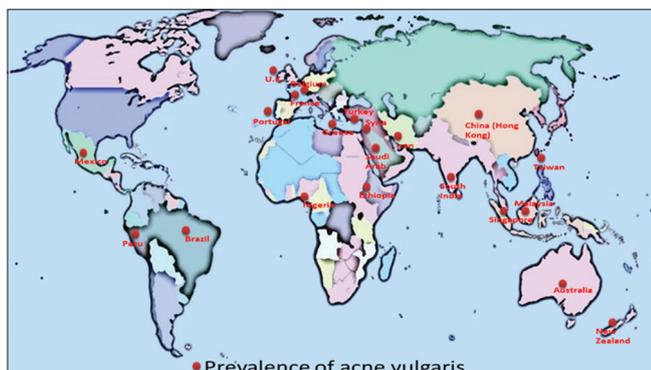


Fig. 4: Acne vulgaris: A global representation of occurrence

vulgaris. Further, back reported to be 30%, chest with 18%, shoulder with 6%, and others with 10% (Fig. 2f) [3,5,32]. Since each skin has varied level of sensitivity based on its type. Therefore, another notable factor in this study is skin type. Medium complexion and oily skin (68.3% and 60.3% respectively, among the entire acne patient) are more likely to be predisposed to skin damage from the sun (Fig. 2) than light and dark complexion. Dry skin is the next leading skin condition prone to acne (34.8%) shown by our investigation (Fig. 2c and f).

The high glycemic diet has adequate impact on acne prevalence [56]. Diets with a high GI, such as white bread, sugar, popcorn, and white rice, are promptly absorbed, conducting increased blood glucose levels and corresponding higher levels of insulin and insulin-like growth factor-1 [57]. It has been shown to enhance sebum production, stimulate adrenal androgen synthesis, and increase androgen bioavailability and facilitating cell proliferation, all of which play a role in the pathogenesis of acne [57], it is the GL that is deciding factor for acne prevalence. GL takes into account the quantity of carbohydrates consumed as well as the rate of carbohydrate absorption. Further, it is also reported that low GL diet resulted in improvement of acne, with improvement in insulin sensitivity, a decrease in testosterone bioavailability, and a reduction in adrenal androgens (Fig. 3) [58].

In addition, dairy diets reveal to comprise positive impacts; proposed justification for this relationship includes revelation of androgen precursors, anabolic steroids [59], and other biogenic elements, namely, whey protein, di-hydro testosterone precursors, and insulin-like growth factor-1 increase [60]. Endocrine factor involved in acne pathogenesis may be affected by dairy product consumption because milk is an insulinotropic nutrient with high-insulinemic index. Like GI, dairy products also increase blood insulin level and IGF-1 [60]. Chocolate consumption has validated negative impact on acne prevalence, possibly it may amend the severity as studies have reported high antioxidant activity of cocoa and presence of phenolic phytochemicals may exhibit remedial benefits to skin [61,62]. Supplementary, spicy, and fatty dietary habit has comparatively increased impact on the occurrence of acne [63,64]. These determinations might have influenced by the lack of diagnostic inaccuracy and recall preconceptions.

The knowledge we gain from the participants were given the equal evaluating worth as they can prove assistive for our research work. These informations are summarized in Table 2.

## CONCLUSION

Our study has profiled out various possible factors accountable for acne prevalence. This population-based study in North central zone of India shows lower occurrence than other Asian countries and Africa. The prevalence is higher in females of this zone. Our survey intensifies the fact that season and dietary habit does effects acne. Facial acne is common among patients that cause foremost impression on their quality of life. Assessment of quality of life in patients with acne is needed as it helps in the pharmacological as well as psychological treatment of the patients in a more active and assimilated way.

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