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Original article

EFFECT OF PHYSICAL ACTIVITY AND DIETARY BEHAVIOUR ON ADOLESCENT HEALTH: A COMPARATIVE STUDY BETWEEN NORMAL AND UNDERWEIGHT GIRLS OF URBAN AREA OF NORTH 24 PARAGANAS, WEST BENGAL

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ABSTRACT

Background:
Undernutrition is a major public health challenge in India, especially among adolescents. Dietary behaviour, physical activity, socio-economic conditions, in addition to schooling influences the health and nutritional well-being of adolescents.

Methods:
A total of 364 adolescent girls from urban areas of North 24 Paraganas were chosen randomly from five schools for this cross-sectional study.

Results:
57.42% of adolescent school-going girls had Normal BMI. The prevalence of underweight is 23.35%. Among physiological and behavioural characteristics, underweight girls were more physically inactive, and had more menstrual irregularities compared to their Normal BMI counterparts. The prevalence of breakfast skipping was higher among underweight girls than among those with a normal BMI, whereas the consumption of junk food was more frequent among girls with a normal BMI than among underweight girls. Majority of eating behaviours were associated with BMI. There is a significant positive correlation between fast food frequency, physical activity, age at menarche and BMI.

Conclusion:
The results of this study call for the promotion of balanced dietary behaviours and adequate physical activity among adolescents. Schools should organize regular awareness programs to highlight the importance of balanced nutrition and active lifestyles.

KEY WORDS: Dietary behaviour, Physical activity, Underweight, Adolescent girls.

INTRODUCTION

Adolescence is a critical phase of human growth and development, marked by rapid physical, psychological, and social change. During this period, adequate nutrition and healthy lifestyle behaviours are essential for proper growth, cognitive development, and future reproductive health, particularly among girls (Patton et al., 2016). Nutritional status reflects the balance between nutrient intake, absorption, and utilization and plays a central role in maintaining overall health and well-being. When nutrient intake is insufficient, imbalanced, or improperly utilized, it may lead to malnutrition, which can manifest as undernutrition, overnutrition, or specific nutrient deficiency.

Growth retardation, delayed physical and mental development, weakened immune system, irregular menstruation, and poor pregnancy outcomes are all associated with undernutrition, which is defined as inadequate energy and nutrient intake over an extended period (Choudhary et al., 2019).However, a high consumption of foods with high energy density results in overnutrition, which causes metabolic disorders, overweight, and obesity. Health outcomes can also be compromised by nutritional imbalance brought on by unequal consumption of essential nutrients. Undernutrition remains a serious public health issue, particularly among Indian teenage girls.

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The National Family Health Survey-5 (NFHS-5) reported that a significant proportion of Indian adolescent girls are underweight, with prevalence rates varying from 41.9% to 47% across surveys, especially in marginalized urban and rural areas (UNICEF, 2020; IIPS & ICF, 2021). Adolescent underweight is caused by a variety of interconnected factors, including inadequate food intake, sedentary lifestyles, socio-economic constraints, and a lack of health consciousness. In spite of the adoption of national nutrition programs, underweight continues to be a comparatively under-emphasized problem when compared to the increasing attention on obesity and lifestyle disorders.

The two main factors influencing adolescents' nutritional status are their level of physical activity and eating habits. While proper dietary intake provides vital macro- and micronutrients required for development, regular physical activity promotes a healthy body composition, musculoskeletal growth, and metabolic health and functioning.

Poor eating habits combined with low levels of physical activity can exacerbate undernutrition and have negative health consequences. Analyzing these factors in conjunction with anthropometry helps determine the nutritional status and associated health risks of adolescents. As anthropometry is easy, safe, and non-invasive, it is widely used to track growth, detect malnutrition, and develop intervention strategies.

Understanding the relationship between dietary behaviour or choices and physical activity in adolescent girls is crucial, given the high prevalence of underweight in this group and its potential impact on their growth and general health. This study comparatively examined the influence of physical activity and eating habits on the health of normal weight and underweight adolescent girls residing in an urban locale of North 24 Parganas, West Bengal.

MATERIALS AND METHODS

The research was carried out among school-aged adolescent girls between 10 to 17 years in the urban locality of Birati, under the North 24 Parganas district of West Bengal during the months of April to May 2025. 364 participants were covered under the study from five schools who agreed to participate after taking the consent from their respective heads. This cross-sectional study design was considered suitable for determining the prevalence and determinants of underweight status at a particular moment in time. A multistage stratified random sampling technique was employed to select the participants. Data were collected through structured interviews based on a pretested questionnaire that gathered information on socio-demographic variables such as age, religion, class, family size, number of siblings, and parental occupation, as well as menstrual health, physical activity, and eating habits. Anthropometric measurements were obtained using standardized procedures following WHO protocols (WHO, 2008). Measurements included height (to the nearest 0.1 cm), weight (to the nearest 0.1 kg), body mass index (BMI), waist circumference (WC), and mid-upper arm circumference (MUAC). BMI was classified according to WHO age-specific percentiles, with values below the 5th percentile considered underweight. All collected data were coded in Microsoft Excel and subsequently analyzed using SPSS (25.0) software. Descriptive statistics, chi-square tests, and Pearson's correlation analyses were performed to examine the relationships between variables.

RESULTS

The socio-demographic profile of the participants, as presented in Table 1, indicates that among the 364 adolescent girls studied, 56.87% were between 10 and 13 years of age, while 43.13% were between 14 and 17 years of age. The majority of the participants belonged to Hindu religion (84.34%), whereas 15.66% belonged to Muslim religion. Most respondents lived in nuclear families (65.66%), with the remaining 34.34% residing in extended families. Regarding parental occupation, majority of the participants' mothers were homemakers (68.13%), while 31.87% were engaged in other occupations. In terms of father's occupations, 29.67% were daily labourers, 19.78% were employed in private jobs, 18.68% worked as industrial or manual workers, 15.38% were self-employed or engaged in business, 2.20% held government jobs, and 14.29% were involved in other forms of employment.

Table 1: Socio-demographic profile of the study participants

Variables	Subgroups	Frequency	Percentage
Age (in years)	10-13	207	56.87
	14-17	157	43.13
Religion	Hindu	307	84.34
	Muslim	57	15.66
Family type	Nuclear	239	65.66
	Extended	125	34.34
No of siblings	0	119	32.69
	1	205	56.31
	2	40	10.98
Mother's occupation	Housewife	248	68.13
	Others	116	31.87
Father's occupation	Factory workers	68	18.68
	Daily Labour	108	29.67
	Private job	72	19.78
	Government Job	8	2.20
	Business	56	15.38
	Others	52	14.29
BMI (Kg/m^2)	Underweight	85	23.35
	Normal	209	57.42
	Overweight	39	10.71
	Obese	31	8.52

Table 2 presents the anthropometric characteristics of the participants. The mean height of the participants was 147.55 ± 7.74 cm and the mean weight was 38.27 ± 8.04 kg. The mean waist circumference was recorded as 61.13 ± 4.96 cm, while the mean body mass index was 17.43 ± 2.75 kg/m^2. The mean mid-upper arm circumference of the participants was 20.34 ± 2.15 cm. In terms of lifestyle factors, the mean frequency of fast-food consumption was 1.99 ± 1.42 days/week, and the average duration of physical activity was 182.16 ± 156.28 minutes/week.

Table 2: Anthropometric Profile of the Studied Adolescent Girls

Variables	Mean	SD	SE
Height (cm)	147.550	7.739	0.451
Weight (kg)	38.267	8.036	0.469
BMI (kg/m^2)	17.430	2.745	0.160
MUAC (cm)	20.338	2.154	0.134
WC (cm)	61.130	4.956	0.348
Fast food frequency (days/week)	1.986	1.418	0.083
Physical activity (minutes/week)	182.160	156.275	9.114

Table 3 shows physiological and behavioural characteristics of underweight and normal adolescent girls. Among 85 underweight adolescent girls, the majority (49.41%) were doing 60–120 minute physical activity in a week, whereas majority (56.94%) of normal BMI girls was doing ≥180 minutes of physical activity in a week. At least 13.88% of students with normal BMI are practicing 60-120 minutes physical activity per week. At least 10.59% of underweight individuals engaged in 120–180 minute physical activity per week. Age at menarche was highest among the age group of 12-16 years both in normal and underweight adolescent girls. 69.41% underweight girls have menstrual irregularities whereas 38.28 % normal girls have menstrual irregularities. Most of the normal weight girls (61.72%) had no menstrual cycle irregularities, whereas 30.59% of underweight girls had no menstrual irregularities. A significant association was observed between category and physical activity, with a large effect size (Cramér's V = 0.441, $p < 0.001$), indicating that normal-weight girls were substantially more active than underweight ones. Cycle length was also significantly associated with BMI (Cramér's V = 0.283, $p < 0.001$), suggesting that normal-weight girls were more likely to have regular cycle lengths. In contrast, no significant relationship was found between BMI and age at menarche (Cramér's V = 0.128, p = 0.186).

Table3: Physiological and behavioural characteristics of underweight and normal adolescent girls

Variables	Sub-groups	Underweight (n=85) N (%)	Normal (n=209) N (%)	χ^2	p-value	Cramér's V
Physical activity (minutes/week)	<60	20 (23.53)	30 (14.35)	57.26	<0.001	0.441
	60–120	42 (49.41)	29 (13.88)			
	120–180	9 (10.59)	31 (14.83)			
	>180	14 (16.47)	119 (56.94)			
Age at Menarche (years)	<10	15 (17.65)	55 (26.31)	4.800	0.186	0.128
	10–12	30 (35.29)	80 (38.28)			
	13–16	30 (35.29)	60 (28.71)			
	>17	10 (11.76)	14 (6.69)			
Cycle length (days)	Regular (21–35)	26 (30.59)	129 (61.72)	23.50	<0.001	0.283
	Irregular (>35/<21)	59 (69.41)	80 (38.28)			

Table 4 demonstrates that 57.65% of underweight girls occasionally consume junk food. Meanwhile, 76.55% of normal students occasionally consumed junk food. Very few (7.06%) students consumed junk food daily, whereas 5.26% consumed it rarely. A strong and statistically significant association was observed between BMI and both breakfast-skipping behaviour (Cramér's V = 0.519, p < 0.001) and junk food consumption (Cramér's V = 0.374, p < 0.001), indicating that underweight girls were more likely to skip breakfast, while normal-weight girls more frequently consumed junk foods. Moderate associations were also found between BMI and the behaviours of eating with friends (Cramér's V = 0.167, p = 0.004) and eating while watching television (Cramér's V = 0.150, p = 0.010), suggesting that social and screen-related eating habits vary moderately with body weight status. In contrast, no significant relationship was detected between BMI and eating more with family (Cramér's V = 0.010, p = 0.860).

Table 5 presents the Pearson correlation analysis between socio-economic and lifestyle variables and body mass index (BMI) among the adolescent participants. A significant positive correlation was observed between BMI and fast food consumption frequency (r = 0.346, p< 0.001), physical activity (r = 0.138, p = 0.018), and age at menarche (r = 0.145, p = 0.012). Conversely, a significant negative correlation was found between skipping breakfast and BMI (r = –0.239, p< 0.001). These findings suggest that higher fast food intake, greater physical activity, and later onset of menarche are associated with a higher BMI, whereas skipping breakfast is associated with a lower BMI.

Table 4: Dietary Habits of underweight and normal adolescent girls

Variables	Sub-groups	Underweight (n=85) N (%)	Normal (n=209) N (%)	χ^2	p-value	Cramér's V
Junk Food	Daily	6 (7.06)	38 (18.18)	41.11	<0.001	0.374
	Occasionally	49 (57.65)	160 (76.55)			
	Rarely	30 (35.30)	11 (5.26)			
Skip Breakfast	Yes	71 (83.53)	56 (26.79)	79.27	<0.001	0.519
	No	14 (16.47)	153 (73.20)			
Eat more with friends	Yes	16 (18.82)	75 (35.88)	8.23	0.004	0.167
	No	69 (81.18)	134 (64.59)			
Eat more with family	Yes	72 (84.70)	156 (74.64)	0.029	0.860	0.010
	No	13 (15.29)	53 (25.36)			
Eat more while watching TV	Yes	36 (42.35)	123 (58.85)	6.62	0.010	0.150
	No	49 (57.65)	86 (41.15)			

Table5: Correlation of Socio-economic and Lifestyle behaviour with BMI

Variables	BMI	
	r	p
No. of family members	0.052	0.322
No. of siblings	0.019	0.723
Fast food frequency	0.346**	0.000
Skipping breakfast	-0.239**	0.000
Physical activity	0.138*	0.018
Age at menarche	0.145*	0.012

DISCUSSION

In the present study, among the 364 participants, 23.35% were classified as underweight, 57.42% had normal body weight, 10.71% were overweight, and 8.52% were obese. A study conducted by Ahmad et al.(2018) in North India reported a higher proportion of underweight adolescents (47.0%) compared to the present findings. Similarly, Ali et al. (2015) observed a high prevalence of undernutrition among rural girls, attributing it to socio-economic disparities. Venkaiah et al. (2002) documented that the prevalence of undernutrition increases with age. In addition, Singh & Amita (2021) determined stunting in 12.2% of the adolescents, whereas Senbanjo et al. (2011) determined a similar prevalence of 17.4%. Still, Venkaiah et al. (2002) and Bisai & Mallick (2008) determined increased rates of stunting of 39% and 27.8%, respectively.

The results of the current research further establish that underweight students have unhealthy eating habits. In particular, underweight students reported a lower intake of junk food than students with normal weight. This is in accordance with the study by Rawal et al. (2021), which investigated the prevalence of underweight and its relationship with knowledge and lifestyle behaviours among adolescents in urban private school adolescents of New Delhi. Their findings revealed that underweight pupils had a slightly reduced awareness of healthy lifestyle behaviours compared to their normal-weight peers.

In the present study, most underweight adolescents reported skipping breakfast more often than normal-weight adolescents. In addition, normal-weight students were found to be more physically active than their underweight peers, and a statistical correlation was determined between physical activity and BMI. These results conform to those of Ochiai et al. (2017), who indicated that Japanese adolescent girls who did not exercise regularly were significantly more likely to be underweight than their counterparts who exercised.

A number of other studies reinforce the findings of the current study. Sahoo et al. (2015) emphasized that poor dietary intake and irregular meal frequency, especially skipping breakfast, are related to lower BMI and poor nutrition in adolescents. Likewise, Rampersaud et al. (2005) identified that adolescents who consumed breakfast daily had improved overall diet quality, greater physical activity, and healthier body weight than breakfast skippers. Another research by Arora et al. (2012) among Indian adolescents found that skipping breakfast and being sedentary were robust predictors of undernutrition, indicating the imperative role of habitual food consumption and regular physical activity in ensuring

optimal health throughout adolescence. Furthermore, Gupta et al. (2020) observed that adolescents with regular participation in sports and physical activity had improved BMI outcomes and lower rates of underweight and overweight conditions. Together, these studies confirm that proper physical activity and balanced nutrition are key determinants of a healthy adolescent body composition.

This study also investigated the relationship between nutritional status and two measures of reproductive health: age at menarche and regularity of menstrual cycles in adolescent girls. The study found that the age at menarche did not significantly differ between underweight and normal-weight adolescent girls. However, the correlation coefficient presented a weak but positive correlation between BMI and age at menarche ($r = 0.145$, $p = 0.012$). This result is contrary to a number of studies that have shown menarche timing to be related to nutritional status. For example, in research conducted by Juliyatmi & Handayani (2015) found that girls with abnormal nutritional status experienced menarche earlier or later than girls with normal nutritional status. Likewise, in a study by Rah et al. (2009), the authors found that nutritional factors, such as mid-upper arm circumference, were correlated with menarcheal age. These variations could be due to differences in sample populations, eating patterns, and methodological steps among the studies.

Contrary to the results on age at menarche, the research revealed a strong relationship between underweight status and higher menstrual irregularity. This is corroborated by Singh et al. (2019), who indicated that underweight adolescent girls experienced a higher prevalence of menstrual irregularities than their normal-weight peers. Furthermore, a study by Itoi et al. (2025) emphasized that underweight and obese adolescents are both at a higher risk of developing menstrual irregularities due to hormonal disturbances. Thus, nutritional status is important for sustaining menstrual health among adolescents.

CONCLUSION

Adolescence is a time of rapid physical, psychological, and social growth, and proper nutrition and lifestyle habits are required for long-term health and well-being. The present research considered behavioural characteristics such as physical activity and eating behaviours on the health of school-going adolescent girls of North 24 Parganas, West Bengal. This study revealed a high prevalence of underweight individuals. Among the 364 participants, 23.35% were underweight, while 57.42% had a normal BMI. Physical activity was shown to affect BMI (Cramér's $V = 0.441$, $p < 0.001$), with normal-weight adolescents engaging more frequently in ≥180 minutes of weekly activity than their underweight peers. Additionally, underweight teens tended to skip breakfast (83.5%), while those with normal BMI consumed more junk food. Menstrual irregularities were also more common among underweight girls.

Statistical analyses revealed significant correlations between BMI and breakfast skipping, physical activity, and menarcheal age. These results emphasize the need to encourage balanced food habits and sufficient physical activity among adolescents. Promoting the intake of home-prepared nutrient-rich foods, such as calorie- and protein-dense snack foods, can promote healthy weight gain. Arrangements for frequent awareness programs on the need for balanced nutrition and an active lifestyle should be made at the school and community levels. In addition, psychosocial issues such as

stress, bullying, and body image issues can also be contributing factors for underweight status and must be treated through counseling as well as supportive teacher interaction. Encouraging frequent physical activity, such as yoga, games, or sports, can improve strength, appetite, and fitness. Regular monitoring of anthropometric indicators, such as BMI, weight, and height, and early referral to nutritionists or pediatricians are also advisable to ensure proper growth and avoid long-term health complications.

However, this study had several limitations. Its cross-sectional design restricts causal inference, and the self-reported nature of the dietary and activity data may introduce reporting bias. Furthermore, the sample was limited to one district**,** which constrains its generalizability to wider populations.

Future research should adopt longitudinal or interventional designs across multiple regions to explore the causal relationships between dietary patterns, physical activity, and menstrual health. Integrating psychosocial and environmental factors may also provide a more comprehensive understanding of adolescent nutritional behaviour.

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