Title: Impacts of Fasting on Depression and Anxiety among University Students in Bangladesh

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Availability of data
The data used for this study are available from the corresponding authors upon reasonable request.

Impacts of Fasting on Depression and Anxiety among University Students in Bangladesh

Abstract

Many pre-post studies have reported that fasting improves depression and anxiety, but such associations do not establish causality as they may be influenced by unobserved confounding. This quasi-experimental study examined the effects of Ramadan fasting on depression and anxiety among university students using a difference-in-differences (DiD) approach. Muslim students who fasted during Ramadan were compared with non-Muslim students who did not fast. We used an unbalanced panel of primary data collected from 366 students across six survey waves in Rajshahi, Bangladesh, in 2024, including two waves before Ramadan, two during Ramadan, and two after Ramadan (N = 698). Pooled and fixed-effects models showed that fasting was associated with lower depression and anxiety scores and lower disorder status (PHQ and GAD score ≥10) . However, the DiD models found no significant association between fasting and continuous depression or anxiety scores, or anxiety disorder status. By contrast, fasting during Ramadan was associated with a 17.0-23.2 percentage-point lower likelihood of depression disorder status among Muslim students, with the association concentrated at mild-to-moderate symptom thresholds rather than at higher levels of severity. Subgroup analyses suggested a broadly similar pattern across sex, institution type, and residential arrangement, while additional findings indicated lower anxiety among Muslim male students and those living off campus without family. These findings suggest that Ramadan fasting may reduce mild-to-moderate depression among practicing Muslim students, although evidence for anxiety and severe depression remains limited. Larger multi-site longitudinal studies are needed to confirm these findings and clarify their implications for student mental health in Bangladesh.

Keywords: Fasting; Depression; Anxiety disorder, Difference-in-Differences; Bangladesh

Introduction

In Bangladesh, the 2018–2019 National Mental Health Survey reported that 16.8% of adults (≥18y) and 13.6% of children and adolescents (7-17y) meet criteria for a mental disorder, and more than 92% of affected adults receive no mental health treatment (WHO, 2019). Young people are particularly affected, e.g., a 2025 study of Bangladeshi students found depressive symptoms in 40.6% and anxiety symptoms in 31.6% of those aged 18–22 years (Al-Amin et al., 2025). The World Health Organization also reports that depression and anxiety rank among the most common causes of disease and disability in adolescents (10-19 years) (WHO, 2025).

Existing evidence suggests that fasting may influence mental health, but findings vary by fasting type, population, and study design. In a 2023 systematic review with meta-analysis of 14 trials, intermittent fasting showed a moderate improvement in depression, while effects on anxiety were not statistically significant (Fernández-Rodríguez et al., 2023). Broader fasting interventions also show potential benefits: a 2021 meta-analysis of 11 studies reported lower anxiety and depression in fasting groups when analyses were restricted to low risk-of-bias RCTs, without evidence of increased fatigue (Berthelot et al., 2021). Evidence specific to Ramadan intermittent fasting is often pre to post and context-dependent, but recent syntheses report that many studies observe reductions in depressive and anxiety symptoms during Ramadan (Ahmed et al., 2025; Elsahoryi et al., 2025).

Although several studies have explored fasting and mental health, key limitations constrain the conclusions that can be drawn. Many Ramadan-related studies rely on simple pre-post designs without appropriate non-fasting comparison groups, making it difficult to isolate the effects of fasting from concurrent lifestyle changes (e.g., sleep and diet) and limiting causal inference. Moreover, most research documented reduced depressive symptoms during Ramadan but lacked longitudinal controls, follow ups and standardized anxiety assessments, resulting in mixed or inconsistent findings on anxiety outcomes (Ahmed et al., 2025). Recent meta-analyses also highlight substantial heterogeneity across fasting interventions (e.g. alternate day fasting, 5:2 diet, time restricted eating etc.) and small sample sizes as limitations (Fernández-Rodríguez et al., 2023).

Furthermore, evidence from Bangladesh and similar low-resource settings is scarce, especially among university student populations burdened by high rates of depression and anxiety, and there is little research examining how the duration or intensity of fasting may relate to mental health changes via behavioral or physiological pathways. These limitations reveal a gap in quasi-experimental, longitudinal evidence on the causal effects of fasting on depression and anxiety in this demographic.

Building on these gaps, the present study focuses specifically on Ramadan intermittent fasting, defined as abstinence from all food and drink from dawn to sunset for approximately 12–16 hours daily over a lunar month (29-30 days), a practice observed by millions of Muslims worldwide. Using a prospective longitudinal observational design that uses Ramadan as a natural experiment, this study examines whether Ramadan fasting affects depression and anxiety among Bangladeshi university students compared with non-fasting students. By incorporating a non-fasting comparison group, the study directly addresses the major limitation of prior simple pre-post Ramadan studies and strengthens causal inference.

Ramadan and Fasting

Ramadan, the ninth month of the Islamic lunar calendar, is observed by Muslims worldwide as a sacred period of fasting, prayer, and spiritual reflection. Fasting from dawn to sunset during Ramadan is one of the Five Pillars of Islam and is generally obligatory for Muslims who have reached puberty and are physically and mentally able to fast. Exemptions apply to individuals for whom fasting may cause hardship, including those who are ill, travelling, menstruating, pregnant or breastfeeding, or elderly and frail (Encyclopaedia Britannica, n.d.; IRW, 2026).

Bangladesh provides an important context for studying Ramadan fasting and mental health because 91.0% of the population identifies as Muslim, making Ramadan fasting a widespread religious and social practice (BBS, 2023). Bangladesh also includes religious minority populations, including Hindus, Buddhists, and Christians, who generally do not observe Ramadan fasting. This context offers a useful quasi-experimental setting in which Muslim students exposed to Ramadan fasting can

be compared with non-Muslim students who are not exposed to the practice. Combined with repeated observations before, during, and after Ramadan, this design strengthens the study of temporal changes in depression and anxiety outcomes associated with fasting (Figures 1 and 2).

Methods

Study design and setting

This study employed a prospective longitudinal observational design. Data were collected across six waves: two before Ramadan, two during Ramadan, and two after Ramadan, allowing for within-subject comparisons over time. By comparing Muslim students who fasted during Ramadan with non-Muslim students who did not fast, the study adopted a quasi-experimental framework to assess the causal effects of fasting on depression and anxiety disorders. The study was conducted between February and June 2024 at three higher educational institutions in Rajshahi, Bangladesh: Islami Bank Medical College, Rajshahi Medical College, and Varendra University.

Participants and sample

Participants were invited during class sessions and completed their first wave in person. Subsequent waves were completed online via follow-up email links. Participation was voluntary and each survey took around 15 minutes to complete.

Among the 810 students invited, 366 (respond rate about 45%) completed at least one survey. The responded students contributed 698 observations across six survey waves. As participation varied across waves, the analytical sample constituted an unbalanced panel. The numbers of observations in waves 1 to 6 were 319, 85, 104, 86, 67, and 37, respectively. Detailed descriptions of each survey wave are provided in the supplementary file (Table S1).

Exposure measure

Fasting was assessed as a time-varying exposure. At each follow-up, participants reported current fasting behavior (binary).

Outcome measure

Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9), a nine-item validated instrument measuring the frequency of depressive symptoms over the preceding two weeks, with total scores ranging from 0 to 27. Anxiety was assessed using the Generalized Anxiety Disorder-7 (GAD-7), a seven-item validated scale measuring anxiety symptom severity over the preceding two weeks, with total scores ranging from 0 to 21. Both scales were administered in English using their standard versions. They have been validated specifically among university students in Bangladesh, confirming high internal consistency for the PHQ-9 (Cronbach's alpha = 0.824) (Rahman et al., 2022) and the GAD-7 (Cronbach's alpha = 0.895) (Dhira et al., 2021) in this population.

We used these depression (PHQ-9) and anxiety (GAD-7) scores as a continuous outcome variables and also constructed binary outcomes for depression and anxiety disorders, coded as 1 if participants had a score of 10 or higher and 0 otherwise. This threshold is widely used to indicate at least moderate depressive and anxiety symptom severity on the PHQ-9 and GAD-7, respectively (Kroenke et al., 2001; Spitzer et al., 2006).

Covariates measure

Baseline covariates included age (years), sex (male or female), marital status (currently married or unmarried), body mass index (BMI), religion (Muslim or non-Muslim), faculty type (medical or engineering), current academic year (1–5), type of university (public or private), and socioeconomic indicators, i.e., residential status, annual expenditure in Bangladeshi Taka (>100k, 100–150k, 150–200k, or 200+k), and sources of the expenditure. Participants also provided information on any diagnosed mental disorder across the six waves.

Currently unmarried includes single/separated/divorced participants. Residential status is a categorical variable indicating student's current living status as off-campus housing with family, off-campus housing without family, or on-campus residence. Source of expenditure is also a dichotomized variable indicating whether a participant receives funds from family/parents or other sources.

Time-varying covariates assessed at each wave included weight, sleep duration (average hours per night), physical activity level (0, 1–2, 2–4, or ≥5 hours), and perceived academic workload (heavy, moderate, or light. Health-related behaviors included dietary intake(fruit and vegetable consumption, street and fast-food intake) and current smoking status (binary). These variables were examined as potential pathways linking fasting to depression and anxiety.

Analytic strategy

As the panel was unbalanced, we first applied pooled models using the ordinary least squares (OLS) method to examine the association between fasting and the outcomes (both binary and continuous scale). We then applied fixed-effects (FE) models to account for unobserved time-invariant heterogeneity within individuals over time. The functional form is given below:

$$y_{it} = \beta_0 + \beta_1 Fast_{it} + \beta_2 T_t + \alpha_i + \varepsilon_{it} . \qquad (1)$$

Where y_{it} denotes the outcomes of student i at wave t ($t = 1, \dots, 6$). $Fast_{it}$ indicates whether the student was currently fasting at wave t. T_t represents wave fixed effects, α_i captures student-specific fixed effects, and ε_{it} is the idiosyncratic error term. In this specification, β_1 captures the average within-student association between fasting and the outcomes over time, while the pooled model captures the overall association across students and waves.

Although the FE model can reduce bias from unobserved time-invariant confounding, it cannot address time-varying unobserved confounding that may influence the outcomes, thereby limiting causal interpretation. We therefore applied a difference-in-differences (DiD) model to strengthen causal inference, assuming that the parallel-trends assumption held between Muslim and non-Muslim students before the treatment period (Ramadan). The DiD functional form is given below:

$$y_{it} = \gamma_0 + \gamma_1 (Muslim_i \times Post_t) + \delta_i + \gamma_2 T_t + \mu_{it}. \qquad (2)$$

Where y_{it} denotes the outcomes of student i at wave t and $Muslim_i \times Post_t$ is the interaction term capturing the DiD estimate. δ_i represents individual-specific unobserved heterogeneity, T_t represents wave fixed effects, and μ_{it} is the error term. Accordingly, γ_1 can be interpreted as the average

treatment effect on the treated (ATT), reflecting the average effect of fasting during Ramadan among Muslim students compared with their non-fasting non-Muslim counterparts.

We excluded most time-varying covariates, including dietary intake, physical activity, sleep, perceived academic workload, weight, and body mass index, from the main models because these factors may themselves be influenced by fasting or Ramadan period and could therefore attenuate the estimated effect. Instead, we examined them as potential mechanisms linking fasting to mental health outcomes. We also estimated additional models including these time-varying factors sequentially to assess whether the main findings were robust to their inclusion.

Additionally, we examined the main results by excluding students, who were diagnosed mental health conditions before the treatment (Ramadan) to reduce potential confounding from prior psychopathology. We also applied nonlinear (logit) DiD model on binary outcomes as a robustness check of our main findings. All statistical analyses and visualizations were conducted using Stata/SE 18.

Results

Descriptive statistics

Table 1 shows that students who fasted and those who did not fast had generally similar baseline characteristics, including age, sex, BMI, source of daily expenditure, total annual expenditure, marital status, residential arrangement, institution type, current academic year, and smoking status. As expected, all students who fasted were Muslim, and 55.4% of them were female. Overall, 7.3% of the students were non-Muslim.

The mean depression and anxiety scores were 10.11 and 7.55, respectively. Among non-fasting students, the corresponding mean scores were 10.32 and 7.83, whereas among fasting students they were 9.46 and 6.71. The prevalence of depression and anxiety disorders was 49.6% and 35.9%, respectively, among non-fasting students, compared with 39.5% and 29.7% among fasting students.

Depression score and disorder status

Table 2 shows that the pooled and the FE models demonstrated a strong association between fasting and improving depression score by 0.9–1.2 points and likelihood of disorder status by 11.7–11.9 percentage points (pp). However, the DiD model did not find any relationship between fasting and depression score among Muslim students who fasted during the Ramadan comparing their non-fasted non-Muslim counterparts. Conversely, the model indicated that fasted Muslim students during the Ramadan were less likely of depression disorder by 17.0 and 23.2 pp using the first four waves and the full six waves of data, respectively.

Anxiety score and disorder status

Table 3 also shows a similar pattern of a negative association between fasting and anxiety score by 0.9–1.4 points and disorder status by 5.7–8.1 pp using the pooled and the FE models. In contrast, we did not find any association between fasting and anxiety score or disorder status using the DiD model.

Placebo tests

We assessed pre-treatment trends in depression and anxiety scores and disorder status between Muslim and non-Muslim students using the two waves before Ramadan (Figure S1). Because only two pre-Ramadan waves were available, the scope for formally evaluating parallel trends was limited. We therefore conducted a placebo test using these two waves, treating wave 2 as a pseudo-treatment period. As shown in Table 4, the DiD estimates were not statistically significant for depression or anxiety scores, or for disorder status, suggesting no evidence of differential pre-treatment changes between the two groups.

We further conducted a placebo test using perceived social support as an alternative outcome, coded as low or very low versus moderate, high, or very high. This analysis was interpreted cautiously because perceived social support could plausibly change around Ramadan and Eid (Ramadan ending festival) through increased family contact, travel, and religious or social activities. To minimize this concern, we restricted the analysis to the first four waves, before Eid, and again found no significant

difference in perceived low social support between Muslim and non-Muslim students during Ramadan relative to the pre-Ramadan period (Table 4).

Robustness checks and sensitivity analyses

We conducted robustness checks by re-estimating the association between fasting during Ramadan and depression disorder status using alternative thresholds for the binary depression outcome, ranging from mild symptoms (depression score ≥6) to severe symptoms (depression score ≥15). The DiD estimates remained statistically significant for thresholds capturing mild-to-moderate depression but became smaller and statistically insignificant ($p>0.1$) at thresholds of 11 or higher (Table 5). This pattern suggests that the estimated association was concentrated at lower and moderate symptom levels rather than severe depression.

This interpretation was broadly consistent with the score distributions shown in Figure 1. During Ramadan, the distribution of depression scores among Muslim students shifted toward lower values, with relatively more observations below the main threshold of 10. In contrast, the distribution among non-Muslim students shifted relatively more toward scores above 10. Taken together, these findings suggest that fasting was associated with a lower likelihood of mild-to-moderate depression, whereas evidence for an association with more severe depression was limited.

We further assessed the robustness of our main findings by excluding students who had been diagnosed with a mental health condition before Ramadan (29 students; 58 observations). The results remained substantively similar (Tables S2–S3). We also re-estimated the DiD models by sequentially adding time-varying controls, which yielded a similar pattern of findings (Tables S4–S7). In the nonlinear (logit) DiD models, the estimated marginal effects were somewhat larger in magnitude: −26.9 pp for depression disorder ($p = 0.046$) and −2.1 pp for anxiety disorder ($p = 0.893$). These results were broadly consistent with our main findings for the binary outcomes.

Given the unbalanced panel structure, we also estimated pooled DiD models, which led to similar conclusions (Table S8). In addition, we assessed the sensitivity of standard errors using participant-

level bootstrap estimation with 3,000 replications. This produced slightly larger standard errors, but the statistical significance of the main findings remained unchanged.

Heterogeneity analyses

We next examined whether the estimated associations differed by sex, residential arrangement, and institution type (public vs. private) using the DiD model. As shown in Table 6, the negative association between Ramadan fasting among Muslim students and depression scores was observed across all subgroups, including males, females, students attending public and private institutions, those living off campus with family, and those living on campus without family. The results also suggested lower anxiety scores among Muslim male students and those living off campus with and without family, with estimated reductions of 3.0, 2.1, and 4.2 points, respectively. By contrast, anxiety scores increased by 2.9 points among female Muslim students.

Potential mechanisms

We further examined time-varying factors that could plausibly be influenced by fasting and, in turn, be related to depression and anxiety outcomes. These included fruit and vegetable intake, street and fast-food intake, weight, sleep duration, physical activity, and perceived academic workload. Fixed-effects models were used to assess whether fasting was associated with changes in these factors. As shown in Table 7, fasting was associated with a 6.5 pp increase in the likelihood of fruit and vegetable intake and an 11.3 pp decrease in the likelihood of street and fast-food intake. Fasting was also associated with 0.4 fewer hours of sleep per night. The remaining time-varying factors were not statistically significant. These findings suggest that improved diet and reduced intake of junk food may represent plausible pathways through which fasting is associated with lower mild-to-moderate depression among Muslim students during Ramadan, despite a modest reduction in sleep duration.

Discussion

This study examined whether Ramadan fasting was associated with depression and anxiety among university students in Bangladesh using a prospective longitudinal quasi-experimental design with pooled, FE, and DiD models. Using the more causally informative DiD method, we found that fasting

during Ramadan was associated with a lower likelihood of depression disorder status among Muslim students relative to non-Muslim students, and this reduction was concentrated at mild-to-moderate symptom thresholds rather than at higher thresholds of depression severity. But we did not find an association between fasting and continuous depression or anxiety scores, or with anxiety disorder status using the DiD method. Placebo tests, sensitivity analyses, and alternative specifications broadly supported the specificity and robustness of this pattern.

These findings add nuance to the existing literature on fasting and mental health. Previous studies, including recent reviews, have often reported improvements in depressive symptoms during fasting, whereas findings for anxiety have been less consistent (Ahmed et al., 2025; Berthelot et al., 2021; Fernández-Rodríguez et al., 2023). However, much of the Ramadan-specific evidence has relied on simple pre-post comparisons without an appropriate non-fasting comparison group, making it difficult to separate the effects of fasting from concurrent changes in sleep, diet, social life, and academic routine (Ahmed et al., 2025; Elsahoryi et al., 2025). In the present study, pooled and FE models likewise suggested broadly favorable associations of fasting with both depression and anxiety outcomes, but these associations were substantially narrowed in the DiD models. This contrast suggests that some of the apparent benefits observed in simpler models may reflect time-varying contextual changes during Ramadan rather than fasting alone. At the same time, the persistence of a negative DiD estimate for depression disorder status indicates that fasting may still have a meaningful association with depressive symptoms at the threshold of clinical relevance.

One plausible interpretation is that Ramadan fasting may be less likely to shift the full distribution of depressive symptoms than to reduce the probability of crossing into mild-to-moderate depressive disorder status. This interpretation is supported by the threshold analyses, which showed statistically significant effects at lower cutoffs but attenuation at higher thresholds (≥11). The score distributions suggested a relative shift toward lower depression scores among Muslim students during Ramadan. These results imply that fasting may be most relevant to students with milder depressive symptom burdens, while evidence for an association with severe depression remains

limited. This pattern is also consistent with the possibility that Ramadan-related changes, such as greater routine adherence, improved diet , or heightened spiritual engagement, may be sufficient to influence lower-level depressive symptoms but insufficient to alter more severe psychopathology.

The null DiD findings for anxiety are also important. Although pooled and FE models suggested lower anxiety scores and anxiety disorder status among fasting students, these associations did not persist in the DiD models. This is broadly consistent with prior evidence showing more heterogeneous and less reliable effects of fasting on anxiety than on depression (Ahmed et al., 2025; Fernández-Rodríguez et al., 2023). Anxiety symptoms in university students may be more strongly shaped by academic pressure, uncertainty about examinations and finances, or interpersonal stressors that were not substantially altered by fasting itself. It is also possible that potentially beneficial aspects of Ramadan, such as spiritual practices or structured meal timing, were offset by competing stressors such as sleep disruption and changed daily schedules. The subgroup findings, which suggested lower anxiety among Muslim male students and some residential subgroups but higher anxiety among Muslim female students, further support the view that anxiety responses to fasting are likely to be heterogeneous and socially patterned rather than uniform.

Mechanism analyses suggest improved depression status may be linked to behavioral changes during fasting. Fasting was associated with higher fruit and vegetable intake and lower fast-food consumption, while sleep duration declined modestly and other factors were not significant. These patterns point to diet as a more plausible pathway than sleep. Healthier eating during Ramadan may influence mood through better meal quality, and a more structured routine (Hosen, 2024). Shorter sleep indicates mixed effects, and the combination may explain the stronger association with disorder status than symptom scores.

The Bangladeshi setting is central to the interpretation of these results. Student mental health burdens are substantial in Bangladesh, while treatment access remains limited (Elsahoryi et al., 2025; WHO, 2019, 2025). In this context, Ramadan is not only a religious obligation but also a socially structured period that may reorganize diet, family contact, community participation, and

daily routines. By comparing with non-Muslim students who generally do not fast, and by following both groups repeatedly before, during, and after Ramadan, the present study moves beyond simple pre-post designs and provides more cautious evidence on the possible mental health implications of fasting in a low-resource setting. Even so, the findings should not be interpreted as indicating that fasting is universally protective. Rather, they suggest that, among practicing Muslim students, Ramadan fasting may be associated with a lower probability of mild-to-moderate depression, while evidence for anxiety and for more severe depression remains limited.

Several limitations should be considered. First, despite the quasi-experimental design, causal interpretation remains conditional on the DiD assumptions, particularly parallel trends. Only two pre-Ramadan waves were available, which limited formal assessment of pre-treatment trends. Although the placebo tests were reassuring, they cannot fully exclude residual time-varying confounding. Second, the panel was unbalanced, with substantial attrition across waves. While pooled DiD models and bootstrap-based sensitivity checks yielded similar conclusions, selective non-response may still have affected precision and internal validity. Third, the study was based on voluntary online participation from three institutions in one metropolitan city, which may limit generalizability to other university populations in Bangladesh. Finally, outcome symptoms and behavioral covariates were all self-reported and may therefore be subject to recall bias.

Conclusion

This study followed university students in Bangladesh over time and found that those who fasted during Ramadan were less likely to have mild to moderate depression. However, fasting did not show clear changes in overall depression and anxiety scores, or anxiety disorders. This suggests the mental health effect is specific and not as broad as simpler comparisons might suggest. One possible reason is improved eating habits during Ramadan. There was no strong evidence for effects on anxiety or more severe depression. Larger studies with better data and more diverse groups are needed to better understand how and for whom these effects occur.

References

Ahmed, D. R., Al Diab Al Azzawi, M., Ahmed, J. O., Elzahaby, A., Hussein, A. M., & Heun, R. (2025). Systematic review reveals mental health benefits of Ramadan fasting with mixed effects on sleep quality and cognitive functioning. *Discover Psychology*, *6*(1), 2. https://doi.org/10.1007/s44202-025-00553-y

Al-Amin, M., Rinky, F., Bhuiyan, M. N. H., Yeasmin, R., Akter, T., Hoque, N., & Reza, S. (2025). Factors influencing mental health outcomes among university students: A cross-sectional study in Bangladesh. *BMJ Open*, *15*(3), e097745. https://doi.org/10.1136/bmjopen-2024-097745

BBS. (2023). *Population and housing census 2022: National report (Vol. I). Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh*.

Berthelot, E., Etchecopar-Etchart, D., Thellier, D., Lancon, C., Boyer, L., & Fond, G. (2021). Fasting Interventions for Stress, Anxiety and Depressive Symptoms: A Systematic Review and Meta-Analysis. *Nutrients*, *13*(11), 3947. https://doi.org/10.3390/nu13113947

Dhira, T. A., Rahman, M. A., Sarker, A. R., & Mehareen, J. (2021). Validity and reliability of the Generalized Anxiety Disorder-7 (GAD-7) among university students of Bangladesh. *PLOS ONE*, *16*(12), e0261590. https://doi.org/10.1371/journal.pone.0261590

Elsahoryi, N. A., Ibrahim, M. O., Alhaj, O. A., Abu Doleh, G., & Aljahdali, A. A. (2025). Impact of Ramadan Fasting on Mental Health, Body Composition, Physical Activity, and Sleep Outcomes Among University Students. *Healthcare*, *13*(6), 639. https://doi.org/10.3390/healthcare13060639

Encyclopaedia Britannica. (n.d.). Ramadan. In *Britannica*.

Fernández-Rodríguez, R., Martínez-Vizcaíno, V., Mesas, A. E., Notario-Pacheco, B., Medrano, M., & Heilbronn, L. K. (2023). Does intermittent fasting impact mental disorders? A systematic review with meta-analysis. *Critical Reviews in Food Science and Nutrition*, *63*(32), 11169–11184. https://doi.org/10.1080/10408398.2022.2088687

Hosen, M. Z. (2024). Effect of Ramadan on purchasing behavior: A panel data analysis. *International Review of Economics*, *71*(2), 325–341. https://doi.org/10.1007/s12232-024-00445-y

IRW. (2026). *What are missed fasts in Islam and who has to make them up? Islamic Relief Worldwide*. https://islamic-relief.org/what-are-missed-fasts-in-islam-and-who-has-to-make-them-up/

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Rahman, M. A., Dhira, T. A., Sarker, A. R., & Mehareen, J. (2022). Validity and reliability of the Patient Health Questionnaire scale (PHQ-9) among university students of Bangladesh. *PLOS ONE*, *17*(6), e0269634. https://doi.org/10.1371/journal.pone.0269634

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

WHO. (2019). *Minister of Health releases first findings of National Mental Health Survey*. https://www.who.int/bangladesh/news/detail/27-11-2019-minister-of-health-releases-first-findings-of-national-mental-health-survey

WHO. (2025). *Mental health of adolescents*. https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

FIGURES

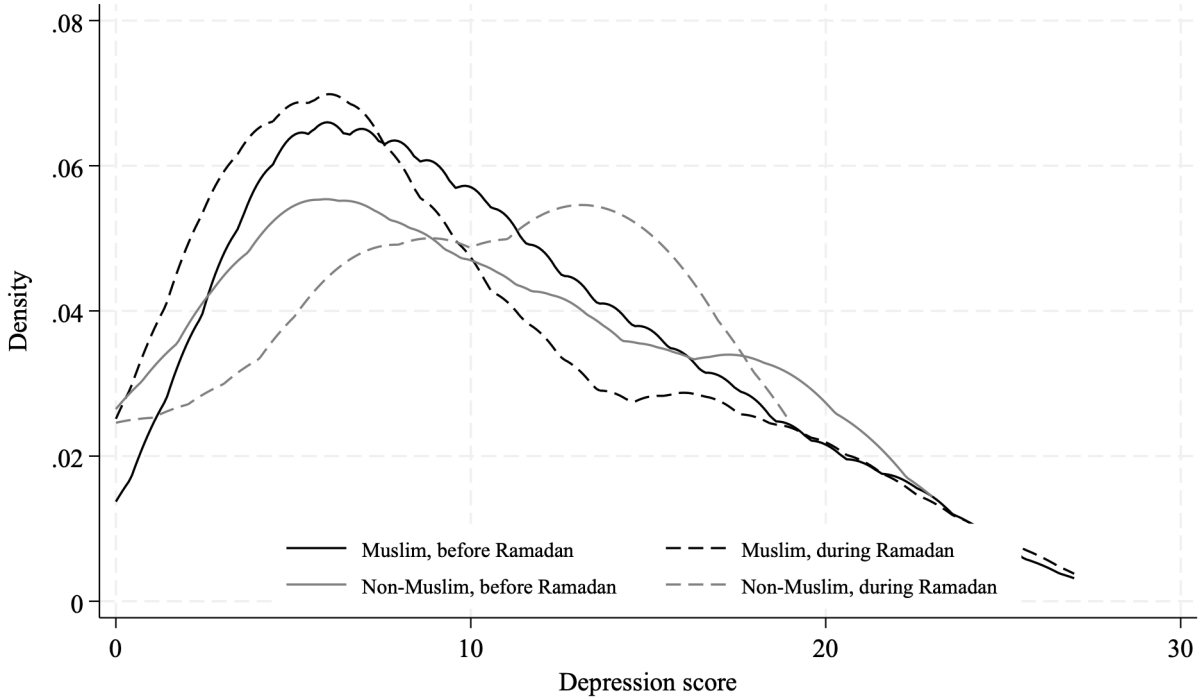


Figure 1. Distribution of depression scores by groups and Ramadan period

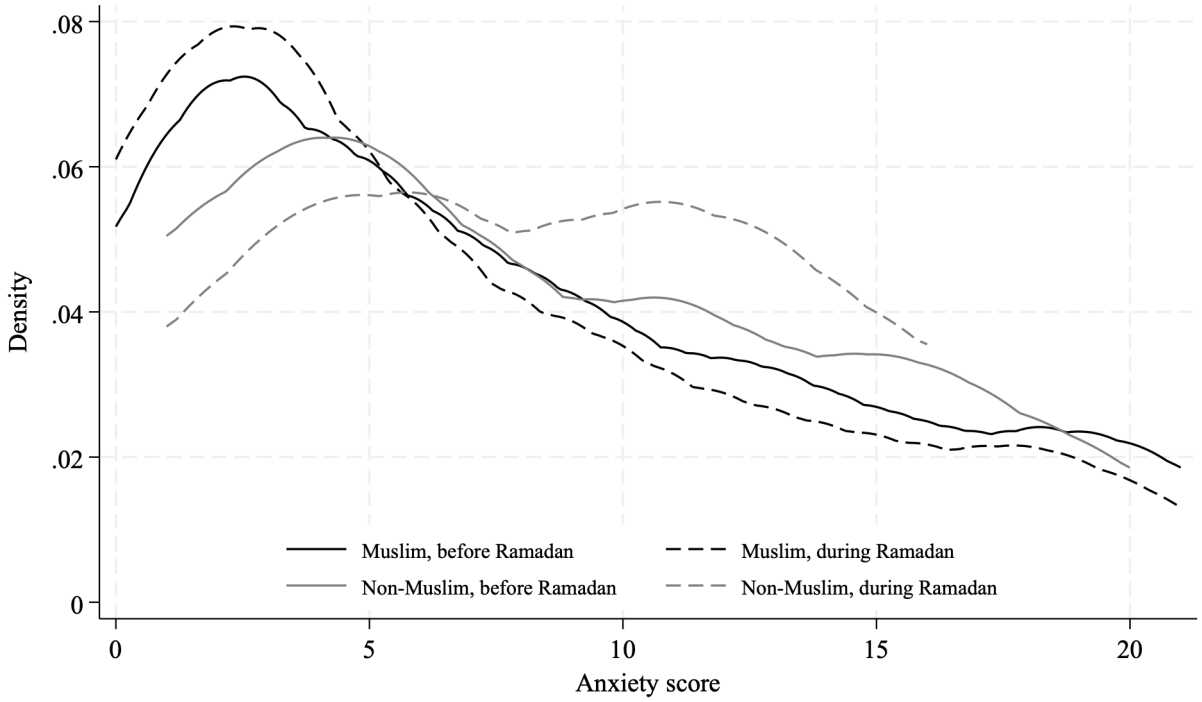


Figure 2. Distribution of anxiety scores by groups and Ramadan period

TABLES

Table 1. Summary statistics

	Fasting status		
	No	Yes	Total
N	526 (75.4%)	172 (24.6%)	698 (100.0%)
Depression (PHQ) score 0–27	10.316 (6.108)	9.465 (6.476)	10.106 (6.207)
Depression disorder status: Yes	0.496 (0.500)	0.395 (0.490)	0.471 (0.500)
Anxiety (GAD) score 0–21	7.829 (6.314)	6.715 (6.122)	7.554 (6.281)
Anxiety disorder status: Yes	0.359 (0.480)	0.297 (0.458)	0.344 (0.475)
Diagnosed mental illness: Yes	0.074 (0.262)	0.110 (0.314)	0.083 (0.276)
Age in years	21.356 (1.402)	21.349 (1.539)	21.354 (1.436)
Sex: Male	0.517 (0.500)	0.436 (0.497)	0.497 (0.500)
Religion: Muslim	0.903 (0.296)	1.000 (0.000)	0.927 (0.260)
Marital status: Married	0.070 (0.256)	0.099 (0.299)	0.077 (0.267)
Residential arrangement			
Off-campus housing with family	209 (39.7%)	82 (47.7%)	291 (41.7%)
Off-campus housing without family	181 (34.4%)	43 (25.0%)	224 (32.1%)
On-campus residence	136 (25.9%)	47 (27.3%)	183 (26.2%)
Sources of expenditure: Others	0.139 (0.346)	0.134 (0.341)	0.138 (0.345)
Annual expenditure in Bangladeshi Taka			
<100k	127 (24.1%)	52 (30.2%)	179 (25.6%)
100–150k	233 (44.3%)	78 (45.3%)	311 (44.6%)
150–200k	114 (21.7%)	28 (16.3%)	142 (20.3%)
200+k	52 (9.9%)	14 (8.1%)	66 (9.5%)
Body mass index (BMI)	22.290 (3.934)	22.983 (4.113)	22.461 (3.987)
Smoking: Yes	0.110 (0.314)	0.093 (0.291)	0.106 (0.308)
Average sleep in hours per night	6.247 (1.772)	5.971 (2.186)	6.179 (1.884)
Perceived social support			
Very high	19 (3.6%)	8 (4.7%)	27 (3.9%)
High	60 (11.4%)	21 (12.2%)	81 (11.6%)
Moderate	270 (51.3%)	85 (49.4%)	355 (50.9%)
Low	131 (24.9%)	43 (25.0%)	174 (24.9%)
Very low	46 (8.7%)	15 (8.7%)	61 (8.7%)
Fruit & vegetable intake: Yes	0.521 (0.500)	0.616 (0.488)	0.544 (0.498)
Street & fast-food intake: Yes	0.494 (0.500)	0.360 (0.482)	0.461 (0.499)
Physical activity: Yes	0.513 (0.500)	0.477 (0.501)	0.504 (0.500)
Perceived academic workload			
Heavy	252 (47.9%)	79 (45.9%)	331 (47.4%)
Moderate	244 (46.4%)	79 (45.9%)	323 (46.3%)
Light	30 (5.7%)	14 (8.1%)	44 (6.3%)
University type: Private	0.671 (0.470)	0.622 (0.486)	0.659 (0.474)
Academic year			
1	130 (24.7%)	42 (24.4%)	172 (24.6%)
2	172 (32.7%)	54 (31.4%)	226 (32.4%)
3	185 (35.2%)	66 (38.4%)	251 (36.0%)
4	22 (4.2%)	7 (4.1%)	29 (4.2%)
5	17 (3.2%)	3 (1.7%)	20 (2.9%)

Notes: PHQ = Patient Health Questionnaire and GAD = Generalized Anxiety Disorder.

Table 2. Effects of fasting on students' depression score and depression disorder status

VARIABLES	(1) Pooled	(2) FE	(3) DiD	(4) DiD	(5) Pooled	(6) FE	(7) DiD	(8) DiD
	Depression score	Depression score	Depression score	Depression score	Depression disorder	Depression disorder	Depression disorder	Depression disorder
Fasting (yes)	-1.195**	-0.931**			-0.119***	-0.117***		
	(0.461)	(0.371)			(0.038)	(0.038)		
Muslim × Post			0.710	0.389			-0.170***	-0.232***
			(1.250)	(1.254)			(0.043)	(0.084)
Controls	yes	-	-	-	yes	-	-	-
Survey wave FEs	no	no	yes	yes	no	no	yes	yes
Observations	698	698	594	698	698	698	594	698
R-squared	0.215	0.021	0.076	0.078	0.141	0.035	0.096	0.033
Mean depression score or disorder prevalence	10.11	10.11	10.40	10.11	0.47	0.47	0.49	0.47

Notes: The binary outcome, depression disorder, was defined as a depression score of 10 or higher. The Pooled and Fixed-Effects (FE) models used the full sample of six survey waves. The Difference-in-differences (DiD) model used data from the first four survey waves (pre-Ramadan and during Ramadan), columns 3 and 7, and the full sample defining waves 3–4 as the post-treatment period and the remaining waves as the control period, columns 4 and 8. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Control variables included age, sex, religion, diagnosed mental illness before Ramadan, and university/college type in the pooled model. Wave fixed effects were excluded from the pooled and FE models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Table 3. Effects of fasting on students' anxiety score and disorder status

VARIABLES	(1) Pooled Anxiety score	(2) FE Anxiety score	(3) DiD Anxiety score	(4) DiD Anxiety score	(5) Pooled Anxiety disorder	(6) FE Anxiety disorder	(7) DiD Anxiety disorder	(8) DiD Anxiety disorder
Fasting (yes)	-1.393***	-0.873***			-0.081**	-0.057*		
	(0.428)	(0.291)			(0.034)	(0.029)		
Muslim × Post			1.675	0.965			0.038	0.004
			(1.017)	(0.930)			(0.184)	(0.144)
Controls	yes	-	-	-	yes	-	-	-
Survey wave FEs	no	no	yes	yes	no	no	yes	yes
Observations	698	698	594	698	698	698	594	698
R-squared	0.196	0.024	0.090	0.066	0.137	0.011	0.026	0.021
Mean anxiety score or disorder prevalence	7.55	7.55	7.68	7.55	0.34	0.34	0.35	0.34

Notes: The binary outcome, anxiety disorder, was defined as an anxiety score of 10 or higher. The Pooled and Fixed-Effects (FE) models used the full sample of six survey waves. The Difference-in-differences (DiD) model used data from the first four survey waves (pre-Ramadan and during Ramadan), columns 3 and 7, and the full sample defining waves 3–4 as the post-treatment period and the remaining waves as the control period, columns 4 and 8. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Control variables included age, sex, religion, diagnosed mental illness before Ramadan, and university/college type in the pooled model. Wave fixed effects were excluded from the pooled and FE models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Table 4. Placebo tests using the Difference-in-differences model

VARIABLES	(1) Placebo Depression score	(2) Placebo Depression disorder	(3) Placebo Anxiety score	(4) Placebo Anxiety disorder	(5) Alternative outcome Perceived weak social support (yes)
Muslim × Post	1.384	0.143	-0.786	-0.196	-0.037
	(1.038)	(0.108)	(1.359)	(0.132)	(0.046)
Survey wave FEs	-	-	-	-	yes
Observations	404	404	404	404	594

Notes: Placebo tests performed using only the first two survey waves, falsely assigning wave 2 as the Ramadan period. The placebo outcome is a binary measure of perceived social support, coded as 1 for low/very low support and 0 for moderate/high/very high support. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 5. Sensitivity analyses across depression disorder status with different thresholds using the DiD model

VARIABLES	(1) Depression	(2) Depression	(3) Depression	(4) Depression	(5) Depression	(6) Depression	(7) Depression
Depression score thresholds	<6 or ≥6 (mild)	<8 or ≥8	<9 or ≥9	<10 or ≥10 (moderate)	11< or ≥11	<12 or ≥12	<15 or ≥15 (severe)
Muslim × Post	-0.129**	-0.237**	-0.295***	-0.232***	-0.198	-0.058	0.115
	(0.063)	(0.109)	(0.119)	(0.084)	(0.141)	(0.169)	(0.105)
Survey wave FEs	yes	yes	yes	yes	yes	yes	yes
Observations	698	698	698	698	698	698	698

Notes: Analyses were conducted on the full sample. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Wave fixed effects were excluded from all models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Table 6. Subgroup analyses using the DiD model

VARIABLES	(1) Depression score	(2) Depression disorder	(3) Anxiety score	(4) Anxiety disorder
Male [N = 291]	-2.521***	-0.180**	-3.015***	-0.550
	(0.627)	(0.077)	(1.046)	(0.346)
Female [N = 303]	1.588	-0.185***	2.899***	0.184
	(1.435)	(0.058)	(0.811)	(0.176)
Public institute [N = 291]	0.608	-0.172**	1.322	-0.068
	(0.931)	(0.072)	(1.666)	(0.059)
Private institute [N = 393]	0.822	-0.139**	1.815	0.104
	(1.778)	(0.058)	(1.301)	(0.268)
Off-campus housing with family [N = 245]	1.589	-0.236***	2.046*	0.098
	(1.422)	(0.068)	(1.208)	(0.178)
Off-campus housing without family [N = 191]	-1.663**	0.047	-4.161***	-0.975***
	(0.822)	(0.096)	(0.628)	(0.069)
On-campus residence [N = 158]	0.976	-0.188**	2.318	-0.045
	(0.957)	(0.073)	(1.483)	(0.084)

Notes: All models were applied on the first four waves. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Total observations are shown in the brackets.

Table 7. Probable mechanism using the Fixed-Effects model

VARIABLES	(1) **Fruit & vegetables** (yes)	(2) **Street & fast-food** (yes)	(3) **Weight** (kilograms)	(4) **Body mass index** (BMI)	(5) **Sleep** (hours per night)	(6) **Physical activity** (yes)	(7) **Academic workload** (moderate/low vs. heavy)
Fasting (yes)	0.065*	-0.113***	-0.214	-0.086	-0.397*	-0.040	-0.013
	(0.036)	(0.045)	(0.165)	(0.062)	(0.214)	(0.036)	(0.047)
Observations	594	594	594	594	594	594	594

Notes: All outcomes are binary variables except weight, BMI, and sleep which are continuous outcomes. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Wave fixed effects were excluded from all models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Supplementary File

FIGURES

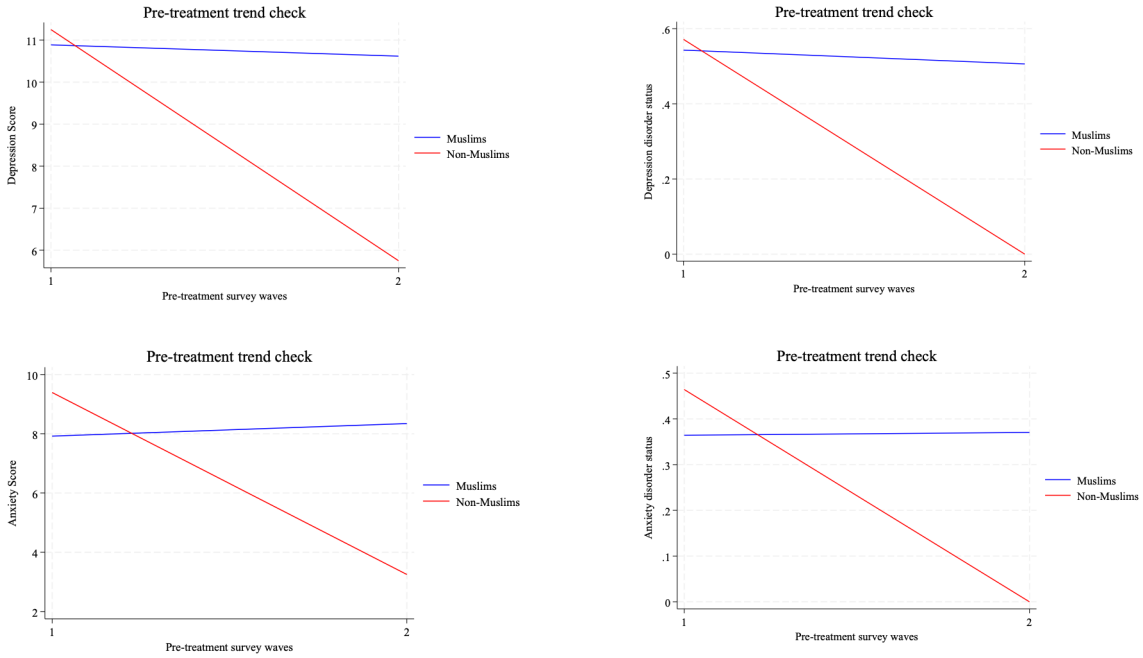


Figure S1. Parallel trend checks

TABLES

Table S1. Description of survey waves

Survey wave/event	Date range or day	Total responses	Notes
Wave 1	February 19 to February 27, 2024	321	Two duplicate responses were excluded
Wave 2	February 28 to March 9, 2024	85	
Wave 3	March 10 to March 24, 2024	104	Ramadan began on March 10, 2024
Wave 4	March 25 to April 6, 2024	86	
Eid al-Fitr in Bangladesh	April 10, 2024	-	
Wave 5	April 15 to April 30, 2024	67	
Wave 6	May 1 to June 12, 2024	37	

Table S2. Effects of fasting on depression score and depression disorder status after excluding students with a prior mental illness diagnosis

VARIABLES	(1) Pooled Depression score	(2) FE Depression score	(3) DiD Depression score	(4) DiD Depression score	(5) Pooled Depression disorder	(6) FE Depression disorder	(7) DiD Depression disorder	(8) DiD Depression disorder
Fasting (yes)	-0.985**	-0.752*			-0.110***	-0.106**		
	(0.481)	(0.390)			(0.041)	(0.040)		
Muslim × Post			0.670	0.233			-0.146***	-0.232**
			(1.347)	(1.341)			(0.042)	(0.090)
Controls	yes	-	-	-	yes	-	-	-
Observations	640	640	543	640	640	640	543	640
R-squared	0.126	0.013	0.057	0.015	0.101	0.029	0.073	0.028
Students		337	337	337		337	337	337

Notes: The binary outcome, depression disorder, was defined as a depression score of 10 or higher. The Pooled and Fixed-Effects (FE) models use the full sample of six survey waves. The Difference-in-differences (DiD) model uses data from the first four survey waves (pre-Ramadan and during Ramadan), columns 3 and 7, and the full sample defining waves 3–4 as the post-treatment period and the remaining waves as the control period, columns 4 and 8. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Control variables include age, sex, religion, and university/college type in the pooled model. Wave fixed effects are excluded from all models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Table S3. Effects of fasting on anxiety score and anxiety disorder status after excluding students with a prior mental illness diagnosis

VARIABLES	(1) Pooled Anxiety score	(2) FE Anxiety score	(3) DiD Anxiety score	(4) DiD Anxiety score	(5) Pooled Anxiety disorder	(6) FE Anxiety disorder	(7) DiD Anxiety disorder	(8) DiD Anxiety disorder
Fasting (yes)	-1.076**	-0.698**			-0.070*	-0.053*		
	(0.436)	(0.302)			(0.036)	(0.032)		
Muslim × Post			1.712	0.978			0.053	0.015
			(1.145)	(0.986)			(0.208)	(0.160)
Controls	yes	-	-	-	yes	-	-	-
Observations	640	640	543	640	640	640	594	640
R-squared	0.135	0.015	0.053	0.019	0.097	0.008	0.021	0.010
Students		337	337	337		337	337	337

Notes: The binary outcome, anxiety disorder, was defined as an anxiety score of 10 or higher. The Pooled and Fixed-Effects (FE) models use the full sample of six survey waves. The Difference-in-differences (DiD) model uses data from the first four survey waves (pre-Ramadan and during Ramadan), columns 3 and 7, and the full sample defining waves 3–4 as the post-treatment period and the remaining waves as the control period, columns 4 and 8. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Control variables include age, sex, religion, and university/college type in the pooled model. Wave fixed effects are excluded from all models due to near-perfect collinearity with fasting status during the Ramadan waves (3 and 4).

Table S4. Effect of fasting on depression score using the DID model

VARIABLES	(1) Depression score	(2) Depression score	(3) Depression score	(4) Depression score	(5) Depression score
Muslim × Post	0.337	0.437	0.352	0.366	0.413
	(1.255)	(1.265)	(1.288)	(1.193)	(1.180)
Perceived academic workload: Ref. Heavy					
Moderate		-0.952*	-0.964*	-0.975*	-0.883*
		(0.497)	(0.507)	(0.497)	(0.496)
Low		-1.306*	-1.312*	-1.307*	-0.637
		(0.734)	(0.736)	(0.736)	(0.738)
Perceived social support: Ref. Very high					
High		0.348	0.377	0.148	0.069
		(1.343)	(1.357)	(1.297)	(1.328)
Moderate		-0.275	-0.299	-0.461	-0.522
		(1.220)	(1.235)	(1.181)	(1.191)
Low		0.294	0.291	0.174	-0.048
		(1.333)	(1.345)	(1.304)	(1.316)
Very low		0.716	0.678	0.435	0.408
		(1.457)	(1.471)	(1.398)	(1.357)
Fruit & vegetables intake (yes)			-0.363	-0.345	0.032
			(0.640)	(0.621)	(0.613)
Street & fast-food intake (yes)			0.235	0.198	0.152
			(0.561)	(0.545)	(0.540)
Body mass index			-0.071	-0.054	-0.026
			(0.399)	(0.401)	(0.407)
Sleep in hours per night				-0.206**	-0.191*
				(0.100)	(0.099)
Physical activity (yes)				-0.587	-0.503
				(0.541)	(0.495)
Survey wave FEs					yes
Constant	10.363***	10.858***	12.549	13.929	13.416
	(0.096)	(1.205)	(9.014)	(8.922)	(9.082)
Observations	698	698	698	698	698
R-squared	0.023	0.041	0.043	0.058	0.103
Number of students	366	366	366	366	366

Notes: Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table S5. Effect of fasting on depression disorder status using the DID model

VARIABLES	(1) Depression disorder	(2) Depression disorder	(3) Depression disorder	(4) Depression disorder	(5) Depression disorder
Muslim × Post	-0.232***	-0.225***	-0.240***	-0.240***	-0.247***
	(0.084)	(0.076)	(0.082)	(0.080)	(0.079)
Perceived academic workload: Ref. Heavy					
Moderate		-0.084	-0.084	-0.084	-0.077
		(0.054)	(0.056)	(0.054)	(0.054)
Low		-0.056	-0.057	-0.056	-0.007
		(0.074)	(0.073)	(0.072)	(0.074)
Perceived social support: Ref. Very high					
High		-0.070	-0.076	-0.095	-0.113
		(0.177)	(0.179)	(0.170)	(0.178)
Moderate		-0.046	-0.046	-0.060	-0.077
		(0.171)	(0.170)	(0.164)	(0.167)
Low		0.096	0.096	0.085	0.057
		(0.178)	(0.178)	(0.172)	(0.174)
Very low		0.047	0.043	0.023	0.004
		(0.188)	(0.188)	(0.181)	(0.181)
Fruit & vegetables intake (yes)			-0.046	-0.045	-0.013
			(0.050)	(0.050)	(0.047)
Street & fast-food intake (yes)			-0.040	-0.042	-0.048
			(0.049)	(0.049)	(0.048)
Body mass index			-0.054	-0.052	-0.050
			(0.040)	(0.042)	(0.042)
Sleep in hours per night				-0.016*	-0.015
				(0.009)	(0.009)
Physical activity (yes)				-0.059	-0.047
				(0.051)	(0.049)
Survey wave FEs					yes
Constant	1.497***	1.543***	2.794***	2.904***	2.891***
	(0.010)	(0.166)	(0.922)	(0.952)	(0.956)
Observations	698	698	698	698	698
R-squared	0.033	0.060	0.071	0.081	0.122
Number of students	366	366	366	366	366

Notes: Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table S6. Effect of fasting on anxiety score using the DID model

VARIABLES	(1) Anxiety score	(2) Anxiety score	(3) Anxiety score	(4) Anxiety score	(5) Anxiety score
Muslim × Post	0.931	1.009	1.078	1.025	1.043
	(0.909)	(0.888)	(0.841)	(0.818)	(0.861)
Perceived academic workload: Ref. Heavy					
Moderate		-0.546	-0.542	-0.510	-0.402
		(0.520)	(0.516)	(0.518)	(0.518)
Low		-1.087	-1.102	-1.092	-0.496
		(0.727)	(0.730)	(0.712)	(0.667)
Perceived social support: Ref. Very high					
High		-0.576	-0.509	-0.660	-0.593
		(0.711)	(0.723)	(0.710)	(0.714)
Moderate		-0.707	-0.699	-0.818	-0.800
		(0.526)	(0.524)	(0.528)	(0.569)
Low		-0.871	-0.881	-0.965	-1.060
		(0.692)	(0.694)	(0.698)	(0.730)
Very low		-0.939	-0.945	-1.073	-1.048
		(0.958)	(0.954)	(0.923)	(0.912)
Fruit & vegetables intake (yes)			-0.082	-0.065	0.244
			(0.495)	(0.492)	(0.480)
Street & fast-food intake (yes)			-0.047	-0.053	-0.035
			(0.477)	(0.473)	(0.465)
Body mass index			0.382	0.395	0.415
			(0.441)	(0.439)	(0.440)
Sleep in hours per night				-0.075	-0.059
				(0.089)	(0.088)
Physical activity (yes)				-0.712	-0.641
				(0.498)	(0.473)
Survey wave FEs					yes
Constant	7.797***	8.853***	0.324	0.961	0.284
	(0.075)	(0.579)	(9.821)	(9.607)	(9.717)
Observations	698	698	698	698	698
R-squared	0.028	0.038	0.042	0.051	0.084
Number of students	366	366	366	366	366

Notes: Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table S7. Effect of fasting on anxiety disorder status using the DID model

VARIABLES	(1) Anxiety disorder	(2) Anxiety disorder	(3) Anxiety disorder	(4) Anxiety disorder	(5) Anxiety disorder
Muslim × Post	0.004	-0.003	0.006	0.004	0.002
	(0.146)	(0.147)	(0.151)	(0.150)	(0.149)
Perceived academic workload: Ref. Heavy					
Moderate		-0.003	0.000	0.001	0.013
		(0.058)	(0.057)	(0.057)	(0.059)
Low		0.022	0.021	0.021	0.064
		(0.077)	(0.076)	(0.075)	(0.081)
Perceived social support: Ref. Very high					
High		-0.006	-0.009	-0.016	-0.011
		(0.071)	(0.070)	(0.070)	(0.072)
Moderate		-0.100	-0.095	-0.100	-0.098
		(0.070)	(0.069)	(0.070)	(0.073)
Low		-0.110	-0.110	-0.114	-0.115
		(0.082)	(0.081)	(0.081)	(0.083)
Very low		-0.193**	-0.190**	-0.196**	-0.196**
		(0.093)	(0.091)	(0.091)	(0.092)
Fruit & vegetables intake (yes)			0.018	0.019	0.035
			(0.047)	(0.047)	(0.048)
Street & fast-food intake (yes)			-0.077	-0.077	-0.077
			(0.050)	(0.050)	(0.050)
Body mass index			0.007	0.007	0.007
			(0.036)	(0.036)	(0.036)
Sleep in hours per night				-0.003	-0.002
				(0.009)	(0.009)
Physical activity (yes)				-0.032	-0.029
				(0.039)	(0.038)
Survey wave FEs					yes
Constant	1.359***	1.456***	1.329*	1.358*	1.358*
	(0.008)	(0.077)	(0.802)	(0.801)	(0.807)
Observations	698	698	698	698	698
R-squared	0.012	0.026	0.035	0.037	0.049
Number of students	366	366	366	366	366

Notes: Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table S8. Estimated results using the pooled DiD model

VARIABLES	(1) Depression score	(2) Depression disorder	(3) Anxiety score	(4) Anxiety disorder	(5) Depression score	(6) Depression disorder	(7) Anxiety score	(8) Anxiety disorder
1.muslim	0.207	0.039	-0.614	-0.029	0.263	0.025	-0.355	-0.008
	(1.203)	(0.097)	(1.218)	(0.093)	(1.222)	(0.096)	(1.195)	(0.092)
1.post	-1.893	0.043	-1.741	-0.140	-1.849	0.028	-1.500	-0.118
	(1.593)	(0.132)	(1.433)	(0.152)	(1.527)	(0.133)	(1.337)	(0.141)
1.muslim#1.post	-0.328	-0.244*	-0.403	0.004	-0.354	-0.228*	-0.678	-0.019
	(1.671)	(0.136)	(1.483)	(0.154)	(1.592)	(0.136)	(1.364)	(0.141)
Age in years	-0.025	-0.006	0.081	-0.000	-0.053	-0.006	0.054	-0.001
	(0.323)	(0.023)	(0.319)	(0.023)	(0.318)	(0.022)	(0.332)	(0.024)
Sex	-2.743***	-0.170***	-3.157***	-0.217***	-2.667***	-0.183***	-3.244***	-0.227***
	(0.659)	(0.055)	(0.687)	(0.053)	(0.661)	(0.054)	(0.699)	(0.054)
Annual expenditure in Bangladeshi Taka: ref. <100k								
100–150k	1.627**	0.117*	2.333***	0.110*	1.680**	0.118*	2.048**	0.099
	(0.755)	(0.063)	(0.742)	(0.061)	(0.745)	(0.063)	(0.817)	(0.065)
150–200k	1.317	0.117	2.073*	0.127	1.581	0.128	2.008*	0.139
	(0.994)	(0.083)	(1.087)	(0.082)	(1.021)	(0.084)	(1.195)	(0.090)
200+k	3.781***	0.249***	4.659***	0.264***	4.041***	0.284***	4.561***	0.277***
	(1.178)	(0.087)	(1.311)	(0.088)	(1.147)	(0.088)	(1.337)	(0.091)
Source of expenditure: others	0.855	-0.001	0.329	0.015	0.681	0.007	-0.121	-0.003
	(0.709)	(0.061)	(0.755)	(0.056)	(0.709)	(0.062)	(0.757)	(0.055)
Institution type: private	1.819**	0.096	1.118	0.114*	1.727**	0.095	1.212	0.116*
	(0.843)	(0.066)	(0.822)	(0.064)	(0.842)	(0.067)	(0.849)	(0.065)
Academic year 2nd: ref. 1st	-1.379	-0.107	-0.581	0.004	-1.588*	-0.142**	-0.806	-0.019
	(0.884)	(0.069)	(0.903)	(0.068)	(0.879)	(0.067)	(0.909)	(0.069)
3rd	-0.215	0.011	-0.027	0.055	-0.332	-0.013	-0.038	0.043
	(1.013)	(0.082)	(1.053)	(0.079)	(1.012)	(0.082)	(1.075)	(0.082)
4th	-0.242	0.008	-1.687	-0.094	-0.323	-0.020	-1.932	-0.114
	(1.767)	(0.131)	(1.629)	(0.120)	(1.734)	(0.130)	(1.630)	(0.120)
5th	-4.133**	-0.252**	-4.845**	-0.332***	-3.878**	-0.254**	-3.293	-0.210
	(1.741)	(0.119)	(1.916)	(0.125)	(1.731)	(0.118)	(2.547)	(0.173)
Smoking status: yes	-0.638	-0.067	-0.683	-0.061	-0.745	-0.080	-0.346	-0.032
	(1.143)	(0.080)	(1.109)	(0.071)	(1.143)	(0.080)	(1.253)	(0.082)
Mental illness history: yes	6.805***	0.387***	6.061***	0.341***	6.687***	0.368***	5.567***	0.300***
	(1.168)	(0.060)	(1.279)	(0.090)	(1.271)	(0.062)	(1.438)	(0.098)
Constant	10.180	0.589	5.799	0.317	10.814*	0.622	6.387	0.335
	(6.593)	(0.471)	(6.509)	(0.473)	(6.488)	(0.454)	(6.777)	(0.495)
Survey wave FEs	yes	yes	yes	yes	yes	yes	yes	yes
Observations	594	594	594	594	698	698	698	698
R-squared	0.218	0.138	0.214	0.151	0.231	0.160	0.201	0.141

Notes: Estimated results in columns 1–4 were based on the first four waves and in columns 5–8 were based on the full six waves samples. Robust standard errors clustered at the individual level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.