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Association between Health Behaviors, Cognitive Functions and Mental Health; Mediating Role of Emotional Regulation

by

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CERTIFICATE OF APPROVAL

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Abstract

Mental health issues, in particular, depression, anxiety, and stress, are becoming a common phenomenon in the world, and among the Pakistani people. It has explored the complicated interaction of modifiable lifestyle factors (dietary patterns and physical activity), cognitive processes and mental health outcomes, and has investigated the mediating contribution of the strategies of emotional regulation (cognitive reappraisal and expressive suppression). The study was based on the Process Model of Emotion Regulation developed by Gross, and employed a cross-sectional survey design to sample 310 university students (65.5% males, 34.5% females) of both public and privately based institutions in Rawalpindi and Islamabad, Pakistan. The standardized self-report instruments were used to collect data, such as Depression Anxiety Stress Scale (DASS-21), Emotion Regulation Questionnaire (ERQ), Cognitive Functioning Self-Rating Scale (CFSS), Brief Healthy Eating Habit Scale (BHEHS-6B), and the International Physical Activity Questionnaire (IPAQ). The macro that was used to perform Mediation analysis was the PROCESS macro (Model 4). The findings showed that the expressive suppression was a significant predictor of the level of stress (p=0.05) but the mediating influence of emotional regulation between lifestyle factors and mental health outcomes was not significantly observed because the indirect effects that were bootstrapped contained zero. Moreover, the levels of physical activity, cognitive functioning, and eating habits did not cause any notable differences between the various age and socioeconomic groups. Such results imply that although some emotional regulation techniques are associated with psychological distress, the connection between lifestyle patterns and mental health among this group of individuals might be subject to the effects of other unmeasured variables. The paper highlights the necessity of culturally sensitive, lifestyle-based mental health interventions in Pakistani youth adults.

Keywords: Health Behaviors, Dietary Patterns, Physical Activity, Cognitive Functions, Emotional Regulation, Mental Health, Depression, Anxiety, Stress.

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Abbreviations

ANOVA	Analysis of Variance
BHEHS-6B	Brief Healthy Eating Habits Scale
CFSS	Cognitive Functioning Screening Scale
DASS-21	Depression Anxiety Stress Scale–21
EFA	Exploratory Factor Analysis
ERQ	Emotional Regulation Questionnaire
ERQ-CA	Emotional Regulation
ERQ-ES	Emotional Regulation Questionnaire–Expressive Suppression
HEC	Higher Education Commission
IPAQ	International Physical Activity Questionnaire
K-S Test	Kolmogorov-Smirnov Test
M	Mean
MS	Master of Science
MSPSS	Multidimensional Scales of Perceived Social Support
SES	Socioeconomic Status
SD	Standard Deviation
SPSS	Statistical Package for Social Science
WHO	World Health Organization

Chapter 1

Introduction

1.1 Background of the Study

Depression, anxiety, and stress are prevalent mental health challenges that profoundly affect individuals, families, and the community. Depression influences about 300 million individuals worldwide, whereas anxiety disorders affect more than 260 million (World Health Organization, 2019). Stress, although not defined as a disorder, is prevalent and can greatly impact both physical and mental well-being.Two essential lifestyle elements that significantly influence the prediction of depression, anxiety, and stress are dietary patterns (Głabska et al., 2020; Rodríguez-Martín et al., 2022) and physical activity (Harris et al., 2017; Schuch et al., 2016).

Studies indicate that a balanced diet and consistent physical activity can assist in reducing symptoms of anxiety, depression, and stress(Głabska et al., 2020; Harris et al., 2017; Schuch et al., 2016). Stress, anxiety, and depression significantly impact cognitive functions, including working memory, attention, executive functions, and emotional regulation(Głabska et al., 2020; Harris et al., 2017). These mental health conditions can impair cognitive performance, increase emotional reactivity, and contribute to the development and maintenance of disorders(Kuppens and Verduyn, 2015; Pizzagalli and Roberts, 2021). A bidirectional relationship exists between cognitive functions and stress, anxiety, and depression,

with cognitive vulnerabilities and neurobiological mechanisms playing a crucial role(Huang et al., 2021; Marcotte et al., 2006).

According to World Health Organization (2019), depression affects 3.8% of the population and is often accompanied by low quality of life and premature death. Research has shown that timely identification of modifiable lifestyle factors, particularly diet can contribute towards reducing the health anxieties of the population with regard to depressive symptoms (Jacka et al., 2017; Arroll et al., 2023). The literature also shows that depressive symptoms are associated with certain nutrients or foods.

However, diets consist of complex blends of foods rather than a single food, offering a combination of a wide range of nutrients that are beneficial to the overall health(Hu, 2011; Kingsley, 2022). Mental health depends significantly on the lifestyle aspects, and proper nutrition and regular physical exercise are essential elements of it(Schuch et al., 2016). A healthy diet influences the state of mental health, whereas physical exercise contributes to the state of mental health, reduces symptoms of depression and anxiety, and improves the overall well-being (Schuch et al., 2016; Harris and Taylor, 2020) . By concentrating on these aspects, people can make proactive moves toward improved mental well-being.

Some dietary elements like saturated fats and omega-6 fatty acids have been observed to increase the levels of anxiety (Hakkarainen et al., 2004; Michaud et al., 1990; Pollard et al., 1995). This association is supported by recent research, in which there is an association between high consumption of processed foods and the presence of anxiety symptoms(Aucoin et al., 2021). Dietary restriction, emotional eating and obesity also play a role in the relationship between diet and anxiety(Greeno and Wing, 1994; Ruderman, 1983). Stress will lead to an increased consumption of food in restrained eaters but not unrestrained eaters.

Research indicates that relationship between dietary patterns, physical activity, emotional regulation, cognitive functions, and signs of depression, anxiety, and

stress create a circular, interrelated system, complicating analysis. Regular physical exercise enhances emotional control, alleviating symptoms of anxiety and depression(Harris et al., 2017).

A nutritious diet enhances cognitive functions, consequently aiding in the reduction of depression and anxiety(Lai et al., 2014). Such interactions form intricate patterns within adult populations. Efficient emotional regulation methods, including mindfulness and cognitive reappraisal, in combination with consistent physical activity, can significantly help lessen the adverse impacts of stress, depression, and anxiety on both physical and mental well-being(Gross and Thompson, 2007; Harris et al., 2006; Schuch et al., 2016; Hofmann et al., 2010). Integrating these habits into everyday routines allows individuals to effectively handle their mental health and enhance their general wellness.

By focusing on emotional regulation as a mediation process, the current study intends to make a contribution to the current theories and literature available in the literature.

1.2 Gap Analysis

Although much valuable research has linked key health behaviors (such as dietary habits and physical activity) cognitive functions, emotional regulation, and mental health outcomes like depression, anxiety, and stress, the majority of the literature up to date has analyzed these variables in piecemeal fashion. By and large, most studies investigate individual relationships, such as how physical activity influences mental health or how diet influences psychological well-being, without appropriately integrating the factors into a single coherent explanatory framework. These fragmented approaches limit holistic understanding of how these interconnected constructs interact in concert to influence mental health.

Besides, emotional regulation has been identified as one of the critical psychological mechanisms that underpin good mental health, but its role as a mediator

between health behaviors, cognitive functioning, and psychological outcomes has remained understudied. Past studies have considered emotional regulation as an outcome variable or used it as an independent predictor without paying attention to its dynamic role as a mechanism by which lifestyle behaviors and cognitive functioning influence mental health. This is a serious conceptual and empirical lacuna in the literature. Another important weakness in the existing literature is the fact that it has a predominantly Western sample focus. differences in cultures, sociocultural backgrounds, and lifestyle factors in both the West and the rest of the world, including developing nations such as Pakistan, identify a set of potential applications in the West that might not work in other environments. Despite growing numbers of people in Pakistan with mental health related problems, there has been a paucity of empirical studies assessing the joint significance of lifestyle factors, cognitive processes, and emotional management in these conditions within the Pakistani culture and environment.

In addition to that, there appear to exist methodological issues that have been present in previous research studies on the topic to date, and those issues include the lack of utilization of cross-sectional designs and the lack of standardization of measurement methods among others. In most research studies on the topic to date, few models that consider all the variables have been used. To address these shortcomings, the current study aims to provide a complimentary approach for understanding health behaviors, cognitive processes, emotional regulation, and outcomes of mental health to the Pakistani population. By focusing on emotional regulation as a mediation process and using a culturally informed approach, the current study intends to make a contribution to the current theories and literature available in the literature.

1.3 Problem Statement

An increase in mental health issues, including anxiety, depression, and stress, is a significant public health concern worldwide, particularly in Pakistan(World Health Organization, 2019). Despite existing studies on this issue, further examination

of the complex interplay between lifestyle factors like dietary patterns, physical activity, and psychological factors such as emotional regulation and cognitive functions is essential in understanding and treating these disorders(Harris et al., 2006; Lai et al., 2014; Chen et al., 2024; Kar and Barreto, 2024). The aim of this study is to examine the associations of these factors with symptoms of depression, anxiety, and stress among Pakistani population in which mental health problems are increasingly becoming an issue because of the lack of resources and cultural limitations Gadit and Mugford (2007) to inform prevention and interventions programs that are relevant to local context.

Chapter 2

Literature Review

2.1 Overview of Depression, Anxiety and Stress

This chapter gives a detailed analysis on the empirical data and conceptualization of the hypotheses on the links between lifestyle variables (dietary habits and physical activity), emotional regulation, cognitive functioning and mental health outcomes (depression, anxiety, and stress) in young adults. The analysis is based on the Process Model of Emotion Regulation by Gross which assumes that emotional regulation is a key mediator of the effect of lifestyle factors on mental health outcomes.

Depression, anxiety and stress are key societal issues in the world, all of which have great consequences on the well-being of the individual, family and community. The World Health Organization (2019)) states that depression is observed in 3.8% of the world population, 300 million people are estimated to suffer, and anxiety disorders are found in over 260 million people. Stress per se is not a disorder itself but it is highly widespread and has immense negative impact on physical and mental well-being (World Health Organization, 2019).

These are highly correlated with poor quality of life, high chances of premature mortality and high disability burden. Cognitive impairment such as the impairment of working memory, attention, executive functions and emotional regulation

is rather commonly found among people with depression, anxiety or increased stress (Kuppens and Verduyn, 2015; Pizzagalli and Roberts, 2021).

Moreover, there is an emerging evidence of a reciprocal connection between cognitive functioning and these mental-health situations: both cognitive vulnerability and neurobiological mechanism changes may predispose and worsen depression, stress, and anxiety (Huang et al., 2021; Marcotte et al., 2006). Simply put, these mental-health conditions are not just common but significantly interdependent with mental processes and expansion in general lifestyle aspects.

2.1.1 Lifestyle Factors as Modifiable Predictors

Considering the high costs of depression and anxiety, there has been a gradual shift toward examining the changes in lifestyle, which could contribute to risk, prevention, and control. Especially problematic areas are eating habits and exercise (Głabska et al., 2020; Rodríguez-Martín et al., 2022; Harris et al., 2017; Schuch et al., 2016). This study specifically examines diet and exercise patterns for three main reasons: many other lifestyle variables including sleep quality, substance use, screen time, and social engagement have been linked to mental health outcomes; and dietary patterns and physical activity are factors that are more readily amenable to change.

First, meta-analysis indicates that there are greater effect sizes for dietary changes and physical activity than for other lifestyle areas, with pooled standardized mean difference estimates of -0.24 for diet (Firth et al., 2020) and -0.43 for exercise (Schuch et al., 2016). Second, both factors act through similar neurobiological mechanisms that are relevant to depression, such as decreasing systemic inflammation, increasing brain-derived neurotrophic factor (BDNF) and normalizing hypothalamic-pituitary-adrenal (HPA) axis function (Marx et al., 2021; Phillips, 2017). Thus, the choice of these two variables is not only empirical in terms of the prominence of these variables in the study, but also methodological in terms of the practicality of the attributes of these variables for the current study.

2.1.1.1 Dietary Patterns

Nutrition is becoming an important modifiable variable in psychological health. the subdiscipline of "nutritional psychiatry" is growing in line with this (Firth et al., 2020). Recent studies not only highlight the importance of looking at nutrients in a whole-diet or dietary-pattern (Hu, 2011; Kingsley, 2022)instead of individual nutrients. As a case in point, it has been observed that the quality of diet e.g. high intake of processed food, saturated fats and free sugars is linked to increased risks of developing depression and anxiety (Chen et al., 2024).

The systematic review discovered that whole-of-diet interventions (as opposed to single-nutrient interventions) were promising to minimize the symptoms of depression and anxiety. To be more specific, Eliby et al. (2023) found that a high amount of free sugars in the diet and saturated fats and a low amount of fruits and vegetables were positively correlated with a depressive and anxiety symptoms.

Likewise, Selvaraj et al. (2022) have identified that healthy eating habits (e.g., high fibre, fruits/vegetables, whole grains) were associated with the reduced symptoms of depression, but the causality is not as evident. Mechanistically, diet may impact mental health through multiple pathways: inflammation and oxidative stress, gut-microbiome interactions (gut–brain axis), nutrient deficiencies, and neuroplasticity changes (Firth et al., 2020). Thus, diet emerges as a modifiable lifestyle factor with meaningful associations to mental health outcomes.

2.1.1.2 Physical Activity

Mental health outcomes are also closely associated with physical activity (PA). Recent umbrella review has asserted that an increased level of physical activity is negatively related to incident depression and anxiety and the relationship is probably causal. Indicatively, (Pearce et al., 2022) established a dose-response relationship: adults who accumulated half the recommended amount of the physical activity had 18-25 per cent lower risk of depression, with decreasing marginal returns on accumulating more.

The pathways through which physical activity can help improve mental health are as follows: through improved emotional regulation, self-efficacy, sleep, less inflammation, and positive structural/functional effects on the brain (White et al., 2024). Summing up, diet and physical activity are the two major lifestyle change agents in prevention and reduction of depression, anxiety and stress.

2.1.1.3 Cognitive Functions

Cognitive functions, such as attention, working memory, executive functioning and cognitive flexibility have been considered the core of good emotional regulation and adaptive behavior. Cognitive dysfunction is seen in a very high percentage of young adults and affects daily functioning (e.g., academic performance) and affects psychological functioning (Pizzagalli and Roberts, 2021).

Depression negatively affects executive control, attention and working memory capacity that manifest themselves in slow information processing rate, decreased concentration and enhanced rumination (Kuppens and Verduyn, 2015). Depression negatively affects executive control, attention and working memory capacity that manifest themselves in slow information processing rate, decreased concentration and enhanced rumination (Kuppens and Verduyn, 2015).

Time frequency ERP analyses revealed more enhanced late (attention and P3b-related) than early (initial perceptual processing of the first stimulus of the target stream, reflecting at-tentional engagement/reorientation to first targets). Moreover, anxiety is related to an inadequate control processing and a greater sensitivity to threat/safety-relevant information that resulted. It is crucial that cognitive functioning and mental health are closely linked in both directions.

On one hand, issues like depression, anxiety, and stress can negatively affect how we think. On the flip side, if someone has cognitive weaknesses already, they might be more prone to psychological distress and find it tough to manage their emotions in healthy ways (Marcotte et al., 2006; Huang et al., 2021). So, cognitive functioning really plays a big part in how mental health issues develop and stick

around, especially as it interacts with emotional regulation and various lifestyle factors.

2.1.1.4 Lifestyle Behaviors, Cognitive Functions and Mental Health: An Inter-related System

Mental health, lifestyle behaviours (dietary patterns and physical activity), cognitive functions and emotional regulation are not simply related in a linear way but are a complex interdependent system.New research suggests unhealthy eating is directly associated with cognitive impairments, including deficits in attention, working memory, and executive function (Spencer et al., 2017; Jacka et al., 2017). A diet rich in saturated fats and refined sugars is linked to less volume in the hippocampus, greater inflammation in the brain and poorer functioning in attention, working memory, and executive control (Jacka et al., 2017; Spencer et al., 2017).

The dietary patterns cause oxidative stress and change the levels of brain derived neurotrophic factor (BDNF), which plays an important role in the plasticity of synapses involved in cognition (Molteni et al., 2002). Therefore, it is possible that unhealthy eating patterns could directly affect cognition, which then may moderate or mediate links to mental health outcomes, including stress, anxiety, and depression (Huang et al., 2021). These effects are compounded by physical inactivity, which also lowers cerebral blood flow and neurogenesis, thus making the situation a vicious cycle of psychological suffering (Marcotte et al., 2006). The mental health issues, in their turn, may include stress, anxiety, and depression and, therefore, may further locate cognitive functions, creating a loop of self-perpetuating psychological suffering (Marcotte et al., 2006).

A very important mediating process in this system is emotional regulation. It shapes the perception, interpretation and reactions of the individuals to the emotional experiences and, consequently, it impacts the cognitive performance and mental health outcomes (Gross and Thompson, 2007). This is linked to dysregulated emotional responses including rumination or emotional suppression which

are linked to more symptoms of anxiety and depression (Aldao et al., 2010; Joormann and Stanton, 2016). In their turn, adaptive emotional regulation techniques, such as mindfulness and cognitive reappraisal, have the capacity to mitigate the adverse effects of stress on mental health and promote cognitive flexibility (Hofmann et al., 2012; Garnefski and Kraaij, 2018). Exercise has also been proven to enhance emotional regulation and executive control, which leads to lower anxiety and depression (Harris et al., 2017; Schuch et al., 2016). Working out activates neuroplasticity and increases the connection between the prefrontal limbs and the limbic, which is a basis of improved emotion regulation and cognitive control (Stillman et al., 2020). Equally, a healthy diet, which is high in the essential micronutrients, omega-3 fatty acids, and antioxidants, helps to support the best functioning of the brain, enabling a person to be in a better state of concentration, working memory, and emotional control, which makes one less vulnerable to mental distress (Lai et al., 2014; Firth et al., 2020). As a result, lifestyle behaviours, cognitive functions, and emotional regulation have a bidirectional and cyclical interaction that has an effect on psychological symptoms. Emotional regulation has been a mediator of lifestyle and mental health outcomes, how healthy lifestyle practices like balanced nutrition and regular exercise can make the body resilient and counteract the impacts of stress, anxiety, and depression (Pan et al., 2021; Geisler et al., 2021). A combination of these lifestyle variables and adaptive emotional-regulation strategies helps the individuals to be more resilient to stressors, maintain cognitive functionality, and overall well-being (Schuch et al., 2016). Accordingly, the combination of nutritional adequacy, exercise and emotional control offers a holistic perspective concerning the etiology, the maintenance and management of stress, anxiety and depression.

2.2 Theoretical Framework

2.2.1 Gross's Process Model of Emotion Regulation

The study is based on the Process Model of Emotion Regulation, a principles framework of the affective science, which describes how people monitor, assess

and control their emotional experiences (Gross and Thompson, 2007; Gross and John, 2003a).

The model offers an organized knowledge of how individuals control feelings and impact it on the psychological comfort. It is particularly applicable to the interpretation of the complicated interrelations between emotional control, lifestyle-related (dietary habits and physical activity) determinants, cognitive processes and mental health (depression, anxiety, stress). Gross (1998) explains that emotion regulation entails conscious and unconscious methods of controlling the occurrence, intensity, duration and expression of emotions. The model offers an organized knowledge of how individuals control feelings and impact it on the psychological comfort. It is particularly applicable to the interpretation of the complicated interrelations between emotional control, lifestyle-related (dietary habits and physical activity) determinants, cognitive processes and mental health (depression, anxiety, stress). Gross (1998) explains that emotion regulation entails conscious and unconscious methods of controlling the occurrence, intensity, duration and expression of emotions.

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processing of emotional information requires working memory capacity. Third, inhibitory control helps to suppress automatic negative interpretations and cognitive flexibility facilitates generation of alternative less distressing appraisals. Empirical evidence shows that people with weaker executive functions have less ability to reappraise and more tendency to use maladaptive strategies like ruminating and suppression to increase stress. So, cognitive function itself is a direct facilitator of adaptive emotion regulation and this emotion regulation is associated with lower perceived stress.

The Process Model classifies these regulatory activities into five sequential stages; and these stages are closely linked with physical activity, dietary pattern and cognitive functions that all have an impact on mental health outcomes including depression, anxiety and stress. In the first phase (situation selection), the person selects environments which either intensify or diminish emotional distress. Regular physical activity and a healthy diet can also lead to improved energy and motivation, making it easier for individuals to interact in positive social and environmental settings, versus negative and stressful settings (Lai et al., 2014; Schuch et al., 2016).

Likewise, when the cognitive functions like planning and decision making are strong, people can steer clear of conditions that can lead to negative emotions. In stage two, situation modification, persons manipulate the environment to decrease its emotionality. Engaging in physical activity, like exercise, can have an immediate effect on mood and stress, and a well-planned diet can support brain functioning and regulate mood, by stabilizing blood sugar levels (Harris et al., 2006; Jacka et al., 2017). Cognitive function also enable people to resolve problems and effectively change stressful situations.

During the third stage, attentional deployment, people ”direct” their attention. The benefits of physical activity-related practices on attention control and less rumination, which is highly correlated with stress and anxiety (Kabat-Zinn, 2003), are important. Support of the brain functions that relate to attention are also

influenced by nutritional factors, and improved cognitive control enables people to redirect attention from negative thoughts (Martinez-Gomez et al., 2010). The fourth stage is cognitive change/reappraisal, which involves changing the way a situation is thought about. This is heavily related to cognitive functioning; those with greater cognitive flexibility can see stressful situations and re-interpret them in a more positive or manageable light (Gross and Thompson, 2007).

Physical activity and appropriate nutrition also contributes to brain processes and neurotransmitter function and may positively influence emotional resilience and positive thinking (Jacka et al., 2017). Lastly, during the response modulation phase, people modulate their emotional response once it has happened. Exercise lowers the physiological stress response to a high cortisol level, and a healthy diet helps maintain emotional stability. Cognitive control also helps to regulate one's behavior and emotional reactions appropriately (Schuch et al., 2016). Overall, all of the above lifestyle and cognitive factors have effects on all five aspects of emotional regulation, and emotional regulation is a major mediator between physical activity, dietary patterns, cognitive functions and mental health outcomes. Good emotional regulation allows people to regulate their emotions, which reduces their depression, anxiety and stress. Thus, this model posits that by improving lifestyle variables and cognitive functioning, emotional regulation processes may be improved, then ultimately better mental health (Gross, 1998; Gross and John, 2003b; Jacka et al., 2017).

2.2.1.1 Role of Emotional Regulation as a Mediator

In this study, emotional regulation is theorized as a mediating factor a process by which lifestyle (dietary habits and physical exercise) interventions have their impact on mental health outcomes (depression, anxiety, and stress). Emotional regulation mediates this interaction as it determines the way people perceive and react to emotional and cognitive difficulties (Pan et al., 2021; Geisler et al., 2021). An example can be a healthy diet that aids neural mechanisms of emotion regulation, including serotonin and dopamine production, to achieve mood stability and depression resilience (Firth et al., 2020; Lai et al., 2014). Similarly, exercise

can also help participants regulate their emotions by improving the prefrontal cortex and having a higher neuroplasticity, thus giving them greater control of their emotional reactions (Schuch et al., 2016; Stillman et al., 2020).

These physiological and cognitive advantages promote adaptive emotion-

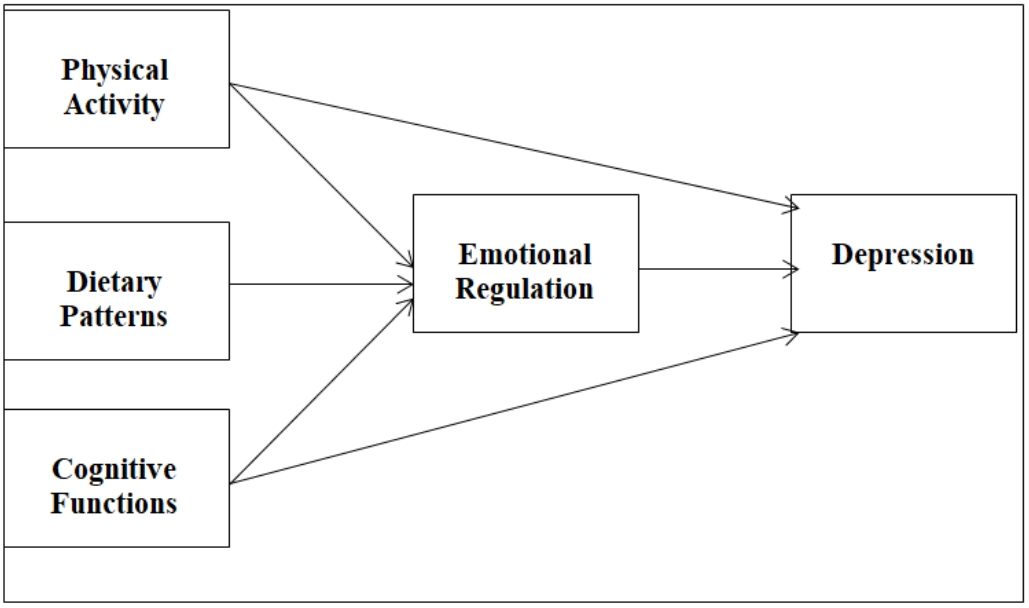


FIGURE 2.1: Conceptual Model with Depression

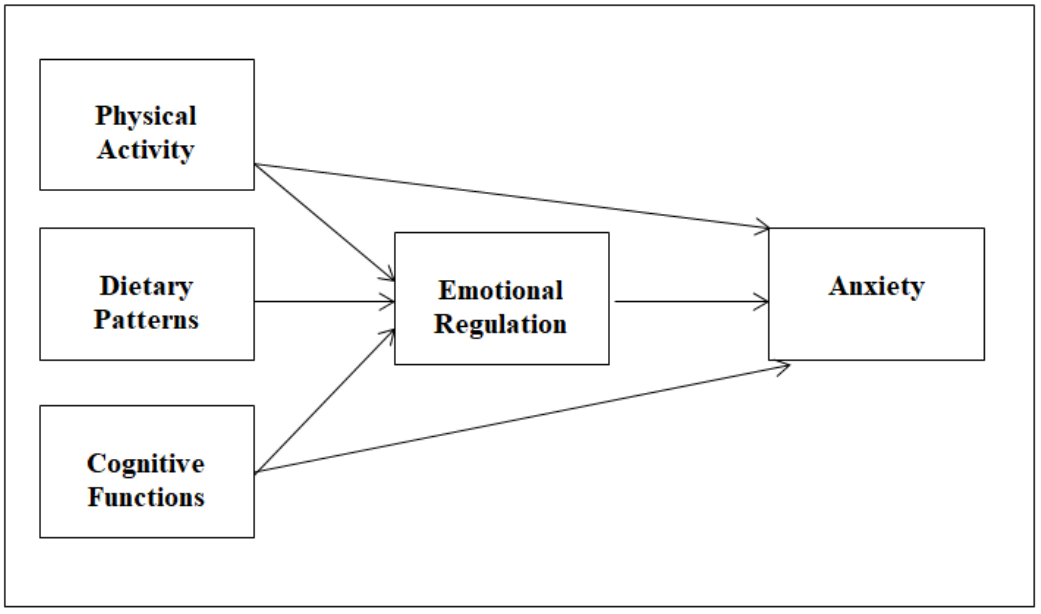


FIGURE 2.2: Conceptual Model with Anxiety

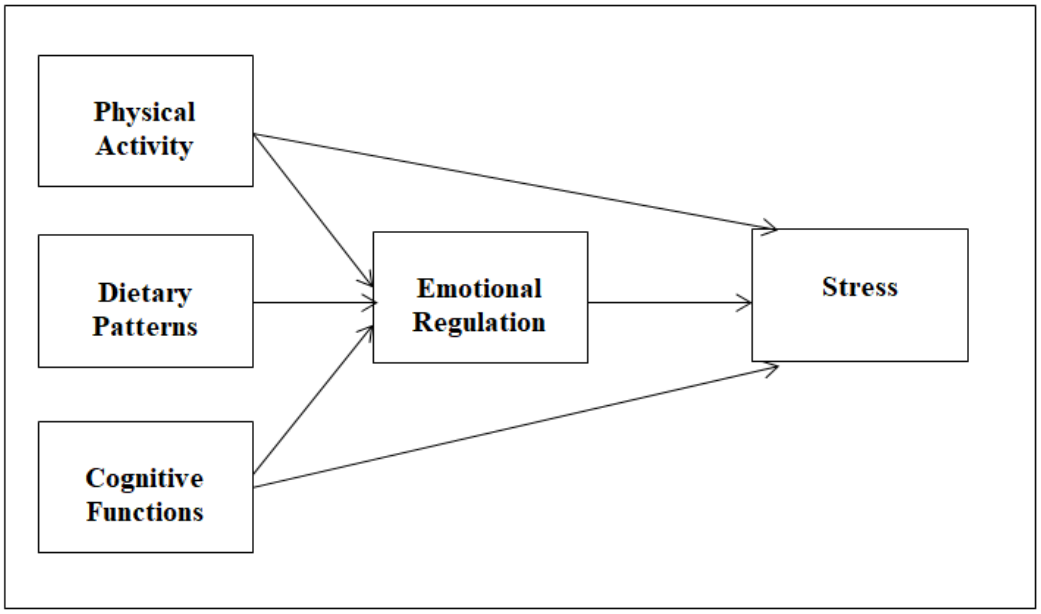


FIGURE 2.3: Conceptual Model with Stress

regulation plans including mindfulness, reappraisal, and problem-solving that alleviate psychological distress. On the other hand, low levels of emotional regulation might intensify poor affective reactions, which result in increased levels of stress, anxiety, and depressive moods (Aldao et al., 2010; Joormann and Stanton, 2016). People whose regulation strategies are maladaptive (e.g., rumination or suppression or avoidance) have lower levels of control over emotional challenges, which can further deteriorate cognitive functioning and reinforce unhealthy lifestyle behaviours (e.g. emotional eating or inactivity), (Greeno and Wing, 1994; Ruderman, 1983). The emotional regulation is therefore a psychological buffer between lifestyle and mental health. In principle, the better dietary and physical activity patterns are, the higher are their emotional regulation abilities, which subsequently cushion against the stress occurrence or the intensity of stress, anxiety, and depression. The conceptual form of the mediational pathways are shown in figure.

2.3 Rationale

Depression, anxiety, and stress are widespread and debilitating mental health issues in every part of the globe and significantly impact emotional, social, and

cognitive performance of individuals (Whiteford et al., 2013; Kessler et al., 2003). The conditions decrease productivity, damage relations, and quality of life. According to the World Health Organization (2022), effective a nd evidence-based interventions that address the alterable risk factors are necessary.

Mental health is significantly affected by lifestyle factors, most notably food and exercise. Poor diet and sedentary lifestyles elevate the risk of depression and anxiety, whereas healthy diets and physical activity have a positive impact on mood, lower the rate of stress, and enhance overall mental performance (Jacka et al., 2017; Schuch et al., 2016; Holt et al., 2017). Nevertheless, the current lifestyle that is characterized by unhealthy diets, sleeping disorders, physical inactivity, and excessive use of screens predispose the youth to the state of psychological distress.

It is also reported that the latest research demonstrates that the lifestyle influences the mental health due to the influence on emotional regulation and cognitive processes (Gross and Thompson, 2007). Individuals who are able to control their feelings are less likely to develop stress, anxiety or depression (Aldao et al., 2010). Emotional control problems, as well as issues in attention, memory, and executive control, might predispose mental health problems (Marcotte et al., 2006; Huang et al., 2021). In contrast, healthy diets and physical activity can help the brain to operate effectively and become more emotionally controlled (Lai et al., 2014).

Based on the Gross Process Model of Emotion Regulation, this paper hypothesizes that mental health outcomes (depression, anxiety, and stress) are mediated by emotional regulation between lifestyle habits (diet and physical activity) and mental health outcomes.

The behavioral changes in lifestyle can reinforce emo-tional and cognitive functions that safeguard against mental distress. The study is particularly applicable to the Pakistani young adults experiencing an increasing number of stressors in the form of academic pressures, financial pressures, unem-ployment, and access to mental health resources.

Nevertheless, the literature on the interaction of lifestyle, emotional control, thought, and mental health is scarce in the same regard. Thus, this study focuses on the relationship between diet, physical activities, emotional control, and cognitive functioning with depression, anxiety, and stress in 395 Pakistani young adults. The research is expected to contribute to the prevention and intervention of mental health by advocacy of the culturally relevant and lifestyle-based mental health intervention. In general, the study identifies significant behavioral and psychological issues that may assist in minimizing the mental health challenges and enhancing the quality of life of the young Pakistani adults (World Health Organization, 2022; Kessler et al., 2017; Schuch et al., 2016).

2.4 Research Objectives

The specific objectives of the study are as follows:

1. To examine the mediating role of emotional regulation between cognitive functioning, lifestyle factors (dietary patterns and physical activity) and symptoms of depression, anxiety, and stress among adults.
2. To investigate the relationship between lifestyle factors (dietary patterns and physical activity), emotional regulation and cognitive functioning, along with depression, anxiety, and stress with age, gender and socioeconomic status.

2.5 Hypothesis of the Study

Based on prior theoretical and empirical evidence, the following hypotheses are proposed:

H1: Increased physical activity are associated with reduced symptoms of depression, anxiety, and stress.

H2: Improved emotional regulation is associated with reduced symptoms of depression, anxiety, and stress.

H3: Enhanced cognitve functions is associated with reduced symptoms of depression, anxiety, and stress.

H4: Improved dietary patterns are associated with reduced symptoms of stress, anxiety, and depression.

H5: Emotional regulation mediates the relationship between physical activity, dietary patterns, cognitive functioning and symptoms of anxiety, depression, and stress.

H6: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress varies by gender.

H7: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress varies by age.

H8: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress varies by socioeconomic status.

Chapter 3

Research Methodology

3.1 Research Design

Research design helps the researchers to interpret the nature of their study, as well as relate empirical evidence to research questions. There are two common approaches of research design known as "qualitative research" and "quantitative research." In social sciences researchers follow quantitative research comparatively because it is more effective and reliable (De Vaus, 2001). The research design for this study will be cross-sectional survey design.

3.2 Ethical Considerations

Ethical clearance of the current research was received from Ethical Review Committee of Faculty of Management and Social Sciences of Capital University of Science and Technology. The participants (18 years and older) were asked to sign written informed consent following a clear explanation of the purpose, nature, and procedures of the study.

All data gathered from the participants was confidentially stored and utilized solely for research purposes. Participants' identities were anonymized through coding or pseudonyms, and no identifying information was disclosed in any report or publication. Participants were made aware that their participation is entirely

voluntary. They could decline to respond to any question and were entitled to withdraw from the study till the point of data analysis, without providing cause and with no consequences.

3.3 Locale

The present study was conducted in Rawalpindi and Islamabad, Pakistan, and involved participants recruited from both public and private sector universities in these cities. Rawalpindi and Islamabad together host a diverse student population, representing a wide range of socioeconomic, cultural, and educational backgrounds, making them an appropriate setting for investigating psychological variables among university students.

Participants were selected from undergraduate and postgraduate programs across the chosen universities. Inclusion of both public and private institutions aimed to ensure the representativeness of the sample and capture variability in academic environments, socialization experiences, and institutional contexts. Data collection was conducted within campus premises with prior permission from university authorities, following ethical guidelines approved for the study. The combined locale of Rawalpindi and Islamabad was suitable for this research, as students in these cities are exposed to multiple academic and social stressors, which are relevant for the variables under investigation.

3.4 Sampling and Sample Size

To identify the appropriate sample size for the present study, the most accepted subject-to-item ratio method was utilized, which suggests a minimum of five participants for each item included in the study instruments (Comrey and Lee, 1992; Hair et al., 2010). The total number of items across the five scales, the Emotion Regulation Questionnaire (10 items), The Cognitive Functioning Self Rating Scale (18 items), International Physical Activity Questionnaire (7 items), Depression Anxiety Stress Scales (21 items) and Brief Healthy Eating Habits Scale (6

items) is equals to 62 items. The 5:1 ratio guideline was used to compute the sample size, and it was calculated as 310 participants (62 x 5 = 310). The current study focuses on individuals aged 18 years and above who are currently enrolled as university students in both public and private universities located within the districts of Rawalpindi and Islamabad. Based on the most recent census statistics, the total population of Rawalpindi and Islamabad districts is approximately 4.9 million people (Pakistan Bureau of Statistics, 2017), with a diverse and sufficient population base for this research.

In Islamabad, there are about 16 recognized universities with an estimated enrollment of approximately 372,974 across both public and private sectors, whereas the estimated number of students enrolled in public and private universities in Rawalpindi is around 52,900 (Pakistan Bureau of Statistics, 2017). A total of 310 university students participated in the study. This sample size is consistent with previous research examining mediation models of lifestyle variables, cognitive functions, and emotion regulation outcomes, which have demonstrated adequate statistical power with sample sizes ranging from 250 to 350 participants Bernstein and McNally (2017); Firth et al. (2020); Troy et al. (2013). Given that the current study employs a parallel mediation model with three predictors, the sample of 310 exceeds the minimum recommendation of N 200 for structural equation modeling and mediation analysis (Kline, 2016). Convenient sampling was used due to accessibility and time constraints, which is common in psychological research with student populations(Etikan et al., 2016).

3.5 Sampling Criteria

3.5.1 Inclusion Criteria

The inclusion criteria is:

i. The individuals who understand and communicate in the language used for the study (e.g., English).

ii. The individuals who are enrolled in university and are pursuing at least a

bachelor's degree.

iii. Participants above the age of 18 years.

3.5.2 Exclusion Criteria

The exclusion criteria is:

i. Individuals with physical and psychological disabilities that hinder their ability to participate in the study will be excluded from the study.

3.6 Instruments

The data for the study were collected through standardized self-report questionnaires. The study will consist of several sections including demographics, Emotional Regulation Questionnaire (ERQ), Cognitive Assessment Questionnaire (CAQ), Brief Heathly Eating Habit Scale (BHEHS-6B), International Physical Activity Questionnaire (IPAQ) and Depression, Stress and Anxiety Scale (DASS-21).

3.6.1 Demographic Sheet

The demographic form includes questions about age, gender and socio-economic status.

3.6.2 Emotion Regulation Questionnaire

The Emotion Regulation Questionnaire Gross and John (2003a) assessed emotional regulation among adult participants of various age groups, such as young adults, middle-aged adults, and older adults. The ERQ is a brief self-assessment tool that evaluates emotional regulation (Gross and John, 2003a). The instrument includes 10 items divided into two subscales: Cognitive Reappraisal (6 items) and Expressive Suppression (4 items). Respondents answer each question on a 7-point Likert scale, which varies from 1 (strongly disagree) to 7 (strongly agree).

Scores vary between 1 and 70, and the ERQ has shown strong internal reliability (Cronbach's alpha = .60-.80) and construct validity (Gross and John, 2003a). To determine the subscale scores, add the responses to the relevant items and divide by the total number of items in the subscale. For Cognitive Reappraisal, sum items 1, 3, 5, 7, 8, and 10, then divide by 6. For Expressive Suppression, add items 2, 4, 6, and 9, and divide by 4. The high scores reveal that reappraisal is used frequently. Normal scores are about 11-18 with a higher score being better according to the data provided by the Emotion Regulation Questionnaire. Lower scores (1 SD below the mean) indicate that this strategy is not used extensively. For Expressive Suppression, add items 2, 4, 6, and 9, and divide by 4. High scores represent high suppression (8-16 on the short form) which is often viewed as a less adaptive strategy. The fact that they score lower implies that they express themselves more open.

3.6.3 Cognitive Functioning Self-Rating Scale

The Cognitive Functioning Self-Rating Scale (CFSS) was developed by Maria Antonietta Annunziata and colleagues. The 18-item questionnaire is a self-assessment tool designed to measure perceived cognitive function in non-clinical populations. The Cognitive Functioning Self-Rating Scale (CFSS) consists of 18 items, each on a 5-point Likert scale, that assess daily life activities related to attention, memory, and spatio-temporal orientation. The response options for each item range from 1 ("never") to 5 ("always"), referring to the past 12 months. The total score is calculated as the average of all item scores, with higher scores indicating poorer self-perceived cognitive functioning. In the original 2012 study, the CFSS showed high internal reliability with a Cronbach's alpha of 0.856. A later 2016 study confirmed these results with a Cronbach's alpha of 0.878. Scoring the CFSS is a simple two-step process to produce an overall average score.

3.6.4 Depression Anxiety and Stress Scale

The DASS-21 Lovibond and Lovibond (1995) will be utilized to assess the mental health of participants. This brief self-assessment tool evaluates depression, anxiety,

and stress in people aged 18 and older (Lovibond and Lovibond, 1995). The DASS-21 instrument has 21 questions and includes three subscales: Depression (7 questions), Anxiety (7 questions), and Stress (7 questions).

Respondents answer each question on a 4-point Likert scale, spanning from 0 (not applicable to me at all) to 3 (applicable to me very much or most of the time). To determine the subscale scores, add the scores of the relevant items for each subscale and then multiply by 2 to get the final score (Lovibond and Lovibond, 1995). DASS-21 displays significant internal consistency (Cronbach's alpha = .74-.93) and construct validity (Lovibond and Lovibond, 1995).

3.6.5 Brief Heathly Eating Habit Scale

Brief Healthy Eating Habit Scale (BHEHS-6B) is a scale invented by a group of researchers, headed by David Javier-Aliaga. The scale was developed and tested in a study of 2025 Peruvian adults; young, middle-aged, and old. The scale is meant to be used in studies that require the use of large sample sizes and in community health interventions. The BHEHS-6B has high psychometric characteristics, which means that it is a valid and reliable instrument. The experts have verified the content validity of the six items in order to measure healthy eating habits.

The internal consistency of the scale is also good with a Cronbachs alpha (-) of 0.769 and McDonalds omega (-) of 0.780 of the overall scale. The BHEHS-6B is scored by adding the results of the six items in the questionnaire, in which respondents have to answer the questions using a five-point Likert scale (never 1, always 5). It is possible to add the points of all six items and obtain the total, which is 6 to 30, the higher the points, the healthier the habits. As an option, the scores of two dimensions may be derived by adding the scores of the first three items in Dimension 1 and the last three in Dimension 2.

3.6.6 International Physical Activity Questionnaire

The IPAQ was first developed in Geneva in 1998. International Physical Activity Questionnaire (IPAQ) is an instrument that is commonly used to conduct a

surveillance of physical activity among adults (15-69). The IPAQ is also shown to be stable in the short term, with the rho reliability coe icients of Spearman showing a tendency to cluster around 0.8 in preliminary tests.

As an example, one study of young adult men established the good reliability of vigorous activity and sitting time and fair reliability of moderate activity and walking. In order to rate the IPAQ, every activity time should be converted to minutes per week and multiplied by the intensity level (vigorous, moderate, walking) the corresponding MET value (8, 4 and 3.3 respectively) to obtain MET-minutes/week. The total MET-minutes/week score is obtained by adding these values and defines the person as low, moderate or high according to certain criteria.

3.7 Analysis

Statistical analyses of the present research study was done through software package for social science-21 (SPSS-21). Research data was cleaned, processed and analyzed on SPSS. There were no missing values. The distribution and variance of data was calculated through descriptive statistics. For categorical variables, freqeunecy and percentage was calculated while mean, median, mode, standard deviation, skewness and kurtosis were computed for continuous variables. Kolmogorov-Smimov (K-S) test, was applied to assess normal distribution of data.

The normality of the data was assessed using the Kolmogorov–Smirnov (K–S) test. The results indicated that the distributions of all study variables violated the assumption of normality ($p < .05$). Specifically, significant departures from normality were observed for the emotion regulation subscales (cognitive reappraisal and expressive suppression), overall cognitive functioning and its subscales (spatio-temporal orientation, attention, and memory), physical activity (IPAQ total score and its subscales), healthy eating habits (BHEHS total score and its subscales), as well as psychological distress measured through the Depression, Anxiety, and Stress subscales of DASS-21.

Although skewness and kurtosis values were largely within acceptable limits, the

consistently significant K–S test results indicated violations of the normality assumption. Therefore, non-parametric statistical analyses were considered more appropriate and were employed in subsequent analyses. The Normality of age was assessed through visual inspection of the histogram and examination of descriptive frequency distributions. Spearman's Rank-Order Correlation Coefficient were computed to examine the relationships among health behaviors, cognitive functions, emotional regulation and mental health outcomes.

Inferential statistics were computed to evaluate the psychometric properties of the study instruments and examine relationships among the study variables. Reliability analysis was conducted using Cronbach's alpha to determine the internal consistency of Depression Anxiety Stress Scale–21 (DASS-21) and its subscales (Depression, Anxiety, and Stress), Cognitive Functioning Self Rating Scale (CFSS) and it's subsclaes (Spatio-Temporal Orientation, Attention, and Memory), the subscales of Emotional Regulation Questionnaire (ERQ) (Cognitive Reappraisal and Expressive Suppression), International Physical Activity Questionnaire (IPAQ) and its subscales (Vigorous Physical Activity, Moderate Physical Activity, Walking Activity and Sedentary Behavior), Brief Healthy Eating Habits Scale and its subscales (Micronutrients and Macronutrients). To test the mediating role of Emotional Regulation in the relationships between the predictor and outcome variables, mediation analyses were conducted using the PROCESS macro for SPSS (Version 4.2) developed by Hayes, employing Model 4.

Chapter 4

Results

The present study was conducted to explore the relationship between emotional regulation, cognitive functions, health behaviors and mental health outcomes (depression and anxiety and stress) among Pakistani youth. Specifically, t he study aimed to examine how health behaviors, cognitive functions and emotional regulations are associated with symptoms of depression and anxiety and stress. Additionally, the mediating role of emotional regulation in these relationships was investigated. The chapter presents the results of descriptive and inferential statistical analyses conducted to address the study objectives and test the proposed hypotheses.

4.1 Demographic Characteristics of the Sample

The final s ample c omprised 3 10 p articipants, o f w hom 2 03 (65.5%) w ere male and 107 (34.5%) were female. Regarding educational attainment, 130 participants (41.9%) were enrolled in bachelor's degree programs, 148 participants (47.7%) were pursuing master's degree programs, and 32 participants (10.3%) were enrolled in PhD programs. In terms of socioeconomic status, the majority of participants belonged to the middle socioeconomic class, accounting for 241 individuals (77.7%), followed by 37 participants (11.9%) from the higher socioeconomic class and 32 participants (10.3%) from the lower socioeconomic class.

Data on participants' academic discipline was not collected in the present study.

With respect to family structure, most participants reported living in nuclear family systems, comprising 221 individuals (71.3%), while 89 participants (28.7%) reported living in joint family systems.

TABLE 4.1: **Table 1**
Frequencies and percentage of demographic variables (N=310)

Demographic variable	Category	*f*	%
Gender	Male	203	65.5
	Female	107	34.5
Socioeconomic status	Lower	32	10.3
	Middle	241	77.7
	Higher	37	11.9
Education level	Bachelor's	130	41.9
	Master's	148	47.7
	PhD	32	10.3
Family structure	Nuclear	221	71.3
	Joint	89	28.7

Note. f = frequencies; % = percentages.

4.2 Demographic Characteristics of the Sample across Age Groups

The sample size was 310 study subjects between early adulthood and later adulthood. The average age of the respondents was 27.09 years (SD = 5.47) with a median of 26 and mode of 25, meaning that most of the respondents were clustered in the younger age groupings. This indicates that the sample was mainly a group of young adults with a relatively small number of participants representing later adulthood. Regarding gender distribution, males were the majority of the sample with 203 participants (65.5%), and females with 107 participants (34.5%).

This trend shows that the males were more represented in the age range in the study. In terms of education level, a significant percentage of the participants were pursuing higher education. In particular, the largest groups of participants in terms of education were 130 participants (41.9%) who had the bachelor degree

and 148 participants (47.7%) who had the master degree. Moreover, 32 individuals (10.3%), were pursuing PhD programs. Such distribution is representative of an upward trend in the level of education with an increase in age where younger participants were more likely to be in undergraduate programs whereas older participants were concentrated in postgraduate and doctoral studies.

Descriptive analyses were performed to examine the distribution of socioeconomic status (SES) across different age groups. Results showed that the socioeconomic status of participants was comparatively homogeneous among the age groups. Most participants belonged to the middle socioeconomic class (N = 241, 77.7%), while fewer participants belonged to higher (N = 37, 11.9%) and lower socioeconomic backgrounds (N = 32, 10.3%). Overall, little variation in SES was observed across age groups, indicating that socioeconomic positioning remained relatively consistent among participants of different ages.

There were also consistent trends in family structure in various age groups. The majority of the respondents stated that they lived in nuclear families with 221 individuals (71.3) indicating same. The proportion of 89 participants (28.7%) reporting joint family systems indicates a sizeable yet smaller sample size.

The nuclear family systems pre-emerged all through the age groups even though joint family systems also existed, especially among particular age groups. This distribution shows the dominance of nuclear family structures still in the sample, and the existence of joint family systems among various ages. In general, the age and gender interaction with educational level, socioeconomic status and family structure are the representative of a well-integrated demographic portrait.

The younger age groups were more identified with undergraduate education, nuclear family systems and middle socioeconomic status, and as age increased there was higher educational attainment and the middle socioeconomic backgrounds were predominant. These results highlight age to be a significant contextual variable that affects the demographic features of the respondents. One sample Kolmogorov-Smirnov test was used to test the age distribution normality. The

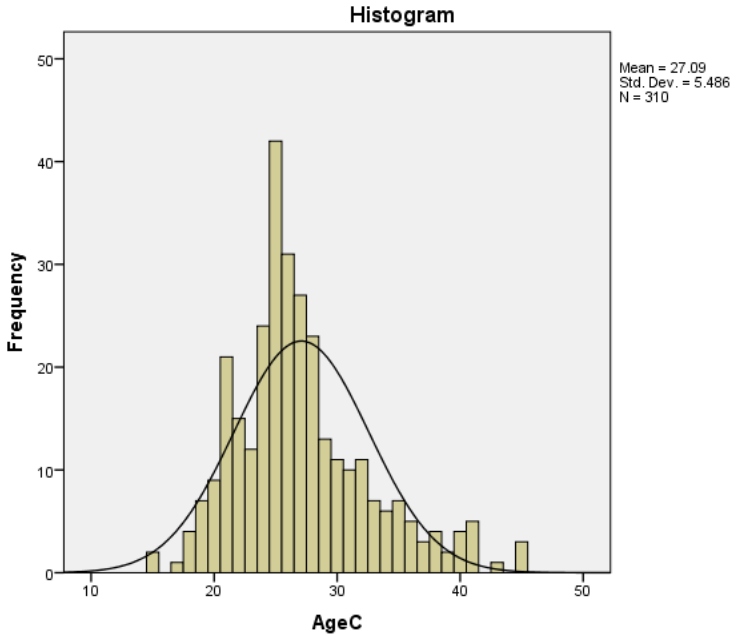


FIGURE 4.1: Distribution of Participant's Age (N=310)

visual analysis of the histogram was that the age data should be distributed normally and the frequencies were close to the normal curve where the distribution was observed (M = 27.09, SD = 5.48, N = 310).
Although this is visually indicated, the Kolmogorov-Smirnov test had a statistically significant value, K-S =.137, Z = 2.415, p .001 and the assumption of normality was violated in the case of the age variable. Since the sample size was so large and normality was highly violated, non-parametric statistical tests were deemed to be more suitable in the further analysis based on the age.

The Shapiro-Wilk test was not utilized for normality assessment in the current study. Although it is often considered more powerful than the K-S test, the Shapiro-Wilk test is specifically recommended for small to moderate sample sizes, typically N 50 . With larger samples, such as the present N = 310, this test also becomes overly sensitive and tends to produce significant results even when the deviation from normality is minor and inconsequential for subsequent analyses (Kim et al., 2015).

The outlier analysis for the variable Age was done by boxplot analysis in SPSS-21. The boxplot showed that there were 9 mild outliers (ages 40 to 45 years).

There were no extreme outliers as there are no asterisk markers in the plot. These cases were identified then reviewed and included in the dataset as they were valid responses from the participants in the target group of adults aged 18 years and above.

4.3 Reliability of Scales

Inferential statistics were computed to assess the internal consistency of all study instruments. Cronbach's alpha coefficients indicated satisfactory to excellent reliability across the scales and their respective subscales.

TABLE 4.2: 4.4.1

TABLE 4.3: *Cronbach's Alpha Reliability of Subscales of the Depression Anxiety and Stress Scale (DASS-21) (N = 310)*

Scale	*N*	Min	Max	*M*	*SD*	α	Range	Skewness	Kurtosis
Depression	7	0.00	21.0	9.11	3.23	.63	.18	−0.84	0.88
Anxiety	7	0.00	21.0	8.85	2.99	.53	.27	−0.21	1.03
Stress	7	0.00	21.0	9.25	2.89	.53	.38	−0.12	1.92

Note. DASS-21 = Depression Anxiety and Stress Scale–21; *N* = number of items; *M* = mean score; *SD* = standard deviation; α = Cronbach's alpha reliability.

The subscales of Depression Anxiety Stress Scale–21 (DASS-21) demonstrated moderate reliability coe icients for the Depression (α = .63), Anxiety (α = .53), and Stress (α = .53) subscales. The Cognitive Functioning Screening Scale (CFSS) demonstrated acceptable overall reliability (α = .73). Subscale reliabilities ranged from low to moderate, including Spatio-temporal Orientation (α = .64), Attention (α = .48), and Memory (α = .35).

The Emotion Regulation Questionnaire (ERQ) demonstrated moderate internal consistency (α = .60), with acceptable reliability for the Cognitive Reappraisal (α = .60) and Expressive Suppression (α = .60) subscales. The reliability analysis indicated that both ERQ subscales demonstrated moderate internal consistency, with Cronbach's alpha values of .60 for cognitive reappraisal and expressive suppression. Although these values fall below the commonly accepted threshold, the

TABLE 4.4: *Cronbach's Alpha Reliability of the Cognitive Functioning Self-Rating Scale and Its Subscales ($N = 310$)*

Scale	N	Min	Max	M	SD	α	Range	Skewness	Kurtosis
CFSS	18	19	70	52.30	7.25	.73	.48	−1.13	2.85
Spatio-temporal orientation	9	10	32	26.20	4.56	.64	.48	−0.86	1.00
Attention	5	6.0	25	14.43	2.53	.48	.32	−0.29	2.00
Memory	4	4.0	17.0	11.85	2.17	.35	.33	−0.28	0.11

Note. CFSS = Cognitive Functioning Self-Rating Scale; N = number of items; M = mean score; SD = standard deviation; α = Cronbach's alpha reliability.

TABLE 4.5: *Cronbach's Alpha Reliability of Emotional Regulation Questionnaire Subscales ($N = 310$)*

Scale	N	Min	Max	M	SD	α	Range	Skewness	Kurtosis
Cognitive Reappraisal	6	8.00	42.0	25.88	4.54	.60	1.17	0.25	1.80
Expressive Suppression	4	4.00	28.0	17.53	3.67	.60	0.24	−0.32	1.08

Note. N = number of items; M = mean score; SD = standard deviation; α = Cronbach's alpha reliability.

subscales were retained due to their theoretical relevance. Overall, the findings suggest acceptable but limited reliability of the ERQ subscales in the present sample. The International Physical Activity Questionnaire (IPAQ) demonstrated low overall reliability (α = .152). Subscale reliabilities ranged from negligible to low, including Vigorous Physical Activity (α = .029), Moderate Physical Activity (α = -.173), Walking Activity (α= .126), and Sedentary Behavior (Sitting Time; α = .089). Participants reported an average total physical activity score of 15.32 MET-min/week (SD = 12.96), with scores ranging from 0.00 to 54.60. Vigorous physical activity contributed the highest proportion of activity (M = 8.41, SD = 9.32), followed by moderate physical activity (M = 3.75, SD = 3.86) and walking activity (M = 3.15, SD = 3.81). The findings indicate considerable variability in physical activity levels among participants. The average self-reported sitting time

TABLE 4.6: *Cronbach's Alpha Reliability of the International Physical Activity Questionnaire and Its Subscales (N = 310)*

Scale	*N*	*M*	*SD*	α	Range	Skewness	Kurtosis
IPAQ	14	14.95	2.86	.15	.79	−0.36	−0.06
Vigorous Physical Activity	4	4.25	1.42	.03	.66	−0.32	−0.22
Moderate Physical Activity	4	4.16	1.33	−0.17	.58	−0.03	−0.29
Walking Activity	4	4.41	1.41	.13	.68	0.23	0.66
Sedentary Behavior (Sitting Time)	2	2.13	1.14	.09	.79	0.71	0.57

Note. IPAQ = International Physical Activity Questionnaire; N = number of items; M = mean score; SD = standard deviation; α = Cronbach's alpha reliability.

was 1.12 units per day (SD = 0.77), with scores ranging from 0 to 3. Overall, the distributions of vigorous, moderate, and walking activity scores were positively skewed, suggesting that most participants engaged in lower levels of physical activity, whereas a smaller number reported relatively higher activity levels.

According to the International Physical Activity Questionnaire (IPAQ) scoring protocol, physical activity data should first be converted into MET-minutes/week before statistical analysis is conducted. The protocol recommends calculating separate MET scores for vigorous activity, moderate activity, and walking, and then summing these values to obtain a total physical activity score, while sitting time is analyzed separately because it reflects sedentary behavior rather than physical activity(Craig et al., 2003).

Therefore, the present study reported IPAQ outcomes in MET-min/week rather than raw frequencies of days and minutes, consistent with previous published studies and theses. Furthermore, Cronbach's alpha was not calculated for the IPAQ because its items assess different domains and intensities of physical activity rather than measuring a single unidimensional construct. Previous methodological research has indicated that internal consistency measures such as Cronbach's alpha are not appropriate for behavioral measures like the IPAQ, where items are intended to capture distinct activity categories independently (Craig et al., 2003). The Brief Healthy Eating Habits Scale (BHEHS-6B) showed acceptable overall

TABLE 4.7: *Cronbach's Alpha Reliability of the Brief Healthy Eating Habits Scale and Its Subscales ($N = 310$)*

Scale	N	Min	Max	M	SD	α	Range	Skewness	Kurtosis
BHEHS	6	7	22	2.43	2.53	.34	1.25	0.02	0.64
Micronutrients & Water	3	1	12	7.22	1.74	.29	1.25	−0.25	−0.02
Macronutrients	3	3	12	7.14	1.65	.29	0.15	0.08	0.18

Note. BHEHS = Brief Healthy Eating Habits Scale; N = number of items; M = mean score; SD = standard deviation; α = Cronbach's alpha reliability.

reliability ($\alpha = .344$), with subscale reliabilities ranging from low to moderate: Micronutrients & Water ($\alpha = .294$) and Macronutrients ($\alpha = .292$). The internal consistency of the scales was assessed using Cronbach's alpha. The overall BHEHS (6 items) demonstrated low reliability ($\alpha = .34$).

Similarly, the Micronutrients & Water (3 items; $\alpha = .29$) and Macronutrients (3 items; $\alpha = .29$) subscales also showed low internal consistency. These values are below the commonly accepted threshold of .70, indicating limited reliability of the measures in the present study.

4.4 Descriptive Statistics of Scales

This section presents the descriptive statistics of the scales administered in this study. The results of the normality tests indicated that the distributions of the study variables significantly deviated from normality.

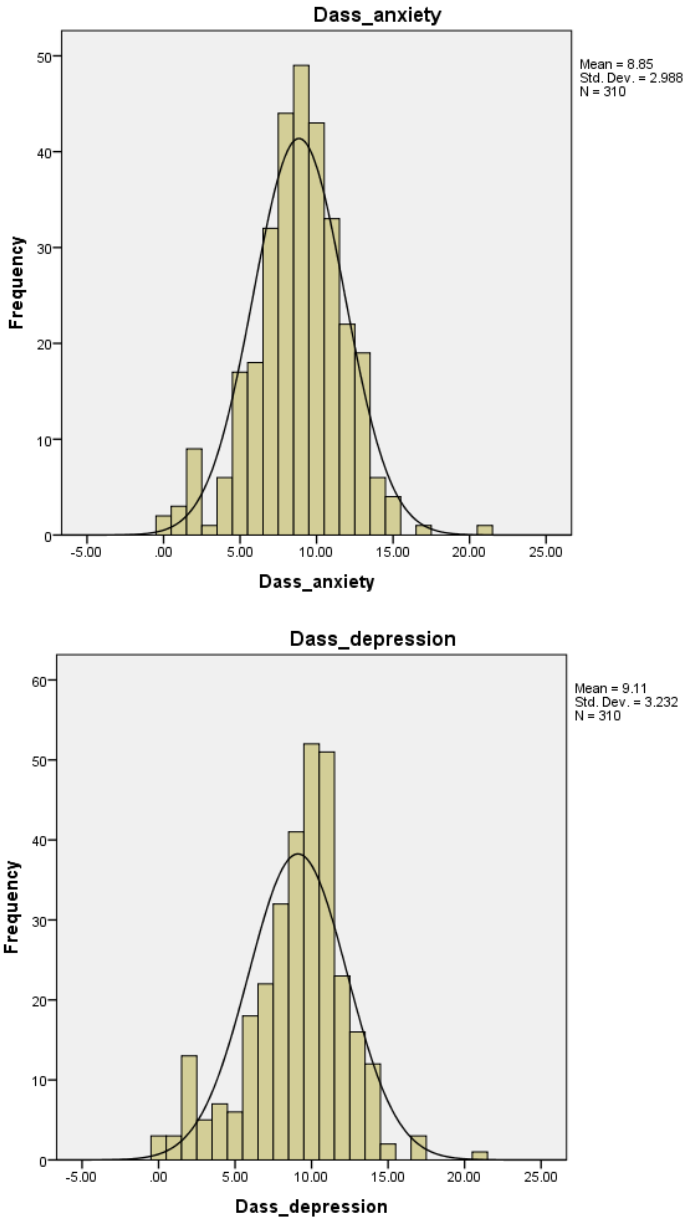
Specifically, the Kolmogorov–Smirnov test was statistically significant (p = .001) for all measured variables, including the emotion regulation subscales (cognitive reappraisal and expressive suppression), overall cognitive functioning (CFSS) and its subscales (spatio-temporal orientation, attention, and memory), physical activity (IPAQ total score and its components: vigorous-intensity activity, moderate-intensity activity, walking, and sitting time), healthy eating habits (BHEHS total score and its subscales: micronutrients & water and macronutrients), as well as

TABLE 4.8: *Descriptive Statistics, Skewness, Kurtosis, and Kolmogorov-Smirnov Test for the Subscales of DASS-21, CFSS, ERQ, IPAQ, and BHEHS (N = 310)*

Scale	*M*	Mdn	Mode	*SD*	Skewness	Kurtosis	K-S	*p*
Cognitive Reappraisal	25.88	26	26	4.54	0.25	1.80	0.13	0.001
Expressive Suppression	17.52	18	19	3.66	−0.32	1.08	0.11	0.001
CFSS	49.37	51	52	6.82	−1.13	2.85	0.17	0.001
Spatio-Temporal Orientation	23.29	24	24	4.00	−0.86	0.99	0.13	0.001
Attention	14.42	14	14	2.53	0.29	2.00	0.15	0.001
Memory	11.85	12	12	2.17	−0.28	0.11	0.12	0.001
IPAQ	14.95	15	16	2.85	−0.36	−0.06	0.11	0.001
Vigorous-Intensity Activity	4.25	4	4	1.42	−0.32	−0.22	0.15	0.001
Moderate Intensity Activity	4.16	4	5	1.33	−0.03	−0.29	0.16	0.001
Walking	4.41	4	4	1.41	0.23	0.66	0.14	0.001
Sitting Time	2.13	2	2	1.14	0.71	0.57	0.22	0.001
BHEHS	14.63	15	13	2.54	0.02	0.64	0.09	0.001
Micronutrients	7.22	7	7	1.73	−0.25	−0.02	0.13	0.001
Macronutrients	7.41	7	8	1.64	0.08	0.18	0.14	0.001
Depression	9.11	10	10	3.23	−0.48	0.88	0.14	0.001
Anxiety	8.85	9	9	2.99	−0.21	1.03	0.104	0.001
Stress	9.25	9	10	2.90	−0.12	1.92	0.10	0.001

Note. *M* = Mean; Mdn = Median; *SD* = Standard Deviation; K-S = Kolmogorov-Smirnov Test; IPAQ = International Physical Activity Questionnaire; BHEHS = Brief Healthy Eating Habits Scale; ERQ = Emotion Regulation Questionnaire; DASS-21 = Depression Anxiety Stress Scale 21; $p < .05$.

psychological distress measured through subscales of DASS-21, indicating non-normal distributions across all constructs. Furthermore, the skewness and kurtosis values, although largely within accept-able ranges, supported the conclusion that the distributions were not strictly normal. Overall, the consistent significance of the Kolmogorov–Smirnov test across all variables reflects systematic departures from normality; therefore, non-parametric statistical procedures were deemed appropriate for subsequent analyses.



4.5 Association of Physical Activity with Depression, Anxiety and Stress

H1 : Increased physical activity are associated with reduced symptoms of depression, anxiety, and stress. The following table displays the association of Physical Activity (Vigorous Physical Activity, Moderate Physical Activity, Walking Activity, Sedentary Behavior) measured through International Physical Activity Questionnaire ((IPAQ) with depression, anxiety and stress measured through Depression Anxiety Stress Scale – 21 (DASS21). Results indicated that Cognitive

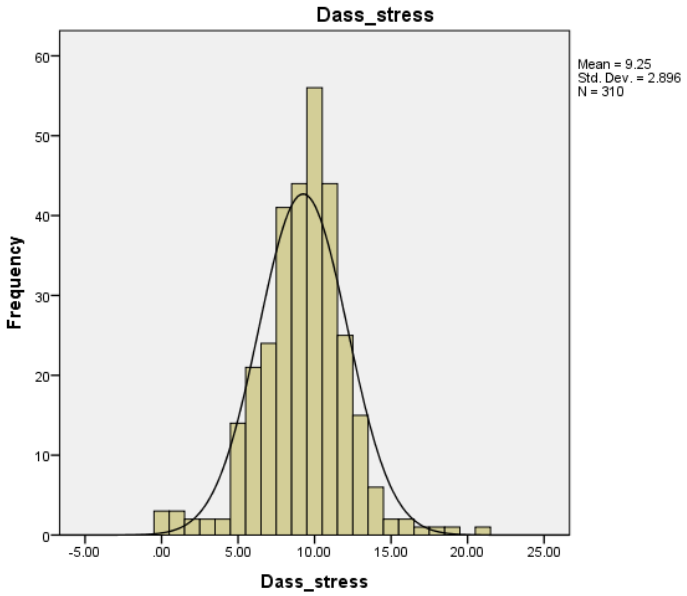


FIGURE 4.2: Distribution of subscales of Depression Anxiety Stress Scale scores (N=310).

TABLE 4.9: *Association of Physical Activity (IPAQ) with Depression, Anxiety, and Stress (DASS-21) (N = 310)*

Variables	1	2	3	4
Physical Activity (IPAQ)	-	-0.10	0.12*	0.09
Depression	-	-	0.38**	0.40**
Anxiety	-	-	-	0.34**
Stress	-	-	-	-

Note. ** $p < .01$, * $p < .05$; IPAQ = International Physical Activity Questionnaire; DASS = Depression Anxiety Stress Scales.

Reappraisal was significantly and negatively correlated with depression (r = -0.12, p .05), suggesting that higher use of reappraisal was associated with lower levels of depression in this sample. However, Cognitive Reappraisal was not significantly correlated with anxiety (r = -0.08, p .05) or stress (r = -0.11, p .05). Similarly, Expressive Suppression showed a significant negative correlation with depression (r = -0.12, p .05) and stress (r = -0.15, p .01) but was not significantly correlated with anxiety (r = -0.07, p .05).

These findings suggest that greater use of suppression was associated with lower levels of depression and stress, although the associations were weak. Association of Cognitive Functioning with Depression, Anxiety and Stress.

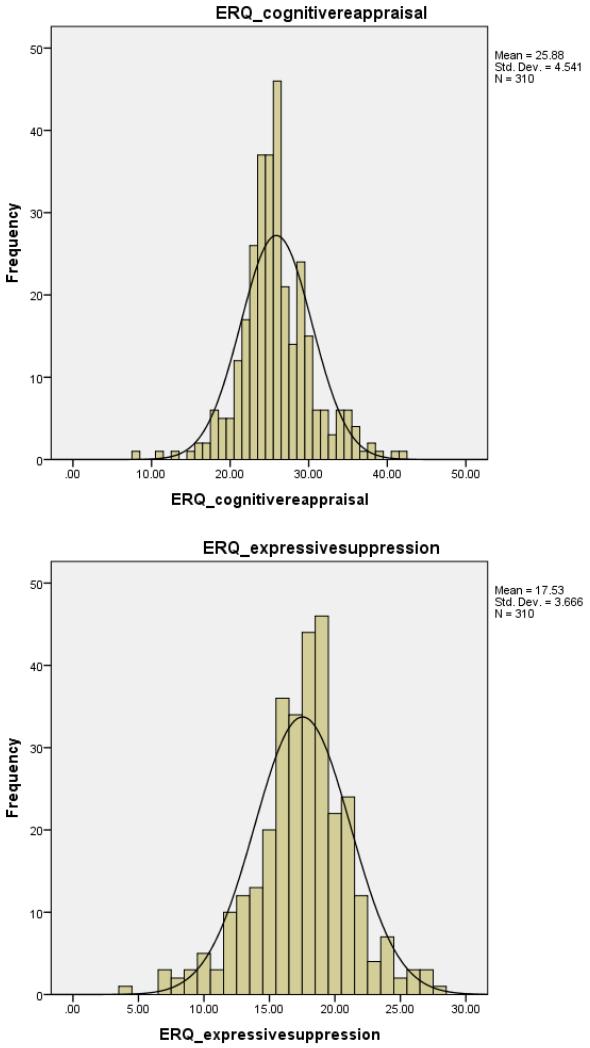
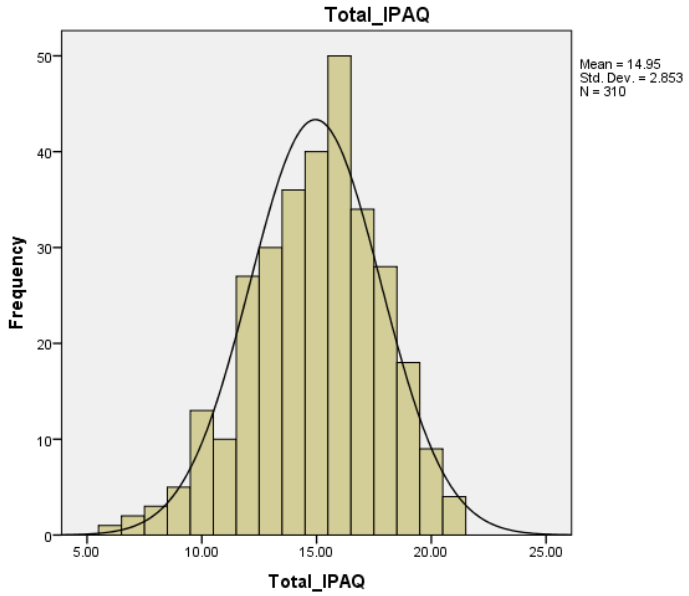


FIGURE 4.3: Distribution of scores across cognitive reappraisal and expressive suppression dimensions of Emotional Regulation Questionnaire (ERQ) (N=310).

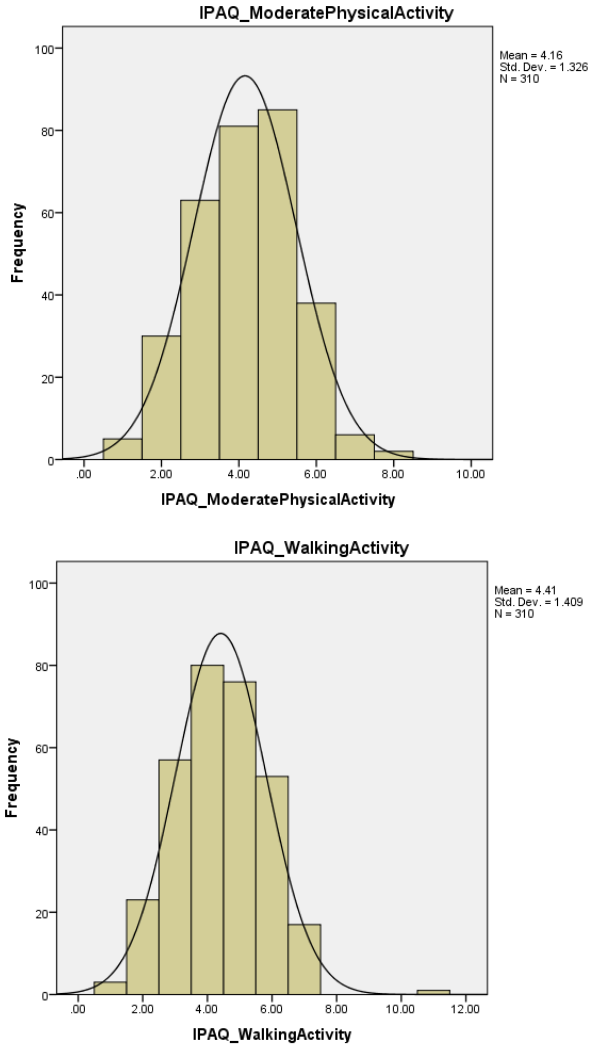
4.6 Association of Emotional Regulation with Depression, Anxiety and Stress

H2: Improved emotional regulation is associated with reduced symptoms of depression, anxiety, and stress.

The following table displays the association of subscales of Emotional Regulation (Cognitive Reappraisal and Expressive Suppression) measured through the Emotional Regulation Questionnaire (ERQ) with depression, anxiety and stress measured through Depression Anxiety Stress Scale -21 (DASS21). Results indicated that emotion regulation, as measured by the subscales of ERQ, was significantly



and negatively correlated with overall psychological distress, as measured by the subscales of DASS ($r = -0.144, p < .05$) suggesting that better emotion regulation was associated with lower levels of depression, anxiety, and stress in this sample. Results indicated that Cognitive Reappraisal was significantly and negatively correlated with depression ($r = -0.12$, $p < .05$), suggesting that higher use of reappraisal was associated with lower levels of depression in this sample. However, Cognitive Reappraisal was not significantly correlated with anxiety ($r = -0.08$, $p > .05$) or stress ($r = -0.11$, $p > .05$). Similarly, Expressive Suppression showed a significant negative correlation with depression ($r = -0.12$, $p < .05$) and stress ($r = -0.15$, $p < .01$) but was not significantly correlated with anxiety ($r = -0.07$,



$p > .05$).These findings suggest that greater use of suppression was associated with lower levels of depression and stress, although the associations were weak. Association of Cognitive Functioning with Depression, Anxiety and Stress.

4.7 Association of Cognitive Functioning with Depression, Anxiety and Stress.

H3: Enhanced cognitve functions is associated with reduced symptoms of depression, anxiety, and stress. The following table displays the association of Cognitive Functioning (Spatio-temporal Orientation, Attention, Memory) measured through the Cognitve Functioning Self Rating Scale (CFSS) with depression and anxiety measured through Depression Anxiety Stress Scale -21 (DASS21).

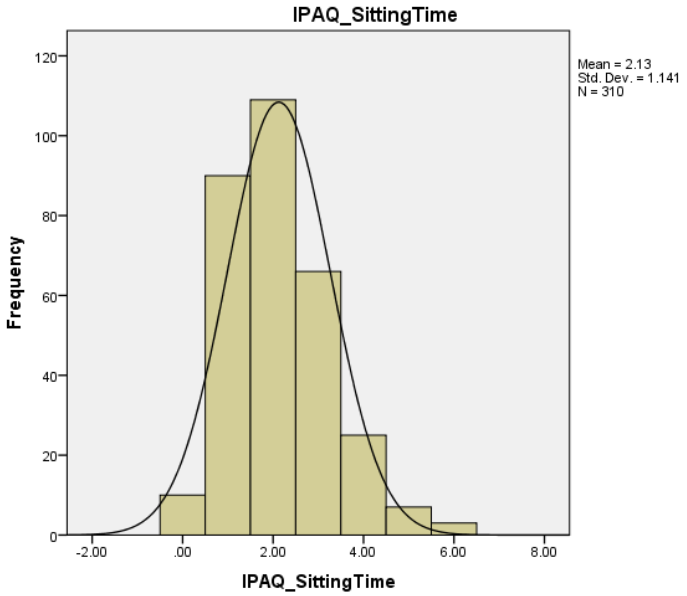


FIGURE 4.4: Distribution of International Physical Activity Questionnaire (N=310).

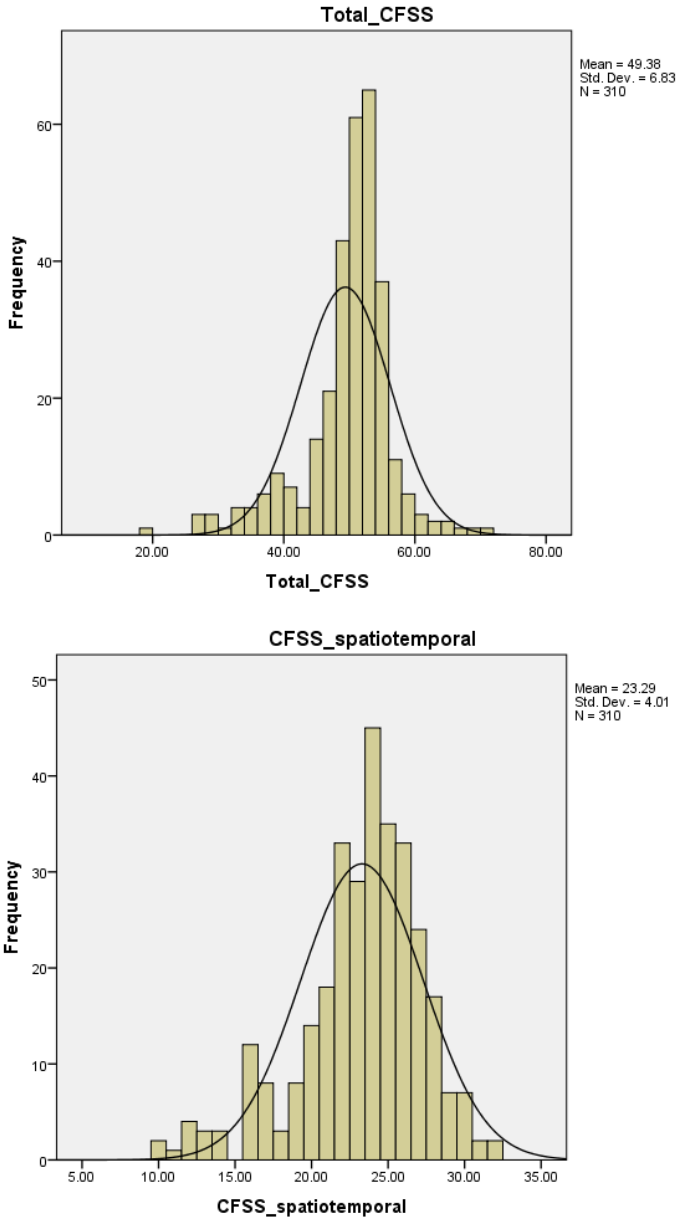
TABLE 4.10: *Association of Emotional Regulation Subscales (Cognitive Reappraisal and Expressive Suppression) with Depression, Anxiety, and Stress (DASS-21) (N = 310)*

Variable	1	2	3	4	5
Cognitive Reappraisal	-	0.37**	-0.12*	-0.08	-0.11
Expressive Suppression	-	-	-0.12*	-0.07	-0.15**
Depression	-	-	-	0.38**	0.40**
Anxiety	-	-	-	-	0.34**
Stress	-	-	-	-	-

Note. $N = 310$. Cognitive Reappraisal and Expressive Suppression are subscales of the Emotion Regulation Questionnaire (ERQ). Depression, Anxiety, and Stress are subscales of the DASS-21. ** $p < .01$ (2-tailed), * $p < .05$ (2-tailed).

Results indicated that cognitive functioning, as measured by the Total CFSS, was not significantly correlated with overall psychological distress, as measured by the subscales of DASS ($r = .017, p > .05$), suggesting that levels of cognitive functioning were not associated with depression, anxiety, or stress in this sample.

Results indicated that cognitive functioning, as measured by the Total CFSS, was not significantly correlated with depression ($r = 0.01$, $p > .05$), anxiety ($r = -0.07$, $p > .05$), or stress ($r = -0.01$, $p > .05$), suggesting that levels of cognitive functioning were not associated with depression, anxiety, or stress in



this sample.

4.8 Association of Eating Habits with Depression, Anxiety and Stress

H4: Improved dietary patterns are associated with reduced symptoms of stress, anxiety, and depression.

The following table displays the association of Dietary Patterns (Micronutrients and macronutrients) measured through the Brief Healthy Eating Habits Scale

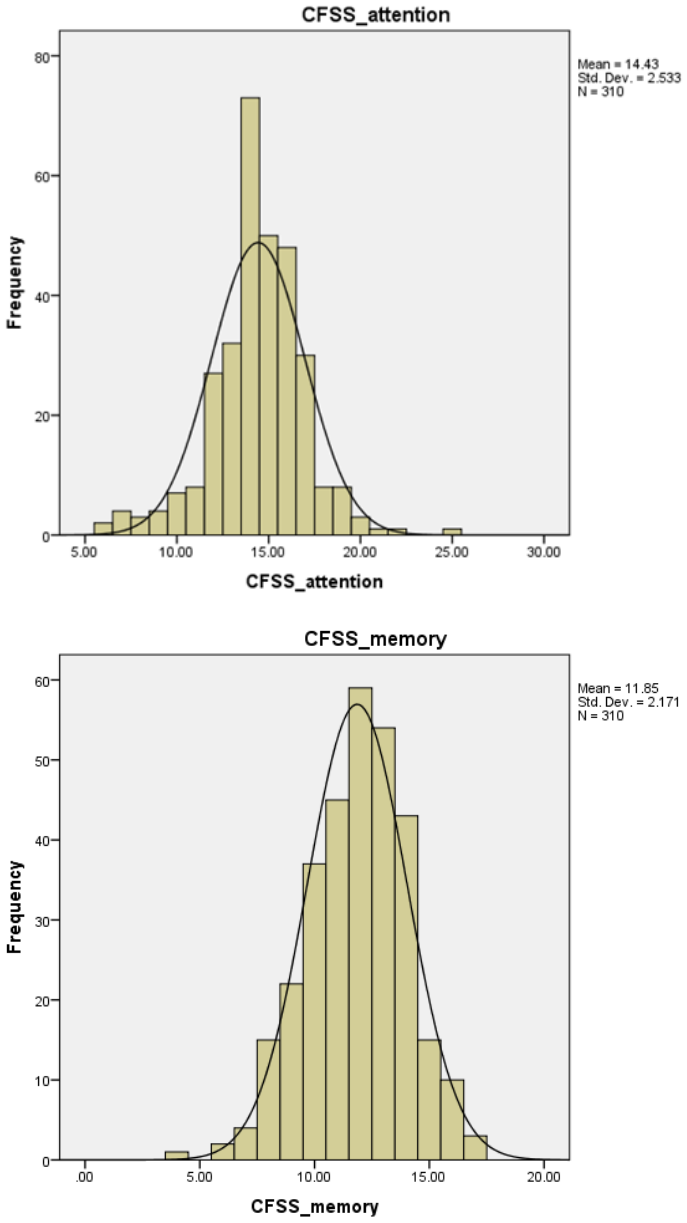
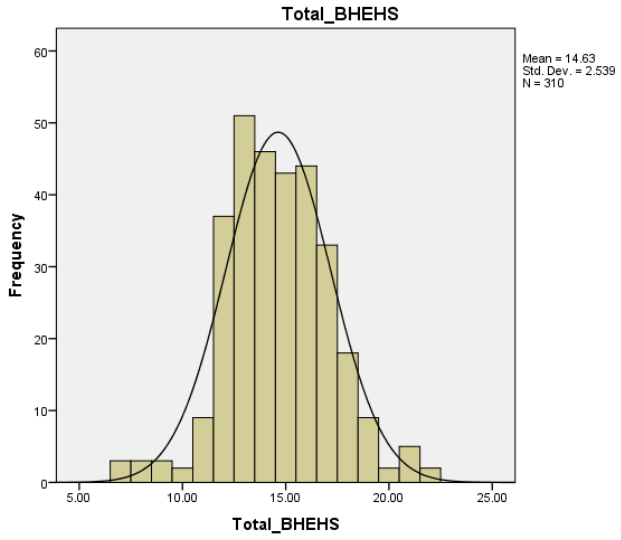
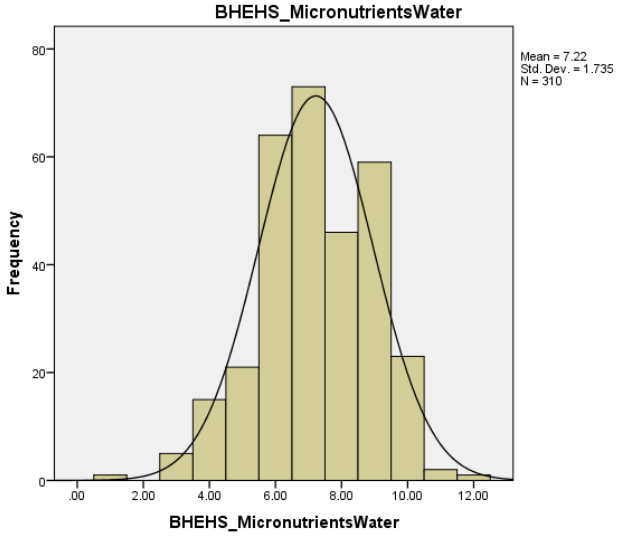


FIGURE 4.5: Distribution of the Cognitive Functioning Self-Rating Scale score (N=310).

(BHEHS) with depression and anxiety measured through Depression Anxiety Stress Scale -21 (DASS21). Results indicated that healthy eating habits, as measured by the Total BHEHS, were not significantly correlated with overall psychological distress, as measured by the Total DASS $r = -0.092,\ p > 0.05$, suggesting that levels of healthy eating habits were not associated with depression, anxiety, or stress in this sample. Results indicated that healthy eating habits, as measured by the Total BHEHS, showed a significant negative correlation with depression ($r = -0.12,\ p < .05$), suggesting that better eating habits were associated with





lower levels of depression in this sample. However, healthy eating habits were not significantly correlated with anxiety ($r = -0.05$, $p > .05$) or stress ($r = -0.03$, $p > .05$).

4.9 Association of Gender with Physical Activity, Cognitive Functioning, Dietary Patterns and Subscales of DASS 21

H6: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress vary by with gender.

The following table shows gender differences across Physical Activity, Cognitive

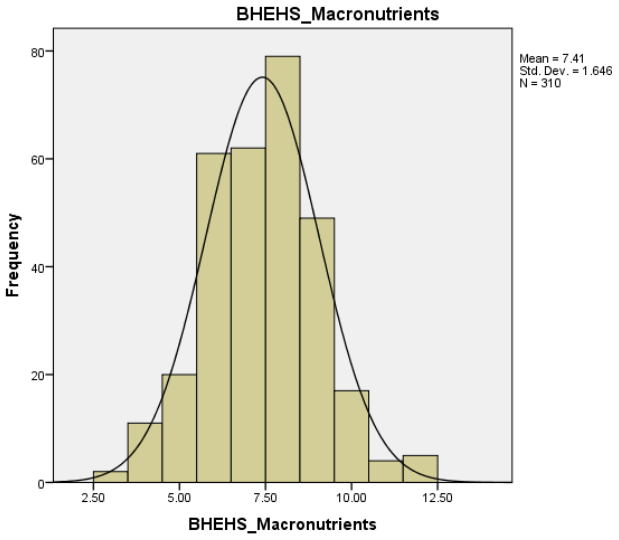


FIGURE 4.6: Distribution of the Brief Healthy Eating Habits Scale scores (N=310).

TABLE 4.11: *Association of Cognitive Functioning (CFSS) with Depression, Anxiety, and Stress (DASS-21) (N = 310)*

Variable	1	2	3	4
Cognitive Functioning Self-Rating Scale (CFSS)	-	0.01	-0.07	-0.01
Depression	-	-	0.38**	0.40**
Anxiety	-	-	-	0.40**
Stress	-	-	-	-

Note. $N = 310$. CFSS = Cognitive Functioning Self-Rating Scale. Depression, Anxiety, and Stress are subscales of the DASS-21. ** $p < .01$ (2-tailed), * $p < .05$ (2-tailed).

Functioning, Dietary Patterns, and subscales of DASS 21 (Depression, Anxiety and Stress). The results indicated that gender was not significantly associated with physical activity, cognitive functioning, dietary patterns, anxiety, or stress, as no statistically significant differences were observed between male and female participants ($p > 0.05$).

However, a significant gender difference emerged for depression, with males demonstrating higher mean ranks compared to females ($U = 8304, Z = -3.43, p = 0.001$). These findings suggest that, within the present sample, gender differences were largely absent across lifestyle and emotional variables, with the exception of depressive symptoms.

TABLE 4.12: *Association of Eating Habits (BHEHS-6B) with Depression, Anxiety, and Stress (DASS-21) (N = 310)*

Variable	1	2	3	4
Brief Healthy Eating Habits Scale (BHEHS)	-	-0.12*	-0.05	-0.03
Depression	-	-	0.38**	0.40**
Anxiety	-	-	-	0.34**
Stress	-	-	-	-

Note. $N = 310$. BHEHS = Brief Healthy Eating Habits Scale (total score). Depression, Anxiety, and Stress are subscales of the DASS-21. ** $p < .01$ (2-tailed), * $p < .05$ (2-tailed).

TABLE 4.13: *Association of Gender with Physical Activity (IPAQ), Cognitive Functioning (CFSS), Dietary Patterns (BHEHS), and Subscales of DASS-21 (Depression, Anxiety, Stress) (N = 310)*

Index	Group	*N*	Mean Rank	*U*	*Z*	*p*
Physical Activity (IPAQ)	Male	203	160	9,944	-1.23	.22
	Female	107	146.9			
Cognitive Functioning (CFSS)	Male	203	160	9,808	-1.41	.16
	Female	107	145			
Dietary Patterns (BHEHS)	Male	203	155	10,797	-0.09	.93
	Female	107	154.9			
Depression (DASS-21)	Male	203	168	8,304	-3.43	.001
	Female	107	131.6			
Anxiety (DASS-21)	Male	203	160	9,924	-1.23	.22
	Female	107	146.9			
Stress (DASS-21)	Male	203	156	10,565	-0.40	.69
	Female	107	152.7			

Note. Mann-Whitney *U* test was used to assess differences between male and female participants. IPAQ = International Physical Activity Questionnaire; CFSS = Cognitive Functioning Self-Rating Scale; BHEHS = Brief Healthy Eating Habits Scale; DASS-21 = Depression Anxiety Stress Scale 21.

4.10 Association of Age Groups with Physical Activity, Cognitive Functioning, Dietary Patterns and Symptoms of DAS

H7: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress vary by with age.

The following table shows age differences across physical activity, cognitive functioning, dietary patterns measured through DASS 21. The descriptive statistics have been calculated on the physical activity, cognitive functioning, dietary patterns, and psychological distress (depression, anxiety, and stress) in three age groups (18-25, 26-35, and 36-45 years).

Participants were categorized into three age groups based on developmental theory: 18-25 years (emerging adulthood; Arnett, 2000), 26-35 years (early adulthood; Levinson, 1978), and 36-45 years (early middle adulthood; WHO, 2021). These classifications reflect distinct psychosocial and behavioral patterns that may influence physical activity and psychological distress (Arnett, 2000; Levinson, 1978).

Since the data does not have normal distribution, Krushal-Wallis tests were used to test the age-based differences in these variables. Those findings showed that the differences among the age groups in terms of physical activity were not significant, χ^2 (2) = 1.02, p =.600, whereas the average rank was slightly higher in the 36-45 age group. Likewise, there were no prominent age-differentiated variables with respect to cognitive functioning, χ^2 (2) = 3.50, p =.174 or healthy eating habits, kχ^2(2) =0.91, p =.633.

There was also no significant difference in levels of anxiety between age groups,χ^2(2) = 0.51, p =.777 and no statistically significant differences in the levels of stress, χ^2 (2) = 4.55, p =.103. Conversely, there was a statistically significant difference in depression between age groups, χ^2(2) = 8.77, p =.012.
Mean rank comparisons showed that depressive symptoms were higher with age with the highest mean rank of 36- 45 year age group and then with 26-35 and 18-25 year age group.

The implications of these results are that although lifestyle factors, cognitive functioning, anxiety, and stress levels do not vary substantially between early and middle adulthood, depressive symptoms can be more eminent in later adulthood, and thus age is a significant determinant of depressive experiences.

TABLE 4.14: *One-Way Analysis of Variance for IPAQ, CFSS, BHEHS, Depression, Anxiety, and Stress Across Age Groups (18–25, 26–35, 36–45 years) ($N = 310$)*

Factor	Cluster	N	Rank Mean	χ^2	p
International Physical Activity Questionnaire (IPAQ)	18–25 years	136	153.23	1.021	.60
	26–35 years	146	154.53		
	36–45 years	28	171.61		
	Total	310			
Cognitive Functioning Self-Rating Scale (CFSS)	18–25 years	136	144.78	3.495	.17
	26–35 years	146	163.64		
	36–45 years	28	165.10		
	Total	310			
Brief Healthy Eating Habits Scale (BHEHS)	18–25 years	136	160.71	0.914	.63
	26–35 years	146	152.26		
	36–45 years	28	147.05		
	Total	310			
Depression (DASS-21)	18–25 years	136	145.70	8.769	.01
	26–35 years	146	156.02		
	36–45 years	28	200.38		
	Total	310			
Anxiety (DASS-21)	18–25 years	136	152.63	0.505	.77
	26–35 years	146	156.26		
	36–45 years	28	165.50		
	Total	310			
Stress (DASS-21)	18–25 years	136	144.09	4.547	.10
	26–35 years	146	162.21		
	36–45 years	28	175.95		
	Total	310			

Note. One-Way Analysis of Variance (Kruskal-Wallis test) was used to assess differences across age groups. IPAQ = International Physical Activity Questionnaire; CFSS = Cognitive Functioning Self-Rating Scale; BHEHS = Brief Healthy Eating Habits Scale; DASS-21 = Depression Anxiety Stress Scale 21.

4.11 Association of Socioeconomic Status with Depression and Anxiety

H8: The relationship between physical activity, cognitive functioning, dietary patterns and symptoms of anxiety, depression, and stress vary by with socioeconomic status. The following table shows socioeconomic differences across Physical Activity Questionnaire (IPAQ), Cognitive Functionning Self Rating Scale (CFSS), Brief Healthy Eating Habits Scale (BHEHS), Anxiety, Depression and Stress measured through DASS 21. Physical activity, cognitive functioning, dietary patterns, and psychological distress (depression, anxiety, and stress) were calculated as descriptive statistics in three groups of people based on socioeconomic status (lower, middle, and higher).

Since the data is not normally distributed, Kruskal-Wallis tests were carried out in order to assess the presence of differences between socioeconomic categories. Results showed no significant differences in physical activity by socioeconomic groups, $\chi^2(2) = 0.93$, p =.627. Likewise, there were no notable distinctions in cognitive functioning, $\chi^2\,(2) = 0.41$, p =.815 or healthy eating habits, $\chi^2(2) = 0.35$, p =.839. There was also no statistically significant difference between the levels of anxiety of socioeconomic groups, $\chi^2\,(2) = 3.79$, p =.150, and the differences in stress were not statistically significant, $\chi^2\ (2) = 4.75$, p =.093. Even though mean rank comparisons indicated a relatively higher level of depression, anxiety and stress in the people under the lower and higher socioeconomic categories than the people under middle socioeconomic categories, the differences were not statistically significant. In general, the results suggest that socioeconomic status did not have a significant impact on the lifestyle behaviors, cognitive functioning, or psychological distress in the current sample, and therefore indicate that these outcomes were rather stable across the socioeconomic strata.

4.12 Mediation Analysis

H5: Emotional regulation mediates the relationship between physical activity, dietary patterns, cognitive functioning and symptoms of anxiety, depression, and

TABLE 4.15: *One-Way Analysis of Variance for IPAQ, CFSS, BHEHS, Depression, Anxiety, and Stress Across Socioeconomic Groups (Lower, Middle, Higher) (N = 310)*

Factor	Cluster	*N*	Rank Mean	χ^2	*p*
International Physical Activity Questionnaire (IPAQ)	Lower	32	166.70	0.933	.627
	Middle	241	155.48		
	Higher	37	145.93		
	Total	310			
Cognitive Functioning Self-Rating Scale (CFSS)	Lower	32	154.69	0.410	.815
	Middle	241	156.93		
	Higher	37	146.86		
	Total	310			
Brief Healthy Eating Habits Scale (BHEHS)	Lower	32	156.45	0.352	.839
	Middle	241	156.62		
	Higher	37	147.36		
	Total	310			
Depression (DASS-21)	Lower	32	158.88	4.859	.088
	Middle	241	150.52		
	Higher	37	184.99		
	Total	310			
Anxiety (DASS-21)	Lower	32	184.08	3.789	.150
	Middle	241	152.92		
	Higher	37	147.59		
	Total	310			
Stress (DASS-21)	Lower	32	184.91	4.750	.093
	Middle	241	150.19		
	Higher	37	164.66		
	Total	310			

Note. One-Way Analysis of Variance (Kruskal-Wallis test) was used to assess differences across socioeconomic groups. IPAQ = International Physical Activity Questionnaire; CFSS = Cognitive Functioning Self-Rating Scale; BHEHS = Brief Healthy Eating Habits Scale; DASS-21 = Depression Anxiety Stress Scale 21.

stress. The following table shows the mediating role of emotional regulation measured through Emotional Regulation Questionnaire (ERQ) in the relationship between Physical Activity measured through International Physical Acivity Questionnaire (IPAQ-T), Dietary Patterns measured through Healthy Eating Habits (BHEHS-T), Cognitive Functions measured through Cognitive Functioimg Self Rating Scale (CFSS-T) and Depression, Anxiety and Stress measured through Depression Anxiety Stress Scale – 21 (DASS 21).

4.12.1 Model Information

The SPSS Model 4 of the PROCESS procedure was used to analyze the data. The predictor (X) is International Physical Activity Questionnaire (IPAQ-T), the outcome (Y) is DASS-21 Depression (DT), the mediator is Emotional Regulation; ERQ-CA (Cognitive Appraisal) and ERQ-ES (Expressive Suppression). There are 310 observations on which analysis is conducted.

4.12.2 Mediators Predicted by X (a Paths)

The following section of the output represents each mediator as the outcome variable and IPAQ-T as the only predictor: ERQ-CA (M1): -0.0456 (p = .6151) is the coefficient (a1 path). This implies that between two cases that differ by one unit in terms of physical activity,the case that is one unit higher is estimated to be less by 0.0456 in terms of cognitive appraisal but the difference between the two is not significant. $ERQ_ES(M2) : -0.0525$(p =.4734) is the coefficient (a2 path). On the same note, an increase in the case by one unit in physical activity is predicted to decrease the expressive suppression by 0.0525 units, which is also insignificant.

4.12.3 X and M (b and c' Paths) Outcome Predicted

Depression (DT) is the outcome variable in the final model, where both mediators are physical activity and both predictors: $ERQ_CA(b1path) : -0.0581$ (p =.2079). Two cases that are one unit apart on cognitive appraisal and the same on

physical activity are approximated to be different by 0.0581 units on depression. $ERQ_ES(b2path) := -0.0491$ (p =.3902). Two cases are different by a single unit on the expressive suppression but equal on physical activity, which are estimated to be different by 0.0491 units on the depression.

Direct Effect (c′ path). The standardized regression coefficient was $\beta = -0.0591$ ($p = .359$), indicating that, holding other variables constant, a one-unit increase in physical activity was associated with a 0.059-unit decrease in depression. This effect was not statistically significant.

4.12.4 Total, Direct and Indirect Effects

In this section, the whole effect of physical activity on depression is summarized: Total Effect: -0.0539(Direct Effect + total Indirect Effect). Direct Effect: = -0.0591, with a 95 percent confidence interval = -0.1856, 0.0675. Indirect Effects (ab): Total Indirect Effect: 0.0052, BootSE =.0124, 95% BootCI = -0.0125, 0.0375.

The indirect effect through cognitive reappraisal (ERQ_CA; a_1b_1) was 0.0027, with a 95% bootstrapped confidence interval of $[-0.0103, 0.0250]$. Sim-ilarly, the indirect effect through expressive suppression (ERQ_ES; a_2b_2) was 0.0026, with a 95% bootstrapped confidence interval of $[-0.0086, 0.0264]$.

The indirect effect is defined as the difference between the total effect and the direct effect ($ab = c - c'$). As the bootstrapped confidence intervals for both indi-rect effects included zero, neither mediation pathway was statistically significant.

4.12.5 Analysis Notes

The calculation of all the confidence intervals in the output was done at a 95% confidence level. The percentile bootstrap confidence intervals were calculated with 5, 000 bootstrap samples, which is the default value when making stable estimates.

TABLE 4.16: *Mediation Analysis of Physical Activity (IPAQ-T) and Depression (DT) through Emotion Regulation Subscales (ERQ-CA, ERQ-ES) as Mediators (N = 310)*

Effect (Pathway)	Outcome	Predictor	*B*	*SE*	*t*	*p*	*F*	df_1	df_2	β	95% CI LL	95% CI UL
a_1 (IPAQ-T → ERQ-CA)	ERQ-CA	IPAQ-T	-0.046	0.091	-0.50	.615	0.25	1	308	-0.029	-0.224	0.133
a_2 (IPAQ-T → ERQ-ES)	ERQ-ES	IPAQ-T	-0.053	0.073	-0.72	.473	0.52	1	308	-0.041	-0.197	0.092
b_1 (ERQ-CA → DT)	Depression (DT)	ERQ-CA	-0.058	0.046	-1.26	.208	–	–	–	-0.082	-0.149	0.033
b_2 (ERQ-ES → DT)	Depression (DT)	ERQ-ES	-0.049	0.057	-0.86	.390	–	–	–	-0.056	-0.161	0.063
c' (IPAQ-T → DT)	Depression (DT)	IPAQ-T	-0.059	0.064	-0.92	.359	1.70	3	306	-0.052	-0.186	0.068

Note. IPAQ-T = International Physical Activity Questionnaire (Total); ERQ-CA = Cognitive Reappraisal; ERQ-ES = Expressive Suppression; DT = Depression (DASS-21). Path *a* represents effects of the independent variable on mediators, path *b* represents effects of mediators on the outcome variable, and c' represents the direct effect of physical activity on depression after controlling for mediators. Confidence intervals are reported at the 95% level.

TABLE 4.17: Mediation Analysis of Cognitive Functioning Self-Rating Scale (CFSS-T) and Depression (DT) Through Emotion Regulation Subscales (N = 310)

Effect (Path)	Outcome	Predictor	B	SE	t	p	F	df_1	df_2	β	95% CI LL	95% CI UL
a_1 (CFSS-T → ERQ-CA)	ERQ-CA	CFSS-T	0.0359	0.0378	0.95	.343	0.90	1	308	0.0540	−0.0385	0.1104
a_2 (CFSS-T → ERQ-ES)	ERQ-ES	CFSS-T	0.0177	0.0306	0.58	.563	0.34	1	308	0.0330	−0.0425	0.0779
b_1 (ERQ-CA → DT)	Depression (DT)	ERQ-CA	−0.0591	0.0461	−1.28	.201	—	—	—	−0.0831	−0.1498	0.0316
b_2 (ERQ-ES → DT)	Depression (DT)	ERQ-ES	−0.0478	0.0571	−0.84	.403	—	—	—	−0.0542	−0.1601	0.0645
c' (CFSS-T → DT)	Depression (DT)	CFSS-T	0.0194	0.0269	0.72	.472	1.59	3	306	0.0409	−0.0336	0.0723

Note. CFSS-T = Cognitive Functioning Self-Rating Scale (Total); ERQ-CA = Cognitive Reappraisal; ERQ-ES = Expressive Suppression; DT = Depression (DASS-21). Path a represents effects of cognitive functioning on emotion regulation strategies, path b represents effects of emotion regulation strategies on depression, and c' represents the direct effect of cognitive functioning on depression controlling for mediators. Confidence intervals are reported at the 95% level. Bootstrap analyses were based on 5,000 samples.

4.12.6 Model Information

The mediation analysis was conducted using Model 4 of the PROCESS macro for SPSS with a sample size of $N = 310$. The model examined the relationship between cognitive functioning, measured through the Cognitive Functioning Self-Rating Scale (CFSS-T), as the predictor variable (X), and depression, measured through the Depression subscale of the DASS-21 (DT), as the outcome variable (Y). Two mediators were included in the model: Cognitive Reappraisal (ERQ-CA) and Expressive Suppression (ERQ-ES), assessed using the Emotion Regulation Questionnaire.

4.12.7 Prediction of Mediators (a Paths)

In this step, the mediators were treated as outcome variables to estimate the a paths. For Cognitive Reappraisal (ERQ-CA; M_1), the coefficient for the a_1 path was $B = 0.0359$ ($p = .343$), indicating that a one-unit increase in cognitive functioning was associated with a projected increase of 0.0359 units in cognitive reappraisal; however, this effect was not statistically significant. Similarly, for Expressive Suppression (ERQ-ES; M_2), the a_2 path coefficient was $B = 0.0177$ ($p = .563$), suggesting that a one-unit increase in cognitive functioning was associated with a 0.0177-unit increase in expressive suppression, which was also statistically non-significant.

4.12.8 Prediction of the Outcome Variable (b and c' Paths)

The outcome variable, depression (DT), was regressed simultaneously on cognitive functioning (CFSS-T), cognitive reappraisal (ERQ-CA), and expressive suppression (ERQ-ES). The b_1 path from ERQ-CA to depression yielded a coefficient of $B = -0.0591$ ($p = .201$), indicating that individuals differing by one unit in cognitive reappraisal, while holding cognitive functioning constant, were estimated to differ by 0.0591 units on depression scores. The b_2 path from ERQ-ES to depression produced a coefficient of $B = -0.0478$ ($p = .403$), suggesting a non-significant association between expressive suppression and depression when

controlling for cognitive functioning. The direct effect of cognitive functioning on depression (c' path) was positive but non-significant ($B = 0.0194$, $p = .472$), indicating that a one-unit increase in cognitive functioning was associated with a 0.0194-unit increase in depression scores when both mediators were held constant.

4.12.9 Total, Direct, and Indirect Effects

The direct effect (c') of cognitive functioning on depression was $B = 0.0194$, with a 95% confidence interval ranging from -0.0336 to 0.0723. The total indirect effect was estimated as $ab = -0.0030$, with a 95% bootstrap confidence interval of $[-0.0205,\ 0.0081]$. Examination of specific indirect effects revealed that the indirect effect through cognitive reappraisal (a_1b_1) was -0.0021 (95% BootCI $[-0.0153,\ 0.0053]$), while the indirect effect through expressive suppression (a_2b_2) was -0.0008 (95% BootCI $[-0.0104,\ 0.0071]$). The indirect effect is defined as the difference between the total effect and the direct effect ($ab = c - c'$). As the bootstrapped 95% confidence intervals for all indirect effects included zero, none of the mediated pathways were statistically significant.

4.12.10 Analysis Notes

All confidence intervals were computed at the 95% confidence level. Percentile bootstrap confidence intervals were generated using 5,000 bootstrap samples. No estimation or convergence issues were reported for this model.

4.12.11 Model Information

The mediation analysis was conducted using Model 4 of the PROCESS macro for SPSS. The predictor variable (X) was the International Physical Activity Questionnaire total score (IPAQ_T), the outcome variable (Y) was anxiety measured through the Depression Anxiety Stress Scale–21 (DA), and the mediators were Cognitive Appraisal (ERQ_CA) and Expressive Suppression (ERQ_ES) subscales of the Emotion Regulation Questionnaire. The analysis was based on a sample of $N = 310$ participants.

4.12.12 X Prediction of Mediators (Paths a)

In this step, the mediators were treated as outcome variables to estimate the a paths. For Cognitive Appraisal (ERQ_CA; M_1), the coefficient for the a_1 path was $B = -0.0456$ ($p = .615$), indicating that a one-unit increase in physical activity was associated with a 0.0456 unit decrease in cognitive appraisal; however, this effect was not statistically significant.

Similarly, for Expressive Suppression (ERQ_ES; M_2), the coefficient for the a_2 path was $B = -0.0525$ ($p = .473$), suggesting that a one-unit increase in physical activity was associated with a 0.0525 unit decrease in expressive suppression. This effect was also not statistically significant.

4.12.13 Prediction X and M (Paths b and c')Outcome

In this stage, anxiety (DA) was treated as the outcome variable, with physical activity (IPAQ_T) and the mediators included as predictors. For Cognitive Appraisal (ERQ_CA), the b_1 path coefficient was $B = -0.0396$ ($p = .352$), indicating that two individuals differing by one unit in cognitive appraisal but equal in physical activity were estimated to differ by 0.0396 units in anxiety.

For Expressive Suppression (ERQ_ES), the b_2 path coefficient was $B = -0.0456$ ($p = .387$), suggesting that a one-unit difference in expressive suppression corresponded to a 0.0456 unit difference in anxiety when physical activity was held constant. The direct effect of physical activity on anxiety (c' path) was statistically significant, with a coefficient of $B = 0.1170$ ($p = .049$). This positive direct effect indicates that, when both mediators were controlled, a one-unit increase in physical activity was associated with a 0.1170 unit increase in anxiety scores.

4.12.14 The Direct, Indirect and Total Effects

The total effect of physical activity on anxiety was $B = 0.1212$, with a 95% confidence interval of [0.0051, 0.2373] ($p = .041$). The direct effect (c) was $B =$

0.1170, with a 95% confidence interval of [0.0005, 0.2336]. The total indirect effect was $B = 0.0042$ (BootSE = 0.0086), with a 95% bootstrapped confidence interval of [–0.0108, 0.0242].

Examination of the specific indirect effects showed that the indirect effect through Cognitive Appraisal (a_1b_1) was $B = 0.0018$, 95%BootCI [–0.0059, 0.0175], and the indirect effect through Expressive Suppression (a_2b_2) was $B = 0.0024$, 95% BootCI [–0.0055, 0.0189]. The indirect effect is defined as the difference between the total and direct effects ($ab = c - c'$). As the bootstrapped confidence intervals for all indirect effects included zero, none of the mediation paths were statistically significant.

4.12.15 Analysis Notes

All confidence intervals were estimated at the 95% level. Percentile bootstrap confidence intervals were computed using 5,000 bootstrap samples. No estimation or convergence issues were detected in the analysis.

4.12.16 Model Information

Model 4 of the PROCESS macro was used to perform the mediation analysis of 310 observations in SPSS. This model used the predictor (X) as the **Brief Healthy Eating Habits Scale Total (BHEHS_T)** and the outcome variable (Y) as **DASS-21 Anxiety (DA)**.

4.12.17 X-Predicted Mediators (a Paths)

In this step, each mediator is treated as an outcome variable to determine the *a paths*: i. ERQ_CA (M1): Coe icient (a_1 path) = 0.2835 ($p = .0052$). This implies that for two cases differing by one unit in healthy eating habits, the case with one unit higher is expected to score 0.2835 units higher on cognitive appraisal. This effect is statistically significant ($p < .05$). ii. ERQ_ES (M2): Coe icient (a_2 path) = 0.2501 ($p = .0022$). A one-unit increase in healthy eating is predicted to increase expressive suppression by 0.2501 units, which is statistically significant.

4.12.18 Predicted by X and M (b and $C\prime$ Paths) Outcome

This section presents the *b and $C\prime$ paths* where anxiety (DA) is the outcome variable:

i. ERQ_CA (b_1 path): Coefficient = -0.0382 ($p = .3733$). Two cases differing by one unit on cognitive appraisal but equal on healthy eating habits are estimated to differ by 0.0382 units on anxiety.

ii. ERQ_ES (b_2 path): Coefficient = -0.0452 ($p = .3961$). Two cases differing by one unit on expressive suppression but equal on healthy eating habits are estimated to differ by 0.0452 units on anxiety.

iii. Direct Effect ($C\prime$ path): Coefficient = -0.0411 ($p = .5471$). This negative direct effect implies that holding both mediators constant, a one-unit increase in healthy eating is predicted to reduce anxiety by 0.0411 units; this effect is not statistically significant.

4.12.19 Total, Direct, and Indirect Effects

The overall effects of healthy eating habits on anxiety are summarized as follows:

i. Total Effect (c): -0.0542, 95% CI = $[-0.1895, 0.0811]$ ($p = .4316$)

ii. Direct Effect ($C\prime$): -0.0411, 95% CI = $[-0.1752, 0.0930]$

iii. Indirect Effects (ab): -0.0221, 95% BootCI = $[-0.0475, 0.0016]$

iv. ERQ_CA (a_1b_1): -0.0108, 95% BootCI = $[-0.0360, 0.0121]$

v. ERQ_ES (a_2b_2): -0.0113, 95% BootCI = $[-0.0401, 0.0150]$

The difference between the total effect and the direct effect is the indirect effect (ab = c - $C\prime$). Since the 95% bootstrapped confidence intervals for all indirect effects contain zero, the mediation is not statistically significant.

4.12.20 Analysis Notes

All confidence intervals were calculated at the 95% level. Percentile bootstrap confidence intervals were obtained using 5,000 bootstrap samples. No problematic errors were reported in the output.

4.12.21 Model Information

Model 4 of the SPSS PROCESS macro was used to conduct the mediation analysis with a sample size of 310 observations. The model tested the correlation between the Cognitive Functioning Self-Rating Scale Total (CFSS_T) as the predictor (X) and DASS-21 Anxiety (DA) as the outcome variable (Y).

4.12.22 Predicted by X (a Paths) Mediators

Here, each mediator is taken as an outcome variable and the predictor (X): In the case of ERQ_CA (M1): a_1 path = 0.0359 (p = .3432). This means that the cognitive appraisal difference between two cases with one unit difference on CFSS_T is predicted to be a difference of 0.0359 units. This correlation is not statistically significant. In the case of ERQ_ES (M2): Coefficient (a_2 path) = 0.0177 (p = .5630). The difference of one unit in CFSS_T is projected to produce a 0.0177 unit difference on expressive suppression. This effect is also not statistically significant.

4.12.23 Predicted by X and M (b and c' Paths) Outcome

Anxiety (DA) is the outcome in this section, predicted by the antecedent (X) and the mediators (M):

i. ERQ_CA (b_1 path): Coefficient = -0.0442 (p = .3075). Two cases differing by one unit on cognitive appraisal but equal on CFSS_T are estimated to differ by 0.0442 units on anxiety.
ii. ERQ_ES (b_2 path): Coefficient = -0.0245 (p = .6533). Two cases differing by one unit on expressive suppression but equal on CFSS_T are estimated to differ by 0.0245 units on anxiety.
iii. Direct Effect ($C\prime$ path): Coefficient = 0.0827 (p = .0341).

This positive direct effect indicates that a case one unit higher on CFSS-T is

predicted to have 0.0827 higher anxiety when mediators are held constant. This effect is statistically significant ($p < .05$).

4.12.24 Total, Direct, and Indirect Effects

This part summarizes the impact of CFSS_T on anxiety:

Total Effect ($C\prime$): 0.0807, 95% CI [0.0123, 0.1490] ($p = .0210$).
Direct Effect ($C\prime$): 0.0827, 95% CI [0.0063, 1.591].
Indirect Effects (ab): Total Indirect Effect = -0.0020, 95% BootCI [-0.0114, 0.0054].
i. ERQ_CA (a_1b_1): -0.0016, 95% BootCI [-0.0084, 0.0029].
ii. ERQ_ES (a_2b_2): -0.0004, 95% BootCI [-0.0049, 0.0030].
The indirect effect is the difference between the total effect and the direct effect (ab = c - $C\prime$). Since all 95% bootstrapped confidence intervals contain zero, none of the mediated effects are statistically significant.

4.12.25 Analysis Notes

All confidence intervals presented are at the 95% level. The percentile bootstrap confidence intervals were calculated based on 5,000 bootstrap samples. No problematic errors or issues were reported in the output.

4.12.26 Model Information

Model 4 of the PROCESS macro on SPSS was used to conduct the mediation analysis on 310 observations. The model tested the hypothesis of the relationship between the International Physical Activity Questionnaire Total (IPAQ-T) as the predictor (X) and the DASS-21 Stress (DS) as the outcome variable (Y).

4.12.27 Mediators X Predicted (a Paths)

Each of the mediators is taken as the outcome variable in this section to determine the a paths:

i. ERQ_CA (M1): The coefficient of the a_1 path = -0.0456 (p = .6151). This means that a one-unit higher case of two cases in physical activity is predicted to be 0.0456 units lower in cognitive appraisal. This correlation is not statistically significant ($p > .05$).
ii. ERQ_ES (M2): The coefficient of the a_2 path = -0.0528 (p = .4734).

An increase in physical activity by one unit is projected to decrease expressive suppression by 0.0528 units, which is also not statistically significant.

4.12.28 Predicted by X and M (b and c' Paths) Outcome

The results of this output are the b and $C\prime$ paths with the outcome variable being stress (DS):
i. ERQ_CA (b1 path): The coefficient = -0.0163 (p = .8216). Two cases that differ by one unit on cognitive appraisal but are equal on physical activity are estimated to differ by 0.0163 units on stress.
ii. ERQ_ES (b2 path): The coefficient = 0.0435 (p = .6133). Two cases differing by one unit on expressive suppression but equal on physical activity are estimated to differ by 0.0435 units on stress.
iii. Direct Effect (c' path): The coefficient = -0.0116 (p = .9188).

The negative direct effect indicates that, on average, given both mediators held constant, a one-unit increase in physical activity is predicted to reduce stress by 0.0116 units, but this is not statistically significant.

4.12.29 Total, Direct, and Indirect Effects

This part summarizes the general effects of physical activity on stress:
i. Total Effect (c): -0.0131, 95% CI = [-0.2374, 0.2112], p = .9083.
ii. Direct Effect (c'): -0.0116, 95% CI = [-0.2371, 0.2138].
iii. Total Indirect Effect (ab): -0.0016, 95% BootCI = [-0.0270, 0.0210]. The indirect effect is the difference between the overall effect of X on Y and the direct effect (ab = c - $C\prime$). Since all 95% bootstrapped confidence intervals include zero,

mediation is not statistically significant. i. ERQ_CA (a_1b_1): 0.0007, 95% BootCI = [-0.0084, 0.0152]. ii. ERQ_ES (a_2b_2): -0.0023, 95% BootCI = [-0.0210, 0.0119].

4.12.30 Analysis Notes

All confidence intervals were calculated at the 95% level of confidence. Percentile bootstrap confidence intervals were based on 5,000 bootstrap samples. No problematic errors or notes were reported in the output.

4.12.31 Model Information

The SPSS sample size of 310 observations was used to run the mediation analysis with the help of Model 4 of the PROCESS macro. The studied model presupposed the association between a predictor (X) and an outcome variable (Y) in which the former could be a Brief Healthy Eating Habits Scale Total (BHEHS-T) and the latter could be a DASS-21 Stress (DS).

4.12.32 X (a Paths) Predicted Mediators

Here, as an outcome variable, each of the mediators is cross-linked with the predictor (X) to determine the a paths: In the case of ERQ_CA (M1), the coefficient of (a1 path) is 0.2835 ($p = .0052$). It means that the difference between cognitive appraisal between two cases that differ by one unit in healthy eating habits is estimated at 0.2835 units. This is a statistically significant relationship ($p < .05$). In the case of ERQ_ES (M2), the coefficient of (a2 path) is 0.2501 ($p = .0022$). The difference between a case one unit above healthy eating habits is projected to be 0.2501 units above expressive suppression. This correlation is statistically significant ($p < .05$).

4.12.33 X and M Predicted Outcome (b and c' Paths)

In this section, the outcome variable is stress (DS), the predictors are X and M, and the paths of b and c are known as b and c'.

i. ERQ_CA (b1 path): The coefficient is -0.0535 ($p = .2721$). Two cases which differ by a unit on cognitive appraisal and which are equal on healthy eating habits would be predicted to differ by 0.0535 units on stress.
ii. ERQ_ES (b2 path): The coefficient is -0.0241 ($p = .6965$).

A pair of cases in which the difference on expressive suppression is one unit above the same cases in which there is no difference on healthy eating habits are approximated to vary by 0.0241 units on stress. Direct Effect (c' path): -0.0556, $p = .4801$. Such a negative direct impact implies that in the remainder of the analysis, all other factors remaining constant, an increase in the case by one unit in healthy eating habits will be predicted as being smaller by 0.0556 units on stress, but this effect is not statistically significant.

4.12.34 Direct, Indirect, and Total Effects

In general, the effect of healthy nutrition on stress can be summarized as follows:

Total Effect (c): -0.0768, 95% confidence interval = [-0.2227, 0.0692] ($p = .3021$).
Direct Effect (c'): -0.0556, 95% confidence interval = [-2.106, -0.0994].
Indirect Effects (ab): Total Indirect Effect = -0.0212, 95% BootCI = [-0.0623, 0.0114].
i. ERQ_CA (a1b1): -0.0152, 95% BootCI [-0.0491, 0.0107].
ii.ERQ_ES (a2b2): -0.0060, 95% BootCI [-0.0392, 0.0231].

The difference between the total effect of X on Y and the direct effect is referred to as the indirect effect (ab = c - $C\prime$). Since all 95% bootstrapped confidence intervals of the indirect effects contain zero, the mediation is not statistically significant.

4.12.35 Analysis Notes

All confidence intervals in the analysis were calculated at the 95.00% confidence level. Indirect effect confidence intervals were obtained based on 5,000 bootstrap samples. No problematic errors were mentioned in the output.

Table 4.18: Mediation Analysis of Physical Activity Questionnaire (IPAQ_T) and Anxiety (DA) Through Emotion Regulation Subscales as Mediators ($N = 310$)

Effect (Pathway)	Outcome	Predictor	B	SE	t	p	F	df_1	df_2	β	95% CI LL	95% CI UL
a_1 (IPAQ_T → ERQ_CA)	ERQ_CA	IPAQ_T	−0.0456	0.0907	−0.50	.615	0.25	1	308	−0.0287	−0.2241	0.1328
a_2 (IPAQ_T → ERQ_ES)	ERQ_ES	IPAQ_T	−0.0525	0.0732	−0.72	.473	0.52	1	308	−0.0409	−0.1965	0.0915
b_1 (ERQ_CA → DA)	DA	ERQ_CA	−0.0396	0.0424	−0.93	.352	2.44	3	306	−0.0601	−0.1230	0.0439
b_2 (ERQ_ES → DA)	DA	ERQ_ES	−0.0456	0.0526	−0.87	.387	2.44	3	306	−0.0559	−0.1490	0.0579
c' (IPAQ_T → DA)	DA	IPAQ_T	0.1170	0.0592	1.98	.049*	2.44	3	306	0.1117	0.0005	0.2336

Note. IPAQ_T = International Physical Activity Questionnaire (Total score); ERQ_CA = Emotion Regulation Questionnaire—Cognitive Appraisal; ERQ_ES = Emotion Regulation Questionnaire—Expressive Suppression; DA = Depression Anxiety Stress Scale–21 (Anxiety subscale). Paths a_1 and a_2 represent effects of the independent variable on the mediators; paths b_1 and b_2 represent effects of the mediators on the dependent variable; c' represents the direct effect of the independent variable on the dependent variable controlling for mediators. Bootstrap samples = 5,000. Confidence intervals are reported at the 95% level. *$p < .05$.

TABLE 4.19: Mediation Analysis of Brief Healthy Eating Habits Scale (BHEHS_T) and Anxiety (DA) Through Emotion Regulation Subscales as Mediators ($N = 310$)

Effect (Pathway)	Outcome	Predictor	B	SE	t	p	F	df_1	df_2	β	95% CI LL	95% CI UL
a_1 (BHEHS_T → ERQ_CA)	ERQ_CA	BHEHS_T	0.283	0.1006	2.82	.005*	7.941	1	308	0.1585	0.0855	0.4815
a_2 (BHEHS_T → ERQ_ES)	ERQ_ES	BHEHS_T	0.250	0.081	3.09	.002*	9.531	1	308	0.1732	0.0907	0.4096
b_1 (ERQ_CA → DA)	DA	ERQ_CA	−0.038	0.042	−0.89	.373	1.253	3	306	−0.0580	−0.1224	0.0461
b_2 (ERQ_ES → DA)	DA	ERQ_ES	−0.045	0.053	−0.85	.396	1.253	3	306	−0.0554	−0.1498	0.0594
$C\prime$ (BHEHS_T → DA)	DA	BHEHS_T	−0.041	0.068	−0.60	.547	1.253	3	306	−0.0349	−0.1752	0.0930

Note. BHEHS_T = Brief Healthy Eating Habits Scale (Total); DA = Anxiety subscale of the Depression Anxiety Stress Scale–21; ERQ_CA = Cognitive Appraisal; ERQ_ES = Expressive Suppression. B = unstandardized regression coefficient; SE = standard error; β = standardized coefficient; CI = confidence interval; LL = lower limit; UL = upper limit. Bootstrap samples = 5,000. * $p < .05$.

TABLE 4.20: Mediation Analysis of CFSS_T and Anxiety (DA) through Emotion Regulation Subscales

Effect (Pathway)	**Outcome**	**Predictor**	**B**	**SE**	**t**	**p**	**F df1**	**df2**	β	**95%CI LL**	**95%CI UL**
a_1 (CFSS_T → ERQ_CA)	ERQ_CA	CFSS_T	0.035	0.037	0.95	.343	0.90 1	308	0.054	-0.039	0.110
a_2 (CFSS_T → ERQ_ES)	ERQ_ES	CFSS_T	0.018	0.030	0.579	.563	0.34 1	308	0.03	-0.042	0.078
b_1 (ERQ_CA → DA)	DA	ERQ_CA	-0.040	0.042	-0.941	.347	1.13 3	306	-0.061	-0.13	0.044
b_2 (ERQ_ES → DA)	DA	ERQ_ES	-0.048	0.052	-0.921	.357	1.13 3	306	-0.06	-0.15	0.05
$C\prime$ (CFSS_T → DA)	DA	CFSS_T	-0.003	0.025	-0.104	.917	1.13 3	306	-0.01	-0.05	0.046

Note. CFSS-T= Cognitive Functioning Self-Rating Scale(Total score); ERQ-CA = Emotion Regulation Questionnaire– Cognitive Appraisal; ERQ_ES= Emotion Regulation Questionnaire– Expressive Suppression; DA= DASS-21 Anxiety subscale. a_1 and a_2 represent paths from the independent variable to the mediators; b_1 and b_2 represent paths from the mediators to the dependent variable; $C\prime$ represents the direct effect of the independent variable on the dependent variable controlling for mediators; $a_i b_i$ represents indirect effects. Bootstrap confidence intervals are 95%, based on 5,000 samples.

TABLE 4.21: Mediation Analysis of IPAQ-T and Stress (DS) through Emotion Regulation Subscales (N = 310)

Effect (Pathway)	**Outcome**	**Predictor**	**B**	**SE**	**t**	**p**	**F**	**df1**	**df2**	β	**95% CI LL**	**95% CI UL**
a_1 (IPAQ-T → ERQ-CA)	ERQ-CA	IPAQ-T	-0.0456	0.0907	-0.50	.615	0.25	1	308	-0.029	-0.2241	0.1328
a_2 (IPAQ-T → ERQ-ES)	ERQ-ES	IPAQ-T	-0.0525	0.0732	-0.72	.473	0.52	1	308	-0.041	-0.1965	0.0915
b_1 (ERQ-CA → DS)	DS	ERQ-CA	-0.0122	0.0409	-0.30	.766	—	—	—	-0.019	-0.0926	0.0683
b_2 (ERQ-ES → DS)	DS	ERQ-ES	-0.1131	0.0506	-2.23	.026*	—	—	—	-0.143	-0.2127	-0.0134
$C\prime$ (IPAQ-T → DS)	DS	IPAQ-T	0.0996	0.0571	1.75	.082	3.63	3	306	0.098	-0.0127	0.2119

Note. IPAQ-T = International Physical Activity Questionnaire (Total); DS = DASS-21 Stress subscale; ERQ-CA = Emotion Regulation Questionnaire – Cognitive Appraisal; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression. a_1 = effect of physical activity on cognitive appraisal; a_2 = effect of physical activity on expressive suppression; b_1 = effect of cognitive appraisal on stress; b_2 = effect of expressive suppression on stress; $C\prime$ = direct effect of physical activity on stress controlling for mediators. * $p < .05$. Bootstrap confidence intervals are based on 5,000 samples.

Table 4.22: Mediation Analysis of Healthy Eating Habits (BHEHS_T) and Stress (DS) through Emotion Regulation Subscales (N = 310)

Effect (Pathway)	**Outcome**	**Predictor**	**B**	**SE**	**t**	**p**	**F**	**df1**	**df2**	β	**95% CI LL**	**95% CI UL**
a_1 (BHEHS_T → ERQ_CA)	ERQ_CA	BHEHS_T	0.2835	0.1006	2.82	.005*	7.94	1	308	0.159	0.0855	0.481
a_2 (BHEHS_T → ERQ_ES)	ERQ_ES	BHEHS_T	0.2501	0.0810	3.09	.002*	9.53	1	308	0.173	0.0907	0.409
b_1 (ERQ_CA → DS)	DS	ERQ_CA	-0.0110	0.0412	-0.27	.790	—	—	—	-0.017	-0.0921	0.070
b_2 (ERQ_ES → DS)	DS	ERQ_ES	-0.1128	0.0512	-2.20	.028*	—	—	—	-0.143	-0.2135	-0.012
$C\prime$ (BHEHS_T → DS)	DS	BHEHS_T	-0.0344	0.0656	-0.52	.600	2.68	3	306	-0.030	-0.1635	0.095

Note. BHEHS-T = Brief Healthy Eating Habits Scale (Total score); ERQ-CA = Emotion Regulation Questionnaire – Cognitive Appraisal; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression; DS = DASS-21 Stress subscale. a_1 and a_2 represent paths from the independent variable to the mediators; b_1 and b_2 represent paths from the mediators to the dependent variable; $C\prime$ represents the direct effect of the independent variable on the dependent variable controlling for the mediators; $a_i b_i$ represents indirect effects. Bootstrap confidence intervals are 95% and based on 5,000 resamples. Asterisks (*) indicate statistical significance at $p < .05$.

Table 4.23: Mediation Analysis of Cognitive Functioning Self-Rating Scale (CFSS_T) and Stress (DS) through Emotion Regulation Subscales (N = 310)

Effect (Pathway)	**Outcome**	**Predictor**	**B**	**SE**	**t**	**p**	**F**	**df1**	**df2**	β	**95% CI LL**	**95% CI UL**
a_1 (CFSS_T → ERQ_CA)	ERQ_CA	CFSS_T	0.0359	0.0378	0.95	.343	0.90	1	308	0.054	-0.0385	0.1104
a_2 (CFSS_T → ERQ_ES)	ERQ_ES	CFSS_T	0.0177	0.0306	0.58	.563	0.34	1	308	0.033	-0.0425	0.0779
b_1 (ERQ_CA → DS)	DS	ERQ_CA	-0.0137	0.0411	-0.33	.740	—	—	—	-0.021	-0.0945	0.0672
b_2 (ERQ_ES → DS)	DS	ERQ_ES	-0.1160	0.0509	-2.28	.023*	—	—	—	-0.147	-0.2160	-0.0159
$C\prime$(CFSS_T → DS)	DS	CFSS_T	0.0104	0.0240	0.43	.665	2.65	3	306	0.025	-0.0368	0.0576

Note. CFSS-T = Cognitive Functioning Self-Rating Scale (Total score); ERQ-CA = Emotion Regulation Questionnaire – Cognitive Appraisal; ERQ-ES = Emotion Regulation Questionnaire – Expressive Suppression; DS = Depression Anxiety Stress Scale–21 (Stress subscale). a_1 and a_2 represent paths from the independent variable to the mediators; b_1 and b_2 represent paths from the mediators to the dependent variable; $C\prime$ represents the direct effect of the independent variable on the dependent variable controlling for mediators; $a_i b_i$ represents indirect effects. Bootstrap confidence intervals are 95% based on 5,000 resamples. Asterisks (*) indicate $p < .05$.

4.12.36 Model Information

Model 4 of SPSS PROCESS analysis was used to perform the mediation analysis using 310 observations. The relationships between Cognitive Functioning Self-Rating Questionnaire Total (CFSS_T) as the predictor (X) and Stress (DS) of DSS-21 as the outcome variable (Y) were analyzed.

4.12.37 X-Predicted mediators (a Paths

In this part, the mediators serve as the outcome variable to determine the a paths: In the case of ERQ_CA (M1), the coefficient (a1 path) is 0.0359 (p = 0.3432). This indicates that given two cases separated by one unit on cognitive functioning, the higher case is estimated to differ by 0.0359 units on cognitive appraisal, but this is not statistically significant. In the case of ERQ_ES (M2), the coefficient (a2 path) is 0.0177 (p = 0.5630). Similarly, a case with 1 unit higher on cognitive functioning is projected to be 0.0177 units higher on expressive suppression, which is not statistically significant.

4.12.38 Predicted by X and M (b and c' Paths) Outcome

This output provides the b and c' paths, where stress (DS) is the outcome variable with CFSS_T, ERQ_CA, and ERQ_ES as predictors:

ERQ_CA (b1 path): The coe icient is -0.0137 (p = 0.7397). Two cases one unit apart on cognitive appraisal but equal on cognitive functioning are predicted to differ by 0.0137 units on stress.

ERQ_ES (b2 path): The coe icient is -0.1160 (p = 0.0233). Two cases differing by one unit on expressive suppression but equal on cognitive functioning are pre-dicted to differ by 0.1160 units on stress. This is statistically significant ($p < 0.05$). Direct Effect (c' path): The coe icient is 0.0104 (p = 0.6647). This positive direct effect implies that, holding other factors constant, a 1-unit increase in cog-nitive functioning is predicted to increase stress by 0.0104 units, but this is not significant.

4.12.39 Total, Direct, and Indirect Effects

This section summarizes the total effects of cognitive functioning on stress:

Total Effect (c): 0.0079, 95% CI [-0.0456, 0.0615], p = 0.7704.
Direct Effect (c'): 0.104, 95% CI [-0.0368, 0.0576].
Indirect Effects (ab): Total Indirect Effect: -0.0025, 95% BootCI [-0.0197, 0.0097].

i. ERQ_CA (a1b1): -0.0005, 95% BootCI [-0.0060, 0.0030].
ii. ERQ_ES (a2b2): -0.0021, 95% BootCI [-0.0165, 0.0054].
The difference between the total effect and the direct effect (ab = c - c') is referred to as the indirect effect. Since all 95% bootstrapped confidence intervals of the indirect effects contain zero, the mediation is not statistically significant.

4.12.40 Analysis Notes

All confidence intervals were calculated at the 95% confidence level. Bootstrap confidence intervals were based on 5,000 samples. No problematic errors were reported in the output.

Chapter 5

Discussion and Conclusion

The present research study was conducted to examine the relationships among health behaviors (physical activity and dietary patterns), cognitive functioning, emotion regulation, and mental health outcomes (depression, anxiety, and stress) in Pakistani university students. Grounded in Gross's Process Model of Emotion Regulation, the study further explored the mediating role of emotion regulation in the associations between lifestyle factors and psychological distress.

Using a cross-sectional research design, data were collected from 310 students enrolled in public and private universities in Rawalpindi and Islamabad. Standardized self-report instruments were employed to assess mental health symptoms, emotion regulation strategies, cognitive functioning, physical activity, and dietary habits. This chapter discusses the findings in relation to the study objectives and hypotheses, focusing on the reliability of the measurement tools, distributional characteristics of the data, demographic influences, and the associations among study variables. The results are interpreted in light of existing empirical evidence and theoretical frameworks, followed by implications, limitations, and recommendations for future research.

5.1 Measurement Scales Reliability

The study instruments were evaluated using psychometrics, which is a significant methodological factor, because the validity of the results depends on the reliability

of the instruments. The results found that the levels of consistency of the measures were different. DASS-21 Depression Anxiety Stress Scale Lovibond and Lovibond (1995) showed moderate levels of reliability in all subscales with a Cronbachs alpha (α) of Depression =.63, Anxiety =.53, and Stress =.53. Although the anxiety and stress coefficients are fairly low, they are in line with other studies that have been developed on the South Asian student populations, and in this case, cultural peculiarities of emotional expression usually tend to impact the self-report measures(Norton, 2007). Cognitive Functioning Self-Rating Scale (CFSS) reported a satisfactory overall reliability (α =.73). Nonetheless, its subscales showed a low internal consistency, such as Spatio-temporal Orientation (α = .64), Attention (α = .48) and Memory (α =.35). This trend is probably indicative of the subjective quality of self-reported cognitive functioning where students might not be well aware of particular deficits relative to their overall cognitive functioning. The ERQ Gross and John (2003a)showed moderate internal consistency of both CR (α=.60) and ES (α =.60). These findings are indicative of the appropriateness of the ERQ in the evaluation of emotion regulation techniques of the present sample. In stark contrast, the International Physical Activity Questionnaire (IPAQ) Craig et al. (2003) had an incredibly low coefficient of reliability (α =.152). The subscales, Vigorous Activity (α=.029), Moderate Activity (α = -.173), Walking (α), and Sedentary Behavior (α= .089) were also weak. This limitation of the IPAQ is usually explained by the presence of recall bias and cultural differences in the perceptions of the intensity (Dugdill and Stratton, 2007). In the same manner, Brief Healthy Eating Habits Scale (BHEHS-6B) Martinez-Gomez et al. (2010) had low reliability (α =.344) and Micronutrients/Water (α =.294) and Macronutrients (α =.292) had low variance. This is probably because of the short 6 item scale format and the fairly homogenous eating habits of university students.

5.2 Demographic Factors and Gender Differences

One of the most valuable findings of the research under consideration is the role of demographic factors in the establishment of the mental health picture of the research sample. An analysis of the demographic data revealed that the difference

in gender in terms of depressive symptoms was very significant (p =.001) thereby a very high empirical evidence against Hypothesis 6 (H6). Interestingly enough the current of this dissimilarity was contrary to the dominant trends which were pronounced in a large part of Western literature.(Albert, 2015)

The depression level of male members of this sample was significantly higher (Mean Rank = 168.0) compared to the female participants (Mean Rank = 131.6) and needs to be viewed very subtly in the Pakistani sociocultural context. Although some might believe that because females are more prone to internalizing disorders associated with depression than males, the result of the current study is linked to the increasing local statistics of possessing a silent epidemic of male mental health in Pakistan(Waqas et al., 2015). Such degree of distress in young men can be attributed to the high degree of socioeconomic pressure that was localized to the area. Not that the male university students are not under a lot of pressure, but generally in terms of career success, financial stability and family responsibility since they are the breadwinners in a collectivist society(Niaz, 2011).

Such anticipations can be converted into major depressive conditions within an economic uncertainty and competitive labor market. Besides, the Pakistani culture standards in terms of masculinity are likely to discourage the weakness of males or excessive display of distress(Khan et al., 2020). The lack of culturally palatable or safe spaces where young men can share and communicate their emotions as well as transfer their predicament is quite large, and most of them turn to internalizing their predicament until it breaks out in the form of manifestations. On the contrary, despite the difference in that female students also experience the academic pressure, it is plausible that the former might have more socially acceptable ways of them to express their anxiety in their social or family circles (Javed et al., 2020).

Interestingly, there are no significant changes in the physical activity and diet that both genders have. This means that, female and male university students of Rawalpindi and Islamabad live a relatively homogenous lifestyle in the said

place. The uniformity of health behaviors would be likely to be supported by common facilities in the hostels, similarity in distance to the campus in walking, and homogeneity of the cafeteria services.

The finding implies, but is likely probably explained by psychological, social, and developmental pressures, which are ingrained that the difference in depression between the genders cannot be ex-plained by lifestyle habits (either eating habits or physical activity). It clarifies why there is a desperate need of gender sensitive mental health interventions in the campuses that is specifically designed to react to the stressors and barricades to help-seeking that are distinct to young male learners in the region.

5.3 Demographic Characteristics of the Sample

The sample primarily consisted of young adults aged 18–35 years, which is representative of the university student population and corresponds to the developmental stage of emerging adulthood(Arnett, 2000). This stage is often characterized by increased academic pressure, identity exploration, and heightened vulnerability to stress, anxiety, and depressive symptoms(Arnett, 2000).

The sample included a higher proportion of male participants compared to females, which may reflect enrollment trends in certain academic disciplines or differences in research participation willingness. Most participants belonged to a middle socioeconomic background and reported living in nuclear family systems, consistent with urban Pakistani demographics(Nayab, 2011). Gender-based analyses revealed a significant difference in depression, with male participants reporting higher depressive symptoms than females.

Although this finding contrasts with much of the international literature, it aligns with emerging evidence from Pakistani contexts, where sociocultural expectations, academic pressure, and limited emotional expression among males may contribute to elevated psychological distress(Bibi et al., 2020). No significant gender differences were observed in physical activity, dietary patterns, anxiety, stress, or

cognitive functioning, suggesting relative lifestyle similarity across genders. Age-group analyses indicated significant differences in depression, with older participants reporting higher depressive symptoms. This finding suggests that cumulative academic, occupational, and life-related stressors may increase vulnerability to depression with age(Sreeramareddy et al., 2007). No significant age differences were observed in physical activity, dietary habits, anxiety, stress, or cognitive functioning. Socioeconomic status did not show significant associations with any major study variables, likely due to the relative homogeneity of the student sample.

Relationship between Mental Health and Health Behaviors One of the main concerns of this study was to analyze the extent to which lifestyle variables, namely physical activity and dietary habits, are predictors of psychological well being. The results, however, provided a multifaceted image that was not very much similar to the initial research assumptions. The findings unlike Hypotheses 1 (H1) and 4 (H4) where increased physical activity and healthy diets were expected to have expansive negative effects on depressive, anxiety, and stress symptoms, showed that there was no significant overall correlation between psychological distress and total physical activity or overall dietary choice. Although there was no extensive connection, there was a subtle and statistically significant association of negative correlation between healthy eating and depression (r = -.121, $p < .05$).

This is a vital discovery because it indicates that nutrition is not a panacea of all kinds of psychological discomfort, but it has a specific role in mood control (Jacka et al., 2017). Within the university student population, the nutritional intake that is characterized by increased micronutrient content and consistent macronutrient balance can serve as the biological basis that will help to withstand the development of depressive symptoms. Nevertheless, the observation that this relationship was not extended to anxiety or stress implies that it could be that it is acute, external environmental forces that influence these specific states and not an internal nutritional condition (Adan et al., 2019). Lacking a broader important association between physical activity and mental health outcomes should be followed by a more thorough examination of the methodological and contextual

facts of the sample. To start with, the fact that International Physical Activity Questionnaire (IPAQ) is the least reliable in this particular sample (alpha = .152) needs to be mentioned as one of the primary factors. Physical activity is not always intentional or recreational, but functional, i.e. walking between departments or hostels, especially in a student population. When self-reported, such patterns can cause high levels of measurement error and thus confound an actual correlation (Dugdill and Stratton, 2007). Second and, maybe, more to the point, the findings outline the enormous impact of environmental stressors that are specific to the Pakistani system of academic. These systemic stressors, in an environment with heavy academic demands, a high level of competition and career insecurity through economic turmoil, might have a far greater influence on the mental health of a student compared to its physical behaviors (Shaikh et al., 2004). Although exercise and diet are commonly considered as preventive factors in the Western literature, they can be poor when the level of stress is unusually high as the floor. The psychological load of future professional stability and academic achievements in these situations becomes the defining factor in health indicating that lifestyle change is not always enough to change the mental health of Pakistani youths without dealing with the systemic and environmental stressors.

5.4 Relationship between Mental Health and Emotion Regulation

The results of the current research had serious empirical evidence to support the hypothesis that adaptive emotion regulation is an essential buffer against psychological distress in university students. In particular, there was a significant negative correlation between the overall emotion regulation (measured by ERQ) and the overall score of psychological distress (r = -.144, p =.011). Such an inverse correlation means that the higher that the student is able to manage and react to emotional experiences, the lower are his/her depression, anxiety, and stress levels. This is in line with Gross (1998) Process Model of Emotion Regulation that postulates that ways people regulate their emotions influence their psychology.

Additional grains of the ERQ subscales showed that the Cognitive Reappraisal was significantly and negatively related to the depressive symptoms (r = -.122, p =.031). This implies that students who take the initiative to reframe the negative or stressful situations in a more positive or neutral perspective have fewer low mood and hopelessness symptoms(Gross and John, 2003a). Equally, Expressive Suppression was significantly negatively correlated with stress (r = -.148, p =. 009), which is also an interesting observation in the Pakistani context.

Although in Western societies suppression is deemed maladaptive, in the context of a collectivist and high-stress academic sphere, the skill to suppress emotional outbursts might be used as a short-term coping strategy to keep the mind focused on the academic requirements(Soto et al., 2011). All this suggests, together, that emotion regulation is not just a peripheral phenomenon but a central psychological asset. Education to teach students to recognize and sometimes re-assess their stressors as opposed to being passive receivers of stressors would be very helpful in lowering the escalating medical health problems on campuses.

5.5 Relationship between Cognitive Functioning and Mental Health

It was quite surprising when compared to the predicted associations between emotion regulation and psychological well being and when actual outcomes of the correlation between Cognitive Functioning as defined in the Cognitive Functioning Self-Rating Scale (CFSS) Cheyne et al. (2006) and mental health outcomes. The statistical comparison has revealed that there was no significant relationship between the overall cognitive functioning and psychological distress (r =.017, $p > .05$).

Consequently, Hypothesis 3 (H3) on which it was assumed that there would be a positive relationship between enhanced cognitive functions and reduced symptoms of depression, anxiety, and stress was rejected. This implies that subjective cognitive abilities in the Pakistani university students population, in this case, e.g.

spatio-temporal orientation, attention, and memory appear to operate without emotional states.

Firstly, most highly educated students of universities were sampled, and this sample might be of extremely high cognitive resilience. Such people are still capable of holding their intellectual performances in order to cope with the requirements of their academic programs which are highly demanding in the sense that they demand high level of intelligence when faced with moderate or high levels of emotional distress (Richardson, 2002). The so-called compartmentalisation helps the student to keep doing it at school (listening to lectures, memorising the facts, staying on track, etc.), to be depressed or even anxious inside.

The last point to be adversely affected by population performance is the cognitive performance, which in most cases is the primary source of identity and safety. Second, this is the use of the CFSS as a self-report instrument. The results reflect on how the students perceive their mental capacities rather than objective test of the mental performance by administering neuropsychological tests(Rabbitt et al., 1995).

It is possible that students are not conscious of the fact that their attention and memory are becoming poor until the psychological distress is so poor that it escalates to life-threatening clinical level.

Lastly, these results also point out that a non-clinical non-academic population might have the noise of day-to-day academic demands that does not allow those in the study to differentiate the stress-induced cognitive lapses, and those that occur due to an excessive work load. Much as cognitive ability, including memory and attention plays an important role in the academic performance, it is the emotional control of the resultant stress associated with academic performance that ultimately determines the level of psychological distressEysenck et al. (2007).

This finding stems this student support being mostly cognitive-remediation oriented, as even students that could be cognitively speaking acute and excellent performers may be experiencing significant underlying mental health problems.

5.6 The Mediating Role of Emotion Regulation

The mediation study was aimed at establishing whether health behaviors (physical activity and diet patterns) and the outcome of mental health (depression, anxiety, and stress) are directly related or they interact through the psychological mechanism of emotion regulation. The mediation analysis findings offered a complex image which partly confirms the theoretical framework although it identifies certain cultural and behavioral realities of the sample.

In terms of the physical activity, the mediation analysis shows that mental regulation was of no significant use to close the gap that exists between the level of activity and psychological distress. This implies that the possible advantages of physical activity be it vigorous, moderate, or walking do not have an immediate effect of reaching an improved mental health in the Pakistani university students in the line of emotional control. Such absence of mediation can be explained by the fact that physical activity among this demographic is functional in most cases, as walking between campus departments can be a necessity, and exercise can be a mindless activity to reduce stress.

Therefore, such exercises might be inadequate to cause the cognitive changes needed to initiate adaptive emotional control(Ussher et al., 2014). Nevertheless, an important and substantial discovery was made in as far as eating habits are concerned. It was found that dietary habits were significantly correlated with emotion regulation that subsequently had an impact on mental health outcomes.

This result supports partly Hypothesis 5 and indicates a biological-to-psychological direction. In particular, the healthy eating habits can offer the physiological stability and nutritional base in which the brain is capable of performing complex executive functions, including cognitive reappraisal(Kiecolt-Glaser, 2010). This reinforces the bottom-up hypothesis of the mental health, in which a stable physiological condition (promoted by healthy eating) helps a student use adaptive psychological mechanisms instead of reverting to maladaptive mechanisms such as

expressive suppression. Here is where diet, in this respect, does not necessarily reduce the stress levels; nevertheless, it serves as a source of resources that enable the student to better manage his/her emotional reactions to the challenges related to academic and personal life.

These findings indicate that emotion regulation is a delicate yet a critical psychological process that connects some lifestyle determinants with psychological health; however, the intensity of such pathways may be situation specific. Here in lies the relevance of holistic interventions, where the nutritional habits are ac-companied by psychological skills-building, to enhance the mental health of the student population in the longer term.

5.7 Limitations of the Research

Although this research is important in shedding light on the psychological and behavioral environment of Pakistani university students, a few methodological and structural weaknesses should be taken into consideration to put the research into perspective.

Psychometric and Measurement Constraints: The tool is not psychometrically sound. It is capable of significantly limiting the internal consistency and consequent generalizability of the findings in relation to health behaviors owing to the low reliability of the primary assessment tools employed in the measuring of the lifestyle factors. In particular, the (IPAQ) produced an excellent low reliability coefficient (α =.152), and the Brief Healthy Eating Habit Scale (BHEHS) also showed a low internal consistency (α =.344).

These low alpha values indicate that items included in these scales did not have strong correlation with each other in this particular cultural situation. Such a lack of reliability could be due to the presence of recall bias, shortness of scales, or cultural interferences in the perception and reporting of physical activity and the dietary habits. The non-significant results concerning the correlation between physical activity and mental health should, therefore, be viewed with a sense of

caution and maybe the instruments did not measure the actual behavioral tendencies of the subjects.

5.7.1 Sample Representation and Skew

The demographic characteristics of the sample are a limitation to the generalizability of findings to the whole population of Pakistani youth. There was a significant bias of the sample towards the male population (65.5%) and the representatives of the middle socioeconomic group (77.7%). Moreover, only university students in such urban centers as Rawalpindi and Islamabad were considered in the study. This means that the results might not be a true measure of the experiences of female youth, lower or upper socioeconomic status, and people living in rural areas. The special stresses of college life and life in a big city imply that this sample is a specialty group, instead of a Whole of Pakistani emerging adulthood.

5.7.2 Statistical Constraints, Data Distribution

The data normality tests showed that all the main variables fell too far below the normal distribution. This resulted in the application of non-parametric tests of statistics in all the inferential tests. Although non-parametric tests (e.g. Spearman Correlation and Mann-Whitney U) are stronger and suited to skewed data, they are usually less powerful statistically than the corresponding parametric tests (e.g. Pearson Correlation and t-tests). This implies that the research might have been inefficient in identifying minor or weak effects in the data. The systematic non-normality indicates that psychological and behavioral characteristics within the population are very diverse and it becomes more challenging to establish linear trends that are generalized.

5.7.3 Cross-Sectional Design and Self-Report Bias

Being a cross-sectional study, the research only provides a picture of what happened at a particular time and thus it is impossible to ascertain the causal relationships between variables. An example is that although the emotion regulation

is positively linked with reduced depression, we cannot find out whether regulation strategies are better to regulate mood or better mood helps to regulate. Also, the use of self-report measures presents the possibility of social desirability bias or inaccurate self-report, especially on sensitive issues such as mental health symptoms or personal cognitive functioning. The participants might have under-reported distress or had over-estimated their cognitive ability to fit in to perceived social or academic expectations.

5.8 Future Research Suggestions

In order to expand the results of this research and overcome the limitations found in it, the following suggestions can be offered in future academic research in the Pakistani context:

5.8.1 Instrument Refinement and Cultural Adaptation

The rigorous validation of prediction and cultural adaptation of tools used in the measurement of lifestyle is one of the most urgent areas of research that the future will require. The poor reliability of the IPAQ and BHEHS in this study is an indication that the scales used to assess the nuances of physical activity and dietary habits in Pakistan which are Western based might not be suitable. Future studies would need to work on creating or updating measures that consider local realities, such as functional physical activity (e.g.: walking to the transit or between campus blocks) and the traditional dietary habits of the South Asians. It should be done through qualitative pilot testing and psychometric analysis because the items must be linguistically and conceptually related to Pakistani youth to boost internal consistency and validity of behavioral responses.

5.8.2 Longitudinal Inquiry- Developmental Trajectories

Since this research was a cross-sectional study, it was only able to find out the associations at that particular point. The longitudinal designs should be applied

in the future research to track the students as they join the university until they enter the job market. This kind of study is required to establish the causal mechanisms underlying the age-related rise in depressive symptoms. Observing how mental health is developing between early and middle adulthood would demystify whether these symptoms are short-lived due to "academic stress" or it is the onset of long-term mental trends. Longitudinal data would enable the researchers to monitor the changes in the effectiveness of emotion regulation strategies e.g. cognitive reappraisal in response to new life stressors i.e. academic stressors are replaced with occupational ones.

5.8.3 Exploration of Gender-Specific Cultural and Social Stressors

The major observation, that the levels of depression were higher among the male participants than the female, is worth a specific study line. Future researches should go beyond generic psychological tests in order to analyse particular cultural and societal stress factors that influence young men in Pakistan.

This involves ex-ploring the breadwinner anxiety, how economic instability affects masculine iden-tity, and how social stigma prevents men from accessing mental health services. The qualitative data, including in-depth interviews or focus groups, may give a clearer picture of the silent distress in males and can contribute to the realization of the possibility of the failure of traditional support systems among this group.

5.8.4 Combination of Objective Measures

Future research ought to adopt objective measurement methods to establish an unbiased data on the subject, compared to relying on self-reported data. As an example, pedometers or other wearable fitness trackers might be more effective in determining the level of physical activity as opposed to the IPAQ. Equally,

stress physiological (e.g. levels of cortisol) or formal neuropsychological (e.g. cognitive functioning) measurements would be a stronger data set to be compared to self-report ratings. The integration of objective data with psychological scales would enable one to gain a more detailed impression of the mind-body relationship among the population of Pakistani students.

5.8.5 Increase of Sample Diversity

The study in the future must aim at increasing demographic diversity to increase generalizability. This involves recruitment of participants in rural universities, vocational training centers and uneducated, unemployed and untrained (NEET). It would be beneficial in comparing the mental health of university students with their non-students to establish whether the agonic case was caused by the academic environment or it was a bigger problem of all Pakistani youth in the emerging adulthood. Also, the comparison of the disparities between students in the public and private institutions may also show how the socioeconomic sources influence the coping strategies and care availability.

5.9 Conclusion

The current study is an in-depth examination of the causes of mental health among Pakistani university students, and it is a critical study on how lifestyles and behaviors, cognitive and psychological stress interact with each other. The greatest value of this study is that it was able to identify emotion regulation as the key psychological predictor of mental health outcomes. The results have clearly shown that internal processes or mechanisms, i.e. the capacity to re-appraise stressful circumstance cognitively is much more effective in forecasting the degree of depression, anxiety, and stress than external variables like physical activity or nutritional habits.

One of the most interesting and surprising conclusions that would be made based

on the research is the high level of gender disparity in mental health, where male students indicate that they experience much higher rates of depression compared to their female colleagues. The result of the study does not fit the established world patterns and leads to the conclusion that a silent crisis of male mental health in Pakistan is probably facilitated by specific socioeconomic pressures and cultural demands placed on masculinity and monetary accountability. Moreover, the study concludes that healthy lifestyle behavior such as nutrition exerts specific protective influence on depression, but the overall effects of lifestyle on the high-stress academic environment are little. It implies that the stress of the environment and school can be so high among Pakistani students that only physical habits will not be effective as a buffer. The research also indicates that there was a significant cognitive resilience of students since their emotional distress did not affect subjective cognitive functioning (attention and memory). It means that the academic performance of the students is being sustained at a time when their inner psychological condition is getting worse.

Lastly, although the regulation of emotion did not occur as an impressive mediator between lifestyle and mental health, it appeared to be one of the most significant direct correlates, and this is why the control that the mind has over the emotion is the most essential thing a student could have. Finally, such results support the change of university support policies. Going beyond health promotion in general, the institutions should concentrate on culturally sensitive interventions, which are emotionally oriented. The Pakistani region has its own impartial developmental or socioeconomic issues that require special attention of the university through gender-specific support and training in cognitive reappraisal. This study can be considered a preliminary move to more sophisticated, psychologically-informed mental health policies on the youth in Pakistan.

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Appendix A

Consent Form

I am Ayesha Iftikhar, enrolled in Master of Science in Psychology at Capital University of Science and Technology, Islamabad. I am conducting a research exploring emotion regulation, cognitive functions, dietary patterns, physical activity and symptoms of anxiety, stress and depression. I would like to request you to participate in this study by filling in the questionnaire. There is no right or wrong answer; you have to choose an answer that suits you the most. The information asked will be kept confidential and your identity will not be revealed in any publications resulting from this study. Your participation in this research study is voluntary. You may choose either to participate or withdraw your consent to participate at any stage of the research prior to the analysis of the data. Data will be collected within 15 days. If you agree to fill out the questionnaires, please provide your consent by answering the following question.

I agree to participate in the study. Yes ☐ No ☐

FIGURE 1: Consent Form

Participant Information Sheet

Study: Association between Health Behaviors, Cognitive Functions and Mental Health; Mediating role of Emotional Regulation

Researcher: Ayesha Iftikhar

My name is Ayesha Iftikhar, and I am a Master's student in Psychology at Capital University of Science and Technology, Islamabad. You are invited to participate in a research study. The following information is provided to help you decide whether you would like to take part in the study. Please read the information carefully. If you have any questions about the study, you may contact the researcher via email at ayeshaiftikhar278@gmail.com

What is the purpose of the study?

The purpose of this study is to explores the relationship between lifestyle factors (dietary patterns and physical activity) and mental health outcomes (depression, anxiety, and stress). It also investigates the role of emotional regulation and cognitive functions in this relationship. This study aims to investigate how dietary patterns, physical activity, emotional regulation, and cognitive functions relate to symptoms of depression, anxiety, and stress.The finding of this research will offer important perspectives on how lifestyle and psychological elements combine to affect mental health outcomes. The findings of the study may aid in developing successful strategies to prevent and address mental health concerns by emphasizing lifestyle choices and emotional regulation.

Why are you invited to participate in the study?

All young adults aged 18 years and above who are currently enrolled in public or private universities in Rawalpindi and Islamabad are invited to participate in this study.

What do you have to do to take part in the study?

If you decide to take part in this study, you will be asked to provide your consent before participation. You will then be required to complete a set of questionnaires, which will take approximately 15–20 minutes. These questionnaires will include items related to emotional regulation, cognitive functions, physical activity, eating habbits and anxiety, depression, and stress.

Who approved the study?

The study has been approved by the Ethics Review Committee of the Faculty of Management and Social Sciences, Capital University of Science and Technology, Islamabad.

What about confidentiality and anonymity?

Your responses will be kept strictly confidential and will not include your name or any identifying details. All the information you provide will be used only for research purposes. Any reports or publications resulting from this study will not include any details that could identify you in any way.

What are the advantages or disadvantages of taking part in the study?

FIGURE 2: Participant's Information Sheet pg 1

There are no personal or academic benefits or drawbacks to participating in this study. You may choose to withdraw from the study at any time until the point of data analysis, without providing any reason. Your decision to withdraw will not affect your academic standing or relationship with the university in any way. Some questions in the study may involve personal or sensitive topics. If at any point you feel uncomfortable or distressed, you may choose to stop participating. A list of professional organizations you can contact for emotional support will be provided at the end of the questionnaire.

What support is available?

If you feel the need to talk about your feelings or thoughts related to the topics covered in this study, you can reach out to the following helplines for professional support.

Youth help line:

1. **Well-Being Center, Capital University of Science and Technology (CUST)**

The Well-Being Center at CUST provides psychological counseling and emotional support to students in a confidential and supportive environment. Students can reach out for guidance regarding stress management, anxiety, academic pressure, or any personal concerns. The center aims to promote mental wellness and resilience within the university community. The WBC is easily accessible to all students within the university premises — appointments can be made through the Student Affairs Office, via email, or by directly visiting the center during working hours.

2. **Umang Helpline (0311-7786264)**

Umang is a national mental health helpline offering free and confidential psychological support to individuals across Pakistan. The service connects callers with qualified mental health professionals who provide counseling and guidance on issues such as depression, anxiety, stress, and emotional distress. The helpline is accessible through calls, WhatsApp, and social media platforms, making mental health care more reachable for all.

FIGURE 3: Participant's Information Sheet pg 2

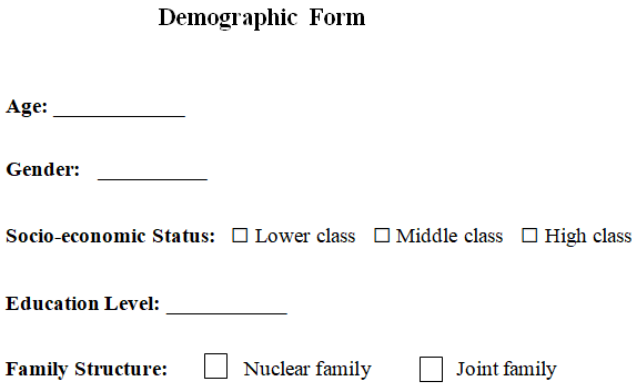
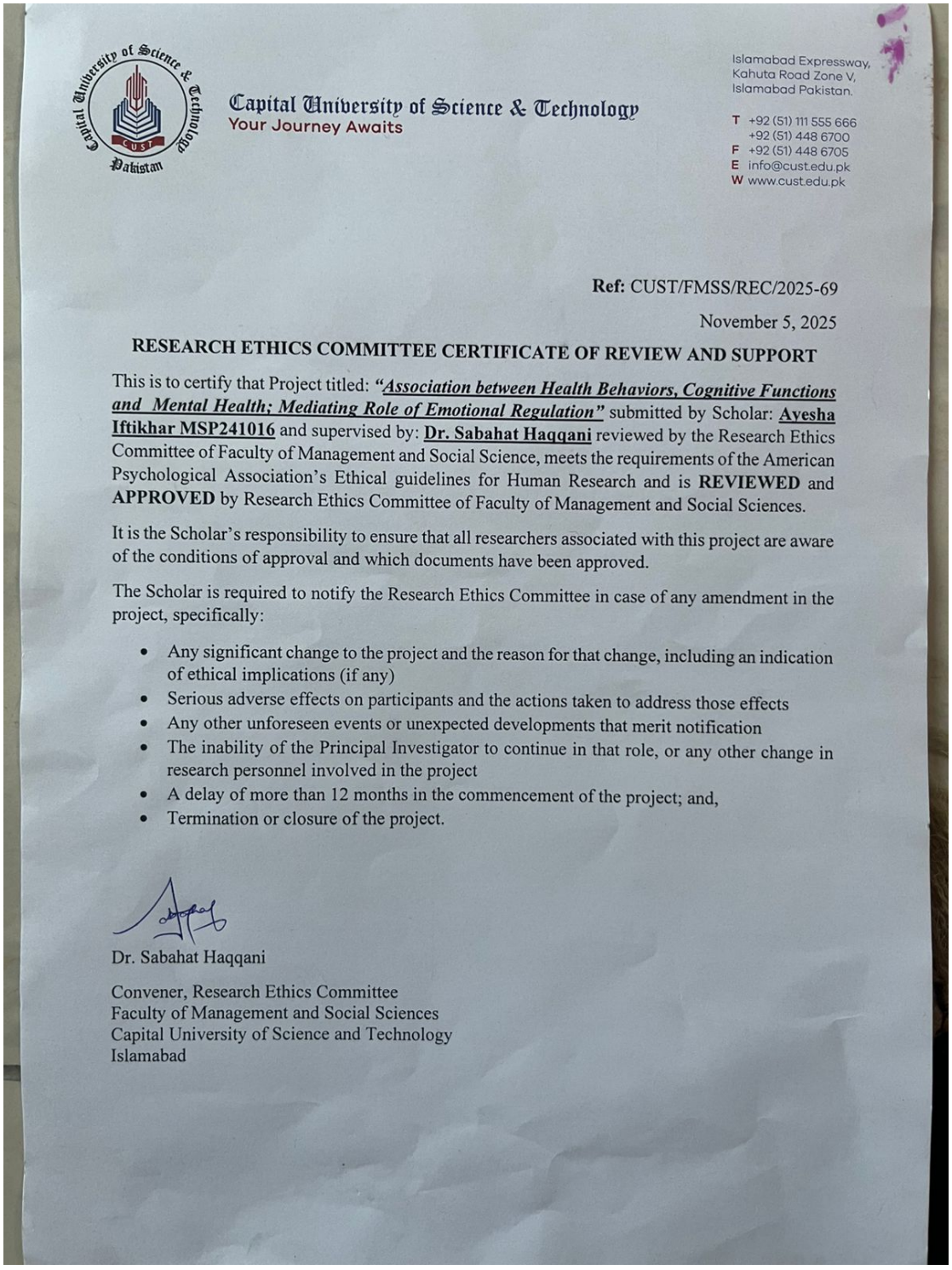


FIGURE 4: Demographic Sheet



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November 5, 2025

RESEARCH ETHICS COMMITTEE CERTIFICATE OF REVIEW AND SUPPORT

This is to certify that Project titled: ***"Association between Health Behaviors, Cognitive Functions and Mental Health; Mediating Role of Emotional Regulation"*** submitted by Scholar: **Ayesha Iftikhar MSP241016** and supervised by: **Dr. Sabahat Haqqani** reviewed by the Research Ethics Committee of Faculty of Management and Social Science, meets the requirements of the American Psychological Association's Ethical guidelines for Human Research and is **REVIEWED** and **APPROVED** by Research Ethics Committee of Faculty of Management and Social Sciences.

It is the Scholar's responsibility to ensure that all researchers associated with this project are aware of the conditions of approval and which documents have been approved.

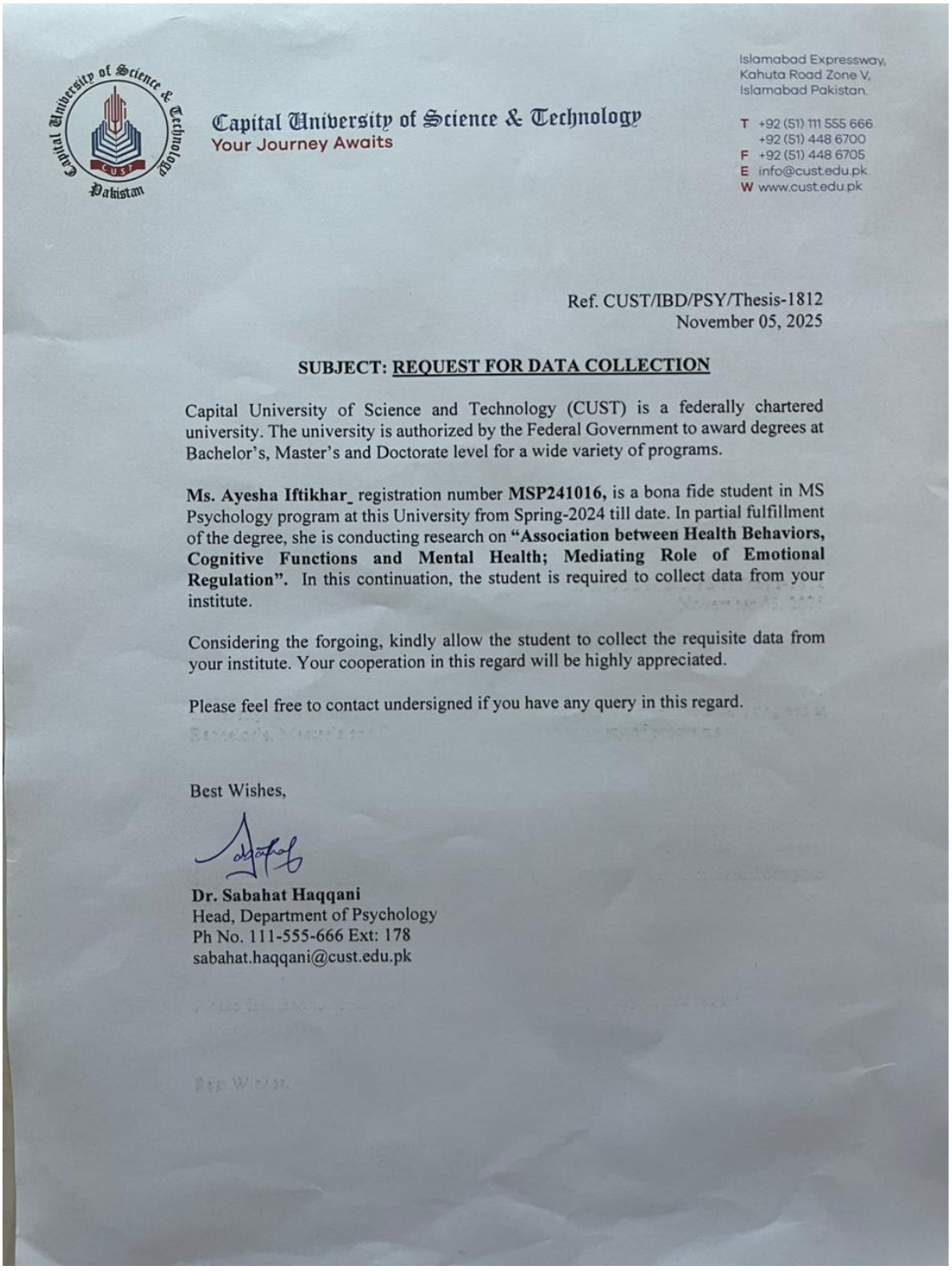
The Scholar is required to notify the Research Ethics Committee in case of any amendment in the project, specifically:

- Any significant change to the project and the reason for that change, including an indication of ethical implications (if any)
- Serious adverse effects on participants and the actions taken to address those effects
- Any other unforeseen events or unexpected developments that merit notification
- The inability of the Principal Investigator to continue in that role, or any other change in research personnel involved in the project
- A delay of more than 12 months in the commencement of the project; and,
- Termination or closure of the project.

Dr. Sabahat Haqqani

Convener, Research Ethics Committee
Faculty of Management and Social Sciences
Capital University of Science and Technology
Islamabad

FIGURE 5: Ethics Review Form



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SUBJECT: REQUEST FOR DATA COLLECTION

Capital University of Science and Technology (CUST) is a federally chartered university. The university is authorized by the Federal Government to award degrees at Bachelor's, Master's and Doctorate level for a wide variety of programs.

Ms. Ayesha Iftikhar registration number **MSP241016,** is a bona fide student in MS Psychology program at this University from Spring-2024 till date. In partial fulfillment of the degree, she is conducting research on **"Association between Health Behaviors, Cognitive Functions and Mental Health; Mediating Role of Emotional Regulation".** In this continuation, the student is required to collect data from your institute.

Considering the forgoing, kindly allow the student to collect the requisite data from your institute. Your cooperation in this regard will be highly appreciated.

Please feel free to contact undersigned if you have any query in this regard.

Best Wishes,

Dr. Sabahat Haqqani
Head, Department of Psychology
Ph No. 111-555-666 Ext: 178
sabahat.haqqani@cust.edu.pk

FIGURE 6: Data Collection Letter

Depression Anxiety Stress Scales (DASS-21)

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time

2 Applied to me to a considerable degree or a good part of time

3 Applied to me very much or most of the time

		Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
1	I found it hard to wind down.				
2	I was aware of dryness of my mouth.				
3	I couldn't seem to experience any positive feeling at all.				
4	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion).				
5	I found it difficult to work up the initiative to do things.				
6	I tended to over-react to situations.				
7	I experienced trembling (e.g. in the hands)				
8	I felt that I was using a lot of nervous energy				
9	I was worried about situations in				

FIGURE 7: DASS-21

	which I might panic and make a fool of myself.				
10	I felt that I had nothing to look forward to				
11	I found myself getting agitated				
12	I found it difficult to relax				
13	I felt down-hearted and blue				
14	I was intolerant of anything that kept me from getting on with what I was doing				
15	I felt I was close to panic				
16	I was unable to become enthusiastic about anything				
17	I felt I wasn't worth much as a person				
18	I felt that I was rather touchy				
19	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)				
20	I felt scared without any good reason				
21	I felt that life was meaningless				

FIGURE 8: DASS-21, pg 2

Cognitive Functioning Self-Rating Scale (CFSS)

Never	Rarely	Sometimes	Often	Always
1	2	3	4	5

		Never	Rarely	Sometimes	Often	Always
1	Lack of concentration (Attention)					
2	Absent-mindedness (Attention)					
3	Difficulty in performing two tasks simultaneously (Spatio-temporal orientation)					
4	Difficulty in performing mental calculation (Spatio-temporal orientation)					
5	Tip of the tongue phenomenon (Memory)					
6	Absent-mindedness during intellectual/cognitive activities (Attention)					
7	Difficulty in organizing extra-routine activities (Spatio-temporal orientation)					
8	Difficulty in recalling recent information (Attention)					
9	Difficulty in recalling old information					

FIGURE 9: CFSS

	(Spatio-temporal orientation)					
10	Difficulty in recalling autobiographical events (Spatio-temporal orientation)					
11	Forgetfulness (Memory)					
12	Lack of concentration while reading (Attention)					
13	Lack of motor coordination (Spatio-temporal orientation)					
14	Slowness in the execution of movements (Spatio-temporal orientation)					
15	Difficulty in finding the appropriate words (Memory)					
16	Use of periphrases or generic terms instead of specific words (Memory)					
17	Difficulty in spatial orientation (Spatio-temporal orientation)					
18	Difficulty in temporal orientation (Spatio-temporal orientation)					

FIGURE 10: CFSS, pg 2

Emotion Regulation Questionnaire (ERQ)

Instructions and Items

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree

		1	2	3	4	5	6	7
		Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
1	When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about.							
2	I keep my emotions to myself.							
3	When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about.							
4	When I am feeling positive emotions, I am careful not to express them.							

FIGURE 11: ERQ

5	When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm.							
6	I control my emotions by not expressing them.							
7	When I want to feel more positive emotion, I change the way I'm thinking about the situation.							
8	I control my emotions by changing the way I think about the situation I'm in.							

FIGURE 12: ERQ, pg 2

International Physical Activity Questionnaire (IPAQ)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days,** on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ days per week

☐ No vigorous physical activities ⟶ **Skip to question 3**

2. How much time did you usually spend doing vigorous physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don't know/ Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

FIGURE 13: IPAQ

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ days per week

☐ No moderate physical activities ⟶ **Skip to question 5**

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days,** on how many days did you **walk** for at least 10 minutes at a time?

_____ days per week

☐ No walking ⟶ **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ hours per day

_____ minutes per day

FIGURE 14: IPAQ, pg 2

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a week day?

_____ hours per day

_____ minutes per day

☐ Don't know/Not sure

FIGURE 15: IPAQ, pg 3

Brief Healthy Eating Habits Scale (BHEHS-6B, Version 1.0)

Instructions: Below is a list of behaviors related to healthy eating. Please indicate how often you perform each of the actions by placing an X or a check (✓) over the word that best represents your response (Never, Rarely, Sometimes, Almost Always, or Always). Please remember to select only one option per item.

	Items	Never	Almost Never	Sometimes	Almost Always	Always
1	Do you consume vegetables of different colors every day?	Never	Almost Never	Sometimes	Almost Always	Always
2	Do you consume fruits of different colors daily?	Never	Almost Never	Sometimes	Almost Always	Always
3	How often do you drink plain water during the day? - Note: 1 glass = 250 mL = ¼ liter	Never	1 to 2 glasses of water	3 to 4 glasses of water	5 to 6 glasses of water	7 to 8 glasses of water, or more
4	Do you consume whole grains and/or tubers daily? - Examples of Whole Grains: whole grain bread, pasta, or rice; oats, quinoa, etc. - Examples of Tubers: potato, cassava, sweet potato, etc.	Never	Almost Never	Sometimes	Almost Always	Always
5	Do you consume animal and/or plant-based proteins daily? - Examples of Animal Protein: fish, chicken, meat, eggs, dairy products, etc. - Examples of Plant Protein: legumes, beans, seeds, nuts, etc.	Never	Almost Never	Sometimes	Almost Always	Always
6	Do you consume sources of vegetable oils daily, such as olives, avocado, vegetable oil, olive oil, sunflower oil, etc.?	Never	Almost Never	Sometimes	Almost Always	Always

FIGURE 16: BHEHS