DOI: https://doi.org/10.4038/seajme.v19i2.675

Original Research Paper

Influence of Hydration on Mood and Cognition: A Cross-Sectional Study in MBBS Students and Interns

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Abstract

Introduction: Adequate hydration is essential for optimal brain function and emotional regulation. In medical education, where sustained attention, decision-making, and emotional resilience are critical, the impact of hydration on cognitive performance and mood remains underexplored. This study aimed to evaluate the relationship between hydration status, cognitive performance, and mood among MBBS students and medical interns.

Methods: A cross-sectional study was conducted among 320 participants (MBBS students and medical interns). Hydration was assessed using self-reported daily water intake and biochemical markers—serum urea and blood urea nitrogen (BUN). Mood was evaluated using the Hamilton Depression Rating Scale (HDRS), and cognitive flexibility was measured with the Stroop Colour and Word Test. Data were analysed using ANOVA for group comparisons and Pearson's correlation for associations between hydration, mood, and cognition.

Results: Interns, particularly those in intensive care unit (ICU) postings, recorded significantly higher HDRS scores (mean: 15.3±3.2) compared to MBBS students (mean: 9.1±2.8; p=0.0051). ICU interns also made more Stroop errors (mean: 7.4±1.9), although the difference across groups was not statistically significant (p=0.6062). Serum urea and BUN levels were higher in interns but not significantly different between groups. Among interns, BUN was moderately correlated with HDRS (r=–0.452, p=0.0027) and Stroop errors (r=0.358, p=0.0200), indicating that hydration status was linked to both mood disturbance and cognitive errors.

Conclusion: Dehydration may contribute to poorer mood and increased cognitive errors, especially among medical interns in high-stress clinical settings. Interventions promoting adequate hydration, alongside broader wellness strategies, could support cognitive efficiency and emotional well-being.

Keywords: Hydration, Cognitive Function, Mood, Medical Education, Depression, Stroop Test, MBBS Students, Interns

Introduction

Water is the most essential nutrient for human survival and optimal physiological functioning. Hydration is vital not only for cellular metabolism and thermoregulation but also for maintaining cognitive functions and psychological wellbeing. In a country like India, where climatic conditions often expose individuals to high temperatures and humidity, maintaining adequate hydration becomes especially critical—particularly for those facing both physical and mental stress, such as medical students and healthcare interns. (Popkin *et al.,* 2010).

Numerous studies have highlighted the impact of hydration on cognitive domains such as

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attention, memory, and executive functioning. Even mild dehydration (1–2% loss of body water) has been shown to result in measurable cognitive impairments and mood disturbances. (Ganio *et al.,* 2011). Rehydration improved performance, with a 1000 mL water intake showing the most beneficial effect (Zhang *et al.,* 2021). Despite this, hydration habits and their psychological implications within the Indian medical student and intern population are seldom studied.

This study aims to explore the relationship between hydration status, cognitive flexibility, and mood using both subjective (questionnaires) and objective (biochemical markers) measures, within the context of medical training. Understanding the role of hydration is essential for informing academic performance, mental resilience, and overall readiness in medical trainees.

Methods

This comparative cross-sectional study was conducted within the academic framework of undergraduate and internship training in a government medical college setting, involving 320 participants:160 MBBS students and 160 interns (subdivided into general ward and ICU postings) at Guntur Medical College, Andhra Pradesh.

Inclusion criteria

- Voluntary participation with informed consent.
- No history of psychiatric illness, metabolic disorders, or medication affecting hydration or cognition.

Assessment tools

Hydration Status: Assessed using a structured questionnaire, which recorded participants water intake over a seven-day period. The questionnaire included all relevant items necessary to evaluate hydration habits comprehensively.

Mood: Assessed using the Hamilton Depression Rating Scale (HDRS). The HDRS (or HAM-D), developed by Max Hamilton in 1960, is a widely accepted clinician-administered tool for assessing the severity of depression in adults. The 17-item version (HDRS-17) was used, evaluating domains such as mood, sleep disturbances, physical symptoms, and anxiety.

Scoring categories:

- 0–7: Normal
- 8–13: Mild Depression
- 14–18: Moderate Depression
- 19–22: Severe Depression
- ≥23: Very Severe Depression

The HDRS has been previously validated within the Indian context (Avasthi *et al.,* 2005).

Cognition: Assessed using the Stroop Test. The Stroop Colour and Word Test, originally devised by J.R. Stroop in 1935, evaluate executive functions, particularly selective attention and cognitive control. Participants were instructed to state the colour of the ink used to print words denoting different colour names, which required them to suppress their automatic reading response. Two outcome variables were recorded:

- Time taken to complete the task
- Number of errors (Stroop mistakes)

The Stroop test has been previously utilised in Indian research to evaluate cognitive performance under stress (Saxena *et al.,* 2013).

Demographic and Anthropometric Data

- Basic demographic data, including height, weight, and gender, were collected using standardised tools.
- Body Mass Index (BMI) was computed, although it was not included in the primary statistical analysis.

Statistical Analysis

Data were entered in Microsoft Excel and analysed using SPSS version 25.0. Descriptive statistics (means and standard deviations) were calculated. Analysis of

Variance (ANOVA) was employed to compare HDRS scores, Stroop errors, serum urea, and BUN levels among the groups. Pearson's correlation coefficient was used to assess relationships between hydration indicators (urea, BUN) and HDRS scores (depression levels), and Stroop test results (cognitive performance). A p-value less than 0.05 was considered statistically significant

Results

Table 1 includes a concise description of participant characteristics across groups, noting higher HDRS scores among interns—particularly those in ICU postings—along with generally low Stroop error rates and relatively higher serum urea and BUN levels in interns compared to MBBS students.

Figure 1 displays the mean HDRS Scores across six participant subgroups. ICU male interns recorded the highest levels of depressive symptoms, followed by ICU females. This reflects the heightened psychological burden experienced in high stress clinical environments.

Table 1: Descriptive Statistics by Group and Gender

Group	Gender	Height (cm)	Weight (kg)	HDRS	Stroop Mistakes	Urea (mg/dL)	BUN (mg/dL)
MBBS Students	Female	159.36±7.09	60.93±11.51	4.23±2.84	0.67±0.90	24.59±12.99	11.46±6.08
	Male	168.93±7.16	68.14±12.06	3.14±4.69	1.00±1.04	22.57±7.24	10.55±3.38
Interns - General	Female	159.93±4.29	62.21±11.96	3.71±3.02	0.83±1.07	26.48±8.33	12.44±3.90
	Male	172.83±7.42	77.42±10.80	3.42±3.00	0.82±1.25	24.36±7.31	11.38±3.42
Interns - ICU	Female	161.00±6.04	64.00±11.31	5.60±2.19	0.60±1.34	18.80±1.92	8.40±0.99
	Male	168.00±8.00	71.00±10.86	8.67±4.76	0.25±0.50	18.25±2.63	8.52±1.23

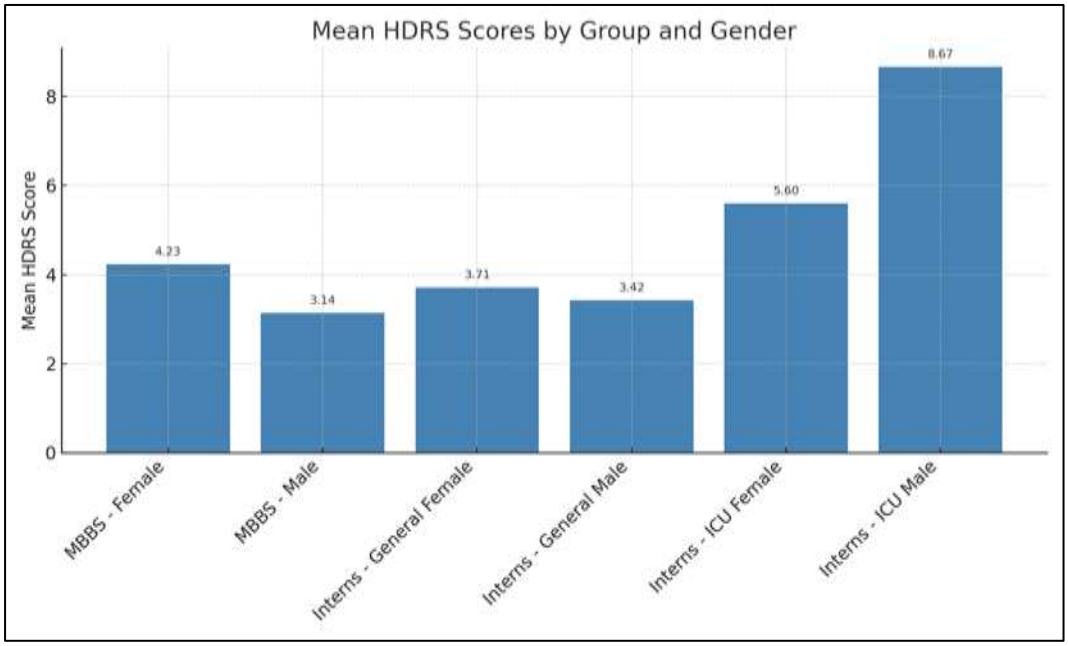

Figure 1: Mean HDRS Scores by Group and gender

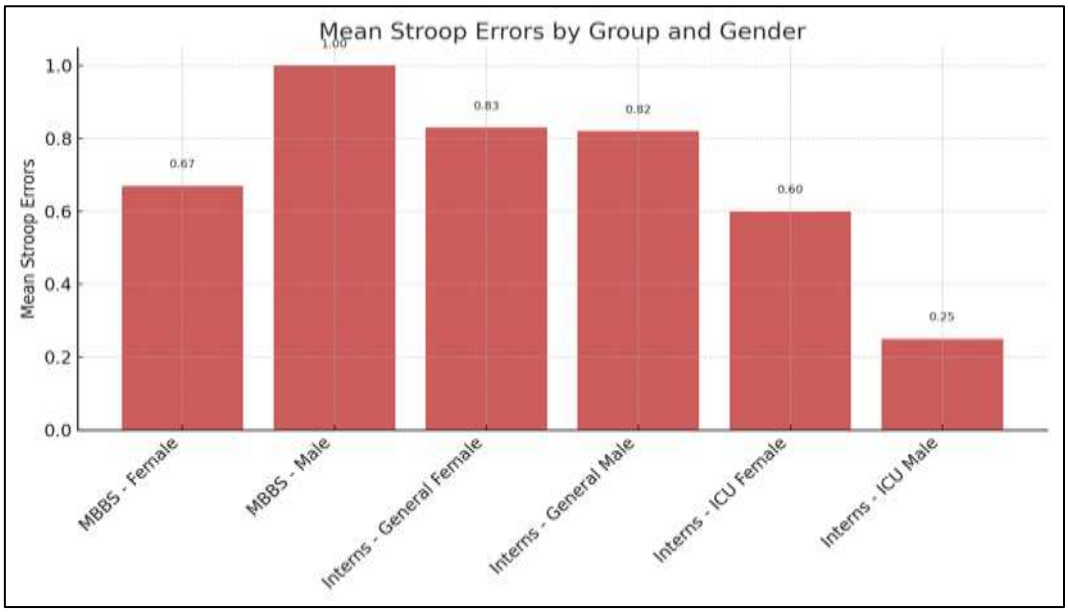

Figure 2: Mean Stroop errors by group and gender

Table 2: ANOVA Statistics (Between Group comparison)

Variable	F-Statistic	*p*-value	Significance
HDRS	5.552	0.0051	✔ Significant
Stroop Errors	0.503	0.6062	✘ Not Significant
Urea	1.810	0.169	✘ Not Significant
BUN	2.057	0.1333	✘ Not Significant

Figure 2 shows average Stroop errors across all gender-specific subgroups. The number of errors remained generally low, suggesting preserved cognitive control across participants. Notably, MBBS males made slightly more errors than their intern counterparts, contrary to the pattern observed in HDRS scores.

Table 2 summarizes the results of ANOVA testing for group differences across psychological and biochemical variables. A Statistically significant difference was found only for HDRS scores (p=0.0051), with interns, especially those in ICU postings, showing elevated depression levels. No significant differences were found for Stroop errors, serum urea, or BUN levels.

ICU interns showed higher depressive symptoms (HDRS: 15.3±3.2) compared to MBBS students (9.1±2.8; p=0.0051). Stroop mistakes were more frequent among ICU interns (7.4±1.9), though intergroup difference was not significant (p=0.6062).

Biochemical hydration markers indicated higher urea and BUN levels in interns, but ANOVA showed no significant difference by group. However, correlations revealed:

- BUN vs HDRS: r=-0.452, p=0.0027
- BUN vs Stroop Errors: r=0.358, p=0.0200
- -Strongest correlation in ICU interns: BUN vs HDRS, r=0.670, p=0.0483

No significant correlations were found in MBBS students.

Discussion

Hydration plays a vital role in physiological homeostasis and increasingly, its influence on psychological and cognitive domains is gaining attention in the context of health professions education. In this study, a clear association was found between suboptimal hydration (as reflected in elevated serum urea and BUN) and higher depressive symptom scores among medical interns, particularly those in ICU settings. Although cognitive errors measured by the Stroop test were not significantly different across groups, ICU interns—despite showing higher emotional distress—did not perform worse, suggesting possible short-term cognitive compensation or resilience.

These findings align with existing literature showing that even mild dehydration can impair attention and mood. Ganio et al. (2011) and Pross et al. (2014) have demonstrated similar effects in non-clinical populations. Our data extend this to the high-stakes environment of Indian medical education, where interns often experience long shifts, irregular breaks, and limited access to hydration—conditions that may exacerbate physiological stress and emotional fatigue.

A related study conducted at Pt. Jawahar Lal Nehru Government Medical College, Chamba, found that nearly half of the doctors surveyed consumed less than 1.5 litres of water per day. Many reported experiencing symptoms such as headaches, dizziness, and fatigue—typical indicators of dehydration (Kumar *et al.,* 2022). The study further highlighted the negative impact of inadequate hydration on alertness and clinical efficiency, which is consistent with the associations identified in our research between hydration status and cognitive and emotional functioning.

Depression among medical students and interns is also an area of growing concern in India. A meta-analysis by Puthran *et al.* (2016) revealed that approximately one-third of Indian medical students exhibited depressive symptoms. High-stress environments, such as ICUs, where interns face emotional strain and physical fatigue, may intensify existing vulnerabilities. The strong correlation between hydration indices and HDRS scores observed among ICU interns in our study lends support to this hypothesis.

From a medical education perspective, these outcomes warrant systemic intervention. Educational institutions tend to focus on curriculum and pedagogy but often underemphasize wellness infrastructure. The relationship between hydration and psychological readiness underscores the need to address student well-being as a foundational component of academic performance. Integrating hydration awareness campaigns, routine mental wellness screening, and infrastructure changes—such as water stations near clinical areas—could foster better outcomes for students both academically and clinically.

Conclusion

This study demonstrates that hydration status significantly affects mood and, to a lesser extent, cognitive function in medical trainees—particularly interns in demanding clinical settings. Given the direct implications for mental readiness, clinical decision-making, and learning capacity, hydration should be considered an important factor in medical education and student wellness strategies.

Promoting hydration is a simple, cost-effective, and scalable intervention. Medical colleges and teaching hospitals should integrate hydration education into orientation programs and support hydration-friendly infrastructure in both academic and clinical areas. Ultimately, safeguarding student wellness through such practical measures may enhance learning, reduce burnout, and improve the overall quality of medical training.

References

Avasthi, A., Kulhara, P. and Malhotra, S. (2005) *Manual of Clinical Rating Scales and Assessment in Psychiatry and Mental Health*.

Ganio, M.S., Armstrong, L.E., Casa, D.J., McDermott, B.P., Lee, E.C., Yamamoto, L.M. and Marzano, S. (2011) 'Mild dehydration impairs cognitive performance and mood of men', *British Journal of Nutrition*, 106(10), pp. 1535–1543. doi: 10.1017/S0007114511002005.

Hamilton, M. (1960) 'A rating scale for depression', *Journal of Neurology, Neurosurgery & Psychiatry*, 23, pp. 56–62.

Kumar, R., Sharma, V. and Negi, P. (2022) 'Hydration habits and health outcomes: Evaluating drinking water consumption patterns among doctors at Pt. Jawahar Lal Nehru Government Medical College, Chamba', *Himalayan Journal of Applied Medical Research*, 7(2), pp. 157–162. Available at: https://himjournals.com/hjamr/1434

Popkin, B.M., D'Anci, K.E. and Rosenberg, I.H. (2010) 'Water, hydration and health', *Nutrition Reviews*, 68(8), pp. 439–458. doi: 10.1111/j.1753-4887.2010.00304.x.

Pross, N., Demazieres, A., Girard, N., Barnouin, R., Santoro, F., Chevillotte, E. and Klein, A. (2014) 'Influence of progressive fluid restriction on mood and physiological markers of dehydration in women', *British Journal of Nutrition*, 109(2), pp. 313–321. doi: 10.1017/S0007114512001080

Puthran, R., Zhang, M.W., Tam, W.W. and Ho, R.C. (2016) 'Prevalence of depression amongst medical students: A meta-analysis', *Medical Education*, 50(4), pp. 456–468. doi: 10.1111/medu.12962.

Saxena, R., Prasad, S., Jain, P., et al. (2013) 'Stroop test performance among Indian medical interns: A study of stress and cognition', *Indian Journal of Psychological Medicine*, 35(4), pp. 373–377.

Stroop, J.R. (1935) 'Studies of interference in serial verbal reactions', *Journal of Experimental Psychology*, 18(6), pp. 643–662.

Zhang, J., Ma, G., Du, S., Liu, S. and Zhang, N. (2021) 'Effects of water restriction and supplementation on cognitive performances and mood among young adults in Baoding, China: A randomized controlled trial', *International Journal of Environmental Research and Public Health*, 13(10), 3645. doi: 10.3390/nu13103645. MDPI