RESEARCH ARTICLE

Physiological health parameters and nutritional status among college-going girls in Murshidabad District of West Bengal, India

Smritiratan Tripathy*, Baishali Basak, Dwipayan Dasgupta

ABSTRACT

Background: Physiological health indicators such as height, weight, and Body Mass Index (BMI) reflect the overall development of a population and are closely linked to nutritional intake patterns. Measurements of blood pressure and Peak Expiratory Flow Rate (PEFR) help to assess disease-related health status within the studied group. There is no such information about the anthropometric data along with respiratory fitness among the college girls of Murshidabad district in West Bengal. *Methods:* One hundred eleven college girls aged 19-22 years were selected randomly to observe their height, weight, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate, body temperature, respiration rate, PEFR, and handgrip strength. All the girls of the mentioned age group were clinically examined for anemia and vitamin A deficiency, *i.e.*, the finding of beta spot, goiter, and other associated iodine deficiency disorders. The dietary practice among the students was also investigated. *Results:* Overall results showed that the mean BMI of these girls is 21.23 ± 3.94 kg/sq m, with a mean PEFR value of 315.77 ± 61.06 l/min. As expected, mean hand grip strength was found to be less in the non-dominant hands (16.22 ± 4.00 kg) than in the dominant hand (18.40 ± 4.76 kg). The mean height and weight are slightly elevated in the studied population as compared with the standard ICMR data. Their regular diet should include more nutritional food, as anemia, and Grade 1 Goiter were found in 6.3% and 3.6% of students, respectively. *Conclusion:* About 50% of the students have a healthy weight, while around 33% are underweight, likely due to nutritional deficiencies. PEFR results show poor respiratory fitness, which could improve with regular exercise. Further investigation is needed to determine the health patterns and nutritional status of female students.

Keywords: Body Mass Index (BMI), Blood pressure (BP), Peak Expiratory Flow Rate (PEFR), Handgrip strength, Girl students.

Indian Journal of Physiology and Allied Sciences (2024); DOI: 10.55184/ijpas.v76i04.231 **ISSN:** 0367-8350 (Print)

INTRODUCTION

Nowadays, anthropometric assessment is a method used to evaluate nutritional status and growth by measuring body dimensions and composition. This approach is widely used due to its simplicity and low cost, allowing for growth and nutritional status to be compared against standardized growth curves.[1] Anthropometric data, particularly height and weight, reflect the health status of a national population or specific segment influenced by heredity and environment.[2] Growth patterns, determined by these easily measurable parameters, are significantly affected by nutritional status and endocrine profiles.[3] Women play a crucial role in society, yet they often lack adequate healthcare and nutrition, making them more susceptible. The health and nutritional status of women is crucial not only for ensuring healthy families and children but also for driving global economic growth. Various factors impact women's health, including malnutrition, poverty, lack of nutrition education, early marriage and pregnancy, gender inequality, inadequate healthcare facilities, domestic violence, and insufficient knowledge and awareness.[4,5] Addressing these issues is essential for improving women's health and, consequently, the well-being of society as a whole. Concerning the emerging issue, this study focused on evaluating the physiological health parameters, conducting clinical investigations, and assessing the nutritional status of college-going girls at Berhampore Girls' College.

Department of Physiology, Berhampore Girls' College, Berhampore, Murshidabad, 742101, West Bengal, India.

***Corresponding author:** Smritiratan Tripathy, Department of Physiology, Berhampore Girls' College, Berhampore, Murshidabad, 742101, West Bengal, India, Email: smritiratan_tripathy@yahoo.com

How to cite this article: Tripathy S, Basak B, Dasgupta D. Physiological health parameters and nutritional status among college-going girls in Murshidabad District of West Bengal, India. *Indian J Physiol Allied Sci* 2024;76(4):73-77.

Conflict of interest: None

Submitted: 14/11/2024 **Accepted:** 26/11/2024 **Published:** 24/12/2024

METHODS

The subjects who had a history of asthma, chronic bronchitis, pneumonia, chest injuries or surgeries, persistent cough, or chest wheezing and who had not received recent treatment for any respiratory conditions, smokers, and alcoholics were excluded from the study. Approval from the ethical committee and written consent from each participant were obtained to conduct the study. The entire process was thoroughly explained to the participants, followed by a demonstration to ensure their understanding and full cooperation. The study design was explained in a flow chart (Figure 1).

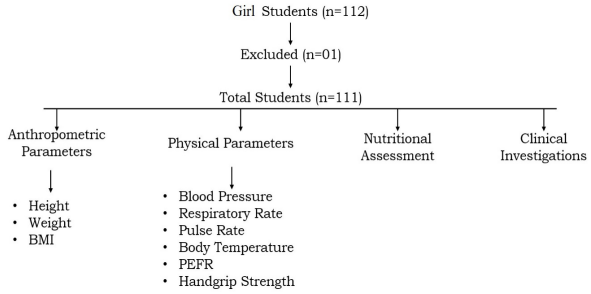

Figure 1: Explanation of the study design by the flow-chart

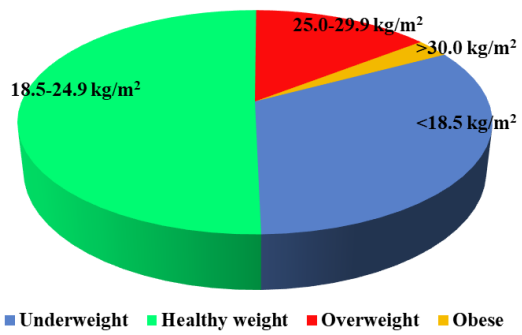

Figure 2: Graphical representation of BMI distribution of the studied population (n = 111)

Girl students (n = 111) aged 19 to 22 years from different departments at Berhampore Girls' College volunteered for the study. After obtaining the informed consent, their ages were verified using their birth dates recorded in the college register and rounded to the nearest whole year. Anthropometric and physiological parameters, including height, weight, body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate, body temperature, respiration rate, peak expiratory flow rate (PEFR) and handgrip strength were measured. Food intake patterns were also observed among the studied population. The height and body weight were measured barefoot and light-weighted clothing with a standard weighing machine (Crown) and a stadiometer Blood pressure was measured using a standard sphygmomanometer (Mark) and stethoscope (Right Care, Mark).[6] PEFR was measured with the help of Wright's Peak Flow Meter in standing posture with the subject's nose clipped, and the value was expressed at body temperature and pressure saturated with vapor (BTPS).[7] After two practice runs, three attempts in succession with a rest period of at least 3-5 minutes between two successive exhalations were recorded, and the highest value was accepted.[8] Body temperature was measured using a digital thermometer (Hicks). Handgrip strength is measured by a standard Hand Grip Dynamometer of both dominant and non-dominant hands.

All the girls in the specified age group underwent clinical examinations for anemia and vitamin A deficiency, including signs like beta spots. They were also checked for goiter and other iodine deficiency disorders, such as gait defects and squints. The grading of goiter was as per the guidelines set by WHO/UNICEF/ICCIDD.[9] We also collected information about the regularity and duration of their menstrual cycle, verbally. The study examined the dietary habits of students to understand their eating patterns. Typically, they consumed two substantial meals each day. Data on their food intake was gathered over a seven-day period, totaling fourteen meals.

All the collected data were tabulated and checked for normality and expressed as mean ± SD, 25% value, 75% value, and median value. The collected data were analyzed using the Student's t-test and Pearson's correlation. The calculated values were compared with the standard ICMR values.[10] The graphical representation was done by Microsoft Excel Office 2019.

RESULTS

Physiological parameters like height, weight, BMI, pulse rate, blood pressure, body temperature, respiration rate, PEFR, and hand-grip strength were measured individually. Mean, SD, and median values were calculated and shown in Table 1. Besides mean and median levels to understand the lower and upper ranges, the results are also expressed in 25% and 75% values. The mean BMI value was found to be 21.23 kg/m^2, and the median value was 20.8 kg/m^2 (Figure 2). We considered both left and right hands, for the measurement of blood pressure. Results showed no such significant differences in systolic and diastolic blood pressure between the data obtained from both hands. The mean PEFR value was found to be 315.77 ± 61.06 l/min, and the median value was 310 l/min. Table 2 shows that 47.7 % of students have a PEFR value of less than 320 l/min. Mean hand grip strength was found to be less in the nondominant hands (16.23 ± 4.00 kg) than in the dominant hands (18.41 ± 4.76 kg).

Clinical investigation among the students showed that 6.3 % of students have anemia. No beta spot was found among the studied students. Investigation showed that 3.6% of students have Grade 1 goiter (palpable goiter); however, no Grade 2 goiter (visible goiter) was found among the students. Associated iodine deficiency disorders like gait defects and squint were not found among the students (Table 3). It was noted that 4.5 % of students were suffering from menorrhagia.

Considering the total meals, 84.43% of meals depended on rice, and 15.7% of meals depended on wheat. 71.88% of meals contained pulses. They consumed relatively more eggs (22.59%) than fish (20.01%). Only 2.38% of meals have red meat, and 11.84% have chicken meat. 40.73% of meals were fully dependent on vegetable items, *i.e.*, they did not consume any nonveg items in their main meal. Of all the meals, 28.64% have leafy vegetables. They preferred to consume cucumber. (Table 4)

It was observed that 9.01% of students have a menstrual flow duration of 3 days, 29.73% have 4 days, 37.84% have 5 days, and 23.42% of studied students have menstrual flow greater than 5 days (Figure 3).

Table 1: Physiological parameter among college girl students (N = 111)

Parameters	*Mean ± SD*	*25% value*	*Median value*	*75% value*
Height (cm)	154.55 ± 5.07	151	154	157
Weight (kg)	50.79 ± 9.91	42	50	55
BMI (kg/sq m)	21.23 ± 3.94	17.9	20.8	23.2
Pulse rate (per min)	86.81 ± 13.83	77	85	94
SBP-LH (mm Hg)	105.67 ± 10.81	98	102	110
DBP-LH (mm Hg)	69.82 ± 8.94	62	70	75
SBP-RH (mm Hg)	105.57 ± 10.05	100	105	110
DBP-RH (mm Hg)	70.02 ± 9.04	61	70	76
Body Temperature (°F)	96.26 ± 1.72	95.4	96.3	97.2
RR (per min)	24.56 ± 7.19	20	22	25
PEFR (L/min)	315.77 ± 61.06	256	310	350
Handgrip strength-non dominant (kg)	16.23 ± 4.00	13	16	18
Handgrip strength-dominant (kg)	18.41 ± 4.76	15	17	21

Table 2: Distribution of PEFR in the studied population (N = 111)

PEFR (L/min)	*No. of students*	*% of total students*
<320	53	47.7
320-470	58	52.3
>470	-	-

Table 3: Clinical investigation among the studied population (N = 111)

Clinical abnormalities	*No. of students*	*% of total students*
Anemia	7	6.3
Vitamin A deficiency	-	-
Grade 1 Goitre	4	3.6
Grade 2 Goitre	-	-
Gait defect	-	-
Squint	-	-
Menorrhagia (interview)	5	4.5
Hypomenorrhea (interview)	-	-

There was a significant difference between the handgrip strength of the non-dominant and dominant hand of the study population (p = 0.003).

A strong correlation was found between BMI and weight (r=0.9), as BMI increased with the increased weight. Another strong correlation was found between dominant and non-dominant handgrip strength (r=0.7). Both the systolic and diastolic blood pressure of the right and left hand were moderately correlated with each other, as depicted in Table 5. The height and weight were compared with the ICMR standard value among various age groups. The mean height and mean weight are slightly elevated in this studied population as compared with the standard ICMR value (Figures 4 and 5).

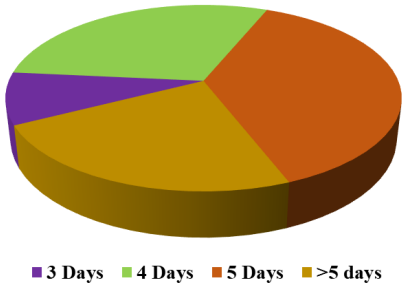

Figure 3: Distribution of students on the basis of duration of menstrual flow of the studied population (n = 111)

DISCUSSION

The body mass index (BMI) is a metric used to define height and weight characteristics in adults, classifying them into different groups. It is commonly interpreted as an indicator of an individual's fatness and is widely used as a risk factor for various health issues. Additionally, BMI plays a significant role in shaping public health policies. It helps estimate the risk of underweight and obesity, which are linked to diseases such as diabetes, stroke, atherosclerosis, hypertension, and nutritional disorders.[11-13] Our findings show that 32.43% of students are underweight, 50.45% have a healthy weight, 14.42% are overweight, and 2.7% are obese. There is a strong correlation between BMI and weight (r=0.9), indicating that as body weight increases, the likelihood of obesity also rises. Consuming excessive food and leading a sedentary lifestyle can result in overweight and obesity. Obesity diminishes the sensitivity of tissues to insulin, affecting glucose utilization. A lack of physical activity and obesity heightens the risk of developing diabetes later in life. To maintain a healthy and active life, a person needs a variety of nutrients which are obtained from their daily diet. It is crucial to select diet

Table 4: Distribution of food intake pattern*

Food	*No. of meal contains*	*% of the total meal*
Rice	1312	84.43
Wheat	244	15.7
Pulses	1117	71.88
Fish	311	20.01
Egg	351	22.59
Red Meat	37	2.38
Chicken meat	184	11.84
Fully Veg items	633	40.73
Leafy vegetables	445	28.64
Cabbage	120	7.72
Cauliflower	152	9.78
Pumpkin	223	14.35
Cucumber	561	36.1
Ladies finger	270	17.37
Carrot	245	15.77
Beat root	43	2.77
Potato	1312	84.43

*Total Meal = No. of meal/day(2) × No. of survey days (7) × No of students (111)

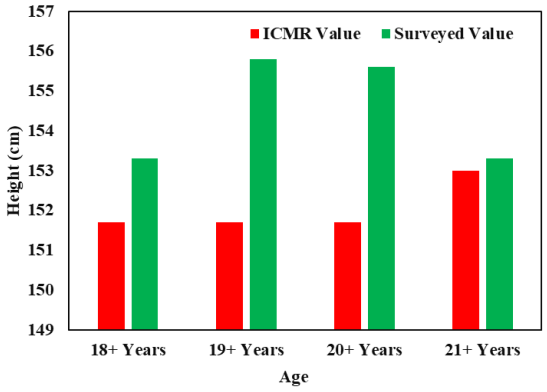

Figure 4: The comparison of heights between ICMR standard value and surveyed value among various age groups

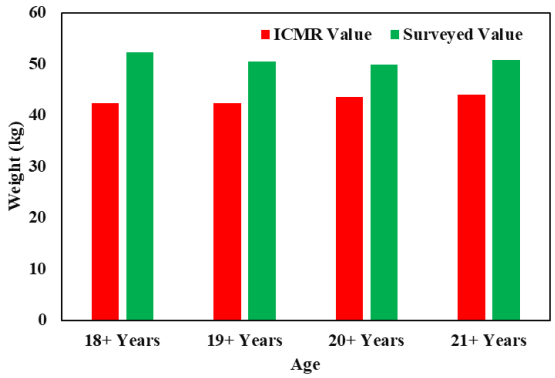

Figure 5: The comparison of body weights between ICMR standard value and surveyed value among various age groups

components wisely to ensure all necessary nutrients are provided in adequate amounts and proper proportions. The required amount of each nutrient varies based on age and physiological status. Adults need nutrients to maintain a stable body weight and ensure proper bodily functions.[14,15] Normal respiration rates for an adult person at rest range from 12 to 20 breaths per minute. A respiration rate under 12 or over 25 breaths per minute while resting may be a sign of an underlying health condition.[16] Our result shows that the average respiratory rate is 24.56 ± 7.19 per minute, and the median value is 20 per minute, indicating the normal range of respiratory rate.

Pulmonary function tests have transitioned from being purely physiological study tools to essential clinical instruments for diagnosing, managing, and monitoring respiratory diseases. They offer objective insights into the degree of pulmonary functional impairment. The measurement of peak expiratory flow rate (PEFR) using a peak flow meter is particularly advantageous, as it can be utilized at the patient's bedside and in epidemiological surveys. This versatility has made PEFR a widely accepted test for assessing ventilatory capacity in outpatient departments, chest clinics, hospitals, and general practice settings.[17] In 2007, Bandyopadhyay *et al.* reported that the PEFR value of college-going girls was 425.20 ± 32.00 liter/min among the students from Bareilly of Uttar Pradesh, India.[18] Our result shows that 47.7% of students have PEFR <320 l/min, *i.e.*, less than the normal range. Regular practice of Pranayama, Yoga, and exercise can help to improve the PEFR value among the studied students.

There is inconsistency in the literature regarding the link between hand grip strength and BMI. Some researchers report a positive correlation across all ages and genders, while others find no such relationship. These studies vary widely, involving participants from different countries, age groups, genders, ethnic backgrounds, occupations, and levels of food access.[19] Hand-grip strength is a low-cost, reliable tool that can be easily used to evaluate the forearm muscular strength of an individual. Moreover, it also serves as a marker for overall muscle strength. From different studies it was found that Hand Grip strength has many important applications in the development of ergonomic tools, in the design of equipment and consumer products, and in sports practices. Walankar *et al.*, 2016, conducted a study on the Indian population and prepared a normative value of hand-grip strength[20]. Walankar *et al.* reported that in the age group 21-30 years, the mean value of a dominant hand is 24.52 ± 2.09 kg, and the non-dominant hand is 20.02 ± 2.34 kg.[20] The study found a significant difference in handgrip strength between the dominant and non-dominant hands of the participants (P value= 0.003, ***p<0.05). Additionally, there was a significant correlation (r=0.7) between handgrip strength in both the dominant and non-dominant hands.

Table 5: Pearson's correlation of Systolic and Diastolic blood pressure of both left and right hand

Pearson's Correlation (r)		*Left Hand*		*Right Hand*	
		SBP (mm Hg)	*DBP (mm Hg)*	*SBP (mm Hg)*	*DBP (mm Hg)*
Left Hand	SBP (mm Hg)	1	0.51*	0.64*	0.37*
	DBP (mm Hg)	0.51*	1	0.47*	0.55*
Right Hand	SBP (mm Hg)	0.64*	0.47*	1	0.57*
	DBP (mm Hg)	0.37*	0.55*	0.57*	1

*indicates $p < 0.001$

This means that as a person's dominant handgrip strength increases, their non-dominant handgrip strength also tends to increase simultaneously. Our studied values are less than the value reported by Walankar *et al*.; it may be due to variations in genetic, environmental, and nutritional factors.

CONCLUSION

The findings indicate that approximately 50% of the students have a healthy weight, while around 33% are underweight according to their BMI, possibly due to nutritional deficiencies. The PEFR results reveal poor respiratory fitness among the students, which could be improved with regular exercise. Further investigation is needed to accurately determine the health patterns and nutritional status of the female students.

ACKNOWLEDGMENT

The authors are thankful to the staff and students for their cooperation in carrying out the present study.

REFERENCES

1. Wessner S, Burjonrappa S. Review of nutritional assessment and clinical outcomes in pediatric surgical patients: does preoperative nutritional assessment impact clinical outcomes? *J Ped Surg*. 2014;49(5):823-30. DOI: 10.1016/j.jpedsurg.2014.01.006.
2. Unisa S, Borkotoky K. An appraisal of anthropometric data and factors influencing height of Indian population. *Demography India*. 2017;46(1):22-37.
3. Bhattacharya A, Pal B, Mukherjee S, Roy SK. Assessment of nutritional status using anthropometric variables by multivariate analysis. *BMC Pub Health*. 2019;19:1-9. DOI: 10.1186/s12889-019-7372-2.
4. Singh P. 2020. Women's health in India today: A matter of concern or denial? *DailyO*. https://www.dailyo.in/.
5. Ghosh J, Pal B. Health and nutritional status of women in different regions of West Bengal, India: a Comparative Study between NFHS-4 and NFHS-5. *Sch J App Med Sci*. 2022;12:2189-200. DOI: 10.36347/sjams.2022.v10i12.024.
6. Homan TD, Bordes SJ, Cichowski E. 2018. Physiology, pulse pressure. *StatPearls Publishing*. PMID: 29494015.
7. Miller MR. Peak expiratory flow meter scale changes: implications for patients and health professionals. *Airways J*. 2004:80-2.
8. Chatterjee S, Mitra SK and Samanta A. Aerobic capacity of the brick field workers in Eastern India. *Ind Health.* 1994;32:79-84. DOI: 10.2486/indhealth.32.79.
9. WHO, UNICEF, and ICCIDD. Assessment of the iodine deficiency disorders and monitoring their elimination. WHO, Geneva, 2001; 1-107. WHO/NHD/01.1.ICCIDD. Available at: https://iris.who.int/bitstream/handle/10665/61278/WHO_NHD_01.1.pdf
10. ICMR (1989) Technical Report Growth and Physical Development of Indian Infants and Children, Indian Council of Medical Research New Delhi, Series No.18.
11. Nuttall FQ. Body mass index: obesity, BMI, and health: a critical review. *Nutr Today*. 2015;50(3):117-28. DOI: 10.1097/NT.0000000000000092.
12. Khanna D, Peltzer C, Kahar P, Parmar MS. Body mass index (BMI): A screening tool analysis. *Cureus*. 2022;14(2). DOI: 10.7759/cureus.22119.
13. Mohajan D, Mohajan HK. Body mass index (BMI) is a popular anthropometric tool to measure obesity among adults. *J Innovat Med Res*. 2023;2(4):25-33. DOI: 10.56397/JIMR/2023.04.06.
14. Powell-Wiley TM, Poirier P, Burke LE, *et al*. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. *Circulation*. 2021;143(21):e984-1010. DOI: 10.1161/CIR.0000000000000973.
15. Chen YK, Liu TT, Teia FK, Xie MZ. Exploring the underlying mechanisms of obesity and diabetes and the potential of traditional Chinese medicine: an overview of the literature. *Front Endocrinol*. 2023;14:1218880. DOI: 10.3389/fendo.2023.1218880.
16. Fritz S, Chaitow L, Hymel GM. Review of pertinent anatomy and physiology. *Clin Massage Healthcare Setting*. 2008:140-95. DOI: 10.1016/B978-032303996-3.50013-1.
17. Ranu H, Wilde M, Madden B. Pulmonary function tests. *Ulster Med J*. 2011;80(2):84. PMID: 22347750.
18. Bandyopadhyay A, Tripathy S, Kamal RB, Basak AK. Peak expiratory flow rate in college students of Uttar Pradesh, India. *Indian Biologist*. 2007; 39(1):71-75. ISSN: 0302-7554.
19. Massy-Westropp NM, Gill TK, Taylor AW, Bohannon RW, Hill CL. Hand Grip Strength: age and gender stratified normative data in a population-based study. *BMC Res Notes*. 2011;4:1-5. DOI: 10.1186/1756-0500-4-127.
20. Walankar P, Verma C, Mehta A. Study of hand grip strength in Indian population. *Int J Health Sci Res*. 2016;6(11):162-6. ISSN: 2249-9571.

PEER-REVIEWED CERTIFICATION

During the review of this manuscript, a double-blind peer-review policy has been followed. The author(s) of this manuscript received review comments from a minimum of two peer-reviewers. Author(s) submitted revised manuscript as per the comments of the assigned reviewers. On the basis of revision(s) done by the author(s) and compliance to the Reviewers' comments on the manuscript, Editor(s) has approved the revised manuscript for final publication.