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Influence of Morningness Orientation in Cognitive Performance in School Girls (Age 11 To 14)

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Abstract

This study endeavors to investigate the impact of Morningness orientation on sleep behavior, cognitive performance, and mental health status among schoolgirls aged 11 to 14**.** The research emphasized the importance of understanding individual chronotypes for optimizing school activities and well-being. Data collection involved assessing various physical parameters and sleep-related aspects, such as sleep timing metrics, sleep duration, and mid-sleep time. The study also included the assessment of cognitive performance through the ruler drop test and letter cancellation. Additionally, the mental health status of the participants was evaluated by the DASS21 self-report questionnaire.The study found that variations in sleep duration significantly affect cognitive performance, with differences observed in the ruler drop test and errors and omissions in activities like letter cancellation throughout the day. Furthermore, distinct patterns of circadian typology showed how different chronotypes responded to changes in cognitive performance concerning mental health, specifically depression, anxiety, and stress levels. The study concluded that adapting schedule to match individual chronotypes can improve cognitive performance and build psychological resilience in children. Scheduling cognitive tasks considering natural alertness variations optimizes performance for different chronotypes.

Keywords: Sleep parameters, cognitive performance, chronotype, mental health.

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Introduction

A chronotype is all about when a person naturally feels most active and alert during the day. Whether it is in the morning, evening, or somewhere in between. This can be influenced by things like a person's genes and daily routines.

For school-going children, physiological and psychological health and well-being can be dependent on the individual's Morningness orientation and circadian typology (Asher and Sassone-Corsi, 2015). The integration of online activity into the lives of school-going children has had a noticeable impact on their sleep patterns. It is not uncommon to see some students pushed towards late bedtimes and wake-up times, causing a cascade of sleep-related challenges to emerge (Van den Bulck, 2010). The shifts in our circadian clock, which governs our sleep and wake cycle, became evident through a notably measurable rhythm. This internal timekeeper was vividly demonstrated in the experience we call 'jet lag.' (Zee and Goldstein, 2010). According to findings from a survey conducted by the American Cancer Society, data from 1960 indicates that the typical nightly sleep duration for many individuals fell within the range of 8 to 8.9 hours (Kripke, et al. 1979). So, sleeping time is an important role in throughout the life. .

The connection between sleep duration and cognitive performance is a fascinating narrative. It reveals that when individuals reduce their sleep, there is a noticeable decline in their cognitive abilities. It is like a temporary dimming of a bright star in the night sky. (Pilcher and Huffcutt, 1996). The burden of sleep debt on schoolchildren casts a shadow over their cognitive performance and behavior. It is akin to a fading spotlight, where

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attentiveness wanes, ruler drop tests reveal slower reactions, tasks like letter cancellation witness more omissions and errors, and the journey of learning becomes a bit more uphill (Beebe, Rose and Amin, 2010). Therefore, when it comes to school-going children, their cognitive abilities can be a crucial factor in determining the ideal duration of their necessary sleep.

The duration of sleep can potentially worsen the growing problem of obesity in adolescents and can also have a detrimental impact on their cognitive abilities. It is crucial to detect obesity at an early stage, as the patterns established during childhood tend to persist throughout life (Lifshitz, 2008). Undoubtedly, the association between inadequate sleep duration and obesity in school-age children has received considerable attention. Nevertheless, it is important to highlight a significant research gap in exploring the consequences of excessive sleep on both obesity and cognitive performance (Shaikh, Patel and Singh, 2009).

A cross-sectional study of rural school children aged 11 to 14, including girls, employed randomized participant selection to mitigate biases, purposefully excluding those with pathological conditions or congenital disorders. Additionally, those students with learning disabilities or visual impairments were unable to undergo cognitive ability testing and were thus excluded from the study to maintain the integrity of the research (Dutta et al., 2019). A straightforward questionnaire was created to collect self-reported sleep-related data, incorporating a standardized formula (Sleep Duration = Sleep-wake time – Sleep Onset time) to precisely calculate sleep duration by excluding the sleep

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latency period, ensuring accuracy in the study without relying solely on self-reported bedtime and wake time (Juda, Vetter and Roenneberg, 2013). Sleep debt was assessed by determining the difference between the daily average sleep requirement and the actual average sleep duration on weekdays (Kantermann, et al. 2007). Anthropometric measurements were carried out by the guidelines established by the International Biological Programme (IBP). Body weight was ascertained utilizing a precision-calibrated weighing machine, accurate to 0.1 kg, while individuals wore standardized clothing and were without shoes. Height measurements were acquired using an anthropometric rod, precise to 0.1 cm (Lipman, 2004). As a result, the Body Mass Index (BMI), a nutritional anthropometric index, was computed to enable further analysis. Both age and sex were considered when categorizing BMI, recognizing the distinct characteristics of this age group characterized by growth spurts (Keys, et al. 1972).

Cognitive function constitutes a broad domain encompassing a diverse array of intricate mental processes. These processes include attention, memory, perception, language comprehension, and decision-making, among others. They collectively shape daily experiences and interactions with the world. Delving into the complexities of cognitive function is crucial for gaining a deeper understanding of how the human mind works and how it influences behavior and thinking (Nouchi and Kaishima, 2014).

The Letter Cancellation Test evaluates cognitive functions, measuring sustained attention, vigilance, and intrinsic motivation as individuals visually scan a letter grid, eliminating specific targets (Sandson, Bachna and Morin, 2000). The Single Letter

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Cancellation Test is a simple and foundational approach used to evaluate cognitive abilities in children. This assessment entails providing children with a sheet of letters and assessing their ability to identify and mark specific target letters while disregarding irrelevant ones. It serves as a basic yet effective tool for appraising cognitive functioning in young individuals (Matier, Wolf and Halperin, 1994). Morning-oriented individuals (morning types) tend to experience fewer psychological and psychosomatic disturbances compared to evening-oriented individuals (evening types). This reflects the influence of chronotype on overall well-being (Mecacci and Rocchetti, 1998). Morning-oriented individuals, often referred to as "morning-types," are often associated with adopting healthier lifestyles compared to evening-oriented individuals, commonly known as "evening-types." This observation suggests a potential link between one's chronotype and their choices regarding health-related behaviors (Wittmann, Paulus and Roenneberg, 2010). Evening-oriented individuals (eveningness) are more likely to experience depression and seasonal affective disorders, suggesting a connection between chronotype and mood disorders (Schmidt & Randler, 2010). Adolescents who have later bedtimes tend to exhibit a correlation with higher levels of depression and an increased likelihood of experiencing suicidal thoughts. In contrast, morning-oriented individuals, known as "morning types," generally report higher overall life satisfaction (Smith & Johnson, 2008). Carried out with adolescents ranging from 10 to 20 years old, two studies delved into the correlation between morningness-eveningness and psychopathology, health-related factors, and overall well-being. The hypothesis posited that a preference for

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morningness is linked to elevated physical and mental well-being, as well as overall health in adolescents **(Randler, 2011).**

Methods

Study Population: This study was performed on 100 female students (12-14 years) from 'DDC girl's HS school,' Katwa, over 8 days, focusing on classes 6-8.

Assessment of Socio-Demographic Data: Data on height, weight, and age was collected through the utilization of surveys, censuses, and interviews.

Assessment of Physical Parameters: The assessment of body fat involved employing Bioelectrical Impedance Analysis, along with using calipers to measure skinfold thickness and a tape measure for vital contours.

Assessment of Morningness-Eveningness Orientation: The preferences of participants were determined using the Reduced Morningness-Eveningness Questionnaire, with higher scores indicating a morning preference.

Assessment of Sleep Quality and Quantity: The Munich Chronotype Questionnaire, incorporating polysomnography, actigraphy, and subjective assessments, was employed for the evaluation of participants' sleep patterns and chronotypes.

Assessment of Cognitive Performance: The study investigated the link between chronotype and cognitive performance using the Ruler Drop Test and explored cognitive abilities in morning, intermediate, and evening chronotypes through letter cancellation tasks.

Assessment of Mental Health Status: DASS21 was utilized for assessing the mental health of school-going children (11-14 years), incorporating sample selection, informed consent, and self-report questionnaires in the study.

Statistical Analysis: ANOVA was employed for goal setting, data collection, hypotheses, F-statistic, and p-value determination, while correlation analysis was applied for numeric data, hypotheses, correlation coefficient calculation, and interpretation, with the choice dependent on research focus and data characteristics.

Results:

After analyzing the data given by the school-going-children on their daily lifestyle and health well-being of the students was being understood somehow to a standard level. The results are being represented this way-

Table 1: Description of the general information of the female school-going-children expressed as mean ±SD and percentage.

General information of the school-going-children(N=100)			
VARIABLES	**MEAN(SD)**		
	MORNING TYPE	**INTERMEDIATE TYPE**	**EVENING TYPE**
	(N1=45)	**(N2=50)**	**(N3=5)**
AGE (years)	12.78±1.17	12.74±1.00	13.00±0.89
HEIGHT (cm)	151.60±4.82	151.64±3.97	152.60±2.94
WEIGHT (m)	44.36±10.01	44.21±8.70	43.84±7.22

Data was represented as mean ±SD or percentage as where applicable

General information (age, height, weight) of the female school-going children (11-14 years) was shown in **Table 1.**

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Table 2: Analysis of the body fat percentage of the school-going-children expressed as mean ±SD and percentage.

VARIABLES	MEAN(SD)			F-VALUE	P-VALUE	SIGNIFICANCE/ NOT
	Group-A (MT)	Group-B (IT)	Group-C (ET)			
	(n=45)	(n=50)	(n=5)			
BMI	19.43±3.63	19.59±3.82	18.74±2.99	0.09	0.91	NS
BSA	1.37±0.16	1.37±0.14	1.36±0.12	0.00	1.00	NS
PI	0.01±0.00	0.01±0.00	0.01±0.00	0.05	0.95	NS
BODY FAT %	22.60±4.16	23.20±4.22	20.40±3.14	0.73	0.49	NS
SUBCUTANEOUS FAT %						
WHOLE BODY	19.78±4.52	19.90±4.52	19.18±3.87	0.04	0.96	NS
TRUNK	15.34±4.82	16.07±5.11	14.86±3.79	0.47	0.63	NS
ARM	34.36±5.55	34.74±5.73	34.90±4.03	0.09	0.91	NS
LEG	31.90±6.28	32.34±6.63	31.76±4.88	0.07	0.93	NS
SKELETAL FAT %						
WHOLE BODY	28.27±2.21	27.65±2.57	28.10±1.63	0.63	0.54	NS
TRUNK	24.04±2.50	23.48±2.62	24.06±1.99	0.07	0.94	NS
ARM	32.87±4.88	33.24±4.15	33.58±3.16	0.05	0.95	NS
LEG	39.57±3.25	38.72±3.45	38.94±1.30	0.34	0.72	NS
MUAC	11.85±2.14	11.42±1.87	11.20±1.17	0.32	0.73	NS
CC	13.60±2.47	13.22±2.11	13.00±1.10	0.15	0.86	NS

Data was represented as mean ±SD or percentage as where applicable

MT = Morning Type
IT = Intermediate Type
ET = Evening Type
S = Significant
NS = Not Significant
mt = Morning Time
it = Intermediate Time
et = Evening Time

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In **Table 2**, The presentation depicted the percentage distribution of body fat among school-going children. Included were the average scores and standard deviations (SD) for BMI, BSA, PI, body fat percentage, subcutaneous fat percentage for the overall body, trunk, arms, and legs, as well as skeletal fat percentage for the overall body, trunk, arms, and legs. Additionally, mid-upper arm circumference and calf circumference data were provided for school-going children.

Table 3: Analysis of the sleep time of the school-going-children expressed as mean ±SD and percentage.

VARIABLES	MEAN(SD)			VALUE	VALUE	SIGNIFICANCE LEVEL
	Group-A(MT)	Group-B(IT)	Group-C(ET)			
	(n=45)	(n=50)	(n=5)			
SLEEP LATENCY						
SCHOOL DAYS	00:10:20±00:06:27	00:14:30±00:09:07	00:15:00±00:07:04	3.91	0.02	S
FREE DAYS	00:10:40±00:07:02	00:07:02±00:10:02	00:19:00±00:05:50	3.89	0.02	S
SLEEP INERTIA						
SCHOOL DAYS	00:10:40±00:07:43	00:13:54±00:09:11	00:10:00±00:06:19	3.18	0.04	S
FREE DAYS	00:11:33±00:06:44	00:15:42±00:09:23	00:12:00±00:05:06	3.10	0.04	S
SLEEP DURATION						
SCHOOL DAYS	06:38:00±01:25:18	06:53:12±01:11:16	06:26:00±00:55:54	0.46	0.62	NS
FREE DAYS	08:01:50±03:09:48	07:40:00±01:13:32	07:46:00±01:11:10	0.46	0.62	NS
SLEEP ONSET						
SCHOOL DAYS	15:41:07±10:37:46	13:43:24±11:07:58	05:26:00±08:45:08	2.05	0.13	NS
FREE DAYS	11:00:23±11:00:23	09:48:12±11:00:23	09:50:00±11:09:45	0.46	0.62	NS
SLEEP OFFSET						
SCHOOL DAYS	06:19:07±00:58:07	06:41:24±01:02:03	07:04:00±01:05:18	2.25	0.11	NS
FREE DAYS	07:12:18±01:44:30	07:52:12±01:28:45	08:00:00±01:47:20	2.11	0.12	NS
MID SLEEP TIME						
SCHOOL DAY	19:00:07±10:52:20	17:10:00±11:17:37	08:39:00±08:39:03	2.00	0.14	NS
FREE DAY	15:35:23±11:15:09	13:38:12±11:04:06	13:43:00±10:39:08	0.37	0.69	NS

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In **Table 3,** chronotype-wise average score and standard deviation of sleep latency, sleep onset, sleep offset, sleep inertia, sleep duration, mid sleep time of school-going children were shown.

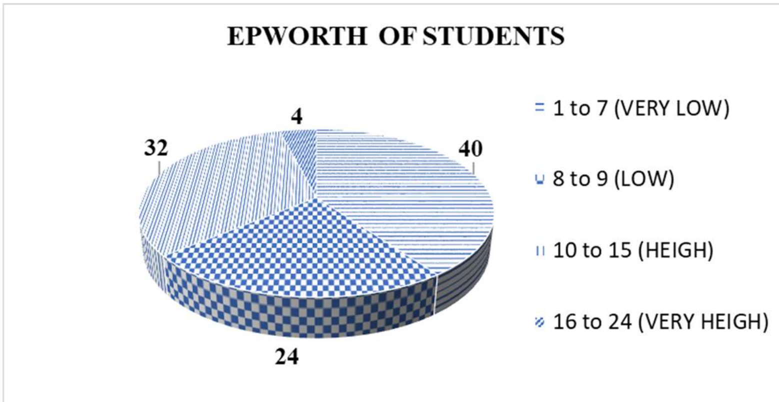

Figure 1: Graphical representation of Epworth score of students

In **Figure 1** Epworth score distribution of school-going-children was shown. Here, 40 students had very low scores, 24 students had low scores, 32 students were high, and 4 students were very high Epworth scores in 100 school-going children.

Table 4: Analysis of the type basis ruler drop test of the school-going-children expressed as mean ±SD and percentage.

Ruler Drop Test (Reaction Time)						
	Group-1	**Group-2**	**Group-3**	**F-VALUE**	**P-VALUE**	**SIGNIFICANCE LEVEL**
	First hr(N1=45)	**Mid hr(N2=50)**	**Last hr(N3=5)**			
MT	0.20±0.05	0.21±0.04	0.22±0.04	1.87	0.22	NOT SIGNIFICANT
IT	0.21±0.03	0.21±0.03	0.21±0.03	0.07	0.92	NOT SIGNIFICANT
ET	0.21±0.01	0.19±0.01	0.17±0.02	10.59	0.002	SIGNIFICANT

Data was represented as mean ±SD or percentage as where applicable

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Type-wise (morning type, intermediate type, evening type) cognitive performance was represented, and their significance level by mean and SD in **Table 4**.

Table 5: Analysis of letter cancellation- no. of omission on school-going-children expressed as mean ±SD and percentage.

LETTER CANCELLATION- NO. OF OMISSION						
	Group-1 (N1=45)mt	Group-2 (N2=50)it	Group-3 (N3=5)	F-VALUE	P-VALUE	SIGNIFICANCE LEVEL
MT	0.36±0.64	0.40±0.77	0.38±0.74	0.042	0.958	NS
IT	0.78±1.24	0.14±0.40	0.28±0.60	7.528	0.0007	S
ET	1.40±1.20	0.40±0.80	0.20±0.40	2.214	0.151	NS

Data was represented as mean ±SD or percentage as where applicable

Chronotype-wise (morning type, intermediate type, evening type) cognitive performance by number of omissions of letter cancellation was represented, and their significance level by mean and SD in **Table-5**.

Table 6: Analysis of letter cancellation- no. of error on school-going-children expressed as mean ±SD and percentage.

LETTER CANCELLATION- NO. OF ERROR						
	Group-1 (N1=45)mt	Group-2 (N2=50)it	Group-3 (N3=5)	F-VALUE	P-VALUE	SIGNIFICANCE LEVEL
MT	0.33±0.70	0.31±0.69	0.62±1.14	1.7504	0.1777	NS
IT	0.52±0.90	0.24±0.51	0.78±1.03	5.0485	0.0075	S
ET	0.40±0.49	0.40±0.49	0.60±0.80	0.1052	0.9009	NS

Data was represented as mean ±SD or percentage as where applicable

Chronotype-wise (morning type, intermediate type, evening type) cognitive performance by the number of errors of letter cancellation was represented, and their significance level by mean and SD in **Table-6**.

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Table 7: Analysis of DASS21 of school-going-children expressed as mean ±SD and percentage.

Depression, Anxiety, Stress Scale(DASS21)						
VARIABLES	MEAN(SD)			F-VALUE	P-VALUE	SIGNIFICANCE LEVEL
	Group-A (MT)	Group-B (IT)	Group-C (ET)			
	(N1=45)	(N2=50)	(N3=5)			
DEPRESSION	3.02±3.26	4.32±3.59	5.40±6.62	1.4874	0.2312	NS
ANXIETY	2.96±2.97	4.16±3.80	5.00±6.13	1.6837	0.1912	NS
STRESS	3.56±2.98	6.72±3.97	6.00±2.00	8.5096	0.0004	S

Data was represented as mean ±SD or percentage as where applicable

Chronotype-wise (morning type, intermediate type, evening type) total scores of depression, anxiety, and stress were represented, and their significance level by mean and SD in **Table 7.**

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Table 8: Analysis of correlation regarding sleep behavior

CORRELATION REGARDING SLEEP BEHAVIOR				
PARAMETERS	**DAYS**	**CORRELATION VALUE**	**t-VALUE**	**REMARKS**
MEQ VS EWS		-0.17	-0.97	NEGATIVELY CORRELATED NOT SIGNIFICANT
MEQ VS SL	SCHOOL DAYS	-0.22	-2.13	NEGATIVELY CORRELATED SIGNIFICANT
	FREE DAYS	-0.26	-2.03	NEGATIVELY CORRELATED SIGNIFICANT
MEQ VS S-ON	SCHOOL DAYS	-0.14	2.38	NEGATIVELY CORRELATED SIGNIFICANT
	FREE DAYS	0.19	1.91	POSITIVELY CORRELATED NOT SIGNIFICANT
MEQ VS S-OFF	SCHOOL DAYS	-0.23	-2.35	NEGATIVELY CORRELATED SIGNIFICANT
	FREE DAYS	-0.34	-3.56	NEGATIVELY CORRELATED SIGNIFICANT
MEQ VS SD	SCHOOL DAYS	0	-0.01	POSITIVELY CORRELATED NOT SIGNIFICANT
	FREE DAYS	0.09	0.91	POSITIVELY CORRELATED NOT SIGNIFICANT
MEQ VS SI	SCHOOL DAYS	-0.21	-2.11	NEGATIVELY CORRELATED SIGNIFICANT
	FREE DAYS	-0.25	-2.57	NEGATIVELY CORRELATED SIGNIFICANT
MEQ VS MST	SCHOOL DAYS	0.23	2.34	POSITIVELY CORRELATED SIGNIFICANT
	FREE DAYS	0.2	2	POSITIVELY CORRELATED SIGNIFICANT

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In **Table 8** the study brings attention to significant findings in sleep behavior, revealing statistically noteworthy results, including a negative correlation between the Epworth sleep score and chronotype ($p < 0.05$). Additionally, a positive correlation was identified between sleep duration and chronotype ($p < 0.05$)

Table 9: Analysis of the correlation between cognitive performance and mental health

CORRELATION REGARDING COGNITIVE PERFORMANCE			
PARAMETERS	**CORRELATION VALUE**	**t-VALUE**	**REMARKS**
MEQ VS RDT	0.02	0.17	POSITIVELY CORRELATED NOT SIGNIFICANT
MEQ VS LC-NO. OF OMISSION	-0.09	-0.93	NEGATIVELY CORRELATED NOT SIGNIFICANT
MEQ VS LC- NO. OF ERROR	-0.10	-0.97	NEGATIVELY CORRELATED NOT SIGNIFICANT
MEQ VS DASS21	-0.28	-2.89	NEGATIVELY CORRELATED SIGNIFICANT

Table 9 underscores noteworthy discoveries concerning cognitive performance and mental health, revealing statistically significant outcomes, including a negative correlation between stress level and chronotype ($p < 0.05$). Moreover, a positive correlation was observed between the ruler drop test and chronotype ($p < 0.05$).

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Discussion

This research project was focused on assessing the overall health of students, which includes their general well-being, sleep patterns, and chronotypes, alongside an investigation into their mental health status. The objective was to uncover potential connections between chronotypes, sleep habits, and mental health. Additionally, the study aims to understand how cognitive performance changes at different times of the day and whether it is linked to students' chronotypes. Ultimately, the research aims to propose sustainable ergonomic solutions and practices tailored to benefit students' well-being and academic performance uniquely. The analysis of the results is described below-

In this study, we collected data on a group of school-going children aged 11 to 14 years. These students were categorized into three chronotype groups: 45 students identified as morning types, 50 as intermediate, and 5 as evening types, making up a total of 100 students in my sample. We also gathered information regarding the age, height, and weight of female school-going children, which was presented in **Table 1**.

Table 2 provides information on the distribution of body fat percentages among the school-going children in our study. It also includes the average values and standard deviations (SD) for several health measurements, including BMI, BSA, PI, body fat percentage, subcutaneous fat percentage for different body regions (whole body, trunk, arms, legs), and skeletal fat percentage for various body parts (whole body, trunk, arms,

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legs). Additionally, we collected data on mid-upper arm circumference and calf circumference. It was important to note that due to the limitations imposed by the fixed school and sleep schedules, we were unable to conduct a statistically significant analysis of the data presented in this table.

Table 3 presents a comprehensive examination of the connection between chronotypes and critical sleep parameters in school-going children, encompassing sleep latency, sleep onset, sleep offset, mid-sleep time, sleep inertia, and sleep duration. The provided averages and standard deviations offer crucial insights into the sleep patterns observed across various chronotypes. This data can shed light on whether certain chronotypes experience difficulties in initiating sleep or encounter heightened grogginess upon awakening, offering essential information for educators and parents seeking to optimize school schedules and daily routines. Additionally, it underscores disparities in sleep duration, sleep timing, and mid-sleep times among morning-type students, intermediate types, and evening-type students, enabling the development of tailored strategies to cater to the distinct sleep requirements of each group. Ultimately, this approach aims to enhance academic performance.

In **Figure 1**, which showcases the distribution of Epworth scores among 100 school-going children, a notable observation emerges: a significant proportion of these students report varying degrees of daytime sleepiness. Specifically, 60 out of 100 students exhibit different levels of sleepiness, with 32 falling into the categories of "high" or "very high" scores. This finding highlights the prevalence of sleep-related issues within this student

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population, potentially impacting their academic performance and overall well-being. To address this concern, it becomes imperative to identify the root causes of daytime sleepiness, implement targeted interventions like sleep education programs, and carefully consider potential adjustments to school policies to foster healthier sleep habits among these students.

The data in **Table-4**, provide valuable insights into school-going children's cognitive performance, considering their chronotype (morning, intermediate, evening type) and the time of testing (first hour, mid-hour, last hour). Table 4 suggests differences in cognitive performance among the chronotypes. However, it was essential to subject these differences to rigorous statistical analysis to determine their significance.

Tables 5 and 6 examine cognitive performance in school-going children categorized by their chronotype (morning, intermediate, evening type) based on omissions and errors in letter cancellation tasks. While **Table 5** highlights potential differences in omissions, **Table 6** delves into errors. However, statistical analysis, like ANOVA or t-tests, was needed to confirm the significance of these variations. Finally, these underscore the importance of considering individual chronotypes in education to enhance cognitive performance and learning outcomes.

Table 7 provides insights into the total scores of depression, anxiety, and stress among school-going children categorized by their chronotype (morning type, intermediate type, evening type). **Table 7** presents mean and standard deviation values, offering an initial glimpse into score variations. However, rigorous statistical analyses, such as ANOVA or

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t-tests, are necessary to determine the statistical significance of these differences.

In the study **Table-8** and **Table- 9** conducted correlation analyses to examine the relationships between chronotype and various sleep-related factors in school-going children. Significantly, an observed negative correlation emerged between chronotype and daytime doziness, with a correlation coefficient of -0.17, suggesting that students with different chronotypes exhibited varying levels of daytime sleepiness. Additionally, there were negative correlations between chronotype and sleep latency on both school days (r=-0.22) and free days (r=-0.26), indicating that students' chronotypes influenced the time it took to fall asleep.

Sleep onset patterns differed: a negative correlation emerged on school days (r=-0.14), implying morning types slept earlier during the school week, whereas a positive correlation appeared on free days (r=0.19), indicating that evening types tended to stay up later on weekends. There were also negative correlations between chronotype and sleep offset on both school days (r=-0.23) and free days (r=-0.34), suggesting that students with later chronotypes tended to wake up later.

The research identified a positive but weak correlation between chronotype and sleep duration, with correlation coefficients of 0 on school days and 0.09 on free days, suggesting that chronotype had limited influence on overall sleep length. Furthermore, negative correlations were observed between chronotype and sleep inertia on both school days (r=-0.21) and free days (r=-0.25), indicating that morning types experienced reduced sleep inertia.

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Finally, a positive correlation was identified between chronotype and mid-sleep time on both school days (r=0.23) and free days (r=0.2), indicating that students with later chronotypes tended to have later mid-sleep times. These findings collectively underscore the intricate connections between chronotype and various sleep parameters among school-going children, emphasizing the importance of considering individual circadian preferences when assessing sleep-related factors in this demographic.

The study conducted various correlation analyses to explore the relationships between chronotype and cognitive and emotional aspects in school-going children. An observed positive correlation of 0.02 indicated that there is a connection between evening chronotype and poorer cognitive performance, as measured by the ruler drop test. Conversely, negative correlations were found between chronotype and the number of omissions (r=-0.09) as well as the number of errors (r=-0.10) in the letter cancellation task, suggesting that individuals with evening chronotypes were prone to more omissions and errors. Furthermore, a negative correlation (r=-0.28) was established between the chronotype and the DASS21 score, indicating that evening chronotypes were associated with higher levels of depression, anxiety, and stress. These findings emphasize the intricate interplay between chronotype, cognitive abilities, and emotional well-being among school-going children, highlighting the importance of tailored support and interventions to address individual circadian preferences and their potential impact on academic and emotional outcomes.

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