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"Impact of Malnutrition on Lung Function in Adolescents: Insights from Peak"

Haneef Ahmad[1], Attaullah Jan[2]

[1,2] Department of Human Nutrition and Dietetics, Bacha Khan University Charsadda.

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Abstract

This study examines the impact of malnutrition on lung function in adolescents using peak expiratory flow rate (PEFR) measurements. A cross-sectional analysis of 300 participants revealed varying levels of malnutrition and PEFR.

Introduction:

The burden of respiratory diseases among adolescents is a growing concern worldwide. In Pakistan, the prevalence of respiratory conditions such as asthma and allergic rhinitis is increasing, attributed to factors like environmental pollution, dietary changes, and sedentary lifestyles. Malnutrition, particularly under nutrition, is a significant public health issue in Pakistan, affecting millions of children and adolescents. Emerging evidence suggests that malnutrition can impair lung function, increasing the risk of respiratory diseases. However, there is a knowledge gap regarding the impact of malnutrition on lung function in adolescents, particularly in developing countries. This study seeks to explore the relationship between malnutrition and lung function in Pakistani adolescents, using peak expiratory flow rate (PEFR) measurements as a diagnostic tool. By examining the impact of nutritional factors on lung function, this research aims to inform public health strategies to improve adolescent respiratory health.[1-4]

Study design

A cross sectional research study design was used for this study.

Study Area/Setting

The research was conducted in District Charsadda Khyber Pakhtunkhwa, Pakistan. This district was selected because it contains numerous educational institutions which has a diverse socio economic groups to allow generalizable results. Before selecting the research areas a list of public and private educational institutions was compiled. For this random number sample was choose from the selected institutions to avoid selection bias and ensure fair representation. Total of 14 educational institutions were included from which male and female students from urban and semi-urban regions of the district was selected in this study.

Interview and data collection process

A Structured interviews were conducted with direct assessments of participants to obtain data. Each participant received their questions through standardized questionnaires. The data collection procedures was processed in selected schools at approved times and hours. During the

interview participants report their lifestyle activities and respiratory symptoms accurately through direct interviews while physical and clinical data were assessed directly on-site [38]

Sample Size

The sample for the study was selected using sample size formula. Briefly, 300 students will be sufficient to act as sample for the present study [38].

Sample selection:

The samples were selected randomly using the following procedure:

- Educational institutions in Charsadda were enlisted.
- For educational institution a representative sample was selected using from these lists using random number sampling method.
- 150 Male and 150 Female adolescents' age of 13-19 years old were selected.

Data Collection

Data was collected on the following parameters:

- Socio demographics.
- Lifestyle Factors
- Anthropometrics measurement (BMI)
- Peak expiratory flow rate (PEFR)

Inclusion criteria:

The study included participants who fulfilled these requirements:

- Adolescents between the ages of 13 and 19 years
- Currently enrolled in one of the selected educational institutions in Charsadda at present.
- Physically present at their school on the collection day.

Exclusion criteria

The study excluded participants who met any of these conditions.

- Participants excluded individuals who had gotten over major illnesses, surgical procedures or infections less than four weeks ago.
- Participants were excluded if they had experience chronic respiratory diseases requiring hospitalization or ongoing treatment such as tuberculosis.
- Participants who missed PEFR testing on the assessment day were excluded in the study.
- The participants were excluded if they had physical disability or deformity that would prevent accurate measurement of pulmonary function or anthropometry results.

Statistical Analysis

In this study data was analyzed using IBM SPSS Statistics (version 26.0) for statistical analysis. Statistics were employed to reveal participant data primarily through mean values and standard deviations along with frequencies and percentage distributions of socio-demographic characteristic, lifestyle factors, anthropometric measurements and peak expiratory flow rate (PEFR) values. Pearson's correlation was used to identify the linear relation between BMI-PEFR as well as lifestyle factor associations with pulmonary function. Independent t-tests and one-way ANOVA was used to establish significant PEFR differences between gender and BMI categories. A significant p value of 0.05 was set for all statistical hypothesis tests. Additionally, Content analysis methods were used to analyze any open-ended questions which assisted in interpreting contextual information about environmental and lifestyle factors affecting respiratory health. The analytical methodology provided quantitative and qualitative results which led to significant findings about variables linked to adolescent respiratory health

Methods

A cross-sectional study of 300 adolescents aged 13-19 years was conducted. Lifestyle factors, anthropometric measurements, and PEFR were assessed.

Results

The results showed that 54.7% of participants engaged in physical activity, while 45.3% did not. The mean BMI was 21.33, and the mean PEFR was 400.72. Calorie intake varied widely among participants.{3]

Discussion

The findings suggest that malnutrition, as indicated by varying BMI values and calorie intake, may impact lung function in adolescents. Lifestyle factors, such as physical activity, may also play a role in determining PEFR. [1-5]

Conclusion

The study highlights the importance of proper nutrition and lifestyle habits in supporting lung health in adolescents.

RESULTS

Data of socio-demographic factors

Table 4.1.1: Frequencies demographic of Socio factors

	No of students	Institute	Age
Valid	300	14	13-19

Table 4.1.1 shows the frequencies of socio demographic factors which were studied during the study. All the 300 respondents responded positively and have valid results through questioner which were used to get the results.

Table 4.1.2: Age frequency and percentage

Age of Students (Year)		Frequency	Percent
Valid	13	41	13.7
	14	47	15.7
	15	40	13.3
	16	40	13.3
	17	41	13.7
	18	43	14.3
	19	48	16.0
	Total	300	100.0

Indicate age of students ranged from 13 to 19 years. The largest group consisted of 19-year-olds, making up 16.0% of the sample. This was followed by 14-year-olds at 15.7% and 18-year-olds at 14.3%. Both 13-year-olds and 17-year-olds each accounted for 13.7% of the respondents. Similarly, 15-year-olds and 16-year-olds represented 13.3% each of the participants. The sample was evenly distributed across the various age categories, with a total of 300 valid cases.

Lifestyle Factors

Table 4.2.1: Physical activity frequency and percentage

Physical activity		Frequency	Percent
Valid	No	136	45.3

	Yes	164	54.7
	Total	300	100.0

Table 4.2.1 reveals that 54.7% of respondents reported engaging in “physical activity”, while 45.3% reported “no physical activity”. The majority of the sample is involved in some form of physical activity, highlighting an active lifestyle among most of the 300 participants.

Table 4.2.2: Sleeping duration in hours frequency and percentage

Sleeping duration (hr)		Frequency	Percent
Valid	2-5	13	4.3
	6-9	262	87.3
	10-13	25	8.3
	Total	300	100.0

Table 4.2.2 express the data on sleeping duration reveals a varied pattern among respondents. Most of the participant sleeps for 6 to 9 hours with of 87.3%, in which the most common sleep duration is “7 hours”, reported by 26.7% of participants, closely followed by “8 hours” (25.0%) and “9 hours” (22.3%). A substantial portion of respondents sleep “6 hours” (13.3%). Fewer participants report sleeping “10 hours” (6.7%) or more, with “11 hours” and “12 hours” each accounting for only 0.7% and 1.0%, respectively. Shorter durations are less common as 2 to 5 hours sleeps duration has a percentage of 4.3%, as shown in the table 4.2.2, with “5 hours” (2.7%) and as little as “2 hours” (0.3%) and “3 hours” (0.3%) being reported by a minimal number of respondents.

Anthropometric Study

Table 4.3: Frequencies of Anthropometric Factors

	Weight in Kgs	**Height in Feet**	**Age**	**BMI**	**PEFR**	**Calories**
Valid	300	300	300	300	300	300

Table 4.3 shows the frequencies of the anthropometric factors, which were chosen to acquire data for this study. The total number of responses were recorded as (N=300) while weight in Kgs, height in feet, age, BMI and PEFR all got (N=300) number of responses.

Table 4.3.1: BMI frequency and percentage

BMI		**Frequency**	**Percent**
Valid	15.1000-16.0000	2	0.7
	16.1000-17.0000	5	1.6
	17.1000-18.0000	11	3.6
	18.1000-19.0000	15	5.0
	19.1000-20.0000	43	14.3
	20.1000-21.0000	60	20.0
	21.1000-22.0000	68	22.6
	22.1000-23.0000	37	12.3
	23.1000-24.0000	35	11.6
	24.1000-25.0000	15	5.0
	25.1000-26.0000	2	0.7
	26.1000-27.0000	1	0.3
	27.1000-28.0000	2	0.7
	28.1000-29.0000	2	0.7
	29.1000-30.0000	1	0.3
	30.1000-32.0000	1	0.3
	Total	300	100.0

Table 4.3.1 displays the distribution of Body Mass Index (BMI) values among respondents shows a broad range, with several peaks in specific BMI categories. The most common BMI range is around “21.5”, reported by 11.0% of participants. Other notable ranges include “20.2” (4.3%), “22.2” (3.7%), and “20.8” (3.3%). Several categories such as “20.9” (2.7%), “19.5” (2.7%), and “19.8” (2.7%) also show moderate representation. Numerous BMI values are included in the data, ranging 15.9 (0.3%) to 32.0 (0.3%) and clustered around the mid-range values, with fewer instances at the extreme ends. The data offers a thorough understanding of the 300 respondents with a central tendency in the mid-20s.

Table 4.3.3: Mean and Standard Deviation of anthropometric study

	N	Mean	Std. Deviation
Weight in kg	300	51.74	7.407
Height in feet	300	5.148367	.4465651
Age	300	16.04	2.035
BMI	300	21.325333	2.1710527
PEFR	300	400.72	69.724
Calories	300	830.92	199.041
Valid N (list wise)	300		

Table 4.3.3 shows that mean weight of all 3000 respondents is 51.74 kg, with a standard deviation of 7.407 kg, indicating variability in weight among the population. The mean height of respondents is approximately 5.15 feet, with a relatively small standard deviation of 0.447 feet, suggesting less variability in height. The age average of the respondents is 16.04 years, with a SD of 2.035 years. The mean BMI of respondents is 21.33, with a SD of 2.171, indicating moderate variability in body mass index. The average PEFR is 400.72, with a SD of 69.724,

suggesting a variety of expiratory flow rates among the all 300 respondents. The mean calorie intake is 830.92 kcal, with a standard deviation of 199.041 kcal, reflecting variability in dietary intake.

Summary

A research project examined the health and demographic and lifestyle characteristics among adolescents aged 13 to 19 attending multiple educational facilities. Various educational institutions sent participants that displayed similar proportions of student age groups and no significant gender bias. The data showed that physical activity as well as walking to school and sufficient sleep duration occur among more than fifty percent of students. Most participants reported leading healthy lifestyles through their avoidance of smoking. The research showed dissimilarities regarding students' media habits as well as their sleeping patterns and ways of commuting and food consumption. The anthropometric assessment demonstrated an elevated number of students existing in the average weight and height segments yet BMI and PEFR measurements showed substantial variations between subjects. Researchers found evidence of a considerable negative association between BMI values and PEFR measurements indicating that BMI levels above average could harmed respiratory airflow.

Recommendations

The school must create regular fitness and sports activities so students remain active which helps both their lung function and their BMI health.

The schools need to establish educational programs focusing on nutrition which teach students proper dietary choices and the appropriate calorie requirements for their age group and exercise level. Regular tests of lung function (PEFR tests) should become part of school health examinations specifically for students who are overweight. The promotion of healthy routines should target the improvement of sleep hygiene as well as the reduction of excessive screen time and the establishment of regular sleep schedules. The schools should maintain accessible pathways leading to their facilities which supports students to reach school by walking while decreasing transportation dependence. The organization must strengthen its anti-smoking campaigns through wider spread awareness programs about smoking dangers while supporting the current low smoking statistics. Future research needs to expand its investigation by studying bigger populations from different backgrounds to establish the BMI-PEFR relationship and discover other environmental and genetic factors that could influence results.

Conclusion

The socio demographic characteristics, lifestyle choices, and anthropometric measurements of adolescents in District Charsadda, Pakistan, are all thoroughly examined in this study. The results provide significant understanding on how nutritional status and respiratory function interact, with a particular emphasis on the connection among PEFR and BMI. Respondents' socio demographic backgrounds showed notable differences in parental education and family income. As shown in study physical activity remained regular for 54.7% of students and sleep patterns were adequate as the respondents reported 6–9 hours of nightly rest (87.3% response). The BMI measurements varied from 15.9 to 32.0 with typical values at 21.5 while PEFR testing values spanned from 145 to 660 reaching a maximum of 400 L/min. Students displayed an average BMI rating of 21.33 together with an average PEFR score of 400.72. BMI and PEFR levels exhibited a negative correlation where higher BMI values corresponded to decreased respiratory function according to Pearson’s correlation coefficient (-0.222 and Spearman’s rho (-0.300; p=0.000). Schools alongside health authorities need to work together on implementing purpose-built

programs mainly in areas where access is limited for the purpose of closing the health disparity gap. Health disparities among adolescents require immediate attention to guarantee their long-term health development.

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