

Research Article**RELATIONSHIP OF NORMAL WEIGHT OBESITY WITH DIETARY HABITS IN YOUNG ADULTS**

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ABSTRACT

Background: Normal Weight Obesity (NWO), also referred to as Metabolically Obese Normal Weight (MONW), describes individuals who have a normal body mass index (BMI <25 kg/m²) but an elevated body fat percentage. Despite having a normal body weight, these individuals may be at increased risk of metabolic abnormalities, including insulin resistance, hypertriglyceridemia, and hypertension. Pakistan has a high burden of obesity; however, data regarding NWO remain limited. Dietary habits are considered an important contributing factor to increased body fat and NWO.

Objective: To determine the prevalence of normal weight obesity among young adults and assess its relationship with dietary habits.

Study Design: Cross-sectional study.

Duration and Place of Study: This study was conducted at Muhammad Medical

College ibn-e-Sina University Mirpurkhas from May 2025 to May 2026

Methodology: This study included 140 subjects aged 15–24 years selected through convenience sampling. Dietary habits were assessed using a Food Frequency Questionnaire, while body fat percentage was estimated using the Deurenberg equation. Sex-specific cut-off values were used to classify normal and high body fat percentages. Data were analyzed using SPSS version 25. The Chi-square test was used to assess associations between dietary habits and body fat status, with a p-value of <0.05 considered statistically significant.

Results: Among the 140 young adults, the mean age was 23 ± 4.82 years. Overall, 55.0% of participants had a high body fat percentage, while normal weight obesity was identified in 27.8% of participants. Consumption of refined carbohydrates, including cereals, white bread, and white rice, as well as fast foods, sweets, flavored

milk, and milkshakes, was significantly higher among participants with high body fat percentages. In contrast, consumption of fruits and whole grains, including bran bread and brown rice, was significantly lower ($p < 0.05$). Almost all assessed dietary factors showed a significant association with body fat status, except for lentils and beans ($p > 0.05$).

Conclusion: The findings demonstrate a significant association between dietary habits and body fat status among young adults. Higher consumption of refined carbohydrates and energy-dense foods, together with lower consumption of fruits and whole grains, was associated with increased body fat and may contribute to the development of normal weight obesity.

Keywords: Obesity; Normal Weight Obesity; Metabolically Obese Normal Weight; Dietary Habits; Body Fat Percentage.

INTRODUCTION

Obesity is characterized by excessive accumulation of body fat, which may be distributed throughout the body or localized to specific regions [1]. Fat deposition may be predominantly central, including truncal and abdominal subcutaneous fat, or peripheral, particularly in the gluteofemoral region involving the thighs and buttocks [2]. Central or abdominal fat accumulation is particularly associated with an increased risk of obesity-related complications. Obesity is an established risk factor for several non-communicable diseases, including cardiovascular disease, diabetes mellitus, and other metabolic disorders [3].

Normal Weight Obesity (NWO), also referred to as Metabolically Obese Normal Weight (MONW), describes individuals who have a normal body mass index (BMI $< 25 \text{ kg/m}^2$) but an elevated percentage of body fat. According to commonly used World Health Organization thresholds, body

fat percentages $> 20\%$ in males and $> 30\%$ in females are considered elevated [4]. Despite having a normal BMI, individuals with NWO may have an increased risk of metabolic abnormalities, including insulin resistance, hypertriglyceridemia, and hypertension.

Pakistan has a substantial burden of overweight and obesity. The Global Burden of Disease estimates ranked Pakistan eighth globally in terms of the number of individuals with obesity in 2014 [5]. According to the Pakistan National Nutrition Survey (NNS) 2018, adolescent girls in Khyber Pakhtunkhwa had a higher prevalence of overweight than boys (15.3% vs. 14.7%), whereas obesity was more prevalent among boys than girls (11.9% vs. 8.5%) [6]. Similarly, data from the Pakistan Demographic and Health Survey 2013 reported obesity among 11% of rural men and 19% of rural women, compared with 23% of urban men and 40% of urban women [7].

Although conventional measures such as BMI are widely used to assess obesity, they may not adequately reflect body fat accumulation. Consequently, NWO has received increasing attention as a distinct phenotype that may be associated with adverse metabolic outcomes despite a normal BMI. A pooled analysis of 32 international studies, including research from Europe, the Americas, and Asia, reported an overall NWO prevalence of 30.04% (95% CI: 25.59–35.57%), although prevalence estimates across individual studies ranged from 5% to 45% [8]. In a study of 269 young adults from Mumbai, India, the prevalence of NWO was 16.4%. Protein-rich diets, frequent restaurant meals, low consumption of home-prepared meals, and alcohol consumption were identified as factors associated with NWO, whereas fish and protein intake and daytime sleep were reported as potentially protective factors [9].

Several lifestyle factors have been associated with NWO, including physical inactivity, smoking, alcohol consumption, and unhealthy dietary practices. The development of metabolic abnormalities in individuals with NWO may involve increased free fatty acid release, insulin resistance, altered lipid metabolism, and oxidative stress, along with abnormal fat deposition in organs such as the liver, skeletal muscles, and pancreas [10].

Dietary habits may play an important role in the development of NWO. Studies conducted among Asian populations have suggested that higher carbohydrate consumption may increase susceptibility to NWO, whereas greater protein consumption may have a protective effect [11]. Other studies, including those conducted in Icelandic and Dutch populations, have suggested that dietary quality may be more important than overall dietary quantity in determining the risk of NWO [12]. Additional factors associated with NWO include increased waist circumference, central obesity, menopause, and a family history of hypertension or diabetes.

Despite the growing recognition of NWO, evidence regarding its prevalence and relationship with specific dietary habits among young adults in Pakistan remains limited. Therefore, the present study was conducted to determine the prevalence of NWO among young adults and to assess its relationship with their dietary habits.

METHODOLOGY

This cross-sectional study was conducted among 140 young adults aged 15–24 years. Participants were selected using a convenience sampling technique.

Inclusion and Exclusion Criteria

Young adults aged 15–24 years were eligible for participation in the study. Individuals younger than 15 years or older than 24 years were excluded.

Assessment of Dietary Habits

Dietary habits were assessed using a Food Frequency Questionnaire (FFQ). The questionnaire was used to obtain information regarding the frequency of consumption of different food groups and commonly consumed dietary items. The dietary patterns of participants were subsequently assessed in relation to their body fat status.

Assessment of Body Mass Index and Body Fat Percentage

Body fat percentage was estimated using the Deurenberg equation. Sex-specific cut-off values were used for the classification of body fat percentage. In females, a body fat percentage of 20–25% was considered normal, while values above 25% were considered high. In males, a body fat percentage of 10–17.5% was considered normal, while values of $\geq 17.6\%$ were considered high.

Normal Weight Obesity (NWO) was defined as the presence of a normal BMI ($< 25 \text{ kg/m}^2$) together with an elevated body fat percentage according to the sex-specific cut-off values used in the study.

Statistical Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were calculated using frequencies, percentages, means, and standard deviations. The Chi-square test was used to assess the association between categorical variables, including dietary habits and body fat status. A p-value of < 0.05 was considered statistically significant.

RESULTS

The total number of young adults participating in this research was 140, whose mean age was 23 ± 4.82 years. The subjects were divided into groups depending on their health status (in terms of BMI) and their

body fat status. In total, 63 subjects (45.0%) were characterized by normal body fat, while 77 subjects (55.0%) had high body fat (see Table No. 1 below). In the group of people with normal BMI, 39 subjects (which is 27.8% of the entire group) were

characterized by normal weight obesity, or, in other words, had a normal BMI and high body fat percentage. None of the subjects with an underweight had high body fat, while overweight (19.3%) and obese (7.9%) subjects had high body fat.

Table No. 1:

Health Status	Normal body fat (n,%)	High body fat (n,%)
Underweight	21 (15.0%)	0 (0.0%)
Normal weight	42 (30.0%)	39 (27.8%)
Overweight	0 (0.0%)	27 (19.3%)
Obese	0 (0.0%)	11 (7.9%)
Total	63 (45.0%)	77 (55.0%)

Table 1. Distribution of Participants According to BMI and Body Fat Status

BMI/Health Status	Normal Body Fat, n (%)	High Body Fat, n (%)	Total, n (%)
Underweight	21 (15.0%)	0 (0.0%)	21 (15.0%)
Normal weight	42 (30.0%)	39 (27.9%)	81 (57.9%)
Overweight	0 (0.0%)	27 (19.3%)	27 (19.3%)
Obese	0 (0.0%)	11 (7.9%)	11 (7.9%)
Total	63 (45.0%)	77 (55.0%)	140 (100.0%)

With respect to starchy foods, there was a significant relationship between eating breakfast cereals, white bread, and white rice for individuals with high body fat ($p < 0.05$), who tended to eat such foods regularly or 4-5 times a week (Table No. 2). However, the participants with high body fat ate bran bread and brown rice very rarely.

Table No. 2:

Food Consumption	Starch Group					p-value
	1-2 days per week	2-3 days per week	4-5 days per week	Daily	Rarely	
Breakfast Cereals (added sugar)						
• Normal body fat (n=63)	27 (42.8%)	12 (19.1%)	9 (14.2%)	4 (6.2%)	11 (17.7%)	<0.05
• High body fat (n=77)	3 (3.8%)	6 (8.1%)	24 (31.1%)	29 (37.6%)	15 (19.4%)	
Bran Bread						
• Normal body fat (n=63)	7 (11.1%)	5 (7.9%)	15 (23.8%)	12 (19.1%)	24 (38.1%)	<0.05
• High body fat (n=77)	17 (22.1%)	13 (17.1%)	4 (5.1%)	4 (5.1%)	39 (50.6%)	
White Bread						
• Normal body fat (n=63)	14 (22.2%)	21 (33.3%)	11 (17.7%)	4 (6.2%)	13 (20.6%)	<0.05
• High body fat	5 (6.4%)	8 (10.3%)	26 (33.7%)	32 (41.5%)	6 (8.1%)	

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(n=77)						
White Rice						
● Normal body fat (n=63)	28 (44.4%)	15 (23.8%)	14 (22.2%)	2 (3.1%)	4 (6.5%)	<0.05
● High body fat (n=77)	6 (7.7%)	13 (17.1%)	36 (46.7%)	20 (25.9%)	2 (2.6%)	
Fruits with peel						
● Normal body fat (n=63)	10 (15.8%)	15 (23.8%)	19 (30.4%)	9 (14.2%)	10 (15.8%)	<0.05
● High body fat (n=77)	32 (41.5%)	16 (21.1%)	6 (7.7%)	4 (5.1%)	19 (24.6%)	
Fruits without peel						
● Normal body fat (n=63)	10 (15.8%)	17 (26.9%)	15 (23.8%)	8 (12.9%)	13 (20.6%)	<0.05
● High body fat (n=77)	30 (38.9%)	26 (33.7%)	6 (7.7%)	4 (5.1%)	11 (14.6%)	
Brown Rice						
● Normal body fat (n=63)	6 (9.7%)	5 (7.9%)	18 (28.5%)	10 (15.8%)	24 (38.1%)	<0.05
● High body fat (n=77)	22 (28.7%)	12 (15.5%)	2 (2.6%)	0 (0.0%)	41 (53.2%)	

Table number 3 compares the food consumption with the junk/fast food group.

Table No. 3:

Food Consumption	Junk/Fast Food Group					p-value
	1-2 days per week	2-3 days per week	4-5 days per week	Daily	Rarely	
Pizza, Lasagna, French Fries						
• Normal body fat (n=63)	9 (14.2%)	11 (17.7%)	6 (9.7%)	5 (7.9%)	32 (50.7%)	0.001
• High body fat (n=77)	1 (1.3%)	9 (11.6%)	19 (24.6%)	35 (45.4%)	13 (17.1%)	
Confectionary Items						
• Normal body fat (n=63)	18 (28.5%)	19 (30.1%)	12 (19.3%)	5 (7.9%)	9 (14.2%)	0.001
• High body fat (n=77)	0 (0.0%)	13 (17.0%)	30 (38.9%)	33 (42.8%)	1 (1.3%)	

Table number 4 compares the food consumption with the milk and protein group.

Table No. 4:

Food Consumption	Milk and Protein Group					p-value
	1-2 days per week	2-3 days per week	4-5 days per week	Daily	Rarely	
Chicken						

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• Normal body fat (n=63)	7 (11.1%)	12 (18.7%)	20 (31.7%)	22 (34.9%)	2 (3.6%)	0.01
• High body fat (n=77)	12 (15.5%)	33 (42.8%)	15 (19.4%)	11 (14.6%)	6 (7.7%)	
Beef/Mutton						
• Normal body fat (n=63)	30 (47.6%)	7 (11.1%)	5 (7.9%)	2 (3.1%)	19 (30.3%)	0.001
• High body fat (n=77)	13 (16.8%)	10 (13.3%)	13 (16.8%)	27 (35.1%)	14 (18.0%)	
Processed Cheese						
• Normal body fat (n=63)	20 (32.3%)	12 (18.7%)	3 (4.7%)	1 (1.5%)	27 (42.8%)	0.001
• High body fat (n=77)	9 (11.6%)	12 (15.5%)	31 (40.2%)	15 (19.4%)	10 (13.3%)	
Lentils/Beans						
• Normal body fat (n=63)	11 (17.4%)	15 (23.8%)	24 (38.3%)	2 (3.1%)	11 (17.4%)	>0.05
• High body fat (n=77)	21 (27.7%)	28 (36.3%)	12 (15.5%)	2 (2.5%)	14 (18.0%)	
Milk/Yogurt (Plain)						
• Normal body fat (n=63)	10 (15.8%)	14 (22.2%)	15 (23.8%)	19 (30.3%)	5 (7.9%)	0.01
• High body fat	26 (33.8%)	19 (24.6%)	13 (17.0%)	7 (9.1%)	12 (15.5%)	

(n=77)						
Milk/Yogurt (Flavoured)						
• Normal body fat (n=63)	19 (30.3%)	6 (9.5%)	3 (4.7%)	5 (7.9%)	30 (47.6%)	0.001
• High body fat (n=77)	8 (10.3%)	6 (7.7%)	28 (36.3%)	24 (31.1%)	11 (14.6%)	
Smoothies and Milkshakes						
• Normal body fat (n=63)	26 (41.2%)	12 (18.7%)	7 (11.1%)	6 (9.7%)	12 (19.3%)	0.001
• High body fat (n=77)	13 (17.0%)	12 (15.3%)	28 (36.3%)	16 (21.1%)	8 (10.3%)	

DISCUSSION

The present study assessed body fat status and dietary habits among 140 young adults, with particular emphasis on Normal Weight Obesity (NWO), defined as the presence of a normal BMI with an elevated body fat percentage. In this study, NWO was identified in 27.8% of participants. This prevalence was comparable to the 28.8% reported among young adults in Lahore, Pakistan, but higher than the 16.4% reported among young adults in Mumbai, India [1,9]. Differences in NWO prevalence between populations may be related to variations in dietary patterns, physical activity,

demographic characteristics, and body composition.

A significant association was observed between the consumption of several starchy foods and body fat status. Participants with high body fat reported more frequent consumption of breakfast cereals containing added sugar, white bread, and white rice, whereas consumption of bran bread and brown rice was less frequent in this group ($p<0.05$). These findings are consistent with previous studies among Thai adults, in which dietary patterns characterized by higher consumption of refined carbohydrates and westernized foods were associated with

metabolic abnormalities and NWO [13–15]. The greater consumption of refined carbohydrate sources observed among participants with high body fat may reflect an overall dietary pattern characterized by greater intake of energy-dense and less nutrient-dense foods.

Fruit consumption also differed significantly between the two groups. Participants with high body fat generally reported less frequent consumption of fruits, both with and without peel, compared with participants with normal body fat ($p < 0.05$). This finding is consistent with previous research suggesting that greater consumption of whole fruits may be associated with more favorable body composition and lower obesity risk [16,17]. Whole fruits provide dietary fiber and other nutrients and may contribute to satiety. However, because of the cross-sectional design of the present study, the observed association should not be interpreted as evidence of a causal protective effect.

A significant association was also observed between body fat status and consumption of junk/fast foods and confectionery items ($p = 0.001$). Participants with high body fat reported substantially more frequent consumption of pizza, lasagna, French fries, and confectionery products, particularly on a

daily basis, compared with those with normal body fat. These findings are consistent with previous studies reporting associations between frequent consumption of fast foods and ultra-processed foods and increased BMI and body fat [18]. Such foods may contribute to higher energy intake because they are often energy-dense and may contain high amounts of refined carbohydrates, fats, and added sugars.

Significant differences were also observed in the consumption of milk and protein-containing foods. Participants with high body fat reported more frequent consumption of flavored milk/yogurt and smoothies/milkshakes, whereas participants with normal body fat more frequently consumed plain milk/yogurt ($p = 0.01$ – 0.001). The higher consumption of flavored dairy products and milkshakes among participants with high body fat may be related to their added sugar content and overall energy contribution. Previous studies have similarly suggested that frequent consumption of sugar-sweetened beverages and sweetened dairy products may be associated with increased energy intake and obesity risk.

Consumption of beef/mutton and processed cheese was also more frequent among participants with high body fat. This finding

is broadly consistent with previous research suggesting that dietary patterns characterized by higher consumption of certain energy-dense animal foods and saturated fats may be associated with increased obesity risk [19,20]. However, the relationship between individual food items and body fat is complex and may be influenced by total dietary intake, portion size, physical activity, and other lifestyle factors.

In contrast, no statistically significant association was observed between consumption of lentils/beans and body fat status ($p>0.05$). Although legumes are important sources of plant-based protein and dietary fiber, the absence of a significant association in the present study does not establish either a protective or harmful effect. Further studies with larger samples and more detailed dietary assessment are required to clarify this relationship.

Overall, the findings suggest that dietary habits are associated with body fat status among young adults. More frequent consumption of refined carbohydrate sources, junk/fast foods, confectionery products, and sugar-containing dairy beverages was observed among participants with high body fat, whereas greater consumption of whole fruits and whole-

grain foods was observed among those with normal body fat. These findings support the importance of considering dietary quality in addition to BMI when assessing obesity-related risk. In particular, individuals with a normal BMI may still have an elevated body fat percentage and may therefore benefit from early identification and appropriate dietary and lifestyle interventions.

Limitations

The present study has several limitations. First, its cross-sectional design does not allow determination of a causal relationship between dietary habits and body fat status. Second, participants were selected using convenience sampling, which may limit the generalizability of the findings to the wider young adult population. Third, the sample size was relatively small, with only 140 participants. Fourth, body fat percentage was estimated using the Deurenberg equation rather than measured directly by a more precise body-composition assessment method. Finally, dietary information was obtained using a Food Frequency Questionnaire and may therefore have been affected by recall and reporting bias. Future studies should include larger and more representative samples and consider longitudinal designs and more accurate methods of body composition assessment.

CONCLUSION

The present study demonstrated a significant association between dietary habits and body fat status among young adults. Participants with high body fat reported more frequent consumption of refined carbohydrate sources, junk/fast foods, confectionery products, and flavored dairy beverages, while consumption of fruits and whole-grain foods was generally less frequent. These findings highlight the importance of promoting healthy dietary habits and improving awareness of body composition among young adults. Assessment of body fat in addition to BMI may help identify individuals with Normal Weight Obesity who might otherwise be overlooked based on BMI alone.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest related to the conduct or publication of this study.

ETHICAL APPROVAL

Ethical approval was obtained from the relevant institutional ethics committee before initiation of the study. The study was conducted in accordance with applicable ethical standards and guidelines.

REFERENCES

1. Arshad D, Sohail Z, Khan N. Association of Normal Weight Obesity with Dietary Habits Among Young Adults in Pakistan. *Pak J Public Health*. 2022;12(3):137-142.
2. Lysen LK, Israel DA. Nutrition in weight management. In: Mahan LK, Raymond JL, editors. *Krause's Food and the Nutrition Care Process*. 13th ed. St. Louis: Elsevier; 2012. p. 462-488.
3. Männistö S, Harald K, Kontto J, Lahti-Koski M, Kaartinen NE, Saarni SE, et al. Dietary and lifestyle characteristics associated with normal-weight obesity: the National FINRISK 2007 Study. *Br J Nutr*. 2014;111(5):887-894.
4. Suliga E, Kozieł D, Cieśła E, Głuszek S. Association between dietary patterns and metabolic syndrome in individuals with normal weight: a cross-sectional study. *Nutr J*. 2015;14:55.
5. Asif M, Aslam M, Altaf S, Atif S, Majid A. Prevalence and sociodemographic factors of overweight and obesity among Pakistani adults. *J Obes Metab Syndr*. 2020;29(1):58-66.
6. Zahid M, Wazir AK, Jadoon AK, Ullah A, Shehwar D, Asif M, et al. Undesirable body mass index profiles in young adults: no one

- is immune to obesity epidemic in Pakistan. *J Khyber Coll Dent*. 2020;10(1):112-116.
7. Tanzil S, Jamali T. Obesity, an emerging epidemic in Pakistan-a review of evidence. *J Ayub Med Coll Abbottabad*. 2016;28(3):597-600.
 8. Wang B, Zhuang R, Luo X, Yin L, Pang C, Feng T, et al. Prevalence of metabolically healthy obese and metabolically obese but normal weight in adults worldwide: a meta-analysis. *Horm Metab Res*. 2015;47(11):839-845.
 9. Hadaye RS, Manapurath RM, Gadapani BP. Obesity prevalence and determinants among young adults, with special focus on normal-weight obesity; a cross-sectional study in Mumbai. *Indian J Community Med*. 2020;45(3):358-362.
 10. Zheng Q, Lin W, Liu C, Zhou Y, Chen T, Zhang L, et al. Prevalence and epidemiological determinants of metabolically obese but normal-weight in Chinese population. *BMC Public Health*. 2020;20:487.
 11. Choi J, Se-Young O, Lee D, Tak S, Hong M, Park SM, et al. Characteristics of diet patterns in metabolically obese, normal weight adults (Korean National Health and Nutrition Examination Survey III, 2005). *Nutr Metab Cardiovasc Dis*. 2012;22(7):567-574.
 12. Olafsdottir AS, Torfadottir JE, Arngrimsson SA. Health behavior and metabolic risk factors associated with normal weight obesity in adolescents. *PLoS One*. 2016;11(8):e0161451.
 13. Nguyen Ngoc H, Kriengsinyos W, Rojroongwasinkul N, Aekplakorn W. Prevalence of metabolically obese, normal-weight individuals and its dietary patterns characteristics: a cross-sectional study in Thai adults. *Curr Dev Nutr*. 2020;4(1):nzz146.
 14. Kobayashi M, Pattarathitwat P, Pongprajakand A, Kongkaew S. Association of normal weight obesity with lifestyle and dietary habits in young Thai women: a cross-sectional study. *Obes Pillars*. 2023;5:100055.
 15. Somnuk S, Komindr S, Monkhai S, Poolsawat T, Nakphaichit M, Wanikorn B. Metabolic and inflammatory profiles, gut microbiota and lifestyle factors in overweight and normal weight young Thai adults. *PLoS One*. 2023;18(7):e0288286.
 16. Takahashi MM, de Oliveira EP, Moreto F, Portero-McLellan KC, Burini RC. Association of dyslipidemia with intakes of fruit and vegetables and the body fat content of adults clinically selected for a lifestyle modification program. *Arch Latinoam Nutr*. 2010;60(2):148-154.

17. Serpen JY. Comparison of sugar content in bottled 100% fruit juice versus extracted juice of fresh fruit. *Food Nutr Sci.* 2012;3(11):1509-1513.
18. Heidari-Beni M, Golshahi J, Esmailzadeh A, Azadbakht L. Potato consumption as high glycemic index food, blood pressure, and body mass index among Iranian adolescent girls. *ARYA Atheroscler.* 2015;11(Suppl 1):81-87.
19. Patel AI, Moghadam SD, Freedman M, Hazari A, Fang ML, Allen IE. The association of flavored milk consumption with milk and energy intake, and obesity: a systematic review. *Prev Med.* 2018;111:151-162.
20. Braithwaite I, Stewart AW, Hancox RJ, Beasley R, Murphy R, Mitchell EA; ISAAC Phase Three Study Group. Fast-food consumption and body mass index in children and adolescents: an international cross-sectional study. *BMJ Open.* 2014;4(12):e005813.