HYGIENIC ASSESSMENT OF THE MEDICAL STUDENTS' MENTAL PERFORMANCE IN RELATION TO CLASS TIME AND DRINKING REGIME

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Today, the issue of preservation, maintenance and development of mental performance is of great importance due to social transformation and the school and higher education system upgrade. The growing body of information, continuous modernization of the training programmes, the use of various technical training aids that result in intensification of cognitive activity have a negative impact on the students' mental state. The study was aimed to assess the medical students' mental performance indicators in relation to the time of the day and the daily fluid intake. A total of 300 students were enrolled, who had both morning and afternoon (after lunch) classes. Mental performance of medical students was assessed using the Anfimov's table. It was found that the students' mental performance depended not only on the start time, but also on the water consumption regime. The main trends of water consumption in young adults were defined: moderate water consumption (1–2 L per day) prevailed, low water consumption (less than 1 L per day) was ranked second, and high water consumption (more than 2 L per day) was the rearest.

Keywords: mental performance, correction test, class time, youth, medical school, university medicine

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Compliance with ethical standards: the study was approved by the Ethics Committee of the Altai State Medical University (protocol № 13 of 20 February 2022). All students submitted the informed consent to study participation.

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ГИГИЕНИЧЕСКАЯ ОЦЕНКА УМСТВЕННОЙ РАБОТОСПОСОБНОСТИ СТУДЕНТОВ МЕДИЦИНСКОГО ВУЗА В ЗАВИСИМОСТИ ОТ ВРЕМЕНИ ЗАНЯТИЙ И ПИТЬЕВОГО РЕЖИМА

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Проблема сохранения, поддержания и развития умственной работоспособности в настоящее время приобретает большое значение в связи с социальными преобразованиями и обновлением системы школьного и высшего образования. Возрастающий объем информации, постоянная модернизация учебных программ, привлечение разнообразных технических средств обучения, влекущие интенсификацию умственной деятельности, — все это отрицательно влияет на нервно-психическое состояние учащихся. Целью настоящего исследования было оценить состояние показателей умственной работоспособности студентов медицинского вуза в зависимости от времени суток и среднесуточного количества потребляемой жидкости. В исследовании приняли участие 300 студентов, занятия у которых проходили как в первой, так и во второй половине дня (после обеда). Оценку умственной работоспособности студентов медицинского университета проводили с использованием таблицы Анфимова. Установлено, что показатели умственной работоспособности студентов зависят не только от времени проведения занятия, но и от режима водопотребления. Определены основные тенденции водопотребления среди молодежи: преобладает умеренное водопотребление (1–2 л в сутки), на втором месте пониженное водопотребление (менее 1 л в сутки), реже всего повышенное водопотребление (более 2 л в сутки).

Ключевые слова: умственная работоспособность, корректурная проба, время занятия, молодежь, медицинский вуз, университетская медицина

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Today, the issue of preservation, maintenance and development of mental performance is of great importance due to social transformation and the school and higher education system upgrade [1, 2, 4]. The growing body of information, continuous modernization of the training programmes, the use of various technical training aids that result in intensification of cognitive activity have a negative impact on the students' mental state [1–5].

Currently, high-level skills and abilities, psychoemotional criteria (perception, attention, etc.), and psychophysiological features form the basis of effective performance [6–9].

The papers [10–17] show that the calcium and magnesium deficiency and imbalance against the background of the increased concentrations of manganese, iron, and silicon in drinking tap water are the risk factors of the mental performance decline in adolescents.

To maintain high performance, students should adhere to the work and rest regime, make breaks, do exercises [18, 19]. There are a lot of theories about what should be the load. However, it should be noted that the load should be calculated individually for each age group taking into account the students' abilities and the training course [20–23]. Medical education has a number of key features, that is why the guidelines for medical students should be different from that for students educated in other areas [24–26]. This is due to the fact that educational process in medical schools is different from that in other higher educational institutions: medical students have a higher level

of responsibility, deal with the larger amount of material to be learned, etc. All the above result in the need to study the medical students' performance.

The study was aimed to assess the medical students' mental performance indicators in relation to the time of the day and the daily fluid intake.

METHODS

Mental performance of students of the medical university was assessed using the Anfimov's table. A total of 300 adult second-year students of the Institute of Clinical Medicine and the Institute of Public Health and Preventive Medicine, Altai State Medical University, were enrolled. Among them there were 247 females and 53 males aged 18–31. The study was performed in spring (March–April 2022). The students, who had morning and afternoon classes, were divided into three groups: group 1 — engaged from 08:00 (n = 143), group 2 — engaged from 14:00 (n = 88), group 3 — engaged from 16:20 (n = 69) local time (UTC+7). The differences in the following indicators were assessed: the total number of symbols viewed, the total number of mistakes, the average speed of perception/processing of visual information (bit/s). Incomplete tables, the tables containing arithmetic errors or completed using the wrong method were excluded.

The students reported their gender, age, and average fluid intake before the correction test when filling in the questionnaire with the following response options: “less than 1 L per day”, “1–2 L per day”, “more than 2 L per day”.

Statistical data processing was performed using the SPSS STATISTICS 19 software package (IBM; USA). The distribution of variables was assessed using the Shapiro–Wilk test and the Kolmogorov–Smirnov test. The quantitative data were presented as median (Me) and the first and third quartiles [Q1; Q3], while the qualitative data were presented as the share and the 95% confidence interval calculated using the modified Wald method and compared using the Pearson's chi-squared test (χ^2). Multiple intergroup comparisons of the mental performance indicators were performed using the Kruskal–Wallis H test, and the differences between the median values of two groups were tested using the Mann–Whitney U test. The differences were considered significant at p = 0.017.

RESULTS

In the first phase of the study we assessed the differences between the mental performance indicators in the studied groups in relation to the start times for the university. Preliminary assessment of the data distribution showed that the distribution of most variables was non-normal (Shapiro–Wilk test and Kolmogorov–Smirnov test, $p < 0.05$) or the requirement of equal variances was not met when performing intergroup comparison, that is why nonparametric statistics was used.

In group 1, the total number of mistakes was 0–7 (Me = 3), furthermore, the results of 50% of subjects ranged between 2 and 5 mistakes. In group 2, the total number of mistakes varied between 0–6 (Me = 3) and the 25th and 75th percentiles corresponded to 2 and 5 mistakes. In group 3, the total number of mistakes was between 1–7 (Me = 4) and the 25th and 75th percentiles corresponded to 2 and 5 mistakes. Since H (Kruskal–Wallis test) appeared to be less than 0.001, thus confirming the differences in the total number of mistakes, the pairwise comparison was further performed using the Mann–Whitney U test and taking into account the new significance level (p = 0.017).

The results of intergroup comparison showed that there were differences in the total number of symbols viewed between groups 1 and 2 (U = 9012.5, Z = –0.363, p = 0.717), however, the total number of mistakes in group 1 was significantly lower than that in group 3 (U = 3126, Z = –3.912, $p < 0.001$). There were similar differences between groups 2 and 3 (U = 1654, Z = –3.72, $p < 0.001$), in which stidents, who started studying at 16:20, made more mistakes than their colleagues, who started studying at 14:00.

The pairwise comparison using the Mann–Whitney U test taking into account the new significance level (p = 0.017) showed that there were no differences in the average speed of perception/processing of visual information between groups 1 and 2 (U = 9206, Z = –0.066, p = 0.947). However, there were significant differences between groups 1 and 3 (U = 56, Z = –10.885, $p < 0.001$) and groups 2 and 3 (U = 35.5, Z = –9.716, $p < 0.001$): students, who started studying at 16:20, showed lower average speed of perception/processing of visual information.

In the next phase, all the study participants were divided into groups based on both start times and water consumption (according to the questionnaire survey results).

In group 1, 30 individuals consumed less than 1 L per day (21%; 95% CI: 15.1–28.4), 97 individuals consumed 1–2 L per day (67.8%; 95% CI: 59.8–75.0), while the number of individuals consuming more than 2 L per day was 16 (11.2%; 95% CI: 6.9–17.5). In group 2, 16 individuals consumed less than 1 L per day (18.2%; 95% CI: 11.4–27.6), 97 individuals consumed 1–2 L per day (69.3%; 95% CI: 59.0–79.0), and the number of individuals consuming more than 2 L per day was 11 (12.5%; 95% CI: 7.0–21.2). In group 3, 14 individuals consumed less than 1 L per day (20.3%; 95% CI: 12.4–31.4), 47 individuals consumed 1–2 L per day (68.1%; 95% CI: 56.4–77.0), and the number of those consuming more than 2 L per day was 8 (11.6%; 95% CI: 5.7–21.5). The intergroup comparison of proportions using the Pearson's chi-squared test (χ^2 = 0.316; p = 0.989) showed that there were no differences in water consumption, and moderate water consumption generally prevailed.

In the subsequent phase, the pairwise comparison of the mental performance and water consumption indicators in different groups was performed. We managed to reveal the following differences: the total number of symbols viewed was significantly higher in group 1 than in groups 2 and 3 among individuals, who consumed 1–2 L or more than 2 L per day. There were no differences between individuals, who consumed less than 1 L per day, which could be due to developing dehydration by lunch time and could require correction. Since there are no differences between groups 2 and 3, we can speak about the continuous trend towards dehydration by the evening time that remains almost unchanged even after the meal, which could be due to drinking sweet carbonated drinks, tea, and coffee that fail to fully compensate the body fluid loss. Perhaps, the relationships between other indicators are more complex and require building a larger sample taking into account individual characteristics of the body and the drinking water microelement composition.

DISCUSSION

It should be noted that today assessment of the medical students' performance requires extra hygienic research, since the results provided show performance estimates for only a part of students. Further research focused on investigation and hygienic assessment of water consumption and performance of undergraduate/graduate students and students with

intermediary classes is required. The issue of the dynamic changes in mental performance of students in part-time and extramural courses seems to be poorly understood. According to the literature data, the preformance estimate is an important indicator allowing one to assess the student's overall physical and psychoemotional well-being [7, 8].

Estimation of a set of indicators in the specialists of the highest qualification category, postgraduate and doctoral students, is also of certain interest. According to the official statistics, each year only about 10–12% of specialists complete their educational programmes with the candidate's or doctor's dissertation defense. This negatively affects the scientific efficiency of the provider institutions. It seems to be important to establish the patterns of changes in the indicators of both mental and physical performance in the specified groups, establish possible relationships between irrational time allocation in learning and mental fatigue. Preventive correction of mental fatigue will make it possible to improve the rate of dissertation defense and preserve high motivation for resuming the scientific and pedagogical activities in valuable professionals.

As for estimation of the relationships between the indicators of mental performance and water consumption based on the data obtained and the literature data, it seems relevant to form, as far as possible, homogeneous samples to study imbalance of calcium and magnesium in drinking water, iodine and selenium deficiency, and adverse effects of contamination with heavy metals and organochlorine compounds.

CONCLUSIONS

It has been found that the students' mental performance depends not only on the class time, but also on the water consumption regime. The main trends of water consumption observed in youth have been defined: moderate water consumption (1–2 L per day) prevail, low water consumption (less than 1 L per day) is ranked second, and high water consumption (more than 2 L per day) is the rearest. Evening classes in combination with dehydration contribute to the general decline in mental performance. Further studies of the dynamic changes in performance of young adults and the combined effects of such factors, as individual features of circadian rhythms, microelement imbalance or deficiency in the body, and psychoemotional background, seem to be promising.

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