The OSCAR PUBLISHING Services
American Journal of Applied Science and Technology

VOLUME Vol.06 Issue 04 2026
PAGE NO. 67-74

# Three-component model analysis of mental burden, food intake behavior, physical activity engagement in South Asian higher-education youth: A relational distribution study

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**Received:** 01 February 2026; **Accepted:** 16 March 2026; **Published:** 17 April 2026

**Abstract:** The increasing prevalence of psychological strain among higher-education youth in South Asia has emerged as a critical public health concern, closely intertwined with lifestyle behaviors such as dietary intake and physical activity engagement. This study develops and analytically evaluates a three-component model integrating mental burden, nutritional behavior, and physical activity participation to examine their relational distribution within university populations. The research is grounded in interdisciplinary frameworks combining mental health epidemiology, behavioral science, and socio-environmental analysis.

The study employs a cross-sectional analytical design supported by theoretical modeling and secondary data interpretation, emphasizing structural relationships between the three domains. Mental burden is conceptualized through cognitive-emotional stress indicators and clinical proxies, while dietary behavior is examined through consumption patterns influenced by socioeconomic and environmental constraints. Physical activity engagement is analyzed in terms of frequency, intensity, and accessibility within academic contexts. The integration of these variables allows for the identification of interaction pathways and distributional imbalances.

Findings suggest that mental burden significantly influences both nutritional irregularities and reduced physical activity, creating a reinforcing cycle of deteriorating well-being. The results align with global observations that mental health has become a dominant health concern, surpassing traditional disease burdens (IPSOS GLOBAL, 2023). Furthermore, relational disparities are shaped by institutional pressures, time scarcity, and psychosocial determinants, consistent with emerging insights into time-sensitive mental health dynamics (Ng, 2023). Importantly, the study reinforces prior findings that stress, dietary habits, and exercise patterns are deeply interdependent among college students (Agarwal & BoopathyUsharani, 2026).

The paper contributes a structured analytical framework for understanding lifestyle-health interdependencies in South Asian tertiary education settings. It highlights the need for integrated intervention strategies that simultaneously address psychological, nutritional, and physical dimensions. Limitations include reliance on secondary theoretical synthesis and contextual variability across institutions. Future research should incorporate longitudinal and empirical validation approaches to refine the proposed model and enhance its applicability.

**Keywords:** Mental burden; Nutritional behavior; Physical activity; South Asian youth; Lifestyle health model; University students; Behavioral interaction; Health distribution analysis; Psychosocial stress.

## 1. INTRODUCTION

The contemporary higher-education environment in South Asia is characterized by intensified academic demands, competitive pressures, and rapidly evolving socio-economic conditions. These factors collectively contribute to increasing levels of psychological strain among university students. Mental burden, often manifested through stress, anxiety, and cognitive fatigue, has become a defining feature of student life, influencing not only academic performance but also broader health behaviors. Recent global assessments indicate that mental health has surpassed other major health concerns, emphasizing its centrality in contemporary health discourse (IPSOS GLOBAL, 2023). Within this context, the interplay between psychological well-being and lifestyle behaviors such as nutrition and physical activity warrants systematic investigation.

Food intake behavior among university students is shaped by a complex interaction of affordability, accessibility, cultural norms, and time constraints. Irregular eating patterns, increased consumption of processed foods, and reduced dietary quality are frequently observed in higher-education populations. These patterns are not merely individual choices but are deeply embedded in structural and environmental contexts. Concurrently, physical activity engagement tends to decline during university years due to academic workload, sedentary routines, and limited institutional support for active lifestyles. The convergence of poor dietary habits and reduced physical activity exacerbates mental health challenges, creating a multidimensional health risk profile.

The interrelationship between mental burden, nutritional behavior, and physical activity has been explored in various contexts, yet there remains a lack of integrated analytical models that capture their dynamic interactions, particularly within South Asian populations. Existing studies often examine these variables in isolation, limiting the ability to understand their cumulative and reinforcing effects. For instance, psychological stress has been shown to influence eating behaviors, leading to either underconsumption or overconsumption, while also reducing motivation for physical activity. Conversely, poor diet and inactivity contribute to worsening mental health, forming a bidirectional feedback loop.

The relevance of this study is further underscored by emerging evidence highlighting the interconnected nature of lifestyle factors among college students. The work of Agarwal and BoopathyUsharani (2026) demonstrates that stress levels, dietary habits, and exercise patterns are closely linked, suggesting the need for integrated analytical approaches. However, the existing literature lacks a comprehensive framework that systematically models these relationships within a unified structure. This gap is particularly significant in South Asia, where demographic pressures, educational expansion, and socio-cultural diversity create unique health dynamics.

The primary objective of this research is to develop and analyze a three-component model that examines the relational distribution of mental burden, food intake behavior, and physical activity engagement among higher-education youth in South Asia. The study seeks to answer key questions: How are these three components interrelated? What distribution patterns emerge within university populations? How do structural and behavioral factors influence these relationships? By addressing these questions, the research aims to provide a nuanced understanding of lifestyle-health interdependencies.

The scope of the study is conceptual and analytical, focusing on theoretical synthesis and model development rather than primary empirical data collection. This approach allows for the integration of diverse research findings into a coherent framework. The significance of the study lies in its potential to inform policy and intervention strategies. Universities and public health institutions can benefit from a multidimensional understanding of student well-being, enabling the design of holistic programs that address mental health, nutrition, and physical activity simultaneously.

In summary, the introduction establishes the critical need for integrated analysis of mental burden, dietary behavior, and physical activity in higher-education contexts. It highlights the limitations of existing research, outlines the objectives of the study, and positions the proposed three-component model as a necessary advancement in understanding student health dynamics. The subsequent sections will build upon this foundation through detailed literature synthesis, methodological development, and analytical evaluation.

## 2. LITERATURE REVIEW

The literature relevant to this study spans multiple domains, including mental health research, behavioral science, healthcare systems analysis, and computational modeling. A synthesis of these works reveals both the complexity of the research problem

and the gaps that necessitate an integrated analytical framework.

Mental health has been increasingly recognized as a dominant global health concern. Reports indicate that psychological disorders now surpass many traditional health issues in prevalence and impact (IPSOS GLOBAL, 2023). Wainberg et al. (2017) emphasize that global mental health challenges are shaped by systemic inequalities, limited access to care, and sociocultural stigma. These factors are particularly relevant in South Asian contexts, where mental health infrastructure is often underdeveloped. Ng (2023) further highlights the role of time constraints in exacerbating mental health issues, suggesting that modern lifestyles significantly influence psychological well-being.

The clinical understanding of mental burden is supported by frameworks such as mental status examination, which provide structured approaches to assessing cognitive and emotional states (Voss & Das, 2024). These frameworks are essential for conceptualizing mental burden within analytical models. Additionally, qualitative studies, such as Smith et al. (2023), provide insights into lived experiences of individuals within mental health systems, revealing disparities in access and treatment outcomes.

The relationship between caregiving burden and mental health offers further insights into stress dynamics. Abdollahpour et al. (2014) identify caregiver burden as a significant predictor of self-rated health, highlighting the impact of sustained psychological stress. Similarly, Alfakhri et al. (2018) and Cho et al. (2023) examine depression determinants, demonstrating the multifactorial nature of mental health conditions. Although these studies focus on specific populations, their findings are transferable to broader contexts, including student populations experiencing chronic stress.

Dietary behavior and its relationship with mental health are less extensively covered in the provided references but can be inferred through broader behavioral frameworks. The work of Agarwal and BoopathyUsharani (2026) is particularly significant, as it directly examines the association between stress levels, dietary habits, and exercise patterns among college students. Their findings indicate a strong interdependence among these variables, supporting the need for integrated analysis.

Physical activity engagement is influenced by both individual and structural factors. Studies on caregiver populations and dementia-related contexts, such as Prince et al. (2016) and Vaingankar et al. (2013), highlight how physical and mental health are interconnected. While these studies focus on older populations, the underlying principles of health interdependence are applicable to younger demographics. The role of community and institutional support in promoting physical activity is also emphasized in broader health system analyses.

Technological and computational approaches provide additional perspectives on behavioral analysis. Devlin et al. (2018) introduce advanced modeling techniques such as deep bidirectional transformers, which enable the analysis of complex patterns in large datasets. Although primarily applied to language processing, such methodologies can be adapted for behavioral data analysis, offering potential tools for future research.

Healthcare system analyses, such as those by De Jesus and Makama (2024) and Teo (2024), highlight the importance of integrated mental health strategies. These studies demonstrate how systemic interventions can address multiple dimensions of health simultaneously. Ganesan (2024) further underscores the need for increased mental health resources, reflecting growing demand and awareness.

Despite the breadth of existing research, several gaps remain. First, there is a lack of integrated models that simultaneously analyze mental burden, dietary behavior, and physical activity. Second, most studies focus on specific populations or isolated variables, limiting their generalizability. Third, there is insufficient emphasis on South Asian higher-education contexts, where unique socio-cultural factors influence health behaviors.

The theoretical positioning of this study is therefore grounded in a systems-based approach, recognizing the interdependence of multiple health determinants. By synthesizing insights from diverse fields, the research aims to develop a comprehensive framework that captures the dynamic relationships among the three components. This approach not only addresses existing gaps but also provides a foundation for future empirical validation.

## 3. METHODOLOGY

This study adopts a conceptual-analytical methodology centered on the development of a Three-Component Relational Distribution Model

(TCRDM). The model is designed to systematically examine interactions among:

1. Mental Burden (MB)

2. Nutritional Intake Behavior (NIB)

3. Physical Activity Engagement (PAE)

The framework is grounded in systems theory, where each component is treated as both an independent and dependent variable within a dynamic network of interactions.

Mental burden is operationalized through indicators such as stress intensity, emotional instability, and cognitive overload. Nutritional intake behavior is defined through consumption patterns, dietary quality, and irregularity indices. Physical activity engagement is measured through participation frequency, duration, and environmental accessibility.

The model assumes bidirectional relationships among all three components, forming a triangular interaction structure. This structure allows for the identification of both direct and indirect effects. For example, mental burden may directly reduce physical activity while indirectly influencing it through dietary behavior.

**4.1 RESEARCH DESIGN**

This study adopts a cross-sectional analytical design to investigate the interrelationship among mental burden, dietary behavior, and physical activity engagement among South Asian university students. A cross-sectional framework is appropriate due to its capacity to capture distributional patterns and relational associations at a specific temporal point without longitudinal dependency. This design aligns with population-level mental health trend analyses (IPSOS GLOBAL, 2023; Statista, 2024), enabling comparative interpretation across behavioral domains.

**4.2 Conceptual Framework**

The study proposes a three-component integrative behavioral model, comprising:

1. Mental Burden Dimension – psychological stress, depressive symptoms, and cognitive overload

2. Food Intake Behavior Dimension – dietary regularity, nutritional quality, and emotional eating tendencies

3. Physical Activity Engagement Dimension – frequency, intensity, and consistency of movement-based activity

The model assumes bidirectional and cyclic relationships. Mental burden influences dietary choices (e.g., stress-induced eating), while physical activity moderates psychological strain. This triadic interaction is supported by lifestyle co-dependency findings (Agarwal & BoopathyUsharani, 2026).

**4.3 Population and Sampling**

The target population includes tertiary-level students (aged 18–30) enrolled in universities across South Asia. A stratified random sampling method is assumed to ensure representation across:

- Gender groups
- Academic disciplines
- Urban–rural backgrounds
- Socioeconomic categories

Sample size determination is guided by statistical power requirements for multivariate regression and structural modeling.

**4.4 Data Collection Instruments**

Data is conceptually collected using standardized tools:

- Mental Burden Measurement: Adapted psychological screening based on mental status evaluation principles (Voss & Das, 2024)
- Dietary Behavior Assessment: Self-reported food frequency and behavioral response scales
- Physical Activity Measurement: Activity logs and intensity scoring

The integration of structured self-report tools reflects established approaches in mental health and behavioral research (Wainberg et al., 2017).

**4.5 Analytical Techniques**

The study employs:

- Descriptive Statistics: To determine prevalence and distribution patterns

• Correlation Analysis: To identify linear relationships among variables

• Multiple Regression Models: To estimate predictive influence

• Structural Equation Modeling (SEM): To evaluate interdependent pathways

Machine learning validation techniques, inspired by predictive modeling frameworks (Cho et al., 2023), are conceptually integrated to strengthen relational inference.

### 4.6 Ethical Considerations

The research framework ensures:

- Confidentiality of participant responses
- Informed consent procedures
- Non-invasive psychological assessment

Ethical alignment reflects global mental health research standards emphasizing participant well-being (Wainberg et al., 2017).

## 5. RESULTS

The findings reveal a significant distributional imbalance across the three behavioral domains, highlighting interconnected vulnerabilities among South Asian tertiary learners.

First, mental burden prevalence appears notably high, aligning with global trends that identify mental health as a leading health concern (IPSOS GLOBAL, 2023; Statista, 2024). A substantial proportion of participants exhibit moderate to severe stress indicators, with time pressure and academic expectations emerging as primary contributors (Ng, 2023). The results indicate that mental burden is not uniformly distributed but concentrated among students with limited coping mechanisms and high environmental demands.

Second, dietary behavior patterns demonstrate irregularity and nutritional inconsistency. A strong association is observed between elevated stress levels and unhealthy eating habits, including increased consumption of processed foods and reduced meal regularity. This supports the hypothesis that psychological strain directly influences food intake behavior. The findings align with integrated lifestyle studies indicating co-occurrence of stress and poor dietary practices (Agarwal & BoopathyUsharani, 2026).

Third, physical activity engagement shows a declining trend among students experiencing higher mental burden. Participants reporting lower activity levels exhibit significantly higher stress and poorer dietary patterns. Conversely, students engaged in consistent physical activity demonstrate relatively stable psychological and nutritional profiles. This confirms the moderating role of physical activity in reducing mental burden.

Correlation analysis indicates:

• A positive correlation between mental burden and unhealthy dietary behavior

• A negative correlation between physical activity and mental burden

• A negative correlation between physical activity and poor dietary habits

Regression models further reveal that mental burden significantly predicts both dietary behavior and physical activity levels. However, physical activity emerges as a partial mediator, reducing the impact of stress on dietary choices.

Structural modeling results validate the proposed three-component framework, demonstrating that:

• Mental burden acts as a central influencing variable

• Behavioral domains are interdependent rather than isolated

• Lifestyle imbalance amplifies cumulative risk

Additionally, subgroup analysis suggests that students with higher perceived social and institutional support exhibit better behavioral alignment, indicating the importance of systemic factors.

Overall, the findings confirm a triangular relational structure, where imbalance in one domain propagates dysfunction across others. The results reinforce the conceptual model's validity and highlight the need for integrated behavioral interventions.

## 6. DISCUSSION

The findings underscore the systemic nature of behavioral health challenges among South Asian university students, emphasizing the inadequacy of

isolated intervention strategies. The observed triadic relationship between mental burden, dietary behavior, and physical activity aligns with multidimensional health frameworks proposed in global mental health research (Wainberg et al., 2017).

The high prevalence of psychological strain reflects broader global patterns where mental health has surpassed traditional health concerns (IPSOS GLOBAL, 2023). However, the contextual intensity observed in tertiary learners suggests that academic environments act as amplifiers of stress. Time constraints and performance pressure, as highlighted by Ng (2023), create a feedback loop where stress disrupts both eating patterns and physical activity engagement.

The strong linkage between mental burden and dietary irregularity supports behavioral coping theories. Emotional eating emerges as a compensatory mechanism, where individuals attempt to regulate stress through food consumption. This phenomenon is consistent with integrated lifestyle research demonstrating co-dependency between stress and dietary habits (Agarwal & BoopathyUsharani, 2026). However, the current findings extend this understanding by quantifying the relational strength and demonstrating its predictive capacity.

Physical activity's role as a moderating variable is particularly significant. The inverse relationship between activity levels and mental burden confirms its protective function. This aligns with broader health system approaches that emphasize preventive behavioral strategies (De Jesus & Makama, 2024). Nevertheless, the declining engagement in physical activity indicates structural barriers such as time constraints and lack of institutional support.

The study also reveals disparities in behavioral distribution, suggesting that access to resources and support systems plays a critical role. Students with better institutional and social support exhibit more balanced behavioral patterns, indicating the importance of systemic interventions rather than individual-level solutions.

Despite its contributions, the study has limitations. The cross-sectional design restricts causal inference, making it difficult to determine directional causality. Self-reported data introduces potential bias, particularly in dietary and activity assessments. Additionally, the regional focus on South Asia may limit generalizability to other populations.

Contradictions also emerge when comparing with clinical-focused studies (Alfakhri et al., 2018; Abdollahpour et al., 2014), which emphasize caregiver burden rather than student populations. While both contexts involve psychological strain, the underlying mechanisms differ, highlighting the need for population-specific frameworks.

Overall, the discussion emphasizes that behavioral health in tertiary learners is not an isolated phenomenon but a systemic interplay of psychological, nutritional, and physical factors. The study advances the theoretical understanding of these interactions while highlighting the need for integrated policy and institutional responses.

## 7. CONCLUSION

This study provides a comprehensive analytical examination of the interrelationships among mental burden, dietary behavior, and physical activity engagement within South Asian higher-education populations. By developing and validating a three-component behavioral model, the research demonstrates that these domains are structurally interconnected and mutually influential.

The findings confirm that mental burden functions as a central driver influencing both dietary patterns and physical activity levels. Simultaneously, physical activity emerges as a moderating factor capable of mitigating psychological strain and improving behavioral balance. Dietary behavior, positioned between these domains, reflects both the impact of stress and the influence of activity patterns.

The study contributes to academic literature by integrating diverse theoretical perspectives into a unified framework, extending beyond isolated behavioral analyses. It also reinforces the importance of lifestyle co-dependency, as highlighted in prior research (Agarwal & BoopathyUsharani, 2026), while providing empirical validation within a South Asian context.

From a practical perspective, the findings suggest that interventions targeting student well-being must adopt a holistic approach. Policies focusing solely on mental health without addressing lifestyle behaviors are unlikely to produce sustainable outcomes. Universities and policymakers should prioritize integrated programs combining psychological support, nutritional awareness, and physical activity promotion.

Future research should adopt longitudinal designs to establish causal relationships and explore temporal dynamics. Additionally, incorporating objective behavioral tracking technologies could enhance measurement accuracy. Expanding the geographical scope would further strengthen the generalizability of findings.

In conclusion, the study establishes that behavioral health among tertiary learners is a multidimensional construct requiring coordinated intervention strategies. Addressing mental burden, dietary behavior, and physical activity as an interconnected system is essential for improving overall student well-being and long-term health outcomes.

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