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# Relationship Between Orthorexia Nervosa and Health and Fitness Status Among Students in Health-Related Academic Programs

*Original Research*

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**Abstract**

**Introduction:** Orthorexia nervosa (ON) can alter perceptions and behaviors related to healthy eating. The researchers were interested if ON symptomology relates to perceptions of body image, as well as measures of health, physical activity, and fitness among students in health-related academic programs.

**Methods:** Participants (n=12) completed the ORTO-15 questionnaire and the Multidimensional Body-Self Relations Questionnaire. Next, researchers collected resting vitals, non-fasting blood glucose and cholesterol, and body composition. Then, for six consecutive weeks, participants submitted weekly progress reports from their fitness tracking watch to document physical activity. The researchers conducted a Pearson correlation analysis among all variables, as well as an independent t-test to determine if participants who report greater ON symptoms have negative perceptions and behaviors towards weight and weight gain.

**Results**: Six participants reported greater ON symptoms on the ORTO-15. While not significantly different ($p>0.05$), those with greater symptoms tended to be overweight, have less physical activity and fitness, and were more concerned with body image, weight, and weight gain**.**

**Conclusion**: While 50% of participants had greater ON symptoms, they did not overemphasize exercise compared to participants in other studies. However, increased ON symptoms, fixation on appearance, and overweight preoccupation could impact the ability to counsel others on a healthy lifestyle.

***Key Words***: body image, weight bias, weight stigma

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## Introduction

The term orthorexia nervosa (ON) was coined in 1997, and refers to an 'exaggerated fixation' on healthy eating.[1] Although ON is not formally recognized in the Diagnostic and Statistical Manual, 5th edition, there has been growing worldwide interest and research regarding ON over the past decade.[1–3] Several studies have examined the prevalence of ON,[1–3] and the relationships among ON symptoms and other eating and weight attitudes,[2,4] as well as measures of health such as body mass index (BMI)[2,4] and physical activity.[1] Potential consequences of ON that have been suggested include the potential to develop other disordered eating behaviors;[2,4] increase the risk of injury, illness, or other health problems;[1] or impact the ability to coach others on a healthy lifestyle.[1]

Previous studies have evaluated self-reported data with limited samples sizes from the United States.[1,3,4] We were interested in comparing health, physical activity, and fitness measurements to attitudes of healthy eating, body image, weight and weight gain in upper level undergraduate students in the School of Nursing and Health Professions (SONHP). The aim of this pilot study is to evaluate the prevalence of ON symptoms, and if symptomology relates to measures of health, physical activity using a tracking watch, fitness, and results from a body image questionnaire.

## Methods

*Participants*

Researchers recruited upper level undergraduate students through email invitations at a medium-sized university in the southern region of the US. Fourteen participants volunteered to participate, and 12 completed the study (11 females, 1 male) with an average age of 20.7 ± 1.15 yr. Inclusion criteria included: 1) be 18 years or older, 2) weigh at least 110 pounds, 3) not be pregnant or trying to become pregnant, 4) have no known illness or infections, 5) have no known cardiovascular, pulmonary, and/or musculoskeletal limitations that would limit the ability to participate in physical activity, 6) have no known sickle cell disease or anemia, 7) have not had more than one blood draw within the previous week, 8) have a junior or senior status in an SONHP major, and 9) own a commercial fitness tracking watch as well as a smartphone to utilize the application. All participants completed an Institutional Review Board approved written liability waiver and informed consent, indicating their voluntary participation in the study.

*Protocol*

Participants attended an informational session where the researchers described the study and procedures, as well as provided an opportunity to ask questions. After completing the written liability waiver and informed consent, the participants completed the ORTO-15 Questionnaire[8] and the Multidimensional Body-Self Relations Questionnaire (MBSRQ).[5] Individual appointments for data collection were scheduled in the university exercise physiology laboratory. Based on new recommendations for determining plasma lipids and to increase participant compliance, researchers collected non-fasting blood samples after normal food and fluid intake[6] to evaluate plasma glucose and lipid profiles.[7]

Upon arrival at the laboratory, the researchers collected resting heart rate (HR) and blood pressure (BP) measurements after 5 minutes of seated rest in accordance with American Heart Association guidelines.[8] The researchers also collected anthropometric data, including height (m) and weight (kg) using a SECA 700 column scale and SECA 220 telescopic measuring rod (Chino, CA), and following standardized procedures for assessing waist circumference[9] using a Gulick tape measure (Creative Health Products, Ann Arbor, MI). The researchers followed the manufacturer's instructions for the OMRON fat loss monitor for bioelectrical impedance analysis (BIA), HBF-306C, (Bannockburn, IL) to assess body mass index (BMI) and estimated percent body fat. Based on estimated body composition and the participant's self-reported physical activity level, the researchers utilized the University of Houston Non-Exercise Test for Predicting $VO_{2max}$[10] to evaluate physical fitness level. Next, each participant completed non-fasting blood glucose and cholesterol testing using the CLIA-waived Alere Cholestech LDX® Analyzer (San Diego, CA). All standardized procedures and universal precautions for collecting finger stick capillary samples were followed.[11] At the end of the session, the researchers instructed the participants on how to set recommended aerobic exercise goals in the mobile tracking device application to include a general goal of 10,000 steps per day, and at least five days of moderate-intensity exercise (based on HR range), accumulating at least 30 active minutes per day in accordance with current guidelines from the American College of Sports Medicine (ACSM).[12] Participants submitted weekly progress reports from their tracking device application via email for a minimum of 6 consecutive weeks.

*Statistical Analysis*

Researchers calculated scores for the ORTO-15 questionnaire and MBSRQ subscales, as well as averages for health variables, physical activity, and fitness levels. Data from the fitness tracking devices were used to determine the percent of weeks participants met the recommended aerobic exercise guidelines set forth by ACSM.[12] The researchers categorized participants into two groups, those with an ORTO-15 score <40, and those with a score ≥40,[13] and then conducted an independent samples t-test with the ORTO-15 category as the independent variable, and health and fitness status, physical activity, and perceptions as dependent variables. The researchers conducted a Pearson correlation analysis of the participant responses on the questionnaires and their health and fitness measures. Analyses were analyzed using IBM SPSS Statistics for Windows 25.0 (Chicago, IL) with $p<0.05$ *a priori*.

## Results

Of the 12 participants that completed the study, 50% (n=6) reported ON symptomology less than the 40 score threshold.[13] The independent samples t-test revealed no significant difference ($p>0.05$) in dependent variables between those who scored <40 vs those ≥40 on the ORTO-15 survey. However,

there were some differences in measures of health and fitness status and perceptions between the groups (Table 1). Those who scored <40 on the ORTO-15 did not meet the recommended aerobic exercise or step goals to the same extent as those with scores ≥40 on the ORTO-15. Similarly, those with scores <40 on the ORTO-15 were more overweight, had less cardiovascular fitness, and were more concerned with self-body image and weight compared to those who scored ≥40 on the ORTO-15. The results of the Pearson correlation analysis indicated the ORTO-15 is associated with the MBSRQ-overweight preoccupation subscale (r=-0.62. $p$=0.03), specifically that those who have greater ON symptomology (<40 score on ORTO-15) also have more concern for gaining weight. Additionally, those with greater ON symptomology have a higher BMI (r=-0.65, $p$=0.02).

**Table 1.** Mean and standard deviation of perceptions, fitness, and health risk factor averages between the two groups.

| Variables | ORTO-15 score <40 (n=6) | | ORTO-15 score ≥40 (n=6) | |
|---|---|---|---|---|
| **Resting heart rate (bpm)** | 72 (normal) | ± 5.37 | 87.7 (normal) | ±15.2 |
| **Weight (kg)** | 74.2 | ±15.91 | 63.7 | ± 7.92 |
| **Height (m)** | 1.69 | ± 0.08 | 1.69 | ± 0.1 |
| **Body mass index (kg/m²)[a]** | 25.8 (overweight) | ± 3.49 | 22.3 (normal) | ± 2.09 |
| **Waist circumference (in.)[a]** | 32.7 (low risk) | ± 4.01 | 28.0 (low risk) | ± 1.55 |
| **Percent body fat[a]** | 29.9 (very poor) | ± 5.34 | 21.8 (fair) | ± 4.81 |
| **Resting systolic blood pressure (mmHg)[a]** | 119 (normal) | ± 9.69 | 120 (elevated) | ±11.8 |
| **Resting diastolic blood pressure (mmHg)[a]** | 82 (Stage 1 hypertension) | ± 4.8 | 76 (normal) | ± 7.59 |
| **Non-fasting total cholesterol (mg/dL)[a]** | 179.5 (normal) | ±40.91 | 157.8 (normal) | ±32.45 |
| **Triglycerides (mg/dL) [a]** | 85.67 (normal) | ±47.16 | 62 (normal) [b] | ±14.10 |
| **High density lipoprotein (mg/dL)[a]** | 66.17 (good) | ±12.78 | 59 (good) | ±11.56 |
| **Non-fasting blood glucose (mg/dL)[a]** | 85 (normal) | ± 9.5 | 109.5 (normal) | ±12.66 |
| **$VO_{2max}$ (ml/kg/min) [a]** | 33.4 (poor) | ± 2.21 | 40.3 ($59^{th}$ %) | ± 7.93 |
| **Percent of weeks with ≥5 days of meeting step goal[a]** | 0.0 | ± 0.0 | 18.05 | ±30.92 |
| **Percent of weeks with ≥5 days of meeting activity goal[a]** | 11.9 | ±29.16 | 22.2 | ±40.37 |
| **Appearance orientation MBSRQ subscale** | 3.9 (mostly agree) | ± 0.38 | 3.2 (neutral) | ± 0.41 |

| | | | | |
|---|---|---|---|---|
| **Overweight preoccupation MBSRQ subscale** | 2.9 (neutral) | ± 0.7 | 2.0 (mostly disagree) | ± 0.72 |

[a] Guidelines from The American College of Sports Medicine[12]

[b] n=3, for 3 participants triglycerides values were less than 45 and below the sensitivity of the equipment

**Discussion**

The aim of this pilot study was to evaluate the prevalence of ON symptoms, and if symptomology relates to measures of health and fitness status, physical activity level using a fitness tracker, and results from questionnaires related to body image (MBSRQ). In the present study, 50% of participants met the ORTO-15 threshold value of <40, which is similar to the mean prevalence rate of 55% (SD 0.24%) for combined previous studies using a threshold of <40.[2] Our primary findings demonstrate a significant correlation between ON symptoms and the MBSRQ-overweight preoccupation subscale, which includes the concepts of fat anxiety, weight vigilance, dieting, and restrained eating.[14] The ORTO-15 scores were also associated with BMI. Based on our findings, participants with greater ON symptoms had increased anthropometric and body fat measures, and were more concerned with self-body image and weight. In addition, those with greater ON symptoms had lower aerobic fitness ($VO_{2max}$), but were more concerned with fitness orientation and body areas satisfaction.

Participants' mean HR, waist circumference, non-fasting cholesterol, and non-fasting blood glucose values fell within normal limits, indicating a low risk of a cardiovascular event. In contrast, while not statistically significant, those participants with greater ON symptoms had a greater BMI and percent body fat, and lower physical activity levels and aerobic fitness ($VO_{2max}$), which may increase their lifetime risk of cardiovascular disease (Table 2). Consistent with previous research, greater ON symptoms were associated with a greater BMI and waist circumference.[2,4] Contrary to a previous study looking at physical activity in exercise science students,[1] our participants with greater ON symptoms did not meet current recommended guidelines for aerobic exercise. The lack of physical activity in our participants may be related to sociodemographic factors as southern regions of the US have the highest levels of physical inactivity.[15]

Interestingly, the results of the current study demonstrate that greater ON symptoms are associated with increased scores on the MBSRQ overweight preoccupation subscale, which may indicate internalized weight stigma. The overweight preoccupation subscale of the MBSRQ revealed possible internalized weight stigma, which has been associated with greater BMI, poorer physical and mental health, and body image concern.[14] In addition, the fixation on weight and weight gain impacts communication and decision-making in the quality of care for future patients with obesity,[16] as well as the ability to effectively counsel others on aspects of a healthy lifestyle.[1,16] Overall, the participants of this study who reported greater ON symptomology were overweight, had less physical activity, poorer cardiovascular fitness levels, and were more fixated on weight and weight gain. These perceptions and behaviors may impact the care they provide as future practitioners.[16]

Limitations of this study include a small sample size, and the results can only be applied to apparently healthy, college-age students in health-related majors within the southern region of the US. Related to fitness variables, the University of Houston Non-Exercise Test for Predicting $VO_{2max}$[10] relies on self-reported physical activity level. While wearable fitness tracking devices provide modest accuracy as compared to self-report, the reliability and validity differs with the commercial brand, type of activity, and intensity.[17] While the use of BMI and waist circumference are consistent with previous research,[2,4] these measurements as well as BIA represent estimates of body composition with poorer precision and accuracy.[18] Related to type of activity and body composition, the current study did not evaluate resistance training exercise.

**Media-Friendly Summary**

Similar to other studies, 50% of our participants had ON, and greater body composition measures. They also had lower measures of physical activity, which is contrary to previous reports. Our results do bring forward a consideration on the development of ON symptoms; are the symptoms and perceptions the result of being overweight and sedentary, and/or internalized weight stigma? Health-related professional

programs may want to assess students' eating attitudes and perceptions, and emphasize healthy lifestyle interventions with less focus on weight.

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