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**Original Research Article**

# Impact of gender, body mass index and educational background on orthorexic tendency in undergraduate students of North India

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## ABSTRACT

**Background:** Orthorexia nervosa (ON) is a recently identified eating behaviour disorder characterized by "obsession for healthy eating". Such behaviour may negatively impact one's physical and psychosocial health. The present study was designed to evaluate the impact of gender, body mass index (BMI) and educational background on orthorexic tendency of undergraduate students in North India.

**Methods:** This analytical, cross-sectional study was carried out at Kalpana Chawla Government Medical College (KCGMC), Karnal, Haryana, India on young, healthy students enrolled in different undergraduate courses (medicine, science and arts) at colleges in Karnal district. Risk of orthorexia was assessed using ORTO-15 questionnaire. Subjects who scored below 40 were classified as having ON. Logistic regression analysis was done to examine the relationship between ON and socio-demographic variables.

**Results:** Study sample comprising of 448 students, of which 273 (61%) were females and 175 (39%) males, had an average age of 19.25 years. Multivariate logistic regression analysis showed that BMI had a significant impact on orthorexic tendency (p=0.024). Students within the normal BMI range were twice (OR=2.0; 95% CI: 1.24-3.24) more likely to have ON than their underweight counterparts. However, no significant relationship was found between gender and ON. With respect to educational background, medical students differed significantly (p=0.001) in their ORTO-15 scores to science students. Arts and science students scores were comparable.

**Conclusions:** This study suggests that socio-demographic variables might influence orthorexic tendency in student populations. Rising prevalence of this eating disorder necessitates more research to gain a better understanding of its magnitude and etiology.

**Keywords:** Eating disorder, Orthorexia nervosa, North India, Socio-demographic, Student population

## INTRODUCTION

In the 21st century, Orthorexia Nervosa (ON) has emerged as a highly sensitive eating behaviour disorder due to the changed dietary habits, daily life styles and cultural background. Steven Bratman first introduced the term ON in 1997, as obsessive eating disorder towards purity and perfection. ON is characterized by an unhealthy fixation for organic foods that are free of herbicides, pesticides and synthetic materials as well as over sensitization about the techniques of food production and preparation. Contrary to other eating disorders such as anorexia and bulimia nervosa, obsession in ON is not about weight loss or ideal body shape but related to quality of ingested food.[1-2]

ON is an unhealthy fixation for organic and hygienic foods that are free of herbicides, pesticides and other chemicals. This unhealthy obsession results in non-consumption of specific foods that are thought to be harmful for health, leading to deficiency of essential nutrients and even malnutrition. The highly sensitive attitudes about the techniques and supplies used in the food preparation leads

to obsession, loss of social relationships, emotional dissatisfactions and obsessive thoughts about food.[3-4] Most prevalence studies for ON report rates from 30-70%.[5-7] ON is influenced by varied socio-demographic factors like age, gender, BMI, education level as well as stream of education and occupation.[8-10]

Out of the demographical variables having a substantial effect on orthorexic tendency, gender has been found to be one of the most important variables. Review of literature suggests higher rate of ON in women than in men in some studies, whereas few studies have reported that there is an increased risk among men.[8,11-12]

Numerous studies have been conducted worldwide among students enrolled in education streams.[6-7,11,13-14,18] Professionals from healthcare sector like doctors, paramedical staff and dieticians have reported increased tendency since they are well oriented to latest dietary knowledge and overall wellbeing.[7,11,13]

Body mass index (BMI) is one of the important factors which has to be taken into account while studying this disorder. Contradictory views are available in literature in regard to correlation between BMI and ON. Some studies reported no positive correlation, whereas others suggested that people with higher BMI show a greater orthorexic behaviour compared to individuals with normal and lower BMI.[6,14,20,7-8,15]

In view of the above said lacunae in the available literature, the present study was designed as there is little substantial data available for Asian populations, particularly the Indian subcontinent. It was aimed at evaluating the impact of socio-demographic parameters namely gender, educational stream and BMI on orthorexic tendency in undergraduate students in North India.

## METHODS

### *Study design and settings*

This analytical, cross-sectional study was carried out on university students enrolled in different undergraduate courses (medical, paramedical, science and arts) at colleges in Karnal district, Haryana, North India. The study was conducted by the Department of Physiology, Kalpana Chawla Government Medical College (KCGMC), Karnal, Haryana, India in collaboration with the Dietetics Department. The project was given due approval by the Institutional Ethics board of KCGMC, Karnal (KCGMC/IEC/2019/39).

### *Study subjects*

The study sample consisted of 448 subjects from the undergraduate student population. Inclusion criteria were the following: College students in Karnal district enrolled in medical/paramedical, science, arts undergraduate course, within the age group 17-20 years showing willingness were considered for inclusion in the study. Those having history of any psychological disorder or suffering from any chronic medical condition were excluded. The student volunteers were approached in their respective colleges by the investigators after taking due permission from their concerned authorities. The students were explicitly told about the purpose and the methodology to be adopted for the survey. They were enrolled for the study after obtaining written informed consent and participation was completely voluntary. Strict confidentiality regarding the information being provided by them was assured.

General information and anthropometric measurements were recorded after enrolment.

Body mass index (BMI) of each subject was calculated using the formula: BMI ($kg/m^2$) = Weight (kg)/Height$(m)^2$. The WHO criterion was followed for assessing the nutritional status of the participants. Those having a BMI within the range of 18.5-24.99 $kg/m^2$ were considered normal weight, ≥25.0 as overweight, ≥30 as obese and <18.5 were categorized as underweight.

### *Instrument*

The enrolled students were approached face to face and were guided and instructed to fill in the ORTO-15 questionnaire, English version, to screen them for the prevalent trends of Orthorexia Nervosa (ON).

The ORTO-15, a self-administered questionnaire developed by Donini et al has been designed to investigate the presence of Orthorexia.[16] It contains 15 closed multiple-choice items scored on 1 to 4 Likert-type scale (always, often, sometimes, never) to investigate the obsessive attitude of the subjects in choosing, buying, preparing and consuming food they consider to be healthy. Answers suggestive of a pathologic “orthorexic” tendency towards nutrition were given a score of “1” (given to always or never response, according to the specific item), while healthier one receives a “4” score. The sum total of individual item score gives the final score of the test. The score considered positive for a diagnosis of ON is for a threshold value of under 40. A preliminary study to assess the reliability and validity of ORTO-15 scale in our study population gave a value of 0.72 for Cronbach’s alpha, which is fairly acceptable.

### *Statistical analysis*

The data was analyzed using Statistical Package for Social Sciences (SPSS) for Windows version 25.0 (SPSS Inc., Chicago, IL, USA). Mean values along with standard deviations were calculated for continuous variables. For categorical data, frequency and percentage scales were used to analyze the observations. Binary logistic regression analysis was used to evaluate the risk of gender and BMI for ORTO-15, using gender and BMI as the independent variables with ORTO-15 as the dependent

variable. Odds ratios (ORs) and 95% confidence intervals (CIs) were presented. One-way ANOVA with Tukey HSD post hoc test was used to compare the average ORTO-15 scores across groups based on educational stream. The level of statistical significance was accepted at $p<0.05$ and confidence interval of 95% for all tests.

## RESULTS

The study population comprised of 448 undergraduate students of different disciplines, of which 273 (61%) were females and 175 (39%) males, with mean age of 19.25 years and mean body mass index 20.39 Kg/m$^2$. Majority [63.8% (n=286)] of the participants were within the normal weight category. Underweight subjects outnumbered the overweight/obese students (Figure 1).

Nearly half [46% (n=206)] of the participants were enrolled in a medical or paramedical course. Those pursuing an undergraduate degree course in arts (B.A. Arts) had similar representation to undergraduate science program (B.Sc. Science) (28% vs 26%; respectively). In our study, orthorexic tendency was more in males [80.9% (n=140)] as compared to females [71.6% (n=197)] and this difference was found to be statistically significant (p=0.027).

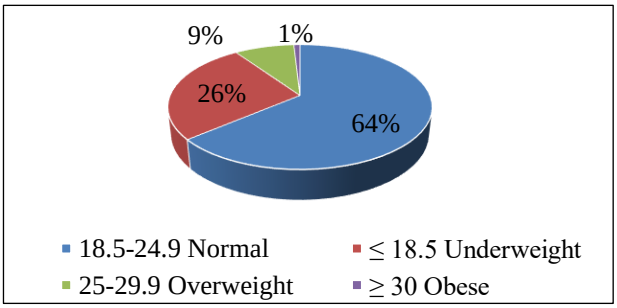


**Figure 1: Distribution of subjects (n= 448) based on body mass index (BMI).**

Socio-demographic parameters i.e. gender, BMI and educational stream were studied for their relation with orthorexic tendency of the subjects. The medical group of students was found to be majorly affected [83.1% (n=172)] by ON, whereas the Science and Arts students were comparable in their orthorexic tendency (68.7% vs 68.3%; respectively) (Table 1).

**Table 1: Association of gender, BMI and educational stream with orthorexia nervosa (ON).**

| Variable | ON Present, % (N) | ON Absent, % (N) | P value |
|---|---|---|---|
| **Gender** | | | |
| Female | 71.6 (n=197) | 28.4 (n=78) | 0.027* |
| Male | 80.9 (n=140) | 19.1 (n=33) | |
| **BMI categories** | | | |
| Underweight | 64.7 (n=77) | 35.3 (n=42) | 0.009** |
| Normal weight | 79.3 (n=228) | 20.7 (n=58) | |
| Overweight | 76.9 (n=30) | 23.1 (n=9) | |
| Obese | 50 (n=2) | 50 (n=2) | |
| **Educational stream** | | | |
| Medicine | 83.1 (n=172) | 16.9 (n=35) | 0.002** |
| Arts | 68.3 (n=86) | 31.7 (n=40) | |
| Science | 68.7 (n=79) | 31.3 (n=36) | |

*Significant ($p<0.05$), **Highly significant ($p<0.01$), †statistical significance determined using Pearson's Chi-squared test

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Examination of the association between BMI based weight categories and orthorexic tendency revealed highly significant relationship (p=0.009) between the two. Orthorexia was reported more frequently by overweight/obese participants as compared to the underweight students (74.4% vs 64.7%; respectively). Also, it was observed that orthorexic tendency was more evident in healthy weight students [79.3% (n=228)].

The effect of gender and BMI on Orthorexia Nervosa were further analyzed by means of Binary logistic regression analysis taking gender and BMI as independent variables and orthorexia nervosa as dependent variable. It was found that BMI had significant impact on orthorexic tendency (p= 0.024). Healthy weight students were found to be more at risk, to suffer from ON as compared to the underweight counterparts (OR= 2.0, 95% CI: 1.24-3.24). With respect to gender, however, no significant relationship was found (Table 2).

The difference of educational stream on ORTO-15 scores was evaluated using One way ANOVA followed by post hoc analysis using Tukey HSD. It was found that there was a highly significant difference (p=0.001) between the medical stream students and Science students. However, there was no significant difference between Medical and Arts students (p=0.11) whereas the difference between Science and Arts groups was comparable (p=0.21) (Table 3). Hence, it can be deduced that students pursuing medical and science streams are most sensitive to dietary intake as compared to students of other streams in the same age group.

**Table 2: Logistic regression analysis to examine the effect of BMI and gender on orthorexic tendency.**

| Dependent variable: Orthorexia nervosa | | | | | |
|---|---|---|---|---|---|
| **Independent variable BMI category** | **S.E.** | **Wald** | **P value** | **Exp (B)** | **95% CI for Exp (B)** |
| **Normal** | | 9.440 | 0.024* | | |
| **Underweight** | 0.245 | 8.066 | 0.005** | 2.005 | 1.24-3.24 |
| **Overweight** | 0.409 | 0.220 | 0.639 | 1.212 | 0.54-2.70 |
| **Obese** | 1.017 | 1.933 | 0.164 | 4.112 | 0.56-30.19 |
| **Gender** | 0.241 | 3.206 | 0.073 | 0.650 | 0.41-1.04 |

* Significant ($p < 0.05$)

**Table 3: Effect of educational stream on ORTO-15 score.**

| Educational stream | (I) Group code | (J) Group code | Mean difference (I-J) | S.E. | P value |
|---|---|---|---|---|---|
| **Medical** | 1 | 2 | -2.13913 | 0.56729 | 0.001* |
| | | 3 | -1.09524 | 0.54835 | 0.114 |
| **Science** | 2 | 1 | 2.13913 | 0.56729 | 0.001 |
| | | 3 | 1.04390 | 0.62341 | 0.216 |
| **Arts** | 3 | 1 | 1.09524 | 0.54835 | 0.114 |
| | | 2 | -1.04390 | 0.62341 | 0.216 |

*Highly significant ($p<0.01$), † statistical significance determined using Tukey HSD

## DISCUSSION

Orthorexia nervosa is a new concept in eating disorders in modern era, where the quality of the food becomes an obsession causing substantial dietetic limitations, affective dissatisfactions and intense social isolation. In the present times, because of the global digitalization and over exposure to social media and influencers, this study in young student population assumes a greater significance The present study was carried out to explore the effect of socio-demographic variables i.e. gender, BMI and educational stream on orthorexic tendency in a sample of undergraduate students in North India. Orthorexia nervosa has been studied and correlated with gender, education level and BMI in various studies done worldwide, and these factors have been reported to play a major role in the etiology of ON. [1-5,7,8,19-22]

In our research, the prevalence of ON was found to be more in men compared to women (80.9% vs 71.6%; respectively, $p = 0.027$). However, multivariate logistic regression analyses showed that gender had no significant impact on orthorexic tendency. The results in different studies have found to be contradictory. Fidan et al, and Donini et al have reported a higher prevalence of orthorexia nervosa in men.[7,16] In one study conducted in Nutrition students in Jordan, male students exhibited greater tendency for ON than female students (39.4% vs. 28.6%; respectively).[23] A study among Turkish adults using ORTO-11 questionnaire, adapted in Turkish from ORTO-15, revealed statistically significant difference ($p<0.001$) in mean ORTO-11 scores of males and females (men: 26.9±4.9; females: 25.6±5.0).[24] However, some authors reported higher ON prevalence among females, [2,4,12] while others revealed no significant gender differences.[6,11,15] The reason for these inconsistent results may be due to the socio-demographic and cultural differences between the sample groups in the studies. Ramacciotti et al observed in a study done in male university students that ON in men might be related to greater indulgence in health and fitness issues, associated with obsessive compulsive traits in relation to ideas such as muscularity, strength, power and sportsmanship.[25]

Present study demonstrated the presence of significant correlation between BMI categories and ON. Orthorexic behaviour was seen most frequently (79.3%) in normal weight participants ($p = 0.009$). Students within normal BMI range were two times (OR: 2.00, 95% CI: 1.24-3.24) more vulnerable for ON as compared to their underweight counterparts. These results emphasize the concern of orthorexic individuals towards pure, clean and natural foods rather than with body image or body weight. Existing literature regarding the effect of BMI on orthorexic tendency reported contradictory findings. A number of studies have suggested that overweight and obese people were more inclined towards an orthorexic behavior than underweight and normal people.[7-8,15] Oberle et al explained that overweight and obese people aim for a diet regime useful for weight reduction than people in normal or underweight categories.[8] Gezer and Kabaran reported a lower ORTO-11 score in underweight individuals compared with those in obese or normal body weight category.[11] Donini et al observed that effect of BMI regarding food preferences may reflect the efforts made by individuals to achieve and maintain an ideal

body weight.[16] However, no correlation was found between ORTO-15 scores and BMI values in few studies.[6,14,20] Soyler et al in their study among Turkish adults also found no significant association between mean ORTO-11 score and BMI.[24]

Our study revealed highest ON prevalence (83.1%) among medical stream students, compared to arts and science students (68.3% and 68.7%; respectively). Malmborg et al reported a similar higher predilection of ON in exercise students than business students (84.5% vs. 65.4%, p = 0.002).[22] Bosi et al found the prevalence of ON among resident medical doctors as 45.5% and suggested that it may be due to the fact that healthcare professionals have more knowledge about the impact of nutrition on health and instruct others for healthy eating.[6] Researchers have also reported that healthcare professionals, dietitians, performance artists and athletes are known to be high-risk groups for ON.[11,14,19,21]

The present study had few limitations that need to be acknowledged. Firstly, cross-sectional nature of study precludes any definitive conclusion about causality. In addition, sample size though was large, but participants were recruited mainly from a single district (Karnal, Haryana) thereby limiting the generalizability of the study findings to the student population in North India. Also, it is worth mentioning that validity of ORTO-15 questionnaire to diagnose ON is being debated. Despite these limitations, greatest strength of this study is the fact that it is one of the few studies to have addressed the issue of orthorexia in student population in India. Large (N = 448) sample size ensured that study was adequately powered.

## CONCLUSION

Healthy eating is crucial for weight control and to achieve optimal health. However, orthorexic behavior may lead to negative impact on individual's physical, psychological and social health. Findings of our study suggest that socio-demographic variables namely BMI, gender and educational background might have an impact on orthorexic tendency in student population in North India. Male students pursuing a course in Medical or science stream and those who are within the normal BMI range were found to be most susceptible to ON. To get a more reliable insight into the magnitude of the orthorexic tendencies, multicentric studies covering major Indian cities in different Indian states needs to be planned. This would help in assessing the impact of varied geographical locations, lifestyle, food preferences, local traditions, religious beliefs, ethnicity etc. on the dietary intake and nutritional outlook of the people.

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