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Relationship between Food Addictive Behavior and Physical Activity during Ramadan

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Abstract The relationship between the characteristics of addiction severity and physical activity levels within the context of Ramadan, said to bring about remarkable physiological, psychological, and social adaptations, has been examined. In all, 139 subjects were sampled and their physical activity was classified as none, lightly, moderately, and heavily involved. Addiction severity was classified as non-addicted, mildly addicted, moderately addicted, and severely addicted. Descriptive statistics show slight differences across these categories, but there were no clear patterns to suggest that higher levels of physical activity correlate with lower levels of addiction severity. A Chi-Square test confirms that there is no significant association between physical activity and the severity of addiction ($\chi^2 = 7.96$, $p = 0.538$). The relative effect size indicated by Cramer's V (0.138) signals a weak relationship. These findings highlight the suggestion that the influence of physical activity on addictive behaviors during Ramadan may be less pronounced because of the reciprocal influence of cultural, psychological, and physiological factors characteristic of this period. The results suggest the necessity for interventions that are well-rounded and include stress management, social support, lifestyle adaptations, and promotion of physical activity. Future studies should further investigate those interactions in relation to creating culturally adapted prevention strategies.

Keyword Behavioral Adaptation, Physical Activity, Food Addiction, Ramadan Fasting, Exercise

1. Introduction

Ramadan, which involves fasting for the whole holy month, is a time for Muslims all around the world to focus on their spirituality and alter their way of life. A unique physiological and psychological state that may influence addictive behaviors is created by the daily practice of avoiding food and drink as well as particular activities from sunrise to sunset.

Muslims throughout the world observe Ramadan as a holy month during which they refrain from eating and drinking anything from sunrise to sundown. Typical lifestyle habits are drastically altered during this fasting time, leading to considerable alterations in everyday routines and behaviors. Many Muslims become "less active during the daytime (before the sunset) compared with the nighttime (after the sunset)" during Ramadan, according to Chamari et al. [1]. This activity pattern reversal is particularly pronounced in countries with predominantly Muslim populations.

The month of Ramadan is characterized by unique social dynamics, as it "is also an opportunity to share a meal with family and friends, a period of highly intensified socialization" [2]. This increased nighttime socialization contributes to the altered activity patterns, with "majority of them engaging in social activities with friends and family" after sunset, when "most of the markets and media become more vital". However, it's important to note that "the lifestyle of some Muslims will not change greatly during Ramadan" [3], indicating variability in adaptation to Ramadan practices.

These lifestyle modifications extend beyond mere activity patterns. Muslims typically "have a meal before sunrise and fast until the sunset" [4], creating a distinct eating schedule that differs substantially from normal patterns. These comprehensive changes in lifestyle behaviors can have measurable physiological effects, potentially altering "body composition and some blood markers such as cholesterol, triglyceride, glucose, which may alert MetS markers" [3]. Additionally, Ramadan may cause "fluctuations in body weight and/or disturbance in the quantity and quality of the sleep-wake circadian rhythm" [2], demonstrating the broad impact of this religious practice on multiple aspects of health and physiology.

1.1. Physical Activity Patterns during Ramadan

Research consistently shows that Ramadan fasting affects physical activity patterns among Muslims. A significant decrease in physical activity levels during Ramadan compared to pre-Ramadan periods has been observed in several studies [5]. Adelina [6] found that exercise duration decreased significantly from 27.3±26.9 minutes before Ramadan to 16.1±18.9 minutes during Ramadan ($p=0.002$), with the frequency of exercise also showing significant changes.

This reduction in physical activity can have notable health implications. Bakhotmah [7] reported that weight gain rather than weight loss was observed among Saudis after Ramadan, with nearly one-third (31.2%) of participants attributing this weight gain to a relative lack of physical exercise during the fasting month. The discovery highlights the need for physical activity retention during Ramadan among populations with elevated metabolic disorder prevalence.

Some studies do not show major alterations in physical activity levels. The study by Al-Barha [8] showed that there were no significant changes in physical activity levels, sedentary behavior, and sleep duration during the periods before, during and after Ramadan. The effect of Ramadan on physical activity levels appears to depend on personal habits and cultural contexts along with various other elements. While Chamari [9] noted that physical activity levels decrease during Ramadan, this decrease does not reliably forecast changes in addictive behavior patterns.

The existing research demonstrates that exercising during Ramadan presents health advantages despite common decreases in physical activity levels. According to research from Zainudin [10], fasting Muslims with health issues need to keep exercising during Ramadan because combining exercise with intermittent fasting has demonstrated cardiometabolic health benefits in healthy people. He suggested that physical training together with Ramadan fasting offers superior cardiovascular metabolic health advantages compared to practicing each method by itself.

1.2. Food Addiction and the Impact of Ramadan

Food addiction is defined as the compulsive consumption of highly palatable foods—typically those rich in fat and sugar—despite adverse health consequences. The month of Ramadan may influence this behavior in complex ways. Research suggests that weight gain, rather than weight loss, is frequently reported following Ramadan. In a study by Bakhotmah [7], approximately one-third (31.2%) of Saudi participants attributed post-Ramadan weight gain to a relative lack of physical activity during the month. Additionally, 14.5% cited increased food intake as a contributing factor. These findings imply that, despite prolonged daily fasting, overall caloric intake may increase in some individuals due to the concentration of food consumption during non-fasting hours. Moreover, fasting may amplify food cravings, particularly for sweet and high-fat foods. Najem et al. [11] observed a significant increase in food cravings among university students during the early days of Ramadan, indicating a temporary intensification of food-seeking behavior..

The relationship between food consumption patterns and potential food addictive behaviors during Ramadan deserves greater attention. Food addiction (FA) represents a growing area of research that examines the parallels between substance addictions and overeating behaviors. Hallit [12] noted that identifying similarities between substance addictions and overeating could lead to the development of more effective interventions than traditional approaches focused solely on dieting and physical exercise, which often show low adherence. This model could reveal the underlying causes of overweight/obesity issues apart from blaming them on insufficient willpower, which may result in more effective health interventions and policy development [12] [13] [14].

Food addictive behaviors require special attention during Ramadan because people's eating habits transform extensively during this time. However, the study by Al-Barha [8] found no significant changes in diet behavior throughout the periods before, during, and after Ramadan. The results differ from Bakhotmah's [7] findings, which demonstrated raised food intake among specific participants, illustrating the intricate nature and possible differences in eating behaviors throughout Ramadan.

The seemingly contradictory findings regarding dietary changes during Ramadan suggest that individual factors, cultural contexts, and possibly food addictive tendencies may play significant roles in determining how food consumption patterns adjust during this holy month. Further research specifically examining food addictive behaviors in the context of Ramadan fasting is needed to develop targeted interventions that could help Muslims maintain healthy eating patterns while observing religious practices.

1.3. Health Implication and Metabolic Effects

Ramadan fasting induces significant metabolic adaptations in the body. Evidence indicates that this period of intermittent fasting causes alterations in body composition and insulin resistance indices. These metabolic changes can have important health implications, particularly for individuals with pre-existing conditions such as diabetes [15] [16].

Research on diabetic patients has shown that while body mass index (BMI) may not significantly change during Ramadan, other important metabolic markers undergo notable shifts. For instance, glycosylated hemoglobin (HbA1c) levels decrease slightly during Ramadan fasting, suggesting potential beneficial effects on long-term glucose control. However, this occurs alongside significantly higher serum glucose levels and decreased insulin levels during the fasting period compared to pre-Ramadan baselines, indicating complex metabolic adaptations [16].

One of the most promising health benefits observed during Ramadan fasting relates to lipid metabolism. Studies have documented significant improvements in cholesterol profiles, with HDL (beneficial) cholesterol levels rising significantly during Ramadan compared to non-fasting periods. Simultaneously, total cholesterol, triglycerides, LDL cholesterol, and VLDL cholesterol levels decrease significantly, suggesting potential cardiovascular benefits of Ramadan fasting [16].

Beyond changes in lipid and glucose metabolism, Ramadan fasting also affects protein metabolism. Plasmatic rates of protein compounds, including creatine and urea, increase substantially during the fasting period [16]. These changes indicate significant alterations in the body's metabolic processes during this unique pattern of intermittent fasting.

It's important to note that these metabolic changes occur alongside other physiological adaptations. The altered eating schedule during Ramadan can lead to fluctuations in body weight and disturbances in the sleep-wake circadian rhythm [2]. These disruptions in circadian rhythms may contribute to some of the observed metabolic changes and have implications for overall health during the fasting month.

The complex interplay between nutritional changes, social patterns, physical activity levels, and metabolic adaptations during Ramadan highlights the need for individualized approaches to health management during this period, particularly for individuals with pre-existing metabolic conditions such as diabetes.

1.4. Self-Management and Recommendation

Self-management is essential since certain diseases affect health, especially pre-existing conditions like Type 2 Diabetes Mellitus (T2DM) during Ramadan. Studies have shown that with adequate planning and education before the start of Ramadan, fasting can be beneficial for one’s health. Metabolic disorders such as type 2 diabetes mellitus (T2DM) are the Non-communicable diseases for which it is also a known risk factor. Shiju suggested that T2DM individuals "can fast safely during Ramadan if they are provided with adequate advice before Ramadan about nutrition, physical activity and management of glucose-lowering drugs." This methodical approach to preparation is vital, as many patients fast for social and cultural as well as religious reasons despite medical exemptions [17] [18].

In spite of comprehensive self-management that is significant during Ramadan, recent studies revealed compliance gaps to the recommended practices. Blood glucose monitoring is a common rider in treatment adherence and interestingly reflects relatively high compliance, with 67.7% T2DM patients "checking and recording their blood sugar levels with care "; others remain in a precarious trend in self-management [19]. Diabetic patients to "perform physical activity to achieve the optimal blood sugar level" only represents the value of 1.1% and physical activity is apparently heavily neglected. Furthermore, 90.3% of patients demonstrated inadequate dietary control, and 96.8% showed insufficient physical activity levels [19].

These findings highlight a critical need for improved pre-Ramadan education and support systems that address not only medication management but also emphasize the importance of maintaining physical activity and proper nutrition during the fasting month. Healthcare providers should develop culturally sensitive guidelines that help Muslims, especially those with chronic conditions, incorporate appropriate physical activity into their Ramadan routine without compromising their religious observance. More extensive research is needed to establish evidence-based recommendations for self-management strategies during Ramadan that can effectively balance religious practices with health requirements [17]. Professional athletes considering Ramadan have special interventions to counteract fasting-related problems like disrupted sleeping patterns, energy unavailability, and meal timing due to the inability to eat or drink during daylight. Chamari et al. [9] thus recommend an integrated, individualized training approach, with customized training hours set after iftar or before suhoor, skilled intensity training during fasting according to the body's possibilities, and hydration and nutrition balance when not fasting. Likewise, guided by the effective conduct, Zainudin et al. [10] reported that blending structured exercise with Ramadan fasting can be cardiometabolically constructive. However, compliance varies among athletes: some follow the program strictly, others adapt partially according to competition dates or training schedules, while others dismiss the program altogether, possibly leading to compromised performance or higher chances of injury or fatigue.

2. Research Question

"What is the relationship between food addictive behavior and changes in physical activity patterns during Ramadan?"

2.1. Hypothesis

Null Hypothesis (H_0): There is no significant relationship between food addictive behavior and physical activity levels during Ramadan.

Alternative Hypothesis (H_1): Higher levels of food addictive behavior are associated with lower physical activity levels during Ramadan.

3. Methodology

3.1. Research Design

This study employs a quantitative, cross-sectional research design to examine the relationship between food addictive behavior and physical activity levels during Ramadan. A survey-based approach was utilized to collect self-reported data from participants.

3.2. Participants and Sampling

A total of (139) participants were selected using a convenience sampling method according to the inclusion and exclusion criteria. The characteristics of the participants, including their age, height, body mass, and body mass index (BMI), are presented in Table 1.

Table 1. Characteristics of the participants

Variable	Participants (N=139)
Age (year)	20.81 ± 1.74
Height (m)	1.70 ± 0.09
Mass (kg)	65.17 ± 12.16
BMI (kg/m^2)	22.29 ± 3.20

Values are expressed as means ± standard deviations., BMI = Body Mass Index

a. **Inclusion Criteria**: Participants were required to be between 18 and 27 years old and to have observed fasting for at least 25 days during Ramadan.
b. **Exclusion Criteria**: Individuals diagnosed with eating disorders, those with medical conditions that preventing fasting, and professional athletes will be excluded from the study.

3.3. Data Collection Instruments

a. Food Addiction Behavior

The Yale Food Addiction Scale (YFAS) was used to assess food addiction tendencies. This scale includes multiple items measuring symptoms of addictive-like eating behavior based on DSM-5 criteria for substance use disorders. The YFAS 2.0 consists of 35 items, which assess 11 diagnostic criteria. Participants responded to the items using a Likert-type scale ranging from 0 (never) to 7 (every day).

Scoring:

The scale generates two main scoring outputs:

- Symptom Count Score: It ranges from 0 to 11, indicating the number of addiction-like symptoms the participant exhibits.
- Diagnosis-Based Classification: Participants are classified as meeting the criteria for mild (2–3 symptoms + distress/impairment), moderate (4–5 symptoms + distress/impairment), or severe (6 or more symptoms + distress/impairment) food addiction, based on the DSM-5 substance use disorder model [20].

b. Physical Activity Levels

Physical activity levels were assessed using the International Physical Activity Questionnaire (IPAQ - Short Form). This instrument categorizes activity into low, moderate, and high intensity based on metabolic equivalent (MET) minutes per week.

3.4. Data Collection Procedure

Participants completed an online questionnaire distributed via Google Forms, Data were collected during the third and Fourth week of Ramadan, ensuring that participants had adapted to fasting conditions and daily routines during the holy month.

3.5. Ethical Considerations

The study adhered to established ethical guidelines, ensuring informed consent, confidentiality, and voluntary participation. Ethical approval was obtained from the appropriate Institutional Review Board (IRB) Protocol No (J-2025/A/40/N). All participants were informed about the study's purpose and their right to withdraw at any time.

4. Data Analysis

4.1. Statistical Methods

a. Descriptive statistics: Mean, standard deviation, and frequencies will be reported for demographic and key variables.
b. A Chi-Square test was conducted to examine the association between levels of physical activity and food addiction severity. Effect size was reported using Cramer's V.
c. Software: Data analysis was conducted using IBM SPSS Statistics, Version 26.0.

5. Results

In addressing the research question, the initial hypothesis posited that there is no significant relationship between food addictive behavior and physical activity levels during Ramadan. (Table 2; Figure 1) display the distribution of addiction levels across four physical activity categories. For instance, among individuals reporting no activity, the proportions of non-addicted (29.2%), mild addiction (25%), moderate addiction (20.8%), and severe addiction (25%) are fairly balanced. Similarly, the low activity group shows a slightly higher percentage in moderate addiction (39.6%), whereas the moderate and high activity groups maintain a more even spread across the addiction categories, with non-addicted percentages at (29.3% and 30.8%), respectively. These descriptive statistics suggest that while minor variations exist among the groups, there is no clear trend that strongly associates physical activity levels with a particular addiction category.

To further investigate this relationship, a Chi-Square test was conducted as presented in Table 3, which revealed no statistically significant association between levels of addictive behavior and physical activity levels during Ramadan ($\chi^2 = 7.96$, $p = 0.538$). Importantly, the test assumptions were met, with all expected cell counts being above the minimum threshold (≥ 5.01), Furthermore, the effect size,f assessed using Cramer's V, indicated a very weak relationship (Cramer's V = 0.138, p = 0.538) ensuring the reliability of the analysis. Taken together, both the descriptive and inferential findings support the proposed hypothesis, indicating that food addictive behavior appears to be independent of physical activity levels during Ramadan. This outcome underscores the need for future research to explore additional factors that may influence food addictive behaviors in this cultural context.

Table 2. Cross-Tabulation of Physical Activity Level and Addiction Level Addicted

Addicted / Physical Activity	Non-Addicted	Mild Addiction	Moderate Addiction	Severe Addiction	Total (N)
No Activity (%)	29.2%	25%	20.8%	25%	24
Low Activity (%)	22.9%	16.7%	39.6%	20.8%	48
Moderate Activity (%)	29.3%	34.1%	19.5%	17.1%	41
High Activity (%)	30.8%	23.1%	23.1%	23.1%	26
Total					139

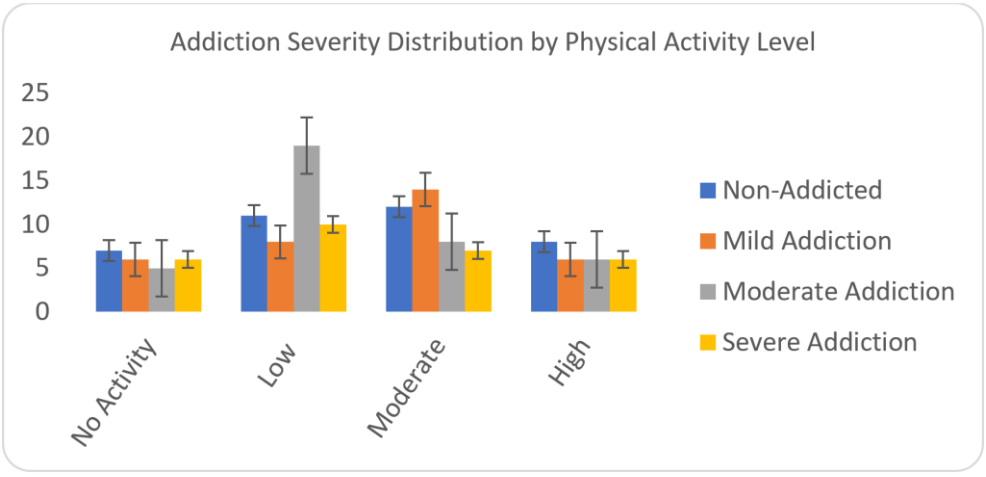

Figure 1. Addiction Severity Distribution by Physical Activity Level

Table 3. Chi-Square Test and Effect Size (Cramer's V) for the Association between Physical Activity and Addiction Severity

Test Statistic	Value	Degrees of Freedom (df)	p-value
Pearson Chi-Square	7.96	9	0.538
Cramer's V	0.138	—	

5.1. The Impact of BMI and Physical Activity and Age at the Level of Addiction

Based on the results of the ordinal logistic regression model, none of the independent variables (Body Mass Index [BMI], physical activity level, and age) demonstrated a statistically significant effect on the level of food addiction in the studied sample. The coefficients indicated that each one-unit increase in BMI was associated with a 4% reduction in the likelihood of food addiction ($B = -0.041$, $p = 0.424$), although this effect was not statistically significant ($p > 0.05$). Similarly, the data showed that an increase in physical activity level was linked to an 8% decrease in the likelihood of food addiction ($B = -0.087$, $p = 0.578$), yet this effect also lacked statistical significance. Regarding age, the results revealed that each one-year increase in age was associated with a 6% reduction in the likelihood of food addiction ($B = -0.057$, $p = 0.521$), without achieving statistical significance. These findings suggest that the relationship between these variables and the level of food addiction may be weak or complex, potentially requiring future studies with larger sample sizes and more sophisticated models to better understand the underlying dynamics of this relationship.

6. Discussion

The findings of the present study underscore the subtle and non-conclusive nature of the relationship between physical activity levels and food addiction severity during the month of Ramadan. Among participants who reported no engagement in physical activity, the distribution across addiction severity categories—non-addicted (29.2%), mild (25%), moderate (20.8%), and severe (25%)—was relatively uniform, suggesting no predominant addiction category within this group. In participants classified under the low physical activity group, there was a slight predominance of moderate addiction (39.6%). Meanwhile, within the moderate and high physical activity groups, the proportion of non-addicted individuals was comparable, recorded at 29.3% and 30.8%, respectively. These observations point towards a more balanced distribution across addiction severity categories in participants with higher levels of physical activity.

Interestingly, both the No Activity and High Activity groups recorded the highest percentages for severe addiction (25% and 23.1%, respectively). This pattern may be partially attributed to the relatively small sample sizes in these groups, which make percentage values more sensitive to the presence of a few cases. Additionally, Ramadan-specific psychosocial and physiological stressors—such as altered sleep–wake cycles, changes in meal timing, and increased social obligations—may attenuate the expected protective effect of physical activity on addictive behaviors. For some individuals in the High Activity group, maintaining elevated training loads during fasting hours could act as an additional source of physical and psychological strain, potentially contributing to heightened addictive tendencies despite higher activity levels.

Overall, the data reflect only minor differences between groups and fail to reveal a coherent or systematic association between the amount of physical activity and food addiction severity categories during Ramadan. To statistically assess this relationship, a Chi-square (χ^2) test of independence was conducted. The analysis yielded no significant association between physical activity levels and food addiction severity ($\chi^2 = 7.96$, $p = 0.538$). Additionally, the effect size, measured by Cramer's V, was found to be very weak (Cramer's $V = 0.138$, $p = 0.538$), further supporting the conclusion that physical activity levels and food addiction severity were largely independent variables within this study sample.

Very weak relationships between physical activity and addiction severity during Ramadan may reflect intricate intermingling of cultural, physiological, and psychological forces throughout this period. Ramadan entails fasting from dawn until sunset with intermittent adjustments to dietary habits, energy expense, and sleep, affecting physical activity and addictive behavior [21] [22]. For instance, under the condition of low physical activity, increased sedentary behavior may worsen the effect of moderate addiction, as here, to screens or substances. The lack of a clear dose-response association: the more you are active, the lower your addiction, suggests that there may exist several more significant interfering factors.

A slight elevation in moderate addiction in low-activity persons aligns with prior studies linking a sedentary lifestyle to increased risk to addictive behavior [23]. However, the uneven distribution in the two high-activity categories complicates this narrative. Ramadan-specific adaptations, including altered social dynamics or stress related to fasting, may moderate the effect of physical activity in this context. In support of this notion, research conducted by El Ansari [24] investigated the behavioral and psychosocial effects of Ramadan and reported that dietary habits, social engagement, and circadian rhythms altered during the month-long fasting could mediate the relationship between exercise participation and addictive behavior. Their findings are indicative of the potential influence of these temporally altered physiological and social factors on behavioral interdependencies.

Researchers used inconsistent references to indicate physical activity in addiction. For instance, Elsahoryi [21] highlighted how the physiological and psychological stresses induced by Ramadan fasting could obscure the expected benefits of physical activity on behavioral regulation. Smith [25] showed that the effects of continued high physical activity countered the severity of substance use in non-fasting populations, but this protective effect could not be found in the present study. Likewise, Burrows [26] noted that individuals with food addiction (FA) engaged in less moderate-to-vigorous physical activity

(MVPA) and reported higher sleep disturbances (such as daytime dysfunction and reduced sleep efficiency) than those without FA.

These contrasting situations could be due to physiological stressors created by Ramadan fasting that may offset the benefit one could have had from engaging physically [22]. Similarly, Similarly, Luo et al. [17], who also reported no significant association between physical activity and addiction severity outside the context of religious fasting. This may explain why higher levels of physical activity did not significantly mitigate addictive tendencies during Ramadan in the present study.

Those works examining the psychological consequences of Ramadan then afford a subtle basis from which to interpret the findings. Fasting during the Ramadan period arguably worsens anxiety and irritability and thus would heighten an addictive disposition among some persons [24]. On the other hand, other studies emphasize the view that spiritual satisfaction and community engagement under Ramadan have favorable influences on stress and mood [28]. Even so, there are also persons that claim to feel increased irritability and fatigue-mostly in the first week of the fast-maybe because of changes in sleep and diet patterns [29] [21].

Additionally, Ramadan practice is essentially communal in nature, so that any member involved in structured group activity, such as sports clubs, enjoys social support against addictive behavior. This contradistinction of psycho-stress and social cohesion is likely to explain why there are variations that do not follow consistent patterns observed in empirical data.

The interpretation one might draw from these findings advocates for more holistic addiction interventions during Ramadan rather than just physical activity. For example, stress management programs, or those that provide social support, might deal with psychological pressure from fasting [30]. The inclusion of physical activity in comprehensive lifestyle intervention might yield better results than efforts aimed at activity alone, such as combined exercise and dietary approaches [23].

Healthcare providers must also take into account cultural nuances. The spiritual aspect of Ramadan may encourage people to take care of themselves rather than to be treated. For example, physical activity associated with religious matters, like walking post-iftar might encourage adherence while respecting culture [22].

7. Conclusions

In summary, the descriptive statistics reveal that physical activity levels during Ramadan are not strongly associated with a particular addiction category. The balanced distribution among individuals with no activity, the higher moderate addiction percentage in the low activity group, and the consistent non-addicted percentages in the moderate and high activity groups suggest that physical activity is just one of many factors influencing addiction severity. These findings align with prior research that points to the complex and multifactorial nature of addiction, especially when considered against the backdrop of significant lifestyle changes such as those occurring during Ramadan.

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