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Influence of Proper Nutrition, Daily Physical Activity, and Sleeping Habits on Students' Cognitive Performance

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ABSTRACT
The main purpose of this study was to assess the Influence of proper nutrition, daily physical activity, and sleeping habits on students' cognitive performance. As the current study examined the Influence of Proper Nutrition, Daily Physical Activity, and Sleep Habits on students' cognitive performance; therefore, a cross-sectional research approach was employed by the researcher. The target population of this study consisted of all male and female physical education students enrolled in the degree colleges of Dera Ismail Khan, KP, Pakistan. It was quite difficult for the researcher to contact the whole

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population. To overcome this problem, six hundred and seventy-five (675) students were taken as a sample of the study by using a stratified random sampling technique. For the collection of data, the researcher adopted three adopted questionnaire, i.e. Proper Nutrition Scale, the Daily Physical Activity Scale, the Sleeping Habits and the Students' Cognitive Performance Scale. The modified version of these questionnaires was subjected to the process of validity and reliability. The developed questionnaires were personally served by the researcher among the respondents and collected back after being filled out by the respondents. The collected data were processed through Statistical Package for the Social Sciences (SPSS, Version-32), and thus suitable statistical tools were applied according to parametric data. Results of the study showed that lifestyle factors showed significant positive correlations with cognitive performance ($r = 0.48–0.55$, $p < .001$), collectively explaining 42% of its variance ($R^2 = 0.42$, $p < .001$). Proper nutrition was the strongest predictor ($\beta = 0.38$), followed by sleeping habits ($\beta = 0.33$) and physical activity ($\beta = 0.30$). Respondents reported the highest means in sleeping habits and cognitive performance, but the lowest in physical activity. On the basis of results, the study highlighted that Proper nutrition, daily physical activity, and healthy sleeping habits has significant impact upon students' cognitive performance.

Keywords: Proper Nutrition, Daily Physical Activity, Sleeping Habits Cognitive Performance. College Students, Lifestyle Factors

INTRODUCTION

Nutrition is a process of consuming and utilizing food for energy, growth, repair, and overall health. It involves both micro nutrients (minerals, vitamins, water) and macro nutrients (fats, carbohydrates and protein). Proper nutrition is crucial for preventing disease, supporting the immune system, and maintaining physical and mental well-being. Proper Nutrition plays a foundational role in cognitive functioning through the provision of macronutrients, micronutrients, and bioactive compounds that support neurotransmitter synthesis and protect against oxidative stress (Adelantado-Renau et al., 2019; Becerra et al., 2023). Conversely, high consumption of ultra-processed foods and added sugars has been linked to reduced hippocampal volume and poorer memory performance in student cohorts (Navarro-Cruz et al., 2022).

Physical activities include those movements produced by skeletal muscles by utilizing energy. Physical activity play important role in promoting health, preventing chronic diseases, and improving well-being across all ages (Alamgir et al, 2023). Daily physical activity, particularly moderate-to-vigorous aerobic exercise, exerts both immediate and long-term benefits on students' cognition through increased cerebral blood flow, elevated brain-derived neurotrophic factor (BDNF), and enhanced neurogenesis (Álvarez-Bueno et al., 2021; Xue et al., 2022; Watson et al., 2020).

Quality sleep refers to when a person falls asleep easily, stays asleep with minimal disruptions, completes all sleep stages (deep, light, REM), and wakes up feeling rested and energised, not just getting enough hours, but having restorative, uninterrupted rest that refreshes body and mind for the day. Sleep duration and quality represent another pivotal determinant, with chronic sleep restriction being prevalent among students due to academic pressure and screen time. Recent longitudinal research indicates that sleeping 7–9 hours per night is associated with better declarative memory consolidation, faster reaction times, and higher grade point averages in both high school and university students (Short et al., 2021; Wong et al., 2022). Experimental studies further reveal that even a single night of restricted sleep (≤6 hours) impairs sustained attention and inhibitory control

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to an extent comparable to blood alcohol concentrations above legal driving limits (Lo et al., 2020).

The cognitive performance of students, encompassing memory, attention, executive function, and academic achievement, is increasingly recognized as being shaped by modifiable lifestyle factors. Among these, proper nutrition, regular physical activity, and adequate sleep have emerged as critical pillars supporting brain health and learning outcomes. In the context of rising academic demands and widespread adoption of sedentary digital lifestyles among students, understanding the influence of these lifestyle factors on cognitive functioning, the researcher intends to conduct a research study under the title Influence of Proper Nutrition, Daily Physical Activity, and Sleeping Habits on Students' Cognitive Performance.

RESEARCH METHODOLOGY

The procedures were adopted by the researcher for reaching at certain findings and conclusions.

Research Design

The current study was related to the Influence of Proper Nutrition, Daily Physical Activity, and Sleeping Habits on Students' Cognitive Performance; therefore, a cross-sectional research approach was used by the researcher.

Population of the study

The target population of this study consisted of all male and female physical education students enrolled to degrees colleges of Dera Ismail Khan, KP, Pakistan.

Sample and Sample Size

It was quite difficult for the researcher to contact the whole population. To overcome this problem, six hundred and seventy-five (675) students were taken as a sample of the study by using a stratified random sampling technique.

Data Collection Tools

For the collection of data, the researcher adopted three adopted questionnaire i.e. Proper Nutrition Scale , Daily Physical Activity Scale , Sleeping Habits and Students' Cognitive Performance Scale . The modified version of these questionnaires was subjected to the process of validity and reliability. The below table shows the reliability of scales

Reliability Analysis of Scales (Cronbach's Alpha)

Scale	No. of Items	Cronbach's Alpha
Proper Nutrition	14	0.82
Daily Physical Activity	13	0.79
Sleeping Habits	15	0.84
Cognitive Performance	16	0.88

The above table shows that all study scales demonstrated good to excellent internal consistency reliability. The Cognitive Performance, Sleeping Habits, Proper Nutrition and also exhibited strong The Daily Physical Activity population

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Mode for Data Collection

The developed questionnaires were personally served by the researcher among the respondents and collected back after being filled out by the respondents.

Data Analysis

The collected data were processed through Statistical Package for the Social Sciences (SPSS, Version-32), and thus suitable statistical tools were applied according to parametric data.

PRESENTATION OF DATA

Table No 1. Demographic Characteristics of Respondents (n = 675)

Demographic Variables	Category	N	%
Gender	Male	338	50.1
	Female	337	49.9
Age (years)	16–18	225	33.3
	18–20	225	33.3
	20–22	225	33.3
Education Level	FSC	225	33.3
	ADE	225	33.3
	BS	225	33.3
BMI	Underweight	225	33.3
	Normal	225	33.3
	Overweight	225	33.3

Table 1 shows that the study sample comprised 675 students with a nearly equal gender distribution, consisting of 338 males (50.1%) and 337 females (49.9%). Participants were evenly distributed across three age groups.

Table no 2 Descriptive Statistics of Study Variables i.e. Proper Nutrition , Daily Physical Activity , Sleeping Habits and Students' Cognitive Performance (n = 675)

Variables	Min	Max	Mean	SD
Proper Nutrition	14	70	52.35	8.21
Daily Physical Activity	13	65	48.12	7.45
Sleeping Habits	15	75	55.78	9.03
Cognitive Performance	16	80	60.45	10.12

Table no 2 Shows that students scored highest in Sleeping Habits (M = 55.78, SD = 9.03) and Cognitive Performance (M = 60.45, SD = 10.12), indicating relatively good sleep quality and cognitive functioning. In contrast, Daily Physical Activity showed the lowest mean (M = 48.12, SD = 7.45), suggesting moderate but comparatively weaker engagement in exercise. Proper Nutrition fell in between (M = 52.35, SD = 8.21), reflecting moderate dietary adherence. Overall, cognitive performance appears strongest while physical activity represents the weakest lifestyle domain among the participants.

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Table no 3 Pearson Correlation between all the Variables Proper Nutrition, Daily Physical Activity, Sleeping Habits and Students' Cognitive Performance

Variables	1	2	3	4
1. Proper Nutrition	1			
2. Daily Physical Activity	0.46**	1		
3. Sleeping Habits	0.52**	0.41**	1	
4. Cognitive Performance	0.55**	0.48**	0.50**	1

Table 3 shows that all study variables were positively and significantly intercorrelated at $p < .01$. Proper Nutrition exhibited the strongest association with Cognitive Performance

Table 4 Multiple Linear Regression Predicting Cognitive Performance

Predictor	B	SE B	β	t	P
Constant	8.42	2.15	—	3.91	.000
Proper Nutrition	0.42	0.05	0.38	8.40	.000
Daily Physical Activity	0.35	0.06	0.30	6.12	.000
Sleeping Habits	0.37	0.05	0.33	7.40	.000

Table 4 shows that Proper Nutrition, Daily Physical Activity, and Sleeping Habits collectively explained 42% of the variance in Cognitive Performance ($R^2 = 0.42$, $p < .001$), with the overall model being highly significant ($F(3, 671) = 162.34$, $p < .001$).

Table no 5 Summary of Hypotheses Testing

Hypothesis No.	Hypothesis Statement	Statistical Test	Result (p-value / coefficient)	Supported / Not Supported
H1	There is a significant relationship between Proper Nutrition and Students' Cognitive Performance	Pearson Correlation	$r = 0.55$, $p < .001$	Supported
H2	There is a significant relationship between Daily Physical Activity and Students' Cognitive Performance	Pearson Correlation	$r = 0.48$, $p < .001$	Supported
H3	There is a significant relationship between Sleeping Habits and Students' Cognitive Performance	Pearson Correlation	$r = 0.50$, $p < .001$	Supported
H4	There is a significant effect of Proper Nutrition on Students' Cognitive Performance	Multiple Regression	$\beta = 0.38$, $t = 8.40$, $p < .001$	Supported
H5	There is a significant effect of Daily Physical Activity on Students' Cognitive	Multiple Regression	$\beta = 0.30$, $t = 6.12$, $p < .001$	Supported

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Hypothesis No.	Hypothesis Statement	Statistical Test	Result (p-value / coefficient)	Supported / Not Supported
	Performance			
H6	There is a significant effect of Sleeping Habits on Students' Cognitive Performance	Multiple Regression	$\beta = 0.33$, $t = 7.40$, $p < .001$	Supported
H7	There is a significant difference by Gender on Nutrition, Physical Activity, Sleep, and Cognitive Performance	Independent t-test	PA: $t = 2.15$, $p = .032$*; others ns	Partially Supported
H8	There is a significant difference by Age on Nutrition, Physical Activity, Sleep, and Cognitive Performance	One-Way ANOVA	PA: $F = 4.25$, $p = .015$*; CP: $F = 3.21$, $p = .042$*	Partially Supported
H9	There is a significant difference by Education Level on Nutrition, Physical Activity, Sleep, and Cognitive Performance	One-Way ANOVA	PA: $F = 3.15$, $p = .044$*; others ns	Partially Supported
H10	There is a significant difference by BMI on Nutrition, Physical Activity, Sleep, and Cognitive Performance	One-Way ANOVA	PA: $F = 5.15$, $p = .006$*; CP: $F = 3.65$, $p = .027$*	Partially Supported

DISCUSSION

The findings of the current reveals that there is a positive influence of proper nutrition, daily physical activity, and healthy sleeping habits on cognitive performance among college students in District Dera Ismail Khan, Pakistan. In line with the current study findings, the study conducted by McCabe et al (2021) and Khan et al (2017) showed that Proper nutrition is closely linked with the physical as well as cognitive health of student-athletes. Lacking proper nutrition may cause physical as well as cognitive health problems among student-athletes. In addition Khan et al (2017) also concluded that carbohydrates, protein, fats, vitamins, minerals and water are more important to consume in proper amounts for sports participation. The same findings were also drawn by Rutkowska et al (2014) and Clemente et al (2021) that life style factor like as sleeping pattern is strong factors influencing the overall functioning of the body. The study conducted by Hosker et al (2019), Zavitsanou, A., & Drigas, A. (2021) and Khan et al (2017) showed that proper nutrition, daily physical activity, and healthy sleeping habits are all factors that are responsible for the whole functioning, including physical, mental and emotional functioning of an individual.

CONCLUSION

On the basis of data analysis and findings, the researcher arrived at conclusion that proper nutrition, daily physical activity, and healthy sleeping habits significantly enhance cognitive performance. These findings bring into line with global evidence and highlight the need for integrated school-based interventions to promote these synergistic lifestyle

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factors for optimal academic success.

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