

**CAPITAL UNIVERSITY OF SCIENCE AND
TECHNOLOGY, ISLAMABAD**



**Relationship between Gaming Addiction
Aggression and Sleep Quality among
Adolescents: Mediating Role of Sedentary
Behaviors**

by

Adeena Arzoo

A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

Faculty of Management & Social Sciences

Department of Psychology

2026

Copyright © 2026 by Adeena Arzoo

All rights reserved. No part of this thesis may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, by any information storage and retrieval system without the prior written permission of the author.



CERTIFICATE OF APPROVAL

**Relationship between Gaming Addiction Aggression and Sleep Quality
among Adolescents: Mediating Role of Sedentary Behaviors**

by

Adeena Arzoo

(MSP241015)

THESIS EXAMINING COMMITTEE

S. No.	Examiner	Name	Organization
(a)	External Examiner	Dr. Sumara Masood ul Hassan	NUST Islamabad
(b)	Internal Examiner	Dr. Sabahat Haqqani	CUST Islamabad

Dr. Ishrat Yousaf

Thesis Supervisor

May, 2026

Dr. Sabahat Haqqani

Head

Department of Psychology

May, 2026

Dr. Arshad Hassan

Dean

Faculty of Management & Social Sci.

May, 2026

Author's Declaration

I, **Adeena Arzoo** hereby state that my MS thesis titled “**Relationship between Gaming Addiction Aggression and Sleep Quality among Adolescents: Mediating Role of Sedentary Behaviors**” is my own work and has not been submitted previously by me for taking any degree from Capital University of Science and Technology, Islamabad or anywhere else in the country/abroad.

At any time if my statement is found to be incorrect even after my graduation, the University has the right to withdraw my MS Degree.



(Adeena Arzoo)

Registration No: MSP241015

Plagiarism Undertaking

I solemnly declare that research work presented **Relationship between Gaming Addiction Aggression and Sleep Quality among Adolescents: Mediating Role of Sedentary Behaviors**” is solely my research work with no significant contribution from any other person. Small contribution/help wherever taken has been duly acknowledged and that complete thesis has been written by me.

I understand the zero tolerance policy of the HEC and Capital University of Science and Technology towards plagiarism. Therefore, I as an author of the above titled thesis declare that no portion of my thesis has been plagiarized and any material used as reference is properly referred/cited.

I undertake that if I am found guilty of any formal plagiarism in the above titled thesis even after award of MS Degree, the University reserves the right to withdraw/revoke my MS degree and that HEC and the University have the right to publish my name on the HEC/University website on which names of students are placed who submitted plagiarized work.



(Adeean Arzoo)

Registration No: MSP241015

Acknowledgement

First and foremost, I am deeply grateful to **Allah Almighty** for granting me the strength, patience, and perseverance to complete this thesis. Without His blessings, this journey would not have been possible.

I would like to express my heartfelt gratitude to my **family**, especially my **Father khawar Rasheed** and my **Mother, Shamim Akthar**, for their immense emotional and physical support throughout this journey. During times when I felt overwhelmed, anxious, stressed, and close to losing hope, they stood by me with constant reassurance and care. Their presence, prayers, and encouragement gave me the strength to continue and complete this work.

I extend my sincere appreciation to my supervisor, **Dr. Ishrat Yousaf**, for her invaluable guidance, continuous support, and thoughtful feedback. Her mentorship, encouragement, and belief in my abilities played a vital role in the completion of this thesis. Without her guidance and direction, this work would not have been possible.

I am also deeply thankful to **Muqqadas Saba** for her constant help, guidance, and support throughout this thesis period. Her assistance and encouragement at different stages of this work were truly meaningful.

Finally, I would like to thank my **friends** who encouraged me, supported me, and believed in me throughout this journey. Their motivation reminded me that I was capable of achieving this milestone. To everyone who supported me in any way, directly or indirectly, I am truly grateful.

Adeena Arzoo

Abstract

The increasing prevalence of digital gaming across all age groups has raised concerns about its potential negative effects on adolescent health and behavior. Excessive gaming has been strongly associated with sedentary behaviors, which may contribute to heightened aggression and poor sleep quality. This study examined the mediating role of sedentary behaviors in the relationship between gaming addiction, aggression, and sleep quality among adolescents. A sample of 330 adolescents aged 12 to 18 years was recruited from educational institutions in Rawalpindi and Islamabad using convenience sampling within a cross-sectional quantitative design. Standardized measures, including the Problematic Online Gaming Questionnaire (POGQ), Aggression Questionnaire (AGQ), Pittsburgh Sleep Quality Index (PSQI), and Adolescent Sedentary Activity Questionnaire (ASAQ), were administered. Data were analyzed using SPSS and Hayes' PROCESS Macro Model 4 (Hayes, 2018) to test direct and indirect relationships through bootstrapping. The findings enhanced understanding of how sedentary behaviors mediated the link between gaming addiction and its psychological outcomes. The study highlighted the importance of physical activity in improving sleep quality, reducing aggressive tendencies, and enhancing the overall well-being of adolescents.

Keywords: *Gaming Addiction, Sedentary Behavior, aggression, Sleep Quality, Adolescents*

Contents

Author's Declaration	iii
Plagiarism Undertaking	iv
Acknowledgement	v
Abstract	vi
List of Figures	ix
List of Tables	x
Abbreviations	xi
1 Introduction	1
1.1 Gaming Addiction	2
1.2 Aggression	6
1.3 Gaming Addiction and Aggression	8
1.4 Sleep Quality	9
1.5 Gaming Addiction and Sleep Quality	12
1.6 Sedentary Behavior	14
1.7 Gaming Addiction and Sedentary Behavior	15
1.8 Research Gap	16
1.9 Problem Statement	17
1.10 Research Objectives	20
1.11 Research Hypotheses	20
2 Literature Review	22
2.1 Introduction to Gaming Addiction	22
2.2 Global Prevalence and Impact of Gaming Addiction	22
2.3 Gaming Addiction in Pakistan	23
2.4 Psychological and Behavioral Outcomes of Gaming Addiction	23
2.5 Gaming Addiction and Aggression	24
2.6 Gaming Addiction and Sleep Quality	25
2.7 Sedentary Behavior as a Mediating Mechanism	25
2.8 Study Justification	26

2.9	Rationale	27
2.10	Theoretical Framework	30
2.11	Conceptual Model	35
3	Research Methodology	38
3.1	Research Design	38
3.2	Sample	39
3.3	Study Setting and Data Collection Procedure	39
3.4	Inclusion Criteria	41
3.5	Exclusion Criteria	41
3.6	Measure and Instrument	41
3.6.1	Demographic Information Sheet	41
3.6.2	Problematic Online Gaming Questionnaire	42
3.6.3	Aggression Questionnaire	42
3.6.4	Pittsburgh Sleep Quality Index	43
3.6.5	Adolescent Sedentary Activity Questionnaire	43
3.6.6	Ethical Considerations	44
3.7	Data Analysis	44
4	Results	46
5	Discussion and Conclusion	59
5.1	Discussion	59
5.2	Conclusion	62
5.3	Limitations	64
5.4	Research Implications	64
5.5	Recommendations	65
	Bibliography	67
	Appendix A	77
	Appendix B	87

List of Figures

2.1	Conceptual Model	35
4.1	Histogram showing the distribution of Peer Victimization scores . .	49
4.2	Normality distribution of score across Sleep Quality Scale	50
4.3	Path Diagram of Sedentary Behavior in the Relationship between Problematic Online Gaming Addiction and Sleep Quality	57

List of Tables

4.1	Demographic Characteristics of Participants (N=300)	47
4.2	Means, Standard Deviations, Skewness, Kurtosis, and Kolmogorov–Smirnov Statistics for Gaming Addiction, Sedentary Behavior, Aggression, and Sleep Quality Scales	48
4.3	Cronbach’s Alpha Reliability of Problematic Online Gaming Questionnaire, Adolescent Sedentary Activity Questionnaire, Aggression Questionnaire, and Pittsburgh Sleep Quality Index	51
4.4	Correlations of Problematic Online Gaming Questionnaire, Adolescent Sedentary Activity Questionnaire, Aggression Questionnaire, and Pittsburgh Sleep Quality Index (N = 300)	52
4.5	Mediation Analysis of Sedentary Behavior in the Relationship between Problematic Online Gaming and Aggression (N = 300)	54
4.6	Mediation Analysis of Sedentary Behavior in the Relationship between Problematic Online Gaming Addiction and Sleep Quality (N = 300)	56

Abbreviations

Acronym	What (it) Stands For
AGQ	Aggression Questionnaire
ASAQ	Adolescent Sedentary Activity Questionnaire
POGQ-SF	Problematic Online Gaming Questionnaire
PSQI	Pittsburg Sleep Quality Index

Chapter 1

Introduction

The rapid expansion of digital technology has transformed the daily lives of adolescents, reshaping patterns of communication, recreation, and social interaction across the globe ([Kuss and Griffiths, 2012](#)). The widespread availability of smartphones, high-speed internet, and interactive online platforms has made video gaming one of the most dominant leisure activities among young people ([King et al., 2013](#)). Unlike earlier forms of entertainment, contemporary gaming environments provide immersive virtual spaces characterized by continuous connectivity, real-time competition, and global social engagement ([Przybylski et al., 2010](#)). For many adolescents, gaming is no longer an occasional pastime but an integrated component of daily routines that occupies substantial discretionary time and influences behavioral choices and lifestyle patterns ([Hale and Guan, 2015](#)). As digital gaming increasingly becomes embedded in adolescent life, concerns have emerged regarding its potential psychological, behavioral, and physiological consequences, particularly when engagement becomes excessive and poorly regulated ([Griffiths, 2018](#)).

Moderate gaming has been associated with benefits such as enhanced problem-solving skills, spatial reasoning, emotional relaxation, and peer bonding ([Griffiths, 2018](#)). However, persistent and uncontrolled gaming behavior has been linked to neglect of academic responsibilities, reduced social interaction, emotional dysregulation, and functional impairment ([Kuss and Billieux, 2017](#)). These patterns reflect

characteristics similar to behavioral addictions, where individuals struggle to regulate time spent on the activity despite negative consequences ([American Psychiatric Association, 2013](#)). This growing recognition has led to the conceptualization of gaming addiction or Internet Gaming Disorder as a clinically relevant behavioral concern during adolescence, a developmental period marked by heightened neurobiological sensitivity and evolving self-regulatory capacities ([Casey et al., 2010](#)). Understanding gaming addiction therefore requires a multidimensional examination of how excessive gaming affects emotional, cognitive, and lifestyle processes during this critical developmental stage.

1.1 Gaming Addiction

The ([American Psychiatric Association, 2022](#)) defines gaming addiction as a persistent and recurrent pattern of gaming behavior that significantly impairs personal, academic, and social functioning. Core diagnostic criteria include preoccupation with gaming, withdrawal symptoms when unable to play, tolerance requiring increasing time investment, unsuccessful attempts to reduce gaming, loss of interest in alternative activities, continued gaming despite negative consequences, deception regarding gaming habits, use of gaming to relieve negative moods, and jeopardizing educational, occupational, or social opportunities ([American Psychiatric Association, 2022](#)). These criteria provide a standardized framework for identifying adolescents whose gaming behaviors pose a risk to psychosocial functioning ([Kuss and Griffiths, 2012](#)).

Gaming addiction is conceptualized as a persistent pattern of excessive and maladaptive gaming behavior characterized by impaired control, prioritization of gaming over other life activities, and continuation of play despite adverse outcomes ([American Psychiatric Association, 2013](#); [Kuss and Billieux, 2017](#)). Contemporary online games are deliberately designed with reward schedules, social validation systems, and hierarchical competition that sustain prolonged engagement ([Przybylski et al., 2010](#)). These design elements increase the likelihood that adolescents will spend extended hours gaming, often at the expense of essential activities such as

sleep, physical movement, academic work, and face-to-face interaction ([Exelmans and Van den Bulck, 2017](#)).

One key feature of gaming addiction is preoccupation, where adolescents experience persistent thoughts about gaming even when not playing, reflecting cognitive dominance of the activity ([Demetrovics et al., 2012](#)). This mental engagement reduces attention to academic tasks and interpersonal responsibilities, gradually shifting priorities toward virtual environments ([Kuss and Griffiths, 2012](#)). Closely related is overuse, which reflects difficulty limiting time spent gaming and repeated unsuccessful attempts to cut back ([Kuss and Billieux, 2017](#)). Overuse often leads to displacement of sleep, physical activity, and real-world interactions, initiating a cascade of lifestyle disruptions ([Hale and Guan, 2015](#)).

Another important dimension is immersion, referring to deep psychological involvement and emotional absorption within the gaming environment ([Przybylski et al., 2010](#)). Immersion makes disengagement difficult, particularly for adolescents whose reward sensitivity is heightened during this developmental stage ([Casey et al., 2010](#)). Prolonged immersion contributes to social isolation, as adolescents increasingly substitute online interactions for real-world relationships ([Demetrovics et al., 2012](#)). Over time, this shift may weaken social skills, reduce empathy, and limit opportunities for emotional learning ([Griffiths, 2018](#)).

As gaming addiction dominates daily life, interpersonal conflict often emerges, particularly with parents, teachers, and peers who attempt to regulate gaming time ([Demetrovics et al., 2012](#)). These conflicts may escalate emotional tension and contribute to irritability and frustration. Finally, withdrawal symptoms such as restlessness, irritability, and mood disturbance occur when gaming is interrupted, reflecting the addictive potential of the behavior ([Kuss and Billieux, 2017](#)). These dimensions collectively illustrate that gaming addiction is not a single behavior but a complex pattern of cognitive, emotional, and social disruptions that set the stage for further psychosocial consequences.

In response to these concerns, the concept of gaming addiction has been advanced

to describe persistent and repetitive gaming behavior that leads to significant distress and functional impairment in daily life ([American Psychiatric Association, 2013](#)). Gaming addiction is reflected in reduced control over gaming, prioritization of gaming above other essential activities, and continued engagement despite negative consequences, underscoring its addictive nature ([Kuss and Billieux, 2017](#)). Modern video games particularly online multiplayer, role-playing, and competitive formats are intentionally structured to maintain player engagement through reward mechanisms, social reinforcement, and progressive achievement systems that encourage prolonged participation ([Przybylski et al., 2010](#)). These structural characteristics increase the likelihood that adolescents will spend extended periods gaming, often at the cost of critical developmental requirements such as adequate sleep, physical movement, and emotional balance, raising concerns regarding long-term well-being ([Exelmans and Van den Bulck, 2017](#)).

As gaming becomes deeply embedded in adolescents' everyday routines, it is essential to examine how gaming addiction interacts with developmental processes. Adolescence represents a transitional stage marked by identity formation, emotional intensity, and the gradual maturation of executive functions such as impulse control and emotional regulation ([Steinberg, 2008](#)). Neurodevelopmental evidence indicates that adolescents demonstrate heightened sensitivity to rewards while their self-regulatory systems are still developing, making them particularly susceptible to compulsive behaviors, including excessive gaming ([Casey et al., 2010](#)).

Sustained involvement in gaming addiction during this sensitive developmental period may interfere with age-appropriate tasks and psychosocial growth, contributing to emotional instability, behavioral challenges, and difficulties in social adjustment, which may be reflected in outcomes such as aggression and sleep disturbances ([Lemmens et al., 2011](#)).

While gaming addiction is widely recognized for its adverse outcomes, it is important to acknowledge that engagement in digital games, when regulated and moderate, may offer certain psychological and cognitive benefits. Structured gaming environments can enhance problem-solving skills, spatial reasoning, strategic

thinking, and hand–eye coordination, and may provide temporary emotional relief from stress through immersive distraction (Griffiths, 2018; Przybylski et al., 2010). Online multiplayer platforms can also facilitate social interaction, teamwork, and a sense of belonging among peers, particularly for adolescents who struggle with face-to-face communication (Kuss and Griffiths, 2012).

However, when gaming behavior becomes excessive and evolves into gaming addiction, these potential benefits are overshadowed by significant disadvantages. Persistent over involvement may lead to neglect of academic responsibilities, reduced real-world social engagement, sleep disruption, physical inactivity, emotional dysregulation, and interpersonal conflicts (Kuss and Billieux, 2017; Hale and Guan, 2015). Gaming addiction has further been associated with irritability, impulsivity, and functional impairment across family, school, and peer contexts, indicating that the negative consequences far outweigh the limited benefits when control over gaming is lost (American Psychiatric Association American Psychiatric Association (2013); Lemmens et al. (2011)).

Several interacting factors contribute to the development of gaming addiction during adolescence. One major factor is the structural design of modern games, which employ reward schedules, achievement systems, and social reinforcement mechanisms that encourage prolonged engagement and repeated play (Przybylski et al., 2010). A second factor involves developmental vulnerability, as adolescent’s exhibit heightened reward sensitivity and still-maturing executive control systems, making them more prone to impulsive and compulsive behaviors (Casey et al., 2010; Steinberg, 2008). Psychological factors such as stress, loneliness, low self-esteem, and the need for escapism may further motivate adolescents to rely excessively on gaming as a coping strategy (Kuss and Griffiths, 2012).

In addition, environmental influences including easy access to digital devices, limited parental monitoring, peer gaming culture, and reduced opportunities for outdoor or physical activities create conditions that normalize prolonged screen engagement (Hale and Guan, 2015). Over time, these cognitive, emotional, developmental, and environmental influences interact to reinforce excessive gaming patterns, increasing the likelihood that recreational gaming transitions into gaming

addiction with broader psychosocial consequences ([Kuss and Billieux, 2017](#)).

The emotional and behavioral consequences of this pattern become particularly evident when examining its relationship with aggression, a multifaceted outcome that reflects underlying dysregulation.

1.2 Aggression

Aggression is a complex and multidimensional construct that encompasses behavioral, emotional, and cognitive tendencies aimed at harming, dominating, or intimidating others ([Baron and Branscombe, 2012](#)). During adolescence, individuals are particularly susceptible to aggression due to heightened emotional reactivity and the ongoing maturation of executive control systems, including impulse regulation and emotional modulation ([Steinberg, 2008](#)). Excessive engagement in gaming environments, particularly competitive and fast-paced formats, can exacerbate impulsivity and emotional arousal, thereby increasing the likelihood of aggressive responses when adolescents encounter frustration, failure, or social provocation ([Anderson et al., 2010](#)). Understanding aggression in adolescents requires recognizing its interplay with developmental processes, environmental stressors, and lifestyle behaviors, such as gaming addiction.

The main four types of aggression are physical aggression, verbal aggression, anger, and hostility. Physical aggression reflects observable behaviors intended to cause harm, such as hitting, pushing, or other forms of physical confrontation, and is often linked to poor impulse control and elevated physiological arousal ([Baron and Branscombe, 2012](#)). In the context of gaming addiction, prolonged exposure to competitive or violent game content can reinforce aggressive behavioral scripts, reduce inhibitory control, and intensify reactive physical aggression among adolescents ([Anderson et al., 2010](#)). Persistent physical aggression may disrupt peer relationships, impede school adjustment, and limit social integration during critical developmental stages ([Steinberg, 2008](#)).

Verbal aggression refers to the use of words or language to intimidate, dominate, or harm others, including yelling, insults, sarcasm, or hostile communication ([Buss and Perry, 1992](#)). Although verbal aggression is less overtly physical, it can

significantly damage interpersonal relationships and emotional well-being. Adolescents engaged in online gaming, especially in competitive multiplayer contexts, are frequently exposed to hostile communication norms that may normalize verbal aggression, increase conflict frequency, and reduce sensitivity to the social consequences of such behavior (Lemmens et al., 2011).

Over time, these verbal interactions can escalate peer conflicts, undermine social cohesion, and impair adolescents' capacity for adaptive emotional expression (Baron and Branscombe, 2012).

Anger is the emotional component of aggression, characterized by heightened arousal, irritability, and difficulty in managing frustration (Buss and Perry, 1992). Unlike physical or verbal aggression, anger is primarily an internal emotional state but exerts a significant influence on behavioral responses and impulse control (Baron and Branscombe, 2012). Adolescents are particularly vulnerable to anger due to ongoing neurodevelopmental changes affecting emotion regulation and stress processing (Steinberg, 2008). Excessive gaming, particularly when interrupted or when expected outcomes are unfavorable, may amplify anger responses by increasing emotional dependence on gaming and limiting opportunities for adaptive coping strategies (Anderson et al., 2010; Lemmens et al., 2011).

The cognitive component of aggression, hostility, involves persistent negative beliefs, mistrust, resentment, and cynical attitudes toward others (Buss and Perry, 1992). Hostility shapes how adolescents interpret social interactions and may predispose them to aggressive reactions in perceived adversarial situations (Baron and Branscombe, 2012). Repeated exposure to competitive or antagonistic gaming environments can reinforce hostile cognitive schemas, reduce empathy, and impair social judgment, which collectively increase the likelihood of both verbal and physical aggression (Anderson et al., 2010). Hostility, therefore, represents a cognitive pathway through which gaming addiction may influence broader psychosocial functioning, intensifying emotional dysregulation and maladaptive social responses (Buss and Perry, 1992).

1.3 Gaming Addiction and Aggression

During adolescence a period characterized by emotional sensitivity, identity formation, and increased responsiveness to environmental influences such excessive engagement can have meaningful psychological and behavioral consequences. Among these, aggression has emerged as one of the most frequently discussed outcomes in the literature examining problematic gaming behaviors (Steinberg, 2008; Anderson et al., 2010; Lemmens et al., 2011).

Aggression in adolescents is a complex construct that extends beyond visible physical or verbal acts. It includes emotional arousal, hostile thinking patterns, irritability, and difficulty regulating frustration and anger (Baron and Branscombe, 2012). These internal processes are particularly relevant when considering the impact of gaming environments that often involve competition, rapid stimulation, and, in some cases, violent content. Prolonged exposure to such settings may influence how adolescents interpret social cues, respond to challenges, and manage emotional reactions, thereby shaping aggressive tendencies in subtle as well as observable ways (Shahid et al., 2024).

Research indicates that repeated engagement in intense gaming contexts can contribute to desensitization toward aggressive stimuli, normalization of hostile responses, and reduced impulse control (Anderson et al., 2010; Lemmens et al., 2011). Over time, adolescents may become more likely to interpret ambiguous situations as threatening and respond with irritability or anger. This suggests that gaming addiction is not confined to recreational habits but may extend into emotional regulation and social interactions, affecting how adolescents behave in real-life environments such as home, school, and peer settings (Saleem et al., 2024).

Understanding aggression as a multifaceted phenomenon is therefore essential when examining its association with gaming addiction. Aggressive behavior interacts dynamically with developmental factors, environmental stressors, and lifestyle patterns that characterize adolescent life (Steinberg, 2008). Excessive gaming may influence not only outward expressions of aggression but also the cognitive and

emotional mechanisms that support such behavior, including poor frustration tolerance and heightened emotional reactivity. These internal changes often remain unnoticed yet contribute significantly to behavioral outcomes (Saleem et al., 2024).

Recognizing the multidimensional relationship between gaming addiction and aggression provides important insight for prevention and intervention efforts. It highlights the need to examine aggression alongside related lifestyle factors such as sleep disruption and sedentary behavior, which may further intensify emotional dysregulation. A comprehensive exploration of this relationship can therefore inform strategies aimed at promoting healthier emotional control, adaptive social functioning, and balanced technology use among adolescents (Baron and Branscombe, 2012; Lemmens et al., 2011).

1.4 Sleep Quality

Sleep is a fundamental biological process that plays a crucial role in physical restoration, cognitive functioning, and emotional regulation during adolescence (Ohayon et al., 2017). Adequate sleep facilitates essential neurological processes such as memory consolidation, synaptic pruning, neural restoration, and emotional processing, all of which are particularly critical during the rapid brain development and heightened psychosocial demands of adolescence (Ohayon et al., 2017). Conversely, poor sleep quality has been consistently linked to emotional dysregulation, irritability, impaired impulse control, and increased susceptibility to behavioral problems, including aggression (Cudney et al., 2022b). Consequently, understanding the interplay between adolescent lifestyle behaviors, such as gaming addiction, and sleep quality is vital for identifying mechanisms that contribute to psychosocial and cognitive vulnerabilities.

Sleep quality is a multidimensional construct which include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction (Buysse et al., 1989). Subjective sleep quality reflects the individual's perception of how restorative and satisfactory their sleep is, capturing overall satisfaction with sleep patterns. Adolescents

engaged in excessive gaming often report poor subjective sleep quality due to late-night gaming sessions, disrupted circadian rhythms, and heightened cognitive or emotional arousal before bedtime (Alghamdi, 2014a). Persistent perceptions of inadequate sleep may heighten vulnerability to emotional reactivity, irritability, and diminished coping capacity during stressful or challenging situations.

Sleep latency, defined as the time required to transition from wakefulness to sleep, is a sensitive indicator of sleep quality in adolescents (Buysse et al., 1989). Evening gaming sessions often heighten physiological arousal and cognitive alertness through fast-paced interaction, emotional engagement, and continuous decision making demands (Alghamdi, 2014a; Lemola et al., 2015). This state of mental activation delays the natural wind-down process necessary for sleep onset, especially when gaming occurs close to bedtime. As a result, adolescents may remain awake in bed for extended periods despite feeling tired, reflecting prolonged sleep latency linked to late-night screen exposure (Saleem et al., 2024).

Over time, extended sleep latency reduces total sleep opportunity and creates frustration associated with difficulty falling asleep (Cudney et al., 2022b). This pattern contributes to daytime fatigue, irritability, and weakened self-regulation, which are closely related to emotional instability and aggressive responses. When adolescents repeatedly experience difficulty initiating sleep, a negative cycle develops in which anticipatory alertness further delays sleep onset on subsequent nights. Thus, sleep latency becomes an early pathway through which gaming habits begin to affect broader emotional and behavioral functioning (Cudney et al., 2022b).

Sleep duration and habitual sleep efficiency are quantitative dimensions reflecting how much sleep adolescents obtain and how effectively they remain asleep during time spent in bed (Buysse et al., 1989). Gaming addiction frequently leads adolescents to sacrifice sleep time in favor of extended gameplay, particularly during late hours when supervision may be limited.

This reduction in total sleep duration contributes to cumulative sleep debt, which gradually affects attention, learning capacity, and mood regulation (Fabbri, 2021).

Insufficient sleep duration is especially concerning during adolescence, when brain maturation and cognitive development rely heavily on adequate rest.

Habitual sleep efficiency, referring to the proportion of time spent asleep relative to time in bed, is also compromised by gaming-related sleep disruption (Buysse et al., 1989). Frequent awakenings, difficulty maintaining sleep, or restless sleep reduce the restorative value of nighttime rest. Poor efficiency impairs executive functions such as decision-making, impulse control, and emotional regulation, increasing vulnerability to irritability and aggression (Fabbri, 2021). Together, reduced duration and poor efficiency weaken the foundation of healthy emotional and cognitive functioning in adolescents.

Sleep disturbances, including nighttime awakenings, restlessness, and discomfort, represent another domain affected by excessive gaming (Buysse et al., 1989). Physiological arousal from immersive gameplay, exposure to bright screens, and emotionally charged interactions before bedtime can fragment sleep continuity (Alghamdi, 2014b). Adolescents may wake repeatedly during the night or experience shallow, non-restorative sleep, which intensifies daytime fatigue and mood fluctuations. These disturbances are often overlooked because adolescents may not fully recognize the extent of their fragmented sleep.

In some cases, persistent sleep difficulties lead adolescents to rely on sleep medication as a compensatory strategy (Buysse et al., 1989). Such reliance may indicate chronic disruption of natural sleep wake cycles caused by gaming habits. Dependence on pharmacological aids can alter normal sleep architecture and reduce the body's ability to achieve restorative sleep independently. This further complicates the relationship between gaming addiction and sleep quality, as attempts to manage sleep problems may introduce additional challenges (Imran et al., 2024). Daytime dysfunction represents the cumulative outcome of disrupted sleep patterns and is a crucial indicator of overall sleep quality (Buysse et al., 1989). Adolescents experiencing insufficient or poor-quality sleep due to gaming habits often report excessive daytime sleepiness, difficulty concentrating, and reduced alertness (Alghamdi, 2014a). These difficulties directly affect academic performance, classroom

engagement, and peer interactions, limiting adolescents' ability to function effectively in daily life.

Furthermore, daytime dysfunction is closely linked to emotional instability and increased aggression (Fabbri et al., 2021). When cognitive resources are depleted due to inadequate sleep, adolescents may struggle to manage frustration, regulate emotions, and respond calmly to challenges. This creates a feedback loop in which poor sleep contributes to maladaptive behaviors, while continued gaming perpetuates sleep disruption. Addressing daytime dysfunction therefore requires attention not only to sleep habits but also to the gaming behaviors that underlie these disturbances (Imran et al., 2024).

1.5 Gaming Addiction and Sleep Quality

During adolescence, biological shifts in circadian rhythms naturally delay sleep timing, making this age group particularly vulnerable to sleep disturbances when exposed to stimulating activities at night (Crowley et al., 2018). Within this context, excessive engagement in digital gaming becomes a significant risk factor that interferes with healthy sleep patterns and overall well-being (Lemmens et al., 2011).

Gaming addiction disrupts several core components of sleep quality, including subjective sleep satisfaction, sleep latency, sleep duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction (Buysse et al., 1989; Alghamdi, 2014a). Adolescents who engage in prolonged gaming sessions, particularly during evening and nighttime hours, frequently delay bedtime and struggle to initiate sleep due to cognitive overstimulation and heightened physiological arousal (King et al., 2013; Hale and Guan, 2015). The immersive and interactive nature of gaming sustains mental alertness, making it difficult for the brain to transition into a restful state necessary for sleep initiation (Cain and Gradisar, 2010).

In addition to delayed sleep onset, exposure to screen light from gaming devices interferes with melatonin secretion and circadian regulation (Hale and Guan, 2015; Crowley et al., 2018). This disruption in biological sleep-wake cycles reduces

sleep efficiency and leads to fragmented, non-restorative sleep (Short et al., 2013). Adolescents with problematic gaming habits often report frequent nighttime awakenings, restless sleep, and feelings of unrefreshing sleep upon waking, which cumulatively reduce sleep quality over time (Alghamdi, 2014a; King et al., 2013). Such patterns gradually establish irregular sleep routines that become difficult to correct without behavioral intervention.

Poor sleep quality resulting from excessive gaming has important consequences for daytime functioning and emotional regulation (Carskadon, 2011; Baum et al., 2014). Sleep deprivation weakens the brain's capacity to manage emotions, control impulses, and cope with daily stressors, thereby increasing irritability, frustration, and mood instability (Baum et al., 2014; Short et al., 2013). These emotional difficulties often manifest in academic challenges, reduced concentration, and strained peer relationships, further compounding the psychosocial impact of gaming addiction (Lemmens et al., 2011; Demetrovics et al., 2012).

The association between gaming addiction and sleep quality also extends to broader behavioral outcomes such as aggression and sedentary lifestyles (Cudney et al., 2022a; Anderson et al., 2010). Disturbed sleep has been linked with heightened aggressive tendencies, poor decision-making, and reduced problem-solving abilities, which may intensify the negative effects already associated with excessive gaming (Baum et al., 2014; Anderson et al., 2010). This creates a cyclical pattern in which late-night gaming disrupts sleep, poor sleep worsens emotional control, and emotional dysregulation increases reliance on gaming as a coping strategy.

Recognizing the interconnected nature of gaming addiction and sleep quality highlights the importance of addressing both factors in preventive and therapeutic interventions (Hale and Guan, 2015; Cudney et al., 2022b). Promoting sleep hygiene practices alongside regulating gaming behaviors can improve adolescents' emotional resilience, cognitive performance, and social adjustment (Carskadon, 2011; Steinberg, 2008). A comprehensive understanding of these relationships is therefore essential for supporting healthy adolescent development and reducing the risk of aggression and other maladaptive outcomes associated with problematic gaming.

1.6 Sedentary Behavior

Sedentary behaviors refer to waking activities characterized by low energy expenditure, typically performed in sitting or reclining positions (Carson et al., 2016). It has become increasingly prevalent among adolescents due to prolonged engagement in screen-based activities, particularly gaming (Saunders et al., 2020). Extended periods of inactivity reduce opportunities for physical exertion that naturally regulate physiological arousal and emotional stress (Hoare et al., 2016). Adolescents who spend significant time in sedentary activities often exhibit increased irritability, emotional dysregulation, and impaired impulse control (Ambreen et al., 2024).

Sedentary behavior includes multiple domains including screen-based recreation, educational sitting, cultural or creative activities, social sitting, and travel-related inactivity (Hardy et al., 2007). This multidimensional approach recognizes that sedentary behavior is not limited to leisure screen time but encompasses broader lifestyle patterns that collectively reduce opportunities for emotional regulation (Silva et al., 2014).

Sedentary behaviors interferes with circadian rhythms, contributes to sleep disruption, and may intensify cognitive and emotional arousal (Cudney et al., 2022a). These factors create conditions conducive to aggression and mood instability (Hoare et al., 2016). This interplay illustrates how sedentary behavior operates as a mechanism linking gaming addiction with adverse developmental outcomes, including poor sleep quality and heightened aggressive tendencies (Ambreen et al., 2024). Adolescents embedded in highly sedentary gaming routines may experience cumulative deficits in emotional resilience, attentional control, and behavioral self-regulation (Carson et al., 2016).

Research indicates that a sedentary lifestyle is closely linked to the emergence of maladaptive behaviors during adolescence (Saunders et al., 2020). Extended sitting time reduces opportunities for social interaction, outdoor engagement, and physical activity, which are vital for psychosocial growth, stress management, and emotional regulation (Hoare et al., 2016).

1.7 Gaming Addiction and Sedentary Behavior

Adolescents who adopt highly sedentary routines as a result of excessive gaming are more likely to experience sleep disruption, emotional instability, and elevated levels of aggression (Hoare et al., 2016; Carson et al., 2016). Extended hours spent sitting with minimal physical movement not only reduce opportunities for healthy activity but also disturb biological rhythms that regulate sleep and mood (Saunders et al., 2020). As sedentary time increases, adolescents may experience fatigue, irritability, and reduced emotional control, which can intensify the behavioral difficulties already associated with problematic gaming patterns (Hoare et al., 2016). This pattern reflects a reinforcing cycle in which sedentary behaviors, poor sleep, and emotional dysregulation mutually influence one another.

Sedentary behavior also limits adolescents' engagement in social, recreational, and outdoor activities that are essential for psychological balance and healthy development (Carson et al., 2016; Saunders et al., 2020). When gaming becomes the primary leisure activity, it often replaces physical play, peer interaction, and structured routines, thereby narrowing the range of experiences that support emotional resilience. Over time, this restriction contributes to heightened stress, frustration, and reduced coping capacity, which may manifest as aggressive responses in everyday situations (Kuss and Griffiths, 2012; Lemmens et al., 2011). Thus, sedentary behavior acts as a key pathway through which gaming addiction influences adolescents' emotional and behavioral outcomes.

Gaming addiction represents a multidimensional behavioral concern with far-reaching implications for adolescent development. Excessive engagement in gaming disrupts sleep patterns, increases sedentary behavior, and heightens emotional arousal, thereby contributing to aggression and emotional dysregulation (Kuss and Griffiths, 2012; Lemmens et al., 2011; Carson et al., 2016). Aggression itself includes physical, verbal, emotional, and cognitive components, which are influenced by lifestyle factors such as sleep quality and activity levels (Buss and Perry, 1992; Buysse et al., 1989). Understanding these overlapping dimensions is essential for

explaining how gaming addiction affects adolescents beyond simple recreational habits.

A comprehensive understanding of these interrelated processes provides valuable direction at promoting healthier adolescent lifestyles. Addressing sedentary routines, improving sleep hygiene, and regulating gaming behaviors together can help reduce aggression and enhance emotional regulation (Saunders et al., 2020; Ambreen et al., 2024). Integrating these factors into research and practice supports the development of balanced behavioral patterns and fosters emotional, cognitive, and social well-being among adolescents.

1.8 Research Gap

The prevalence of gaming addiction among adolescents has increased noticeably in urban areas where smartphones, high-speed internet, and online gaming platforms are easily accessible (Zahra et al., 2019). For many young individuals, gaming has shifted from a recreational activity to a dominant daily routine that occupies substantial time and attention. While this rise in gaming engagement reflects technological advancement and changing leisure patterns, it also raises concerns regarding its potential psychological and behavioral consequences during adolescence, a developmental stage already marked by emotional sensitivity and heightened environmental influence (Steinberg, 2008).

Despite the growing presence of gaming in adolescents' lives, research in Pakistan has largely concentrated on documenting the frequency and patterns of gaming rather than examining its broader psychological implications (Turabi et al., 2025). Limited attention has been given to understanding how excessive gaming may relate to sleep disturbances, aggression, and sedentary lifestyles, which are critical indicators of adolescent well-being. This narrow research focus restricts the ability to understand gaming addiction as a multidimensional issue that affects emotional, behavioral, and lifestyle domains simultaneously (Turabi et al., 2025).

Contextual factors within the Pakistani environment may further intensify adolescents' engagement in prolonged gaming. Academic pressure, limited availability of

structured recreational and physical activities, safety concerns restricting outdoor play, and easy access to personal digital devices create conditions that encourage sedentary indoor entertainment (Shabih et al., 2022). As a result, adolescents may increasingly rely on gaming as a primary source of relaxation and escape, potentially reinforcing patterns of excessive use that interfere with healthy routines and emotional regulation.

Moreover, the role of sedentary behavior as a possible mechanism linking gaming addiction with adverse psychological outcomes has received minimal empirical attention in local research (Riaz et al., 2021; Turabi et al., 2025). Sedentary routines may not only contribute directly to poor sleep quality and reduced emotional stability but may also strengthen the pathway through which gaming addiction influences aggression and psychosocial difficulties. Without examining this mediating pathway, the understanding of how and why gaming addiction affects adolescents remains incomplete (Turabi et al., 2025).

Addressing these gaps, the present study aims to examine the impact of gaming addiction on aggression, sleep quality, and sedentary behavior among adolescents in Pakistan (Kuss and Griffiths, 2012; Riaz et al., 2021; Saunders et al., 2016). In particular, it seeks to explore the potential mediating role of sedentary behavior in explaining the relationship between gaming addiction and psychological outcomes, an area that remains largely unexplored in Pakistani research. By investigating these interconnected factors together, this study contributes to a more comprehensive understanding of adolescent gaming behaviors and offers evidence that can inform prevention strategies, school-based interventions, and public health policies.

1.9 Problem Statement

Adolescence is a crucial developmental stage characterized by rapid physical, emotional, and social changes, during which individuals establish their academic orientation, coping strategies, and behavioral patterns (Steinberg, 2014). Excessive engagement in gaming during this period can disrupt these processes, potentially leading to emotional instability, poor sleep, aggression, and physical inactivity.

Globally, research has shown strong associations between gaming addiction, aggressive behavior, and sleep disturbances (Kuss and Billieux, 2017; Lemmens et al., 2015). In Pakistan, evidence suggests that approximately 12 to 17 percent of adolescents exhibit signs of gaming addiction, which is linked to poorer sleep quality, and increased emotional dysregulation (Imran et al., 2024; Zaman et al., 2022).

Despite these findings, research in the Pakistani context remains limited, highlighting the need for context-specific investigations (Imran et al., 2024). Cultural norms, family expectations, and academic pressures in Pakistan differ significantly from Western societies, potentially influencing the development of gaming behaviors and their impact on youth (Ahmer et al., 2023; Khan and Burton, 2021). Most previous studies focus on urban or university populations, which restrict population diversity and limits the generalizability of findings to younger adolescents (Imran et al., 2024).

Furthermore, little research has explored the mechanisms underlying the relationship between gaming addiction, aggression, and sleep quality, particularly the mediating role of sedentary behavior, leaving gaps in understanding how excessive gaming affects both emotional and physical health (Alimoradi et al., 2021). Theoretical models explaining these interactions in the Pakistani context are limited. Conducting research on a more diverse adolescent population and examining sedentary behavior as a mediator can address these gap (Imran et al., 2024).

Adolescence is a pivotal developmental stage characterized by rapid physical maturation, emotional variability, and expanding social roles. During this period, individuals begin to establish academic direction, coping strategies, peer relationships, and behavioral patterns that often extend into adulthood (Steinberg, 2014). Because adolescents are highly responsive to environmental influences, their daily habits and routines play a crucial role in shaping emotional and behavioral adjustment. Excessive engagement in gaming during this sensitive phase may interfere with healthy developmental processes by replacing essential activities such as sleep, physical movement, academic focus, and face-to-face interaction. Over time, such disruption can contribute to emotional instability, sleep problems, aggressive tendencies, and reduced physical activity (Steinberg, 2014; Imran et al., 2024).

International literature has consistently highlighted strong associations between gaming addiction, aggression, and sleep disturbances among adolescents (Kuss and Billieux, 2017; Lemmens et al., 2015). Gaming environments often involve intense stimulation, competition, and rapid feedback, which can heighten emotional arousal and reduce opportunities for relaxation before sleep. Prolonged exposure to such environments may weaken emotional regulation and impulse control, increasing the likelihood of irritability and aggressive responses in real-life situations. Simultaneously, late-night gaming and screen exposure interfere with sleep timing and quality, further intensifying emotional dysregulation and daytime fatigue (Kuss and Billieux, 2017; Lemmens et al., 2015).

Within Pakistan, emerging evidence suggests that approximately 12–17% of adolescent's exhibit signs of problematic gaming; with reported links to poor sleep quality and heightened emotional difficulties (Imran et al., 2024; Zaman et al., 2022). However, much of the existing research has focused primarily on identifying the prevalence of gaming behaviors rather than examining their broader psychological and lifestyle consequences (Kuss and Griffiths, 2012; Gentile et al., 2011). This study examines how gaming addiction is associated with aggression, sleep quality, and activity patterns among Pakistani adolescents. It also considers how these relationships are shaped by contextual factors such as strong academic expectations, limited access to structured recreational facilities, safety concerns that restrict outdoor activity, and widespread availability of smartphones and internet connectivity, all of which may contribute to increased sedentary, screen-based leisure and gaming behavior. (Ahmer et al., 2023; Khan and Burton, 2021).

Additionally, many previous studies have targeted university students or urban samples, which narrows population diversity and limit the generalizability of findings to younger adolescents in schools and colleges (Imran et al., 2024). These contextual differences highlight the need for research that is specifically grounded in the Pakistani adolescent experience.

Another critical gap in the literature involves understanding the mechanisms that

explain how gaming addiction leads to aggression and sleep problems. While associations have been documented, fewer studies have explored the pathways through which these relationships occur ([Alimoradi et al., 2021](#)). Sedentary behavior, which naturally accompanies prolonged gaming, may act as an important mediating factor influencing both emotional and physical health. Excessive sitting time can contribute to fatigue, mood fluctuations, and disrupted sleep patterns, which in turn may intensify aggression and emotional instability ([Imran et al., 2024](#); [Kuss and Billieux, 2017](#)).

Addressing these gaps, the present study examines gaming addiction in relation to aggression, sleep quality, and sedentary behavior among a broader and more diverse adolescent population. By investigating sedentary behavior as a potential mediator, this research aims to provide a more comprehensive explanation of how excessive gaming affects both psychological and lifestyle outcomes. Such an approach not only contributes to theoretical understanding within the local context but also offers practical guidance for developing targeted interventions for adolescents in educational settings across Pakistan ([Imran et al., 2024](#)).

1.10 Research Objectives

- i. To examine the relationship between gaming addiction, sedentary behaviors, aggression and sleep quality among adolescents.
- ii. To explore the mediating role of sedentary behaviors in the relationship between gaming addiction and its psychological outcomes such as aggression and sleep quality, among adolescents.

1.11 Research Hypotheses

- i. Gaming addiction will be positively associated with sedentary behaviors among adolescents.
- ii. Gaming addiction will be positively associated with aggression among adolescents.

- iii. Gaming addiction will be negatively associated with sleep quality among adolescents.
- iv. Sedentary behaviors will positively mediate the relationship between gaming addiction and aggression among adolescents.
- v. Sedentary behaviors will negatively mediate the relationship between gaming addiction and sleep quality among adolescents.

Chapter 2

Literature Review

2.1 Introduction to Gaming Addiction

Over the past decade, gaming addiction has emerged as a significant behavioral concern, particularly in relation to adolescents' mental health and lifestyle patterns ([Macur and Pontes, 2021](#)). Globally, gaming has become one of the most dominant forms of digital entertainment, with approximately 83.6% of internet users engaging in video games by 2021. In certain countries, such as the Philippines and Thailand, participation rates exceed 94%, highlighting the widespread nature of gaming across cultures ([Taş et al., 2025](#)). Due to heightened emotional sensitivity, reward responsiveness, and ongoing identity development, adolescents are especially susceptible to developing problematic gaming behaviors ([Zeiler and Mukherjee, 2022](#)).

2.2 Global Prevalence and Impact of Gaming Addiction

International research consistently demonstrates that excessive gaming is associated with a range of negative psychological and behavioral outcomes. These include increased aggression, poor sleep quality, and heightened sedentary behavior, all of which contribute to compromised functioning among adolescent ([Anderson and Bushman, 2002](#); [Exelmans and Van den Bulck, 2017](#); [Peng et al., 2025](#)).

Empirical studies across different cultural contexts further reinforce these findings. For instance, a large-scale study conducted in China involving 1,400 students found that gaming often serves as a coping mechanism for emotional distraction but results in impaired time management, reduced sleep duration, and academic difficulties (Li et al., 2023). Similarly, research conducted in Canada with 5,840 adolescents revealed that excessive gaming is associated with social withdrawal, reduced initiative, and increased aggression (Müller et al., 2015). These findings indicate that gaming addiction is a globally consistent phenomenon with similar behavioral consequences across diverse populations.

2.3 Gaming Addiction in Pakistan

Within the Pakistani context, research on gaming addiction is emerging but remains relatively limited compared to global literature. Existing studies suggest that increased internet accessibility, widespread smartphone usage, and limited awareness of healthy gaming practices have significantly contributed to elevated gaming engagement among adolescents (Zahra et al., 2019; Ambreen et al., 2024). The COVID-19 pandemic further intensified gaming behaviors due to prolonged lockdowns and reduced outdoor activities. (Zaman et al., 2022) reported that approximately 57% of adolescents engaged in regular gaming during the pandemic, with 12.5% meeting the criteria for gaming addiction. Recent findings also highlight the psychological and behavioral implications of gaming addiction among Pakistani youth. Imran et al. (2024) reported increased irritability, social withdrawal, and daytime dysfunction among adolescents exhibiting problematic gaming behaviors. Similarly, Khalid et al. (2025) found that more than half of university students engaged in online gaming showed symptoms of addiction. These findings emphasize the need to examine gaming addiction within the local sociocultural context.

2.4 Psychological and Behavioral Outcomes of Gaming Addiction

Gaming addiction is a multidimensional phenomenon associated with a range of psychological and behavioral consequences. Adolescents who engage excessively in

gaming are more likely to experience emotional dysregulation, reduced academic performance, and impaired social functioning (Demetrovics et al., 2012). The General Aggression Model (GAM) provides a theoretical explanation for these outcomes, suggesting that repeated exposure to competitive or violent gaming environments increases aggressive cognitions, emotional arousal, and hostile behavioral tendencies (Anderson and Bushman, 2002).

Given these broad consequences, specific outcomes require further detailed examination.

2.5 Gaming Addiction and Aggression

A substantial body of research has established a consistent association between gaming addiction and increased aggressive behavior among adolescents (Müller et al., 2015; Lemmens et al., 2011). Exposure to violent and competitive gaming environments is linked to heightened irritability, impulsivity, and verbal aggression, suggesting that excessive gaming may reinforce maladaptive behavioral responses (Gentile et al., 2011).

The General Aggression Model provides a theoretical explanation for this relationship, proposing that repeated exposure to aggressive gaming content strengthens aggressive cognitions while weakening emotional regulation over time (Anderson and Bushman, 2002; Shabih et al., 2022). This indicates that gaming addiction is not merely associated with aggression but may actively contribute to its development through cognitive and emotional pathways.

Although aggression is influenced by multiple factors such as personality traits, family dynamics, and peer interactions (Bandura, 1977; Bushman & Anderson, 2001), research highlights that gaming addiction contributes a significant and independent proportion of variance in aggressive outcomes (Lemmens et al., 2011; Müller et al., 2015). This underscores the relative importance of gaming addiction as a predictor of aggression compared to other psychosocial variables. In the Pakistani context, emerging evidence further supports this relationship. Studies have shown that emotional dysregulation mediates the link between gaming addiction

and aggression, indicating an underlying psychological mechanism (Malik et al., 2024), while other findings demonstrate a significant positive association between PUBG addiction and hostility among youth (Kausar et al., 2024).

Overall, while aggression is a multidetermined outcome, the literature consistently identifies gaming addiction as a strong and meaningful predictor. This positions gaming addiction as a central variable in explaining aggressive behavior, justifying its inclusion as a key focus in the present study.

2.6 Gaming Addiction and Sleep Quality

Sleep quality is a fundamental component of adolescent health, influencing cognitive functioning, emotional regulation, and overall well-being (Wong et al., 2020). However, excessive gaming has been consistently associated with sleep disturbances, including delayed sleep onset, shorter sleep duration, and poor sleep efficiency (King et al., 2013).

Gaming, particularly during nighttime hours, increases physiological and cognitive arousal, disrupts circadian rhythms, and delays melatonin secretion, thereby impairing sleep quality (King et al., 2013). Additionally, the relationship between gaming and sleep is often bidirectional, as poor sleep may increase reliance on gaming as a coping mechanism (Peng et al., 2025).

Studies conducted in Pakistan further confirm these findings. Adolescents with higher levels of gaming addiction report poorer sleep quality and increased daytime fatigue compared to their peers Zaman et al. (2022). These findings justify the inclusion of sleep quality as a critical outcome variable in the present study.

2.7 Sedentary Behavior as a Mediating Mechanism

Sedentary behavior is increasingly recognized as a key mechanism linking gaming addiction with adverse psychological and physiological outcomes. Defined as low-energy activities performed in a sitting or reclining position, sedentary behavior is inherently associated with prolonged gaming (Tremblay et al., 2011).

Research suggests that excessive gaming reduces physical activity, leading to increased sedentary lifestyles that negatively impact emotional regulation and sleep patterns [Macur and Pontes \(2021\)](#). [Peng et al. \(2025\)](#) demonstrated that sedentary behavior significantly mediates the relationship between gaming addiction and sleep disturbances. Similarly, reduced physical activity has been associated with increased aggression due to limited opportunities for emotional release ([Maden and Bayramlar, 2022](#)).

In the Pakistani context, [Khan and Burton \(2021\)](#) reported that adolescents engaged in excessive gaming exhibited sedentary behaviors, which were associated with poor sleep and increased irritability. These findings support the conceptualization of sedentary behavior as a mediating variable in the relationship between gaming addiction and its outcomes.

2.8 Study Justification

Despite growing research on gaming addiction, several important gaps remain. Previous studies have mostly examined aggression, sleep quality, and sedentary behavior separately and have largely focused on adult populations, limiting a clear understanding of these relationships in adolescents. Early adolescence is particularly under-researched, despite being a critical developmental stage where problematic gaming behaviors often begin to emerge ([Zahra et al., 2019](#)).

In the Pakistani context [Imran et al. \(2024\)](#) particularly highlighted this gap, noting that research on adolescent gaming addiction remains limited and fragmented, with most studies focusing on single outcomes such as aggression or sleep disturbances rather than examining their combined effects. Similarly, other local studies ([Muazzam et al., 2024](#); [Khan et al., 2023](#)) provide only partial evidence without integrating multiple psychological and behavioral variables into a unified model.

To address these limitations, the present study adopts a comprehensive framework examining gaming addiction, aggression, sleep quality, and sedentary behavior among Pakistani adolescents. Sedentary behavior is conceptualized as a key mediating mechanism linking gaming addiction to negative outcomes. Excessive

gaming may increase aggression through exposure to competitive or violent content (Anderson and Bushman, 2002; Shabih et al., 2022), and may also disrupt sleep by delaying sleep onset and reducing sleep duration (Exelmans and Van den Bulck, 2017; Håkansson and Widinghoff, 2020). At the same time, prolonged gaming promotes sedentary behavior, which reduces physical activity, weakens emotional regulation, and disrupts circadian rhythms, thereby further intensifying both aggression and sleep problems (Macur and Pontes, 2021; Peng et al., 2025; Khan and Burton, 2021).

This framework positions sedentary behavior not simply as an outcome of gaming but as a central pathway through which gaming addiction affects psychological and physiological health. Accordingly, the study applies a mediation model in which sedentary behavior partially explains the relationship between gaming addiction, aggression, and sleep quality, while also allowing for direct effects of gaming on these outcomes. By focusing specifically on Pakistani adolescents, the study directly responds to the gap identified by Imran et al. (2024) and contributes a more integrated understanding of gaming-related behaviors within a context where empirical evidence remains limited. Overall, this research aims to provide a more comprehensive and empirically grounded explanation of how gaming addiction influences adolescent well-being and to inform targeted interventions aimed at reducing sedentary behavior, improving sleep hygiene, and managing aggression.

2.9 Rationale

The rapid expansion of digital technology has transformed adolescents' leisure activities; with gaming addiction emerging as a major behavioral concern worldwide (Kuss and Griffiths, 2012). The widespread availability of smartphones, low-cost internet, and immersive gaming platforms has resulted in adolescents spending extended periods engaged in gaming activities (Anderson et al., 2017). Although gaming may provide recreational and cognitive benefits, excessive and uncontrolled gaming addiction has raised concerns due to its potential adverse effects on adolescents' psychological, behavioral, and physical well-being (World Health Organization, 2019).

Research consistently highlights a strong association between gaming addiction and aggressive behavior among adolescents. Exposure to competitive or violent gaming content, combined with reward-based reinforcement mechanisms, has been linked to heightened irritability, impulsivity, and frustration ([Anderson and Bushman, 2001](#); [Gentile et al., 2011](#)). Adolescents exhibiting high levels of gaming addiction often have fewer opportunities for real-world emotional regulation, peer interaction, and conflict resolution, which may exacerbate aggressive tendencies in both academic and social environments. However, much of the existing evidence originates from Western populations, where sociocultural norms, parenting practices, and educational systems differ from those in South Asia.

In addition to aggression, gaming addiction has been shown to disrupt sleep patterns among adolescents. Late-night gaming sessions, increased cognitive arousal, and prolonged exposure to screens delay sleep onset, reduce total sleep duration, and impair overall sleep quality ([Weinstein and Lejoyeux, 2010](#)). Adolescence is a critical developmental period requiring sufficient sleep for emotional regulation, cognitive functioning, and physical growth ([Carskadon, 2011](#); [Shochat et al., 2014](#)). Poor sleep has been associated with elevated stress, mood disturbances, academic difficulties, and long-term mental health risks ([Owens and Weiss, 2017](#); [Short et al., 2013](#)). Despite recognition of sleep problems, prior studies often examine sleep solely as a direct outcome of gaming addiction, without considering behavioral pathways that may explain this relationship ([Exelmans and Van den Bulck, 2015](#); [Hale and Guan, 2015](#)). One such pathway is sedentary behavior, which remains understudied as a mediating factor. Prolonged engagement in gaming frequently replaces physical activity, contributing to a sedentary lifestyle ([Staiano and Calvert, 2011](#)).

Sedentary behavior not only impacts physical health but also influences emotional regulation, stress responses, and sleep quality ([Tremblay et al., 2017](#); [Saunders et al., 2020](#)). Limited physical movement reduces natural fatigue, disrupts circadian rhythms, and can amplify emotional reactivity, increasing susceptibility to aggression and sleep disturbances ([Chaput et al., 2019](#)). Previous research has primarily treated sedentary behavior as a consequence of gaming rather than as

an explanatory mechanism linking gaming addiction to psychological and sleep-related outcomes (Stiglic and Viner, 2019; LeBlanc and et al., 2018), indicating a methodological gap.

Adolescents in Pakistan face distinct sociocultural factors, such as strong parental control, high academic expectations, limited access to recreational facilities, and fewer opportunities for independent decision-making, all of which can influence their behavior and coping strategies (Khan and Burton, 2021). These factors may increase reliance on gaming as a source of psychological fulfillment (Kardefelt-Winther, 2014). Additionally, family expectations for academic success, combined with limited awareness of healthy digital practices, may further promote gaming addiction (Ahmer et al., 2023). Although recent studies have explored adolescent mental health in Pakistan (Ahmer et al., 2023; Khan and Burton, 2021), empirical research examining gaming addiction, aggression, sleep quality, and sedentary behavior within this population remains scarce (Tremblay et al., 2011; Hale and Guan, 2015).

Most existing research on gaming addiction has relied on correlational designs that establish associations with negative psychological and behavioral outcomes but fail to explain the underlying processes driving these relationships (Kuss and Griffiths, 2012; Kardefelt-Winther et al., 2017). A more comprehensive, theory-driven explanation can be understood through a mediation framework in which sedentary behavior functions as a key mechanism Kardefelt-Winther (2014). Specifically, excessive engagement in digital gaming typically involves prolonged screen time and reduced physical activity, leading individuals to adopt a predominantly sedentary lifestyle (Tremblay et al., 2011). This increased sedentary behavior, in turn, contributes to multiple adverse outcomes. For instance, extended inactivity and late-night screen exposure disrupt circadian rhythms and reduce sleep pressure, thereby impairing sleep quality (Hale and Guan, 2015; Exelmans and Van den Bulck, 2017). Similarly, the lack of physical activity limits opportunities for emotional regulation and stress release, which may heighten irritability and aggressive tendencies (Anderson and Bushman, 2001; Biddle and Asare, 2011). Moreover, sedentary patterns are associated with reduced social interaction and increased

psychological isolation, thereby exacerbating symptoms of anxiety and depression (Allen et al., 2014; Teychenne et al., 2015). Thus, gaming addiction does not influence these outcomes directly alone; rather, its effects are partially transmitted through sedentary behavior as an intervening variable. This mediation-based perspective provides a clearer understanding of the causal pathways involved and highlights the importance of incorporating behavioral mechanisms when examining the broader impact of gaming addiction.

To address this gap, the present study applies Self-Determination Theory to examine the mechanisms linking gaming addiction with adolescent outcomes by specifically testing sedentary behavior as a mediator between gaming addiction, aggression, and sleep quality. This approach moves beyond simple associations and provides a more explanatory understanding of how gaming addiction influences behavioral and psychological outcomes (Deci and Ryan, 2000; Przybylski et al., 2010; Tremblay et al., 2017).

2.10 Theoretical Framework

The present study is grounded in self-determination theory (SDT), a well established motivational framework developed by (Deci and Ryan, 2000), which explains human behavior in terms of the satisfaction or frustration of three innate psychological needs: autonomy, competence, and relatedness. According to SDT, these needs are universal and essential for optimal psychological functioning, well-being, and healthy behavioral regulation (Deci and Ryan, 2000). When individuals are able to satisfy these needs through daily life activities, they are more likely to exhibit adaptive behaviors and emotional stability. Conversely, when these needs remain unmet, individuals may seek alternative or compensatory activities to fulfill them, sometimes in maladaptive ways (Deci and Ryan, 2008). Within the SDT framework, adolescence is recognized as a highly sensitive and critical stage of development. During this stage, individuals experience heightened emotional reactivity, identity exploration, and an increasing desire for independence and peer acceptance. However, adolescents often face external constraints related to

academic pressure, parental control, limited autonomy, and restricted opportunities for competence and social validation in real-world contexts ([Männikkö et al., 2017](#)). As a result, their basic psychological needs may remain partially unsatisfied, increasing vulnerability to compensatory behaviors. Within this context, video gaming emerges as an easily accessible and highly reinforcing activity capable of fulfilling these unmet psychological needs.

From an SDT perspective, gaming environments are uniquely structured to support autonomy, competence, and relatedness. Autonomy is experienced through freedom of choice, self-directed exploration, and independent decision-making within virtual worlds. Competence is reinforced through skill development, level progression, achievement systems, and performance feedback that provide immediate rewards and a sense of mastery. Relatedness is satisfied through multiplayer interactions, online communities, teamwork, and social recognition from peers ([Ryan and Deci, 2017](#); [Kaya et al., 2023](#)). These features make gaming particularly attractive to adolescents who may feel restricted, unsuccessful, or socially disconnected in offline environments.

While gaming can initially serve adaptive and recreational purposes, SDT suggests that problems arise when individuals over-rely on a single activity to satisfy their psychological needs. When gaming becomes the primary or exclusive source of autonomy, competence, and relatedness, motivation may shift from autonomous engagement to controlled or compulsive use, increasing the risk of gaming addiction. Gaming addiction is characterized by excessive preoccupation with gaming, impaired control over gaming behavior, tolerance, withdrawal symptoms, and continued engagement despite negative academic, social, or health consequences ([Deci and Ryan, 2008](#)). Within this framework, gaming addiction reflects a maladaptive pattern of need satisfaction that substitutes real-world engagement with virtual fulfillment.

Within the framework of Self-Determination Theory (SDT), sleep quality can be understood as an outcome influenced by the satisfaction or frustration of basic psychological needs. SDT posits that individuals function optimally when their needs for autonomy, competence, and relatedness are fulfilled, whereas frustration

of these needs leads to psychological distress and maladaptive behavioral patterns (Deci and Ryan, 2000; Ryan and Deci, 2000). When adolescents experience unmet psychological needs in their daily lives, they may turn to gaming as a compensatory activity to fulfill these needs. Although gaming may temporarily provide a sense of autonomy, competence, and social connection, excessive engagement disrupts daily routines and creates behavioral imbalance. This imbalance directly affects sleep patterns by delaying sleep onset, increasing cognitive and emotional arousal, and reducing overall sleep duration (Exelmans and Van den Bulck, 2017; Hale and Guan, 2015).

From an SDT perspective, poor sleep quality is not merely a physiological outcome but also a reflection of dysregulated motivation and unmet psychological needs. When gaming becomes the primary source of need satisfaction, adolescents may neglect other health-promoting behaviors such as maintaining regular sleep schedules, engaging in physical activity, and participating in offline social interactions. This over-reliance on gaming weakens self-regulation, leading to irregular sleep patterns and reduced sleep quality (Ryan and Deci, 2020b).

Furthermore, sedentary behavior acts as a key mechanism within this process. As adolescents spend prolonged periods engaged in gaming, physical fatigue decreases, and physiological readiness for sleep is reduced. At the same time, continuous screen exposure and psychological stimulation increase arousal, making it more difficult to initiate and maintain sleep. In this way, sedentary behavior mediates the relationship between gaming addiction and sleep disturbances within the SDT framework (Tremblay et al., 2011; Exelmans and Van den Bulck, 2017).

Importantly, SDT also provides insight into how these issues can be addressed. When adolescents' psychological needs are fulfilled through healthier and more balanced activities such as supportive social relationships (relatedness), opportunities for skill development (competence), and environments that encourage independence (autonomy) their reliance on gaming as a primary coping mechanism decreases. This promotes better self-regulation, healthier daily routines, and improved sleep quality (Teixeira et al., 2012; Ryan and Deci, 2020a).

A key behavioral consequence of gaming addiction, as conceptualized in the present framework, is the development of sedentary behavior. Excessive gaming typically involves prolonged screen time, extended sitting, and reduced participation in physical, academic, and social activities. SDT posits that when individuals become overly dependent on a single need-satisfying activity, other life domains are neglected, leading to behavioral imbalance (Ryan and Deci, 2020a). In adolescents, this imbalance often manifests as increased sedentary habits, reduced physical movement, and disrupted daily routines.

In the current theoretical model, sedentary behavior is conceptualized as a mediating variable linking gaming addiction with adverse psychological and physiological outcomes (Ryan and Deci, 2020a). Rather than viewing sedentary behavior as a mere byproduct of gaming, Self-Determination Theory (SDT) allows it to be understood as an outcome of motivational displacement (Ryan and Deci, 2020a). SDT posits that human behavior is driven by the satisfaction or frustration of basic psychological needs (autonomy, competence, and relatedness), which influences motivation toward various behaviors, including physical activity and health-related outcomes (Ryan and Deci, 2000). As gaming becomes central to need fulfillment, adolescents may be less motivated to engage in activities that would otherwise satisfy psychological needs in healthier ways such as sports, face-to-face social interaction, or structured routines (Ryan and Deci, 2000). This prolonged inactivity has significant implications for emotional regulation and sleep functioning, as reduced engagement in physical and social activities may undermine well-being and healthy sleep patterns (Ryan and Deci, 2000).

One important outcome associated with increased sedentary behavior is aggression. From an SDT perspective, aggression can arise when psychological needs are chronically frustrated or when emotional regulation capacities are compromised. Prolonged sedentary screen-based activities may increase irritability, frustration, and emotional dysregulation due to reduced physical outlet, social isolation, and overstimulation (Ryan and Deci, 2017). Furthermore, competitive or high-intensity gaming content, combined with physical inactivity, may exacerbate

stress responses, thereby heightening aggressive tendencies. Thus, sedentary behavior functions as a behavioral mechanism through which gaming addiction may indirectly contribute to aggression among adolescents.

Similarly, sleep disturbance represents another critical outcome within this framework (Hale and Guan, 2015). Excessive gaming often leads to delayed bedtimes, irregular sleep schedules, increased cognitive arousal, and prolonged exposure to screen light, all of which negatively affect sleep quantity and quality (Exelmans and Van den Bulck, 2017; Hale and Guan, 2015). SDT emphasizes the role of balanced daily functioning in supporting psychological well-being (Ryan and Deci, 2020a). When gaming disrupts natural biological rhythms and reduces restorative sleep, adolescents may experience impaired emotional regulation, reduced concentration, and heightened vulnerability to stress (Ryan and Deci, 2020a). Sedentary behavior further compounds these effects by reducing physical fatigue and delaying sleep onset, thereby serving as a mediator between gaming addiction and poor sleep outcomes (Hale and Guan, 2015; Exelmans and Van den Bulck, 2017).

Overall, this theoretical framework conceptualizes gaming addiction as a maladaptive compensatory strategy arising from unmet psychological needs during adolescence (Ryan and Deci, 2020a; Kardefelt-Winther, 2014). While gaming temporarily fulfills needs for autonomy, competence, and relatedness, excessive reliance on gaming undermines balanced motivation and promotes sedentary behavior (Ryan and Deci, 2000; Przybylski et al., 2010). In turn, sedentary behavior mediates the relationship between gaming addiction and negative psychological and physiological outcomes, particularly aggression and sleep disturbances (Tremblay et al., 2011; Hale and Guan, 2015). By situating these constructs within Self-Determination Theory, the framework highlights the motivational processes underlying gaming addiction and emphasizes the importance of addressing psychological need satisfaction through healthier, real-world avenues (Ryan and Deci, 2020a).

SDT provides a comprehensive explanatory lens for understanding how unmet psychological needs drive gaming addiction, how addiction fosters sedentary behavior, and how this behavioral pattern contributes to emotional dysregulation and sleep

problems in adolescents (Ryan and Deci, 2020a; Exelmans and Van den Bulck, 2017). This framework not only guides the conceptual relationships examined in the present study but also underscores the importance of need-supportive environments in preventing maladaptive gaming behaviors and their associated outcomes (Ryan and Deci, 2020a; Przybylski et al., 2010).

Self-Determination Theory further explains that adolescents who experience frustration in their basic psychological needs are more likely to engage excessively in online gaming as a compensatory coping mechanism (Ryan and Deci, 2020a; Przybylski et al., 2010). Prolonged engagement in gaming activities often reduces participation in physical and social activities, thereby reinforcing sedentary lifestyles and increasing vulnerability to psychological distress and poor sleep quality (Exelmans and Van den Bulck, 2017). Accordingly, SDT offers a valuable theoretical foundation for examining the interconnected pathways between gaming addiction, sedentary behavior, emotional outcomes, and sleep disturbances among adolescents.

2.11 Conceptual Model

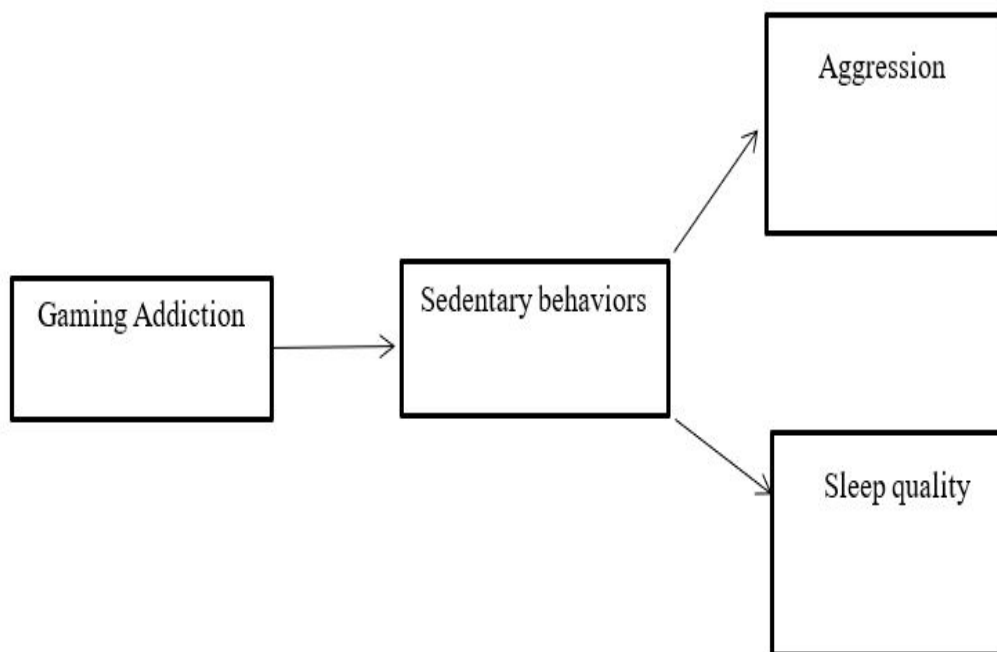


FIGURE 2.1: Conceptual Model

The present conceptual model proposes that gaming addiction influences adolescents' behavioral and health outcomes both directly and indirectly through sedentary behavior. Specifically, gaming addiction is considered the independent variable, sedentary behavior acts as a mediating variable, and aggression and sleep quality are the outcome variables.

Excessive engagement in gaming has been widely associated with increased sedentary behavior, as gaming typically involves prolonged screen time and reduced physical activity ([Tremblay et al., 2011](#)). According to Self-Determination Theory (SDT), when adolescents rely heavily on gaming to fulfill unmet psychological needs such as autonomy, competence, and relatedness, they tend to reduce participation in other real-life activities, resulting in behavioral imbalance and increased sedentary lifestyles ([Ryan and Deci, 2020a](#)).

Sedentary behavior, in turn, plays a critical role in influencing both aggression and sleep quality. With regard to aggression, prolonged inactivity and continuous exposure to stimulating gaming environments may increase emotional arousal, irritability, and reduced emotional regulation, thereby contributing to aggressive tendencies ([Anderson and Bushman, 2002](#); [Shabih et al., 2022](#)). Thus, sedentary behavior serves as a pathway through which gaming addiction may indirectly lead to aggression.

The inclusion of sleep quality as an outcome variable is strongly supported by existing literature. Sleep is a fundamental component of adolescent development, essential for cognitive functioning, emotional regulation, and overall well-being ([Hale and Guan, 2015](#)). However, excessive gaming has been consistently linked with poor sleep quality, including delayed sleep onset, reduced sleep duration, and disrupted sleep patterns ([Exelmans and Van den Bulck, 2017](#)). From an SDT perspective, when gaming becomes the primary source of psychological need satisfaction, adolescents may neglect healthy routines such as maintaining regular sleep schedules, leading to impaired sleep quality ([Ryan and Deci, 2020a](#)).

Furthermore, sedentary behavior intensifies sleep-related problems by reducing physical fatigue and increasing physiological and cognitive arousal, which delays

sleep initiation ([Tremblay et al., 2011](#); [Hale and Guan, 2015](#)). Therefore, sedentary behavior is conceptualized as a mediator that explains how gaming addiction contributes to poor sleep quality.

Overall, this model is justified as it integrates behavioral (aggression), physiological (sleep quality), and lifestyle (sedentary behavior) outcomes within a single framework. It is grounded in Self-Determination Theory, which explains how unmet psychological needs lead to maladaptive behaviors such as gaming addiction, and how these behaviors disrupt healthy functioning. By examining sedentary behavior as a mediating mechanism, the model provides a more comprehensive understanding of how gaming addiction affects adolescent well-being.

Chapter 3

Research Methodology

3.1 Research Design

For the present study, a cross-sectional correlational design was used it was considered most appropriate for the present study due to its alignment with the research objectives, which focused on examining the relationships among gaming addiction, sedentary behavior, aggression, and sleep quality in adolescents. Since the primary aim was to assess the strength and direction of associations rather than establish causal relationships, a correlational approach was suitable.

The cross-sectional nature of the design allowed data to be collected at a single point in time, making it time-efficient and practical, particularly when working with a large adolescent sample in school settings. Longitudinal or experimental designs, although stronger for causal inference, were not feasible due to time constraints, resource limitations, and ethical considerations. Furthermore, this design is widely used in behavioral and psychological research to explore patterns and relationships among variables in natural settings ([Kuss and Griffiths, 2012](#); [Kardefelt-Winther et al., 2017](#)). It enabled the researcher to examine not only direct relationships but also the potential mediating role of sedentary behavior using statistical techniques, without interfering with participants' natural behaviors.

Data were collected at one-time point using standardized self-report measures and structured questionnaires, ensuring consistency, reliability, and generalizability of

the findings. The selection of instruments for the present study was based on their strong psychometric properties, widespread use in previous research, and appropriateness for adolescent populations. All selected measures have demonstrated satisfactory reliability and validity across diverse samples, including adolescents, making them suitable for the current study.

3.2 Sample

A total of 300 adolescents age (12-18) who engaged in digital gaming for a minimum of three hours per day (Turabi et al., 2025) were recruited, including both male and female participants. A sample size of 300 adolescents was selected based on both methodological justification and practical feasibility. Previous research on Gaming addiction has successfully used similar sample sizes (Adiele & Amanze, 2022). Therefore, the selected sample size is considered adequate for producing reliable and generalizable findings while remaining feasible within the study's constraints.

3.3 Study Setting and Data Collection Procedure

The study employed convenience sampling, as participants were selected based on their accessibility and willingness to participate. This method allowed the researcher to efficiently collect data from adolescents in schools, colleges, and academies who were available during the data collection period. Although convenience sampling does not allow for strict generalization, it is commonly used in behavioral research where specific populations (e.g., adolescents with access to digital devices and engaged in gaming) are targeted.

The adolescent participants included both male and female students from school and college ensuring diversity in terms of gender and educational setting. Convenience sampling enabled the researcher to gather sufficient data within a limited timeframe while maintaining focus on the target population. The study was conducted in accordance with established ethical guidelines to ensure systematic and

responsible data collection. Initially, approval was obtained from the departmental research committee, and permission letters were issued to the administrations of the selected educational institutions. Data were collected from schools, colleges, and academies. Participants belonged to Grade 6, 7, 8, 9, and 10, as well as First Year and Second Year classes, ensuring representation across the targeted adolescent age range.

The ethical approval letter issued by the university was presented to the school authorities as official documentation. After reviewing the approval letter, the school administration granted permission to proceed with data collection. Following this approval, data were collected from the participants in accordance with the approved research protocol.

Written parental consent was obtained prior to data collection. Consent forms were distributed to parents through the school administration and attached to students' diaries for completion. Only students whose parents provided written consent were included in the study. After obtaining parental permission, participants were invited to take part in the research. All participants were then screened for eligibility based on age criteria (12–18 years) and current enrollment in the specified grades and classes before final inclusion in the study.

Before administration of the questionnaires, participants were briefed about the purpose of the study, the nature of the assessment, and the approximate duration of the session. They were assured of confidentiality, informed that participation was voluntary, and reminded of their right to withdraw or skip any question without penalty. Rapport was established to create a comfortable environment for sharing information related to gaming habits, aggression, sleep patterns, and sedentary behavior.

The data for this study was collected through the administration of questionnaires. Each participant completed the assessment individually in a single session lasting approximately 25 to 30 minutes. During data collection, the researcher was present along with one class teacher in each classroom to supervise and assist participants if needed. Students who experienced difficulty understanding items in English were

provided literal explanations in the local language without altering the meaning of the items.

No personal identifying information was recorded of participant. After completing the questionnaires, participants were thanked for their cooperation and participation. The collected data were securely stored and used solely for research purposes.

3.4 Inclusion Criteria

The study included adolescents aged 12 to 18 years, corresponding to the developmental stage of adolescence as defined by Erikson's psychosocial theory (Erikson, 1968). Participants were required to:

- Provide informed assent.
- Be enrolled in educational institutions located in Rawalpindi or Islamabad

3.5 Exclusion Criteria

Adolescents were excluded in the study based on the following criteria:

- Adolescents with clinically diagnosed psychiatric disorders.
- Individuals with cognitive impairments or disabilities affecting comprehension.

3.6 Measure and Instrument

3.6.1 Demographic Information Sheet

Participants completed a demographic questionnaire that included age, gender, educational level, and economy status (categorized as lower, middle, or upper class). These variables were analyzed to identify potential differences in gaming addiction, sedentary behaviors, aggression, and sleep quality across demographic groups.

3.6.2 Problematic Online Gaming Questionnaire

The Problematic Online Gaming Questionnaire (POGQ-SF), developed by (Demetrovics et al., 2012) was used to assess problematic online gaming behavior among adolescents. The POGQ-SF is a concise version of the original instrument and is specifically designed to measure excessive and maladaptive gaming behaviors that may negatively affect daily functioning. The scale consists of 12 items that assess six core dimensions of problematic gaming: preoccupation, overuse, immersion, social isolation, interpersonal conflict, and withdrawal symptoms. Each item is rated on a five-point Likert scale ranging from 1 (“never”) to 5 (“always”), with higher scores indicating greater severity of problematic gaming behavior. The short form retains the multidimensional structure of the original POGQ while offering improved efficiency and suitability for adolescent samples. Previous studies have demonstrated that the POGQ-SF exhibits strong internal consistency ($\alpha \approx 0.88$) and satisfactory construct validity across different cultural contexts. Due to its conciseness, reliability, and robust psychometric properties, the POGQ-SF was considered an appropriate and effective instrument for assessing problematic online gaming tendencies in the present study (Demetrovics et al., 2012).

3.6.3 Aggression Questionnaire

Aggression Questionnaire (AQ) was developed by Buss and Perry (1992) as a 29-item self-report scale measuring four components of aggression: physical aggression, verbal aggression, anger, and hostility. Each statement is rated on a seven-point Likert scale ranging from 1 (“extremely uncharacteristic of me”) to 7 (“extremely characteristic of me”), with two items reverse-scored to reduce response bias. Subscale scores are calculated by summing the relevant item scores, with higher scores indicating greater levels of aggression. The AQ is widely used in both research and clinical settings and has demonstrated strong psychometric properties, with a Cronbach’s alpha of approximately 0.89, indicating good internal consistency. The scale also shows satisfactory construct validity, supported by consistent factor structure and significant correlations with related behavioral and emotional constructs. Due to its reliability and validity, the AQ

was considered an appropriate instrument for assessing aggression in the present study (Buss and Perry, 1992).

3.6.4 Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI), (Buysse et al., 1989), is a 19-item self-report questionnaire designed to assess sleep quality over the last 4 weeks. It measures seven key components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored individually, and the total scores yields a global score ranging from 0 to 21, with higher scores representing poorer overall sleep quality. The PSQI shows strong internal reliability, with a Cronbach's alpha value of 0.83 (Buysse et al., 1989). It generally takes about 5–10 minutes to complete and is appropriate for individuals aged 13 years and above, including both adolescents and adults (Mollayeva et al., 2016).

3.6.5 Adolescent Sedentary Activity Questionnaire

The Adolescent Sedentary Activity Questionnaire (ASAQ) was developed by Hardy , Booth, and Okely (2007) as a self-report scale measuring sedentary behaviors among adolescents. It includes two parts including weekday consist of 11 items and weekend consist of 12 item. The scales assess time spent in five domains of sedentary activities: screen-based recreation, educational activities, cultural/creative activities, social activities, and travel/transport. Participants report the average time spent in each activity on weekdays and weekend days, with instructions to avoid double-counting overlapping behaviors. Subscale scores can be calculated by summing items within each domain, and a total sedentary time score is obtained by summing all items. Higher scores indicate greater levels of sedentary behavior. The ASAQ has demonstrated acceptable reliability, with test-retest intraclass correlation coefficients ranging from 0.53 to 0.71 across different domains, and has been validated in multiple countries and languages, supporting its use in diverse adolescent populations (Hardy et al., 2007; Silva et al., 2014).

3.6.6 Ethical Considerations

Ethical approval for the study was obtained from the Ethics Review Committee of the Faculty of Management and Social Sciences, Capital University of Science and Technology (CUST). Ethical principles of autonomy, confidentiality, beneficence, and voluntary participation were strictly observed throughout the research process.

Participants and their guardians were provided with a detailed explanation of the study's purpose, procedures, potential risks, and benefits before data collection. Written guardian consent and adolescent assent were obtained. Participants were informed of their right to withdraw at any stage or skip any question without any consequences.

Confidentiality was maintained by assigning coded identifiers to all responses. No personal or identifying information was included in reports, and data were used solely for academic research purposes.

3.7 Data Analysis

The data of the present study was analyzed with the help of the Statistical Package for Social Sciences (SPSS). Prior to conducting the main analyses, descriptive statistics were computed to assess the distribution of the data. Normality of the data was examined through skewness, kurtosis, Kolmogorov–Smirnov test, and visual inspection of histograms. Although the Kolmogorov–Smirnov test indicated significant results, the values of skewness and kurtosis were within acceptable limits; therefore, parametric statistical tests were applied. In order to assess the reliability of the instruments used in the study, Cronbach's alpha coefficient was calculated for all scales. To examine the relationships among the study variables, Pearson product–moment correlation analysis was conducted. The correlation table included descriptive statistics along with the relationships between gaming addiction, aggression, sedentary behavior, and sleep quality. In the correlation table, ** indicates a highly significant relationship, while * indicates a significant relationship. Furthermore, mediation analyses were conducted using bootstrap

analysis through Hayes' PROCESS Macro (Model 4) in SPSS to examine whether sedentary behavior mediates the relationship between gaming addiction and aggression, as well as between gaming addiction and sleep quality. The mediation results were reported in the corresponding tables, including regression coefficients, standard errors, t-values, p-values, and 95% bootstrap confidence intervals. The results of all statistical analyses are presented in the following tables. The findings are reported sequentially in relation to each of the proposed hypotheses of the study.

Chapter 4

Results

This chapter presents the findings of the study, including analysis of descriptive statistics, correlation analyses, and mediation analysis. Before conducting main analyses, descriptive statistics were computed to assess the distribution of the data. Normality of the data was examined through skewness, kurtosis, Kolmogorov–Smirnov test, and visual inspection of histograms. The Kolmogorov–Smirnov test indicated that data is non-normally distributed therefore, non-parametric statistical tests were applied. In order to assess the reliability of the instruments used in the study, Cronbach’s alpha coefficient was calculated for all scales. To examine the relationships among the study variables, spearman correlation analysis was conducted. The correlation table included the relationships between gaming addiction, aggression, sedentary behavior, and sleep quality. In the correlation table, ** indicates a highly significant relationship, while * indicates a significant relationship. Furthermore, mediation analyses were conducted using bootstrap analysis through Hayes’ PROCESS Macro (Model 4) in SPSS to examine whether sedentary behavior mediates the relationship between gaming addiction and aggression, as well as between gaming addiction and sleep quality. The mediation results were reported in the corresponding tables, including regression coefficients, standard errors, t-values, p-values, and 95% bootstrap confidence intervals. The results of all statistical analyses are presented in the following tables. The findings are reported sequentially in relation to each of the proposed hypotheses of the study.

TABLE 4.1: Demographic Characteristics of Participants (N=300)

Variable	Category	F	(%)
Age (years)	12–14	96	32.0
	15–18	204	67.7
Gender	Male	167	55.7
	Female	133	44.3
City	Rawalpindi	186	62.0
	Islamabad	114	38.0
Family Structure	Nuclear	138	46.0
	Joint	117	39.0
	Single parent	45	15.0
Socioeconomic Status	Lower	51	17.0
	Middle	184	61.3
	Upper	62	20.7

Note: f = frequency; % = percentage.

Table 4.1 Table 4.1 presents the demographic characteristics of the study participants ($N = 300$). In terms of age distribution, 96 participants (32.0%) were aged 12–14 years, while 204 participants (68.0%) belonged to the 15–18 years' age group. Regarding gender, 167 respondents (55.7%) were male and 133 (44.3%) were female. With respect to city of residence, 186 participants (62.0%) were from Rawalpindi, whereas 114 participants (38.0%) were from Islamabad. The analysis of family structure indicates that 138 participants (46.0%) belonged to nuclear families, 117 (39.0%) to joint families, and 45 (15.0%) to single-parent families. Regarding socioeconomic status, the majority of participants were from a middle socioeconomic background ($f = 185$, 61.7%), followed by upper socioeconomic status ($f = 63$, 21.0%), and lower socioeconomic status ($f = 52$, 17.3%).

TABLE 4.2: Means, Standard Deviations, Skewness, Kurtosis, and Kolmogorov–Smirnov Statistics for Gaming Addiction, Sedentary Behavior, Aggression, and Sleep Quality Scales

Variable	M	SD	Sk	Kurt	Min	Max	K-S	<i>P</i>
Gaming Addiction	41.91	13.44	-0.03	-0.47	21–105	12–89	.68	.001
Sedentary Behaviors	9.21	7.23	1.42	3.89	0–50	0–45	.78	.000
Aggression	94.95	26.76	0.92	1.98	29–203	29–181	.76	.001
Sleep Quality	47.53	13.31	0.31	-0.72	19–95	21–75	.72	.000

Note: M = Mean, SD = Standard Deviation, Sk = Skewness, Kurt = Kurtosis, Min = Minimum, Max = Maximum, K-S = Kolmogorov–Smirnov.

Table 4.2 explains the descriptive statistics for gaming addiction, sedentary behaviors, aggression, and sleep quality, including measures of central tendency, variability, distribution shape, and normality. Participants reported moderate levels of gaming addiction ($M = 41.91$, $SD = 13.44$) and sleep quality ($M = 47.53$, $SD = 13.31$), lower levels of sedentary behaviors ($M = 9.21$, $SD = 7.23$), and relatively higher levels of aggression ($M = 94.95$, $SD = 26.76$). Skewness values indicate that gaming addiction ($Sk = -0.03$) and sleep quality ($Sk = 0.31$) approximated a normal distribution, whereas sedentary behaviors ($Sk = 1.42$) and aggression ($Sk = 0.92$) displayed positive skewness, suggesting that a larger proportion of participants scored at the lower end of these scales. Kurtosis values revealed that gaming

addiction (Kurt = -0.47) and sleep quality (Kurt = -0.72) were relatively normally distributed, while sedentary behaviors (Kurt = 3.89) and aggression (Kurt = 1.98) showed leptokurtic distributions, indicating more peaked distributions with heavier tails.

The Kolmogorov–Smirnov (K–S) test indicated that all study variables deviated significantly from normality ($p < .001$). The K–S statistic values ranged from 0.68 to 0.78, with sedentary behaviors (K–S = 0.78, $p < .001$) showing the highest deviation from normality, followed by aggression (K–S = 0.76, $p < .001$) and gaming addiction (K–S = 0.68, $p < .001$). Sleep quality exhibited the lowest deviation from normality (K–S = 0.72, $p < .001$). Although the data were not perfectly normal, the distributions were considered approximately normal given the sample size, allowing for parametric analyses to be conducted. The following figures, **figure 4.1** and **4.2** shows the distribution of Aggression Questionnaire and Pittsburgh Sleep Quality Index.

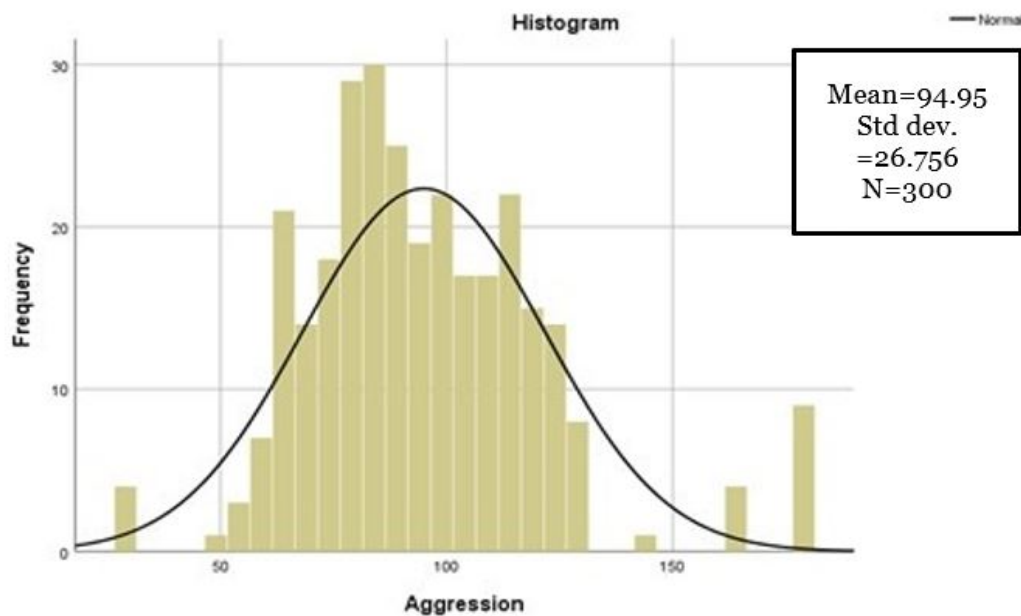


FIGURE 4.1: Histogram showing the distribution of Peer Victimization scores

The histogram of aggression scores demonstrates a generally normal distribution with a slight positive skew. All potential outliers were reviewed to assess whether they resulted from data entry mistakes or reflected actual participant responses. Based on this evaluation, the extreme values were identified as valid observations

rather than errors. In behavioral research, particularly in areas such as aggression, the occurrence of higher scores is expected due to natural individual differences among participants. Furthermore, these values do not significantly influence the overall distribution, as most scores are concentrated around the central range. Considering the relatively large sample size ($N = 300$), the statistical analyses are unlikely to be adversely affected by a limited number of extreme cases.

For these reasons, all data points were retained to ensure that the variability and authenticity of the dataset were preserved. This decision aligns with established methodological recommendations, which suggest that valid extreme values should only be excluded when there is clear evidence that they distort the results (Tabachnick & Fidell, 2013; Field, 2018).

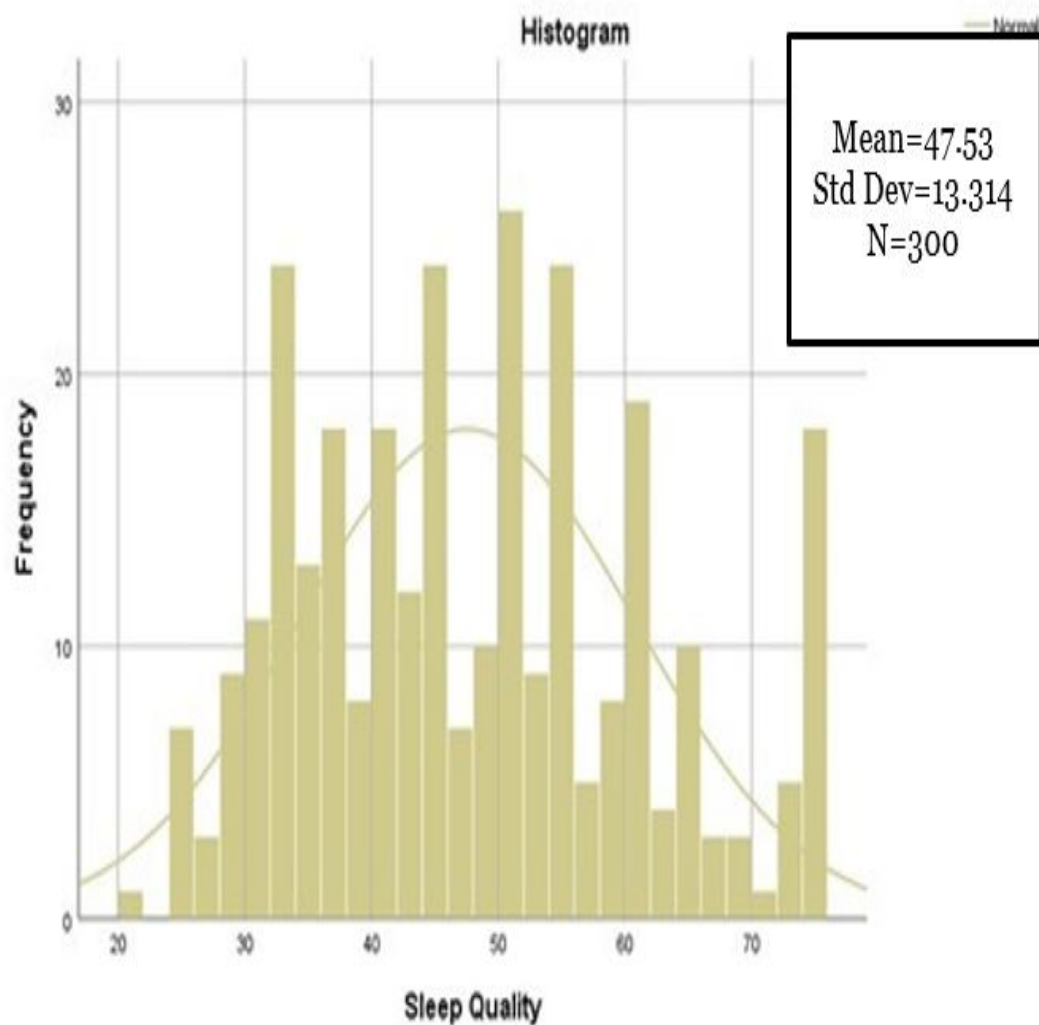


FIGURE 4.2: Normality distribution of score across Sleep Quality Scale

TABLE 4.3: Cronbach's Alpha Reliability of Problematic Online Gaming Questionnaire, Adolescent Sedentary Activity Questionnaire, Aggression Questionnaire, and Pittsburgh Sleep Quality Index

Scales	N	M	SD	α	Potential Range	Actual Range
Problematic Online Gaming Questionnaire	21	41.91	13.44	0.89	21–105	12–89
Adolescent Sedentary Activity Questionnaire	10	9.21	7.23	0.76	0–50	0–45
Aggression Questionnaire	29	94.95	26.76	0.91	29–203	29–181
Pittsburgh Sleep Quality Index	19	47.53	13.31	0.78	19–95	21–75

Note: POGQ = Problematic Online Gaming Questionnaire; ASAQ = Adolescent Sedentary Activity Questionnaire; AQ = Aggression Questionnaire; PSQI = Pittsburgh Sleep Quality Index; N = number of items; α = Cronbach's alpha.

Table 4.3 presents the reliability analyses of the measurement scales used in the study among adolescents, indicating satisfactory to excellent internal consistency across all instruments. The Problematic Online Gaming Questionnaire demonstrated high reliability ($\alpha = .89$), suggesting that the 21 items consistently measure the construct of gaming addiction. Similarly, the Aggression Questionnaire showed excellent internal consistency ($\alpha = .91$), indicating a strong level of coherence among its 29 items in assessing aggressive behaviors. The Adolescent Sedentary Activity Questionnaire yielded acceptable reliability ($\alpha = .76$), reflecting a reasonable level of consistency in measuring sedentary behaviors. Likewise, the Pittsburgh Sleep Quality Index exhibited good reliability ($\alpha = .78$), supporting its adequacy in assessing sleep quality among adolescents. Overall, these Cronbach's alpha values confirm that all scales used in the study are reliable and suitable for further statistical analyses.

TABLE 4.4: Correlations of Problematic Online Gaming Questionnaire, Adolescent Sedentary Activity Questionnaire, Aggression Questionnaire, and Pittsburgh Sleep Quality Index (N = 300)

Variables	1	2	3	4
1. Gaming Addiction	-			
2. Aggression	0.511**	-		
3. Sleep Quality	0.566**		-	
4. Sedentary Behavior	0.286**			-

Note: *p < 0.05; **p < 0.01 (2-tailed).

Table 4.4 presents the Spearman's rank-order correlations among problematic online gaming, aggression, sleep quality, and sedentary behavior for a sample of 300 adolescents. The analysis revealed that problematic online gaming was significantly positively correlated with aggression, poor sleep quality, and sedentary behavior. A moderate positive correlation was observed between gaming addiction and aggression ($\rho = .44$, $p \leq .01$), indicating that adolescents who reported higher levels of problematic gaming were more likely to exhibit aggressive behaviors. This suggests that excessive engagement in online gaming may contribute to increased irritability, impulsivity, and behavioral dysregulation among adolescents. Furthermore, gaming addiction showed a significant positive relationship with sleep quality ($\rho = .37$, $p \leq .01$). Given that higher scores on the sleep quality scale indicate poorer sleep, this finding implies that adolescents with higher levels of gaming addiction tend to experience more sleep disturbances, such as difficulty initiating sleep, shorter sleep duration, and disrupted sleep patterns. This supports previous research suggesting that prolonged gaming, especially during late hours, interferes with healthy sleep cycles.

In addition, a positive correlation was found between gaming addiction and sedentary behavior ($\rho = .29$, $p \leq .01$). Although this relationship is relatively weaker compared to aggression and sleep quality, it still indicates that adolescents engaged in problematic gaming are more likely to adopt sedentary lifestyles, including prolonged sitting and reduced physical activity.

Moreover, aggression was also significantly positively correlated with sleep quality ($\rho = .68, p < .01$), suggesting that higher levels of aggression are associated with poorer sleep outcomes. Similarly, aggression showed a moderate positive association with sedentary behavior ($\rho = .51, p < .01$), indicating that more aggressive adolescents may also engage in higher levels of inactivity.

Sleep quality was further found to have a significant positive correlation with sedentary behavior ($\rho = .57, p < .01$), implying that adolescents with poorer sleep quality are more likely to exhibit sedentary patterns of behavior.

All correlations were statistically significant at the 0.01 level, demonstrating strong and consistent relationships among the variables. Overall, these findings suggest that problematic online gaming is associated with a range of negative psychological and behavioral outcomes, including increased aggression, poorer sleep quality, and greater sedentary behavior. This highlights the multifaceted impact of gaming addiction on adolescents' mental health and lifestyle patterns.

Overall, the findings of the present study indicate that problematic online gaming is significantly associated with increased aggression, poorer sleep quality, and greater sedentary behavior among adolescents. The positive correlations among all study variables suggest that excessive engagement in online gaming may negatively influence adolescents' emotional regulation, behavioral patterns, and overall well-being. In particular, adolescents with higher levels of gaming addiction were more likely to experience aggressive tendencies, sleep disturbances, and reduced physical activity, highlighting the multidimensional impact of problematic gaming on psychological and lifestyle outcomes.

Furthermore, the strong associations between aggression, poor sleep quality, and sedentary behavior emphasize the interconnected nature of adolescents' mental and physical health. These findings suggest that unhealthy gaming behaviors may contribute to broader psychosocial difficulties that affect daily functioning and healthy development. Therefore, there is a need for parents, educators, and mental health professionals to promote balanced gaming habits, healthy sleep routines, and physically active lifestyles among adolescents.

TABLE 4.5: Mediation Analysis of Sedentary Behavior in the Relationship between Problematic Online Gaming and Aggression (N = 300)

Path	Predictor → Outcome	B	SE	t	p	95% CI	
						LL	UL
A	POGQ_TOT → ASAQ_TOT	0.117	0.030	3.85	<0.001	0.057	0.177
B	ASAQ_TOT → AQ_TOTAL	0.831	0.185	4.49	<0.001	0.467	1.196
C	POGQ_TOT → AQ_TOTAL (Total Effect)	0.985	0.100	9.83	<0.001	0.788	1.182
c'	POGQ_TOT → AQ_TOTAL (Direct Effect)	0.888	0.100	8.92	<0.001	0.692	1.084

Note: POGQ_TOT = Problematic Online Gaming total score; ASAQ_TOT = Aggression total score; PSQI_TOTAL = Sleep Quality total Score.

The mediation analysis using PROCESS Model 4 indicated that problematic on-line gaming (POGQ_TOT) had a significant positive total effect on aggression (AQ_TOTAL), explaining 24.5% of the variance ($R^2 = .245$, $p < .001$). When the mediator, sedentary behavior (ASAQ_TOT), was included in the model, the direct effect of problematic gaming on aggression remained significant but was reduced (from $B = .985$ to $B = .888$), suggesting partial mediation.

Problematic gaming significantly predicted sedentary behavior ($B = .117$, $p < .001$), and sedentary behavior, in turn, significantly predicted aggression ($B = .831$, $p < .001$). The indirect effect of problematic gaming on aggression through sedentary behavior was significant ($B = .097$), as the 95% bootstrap confidence interval did not include zero [0.044, 0.171], confirming the presence of a mediation effect.

Overall, these findings suggest that higher levels of problematic gaming are associated with increased aggression both directly and indirectly through increased sedentary behavior, highlighting sedentary behavior as a meaningful psychological mechanism linking gaming addiction to aggressive outcomes.

Table 4.5 shows that gaming addiction had a significant total effect on aggression ($B = .985$, $p < .001$). When sedentary behavior was included as a mediator, the direct effect of gaming addiction on aggression remained significant but was reduced ($B = .888$, $p < .001$), indicating partial mediation.

Gaming addiction significantly predicted sedentary behavior ($B = .117$, $p < .001$), and sedentary behavior, in turn, significantly predicted aggression ($B = .831$, $p < .001$). The indirect effect of gaming addiction on aggression through sedentary behavior was significant ($B = .097$), with the 95% bootstrap confidence interval not including zero [0.044, 0.171]. Overall, the mediation analysis demonstrated that sedentary behavior partially mediates the relationship between problematic online gaming and aggression among adolescents. Problematic gaming directly increased aggression and also indirectly contributed to it through increased sedentary activity, highlighting sedentary behavior as an important mechanism linking gaming addiction with aggression.

TABLE 4.6: Mediation Analysis of Sedentary Behavior in the Relationship between Problematic Online Gaming Addiction and Sleep Quality (N = 300)

Path	Predictor → Outcome	B	SE	t	p	95% CI	
						LL	UL
Total Effect (<i>c</i>)	POGQ_TOT → PSQI_TOT	0.557	0.047	11.729	0.000	0.463	0.650
Direct Effect (<i>c'</i>)	POGQ_TOT → PSQI_TOT	0.524	0.048	10.929	0.000	0.429	0.618
Indirect Effect (<i>a × b</i>)	POGQ_TOT → ASAQ_TOT → PSQI_TOT	0.033	0.012	–	–	0.012	0.060
Mediator Path (<i>a</i>)	POGQ_TOT → ASAQ_TOT	0.117	0.030	3.851	0.000	0.057	0.177
Mediator Path (<i>b</i>)	ASAQ_TOT → PSQI_TOT	0.284	0.089	3.184	0.002	0.108	0.459

Note: POGQ_TOT = Problematic Online Gaming total score; ASAQ_TOT = Agression score; PSQI_TOT = Sleep Quality total score.

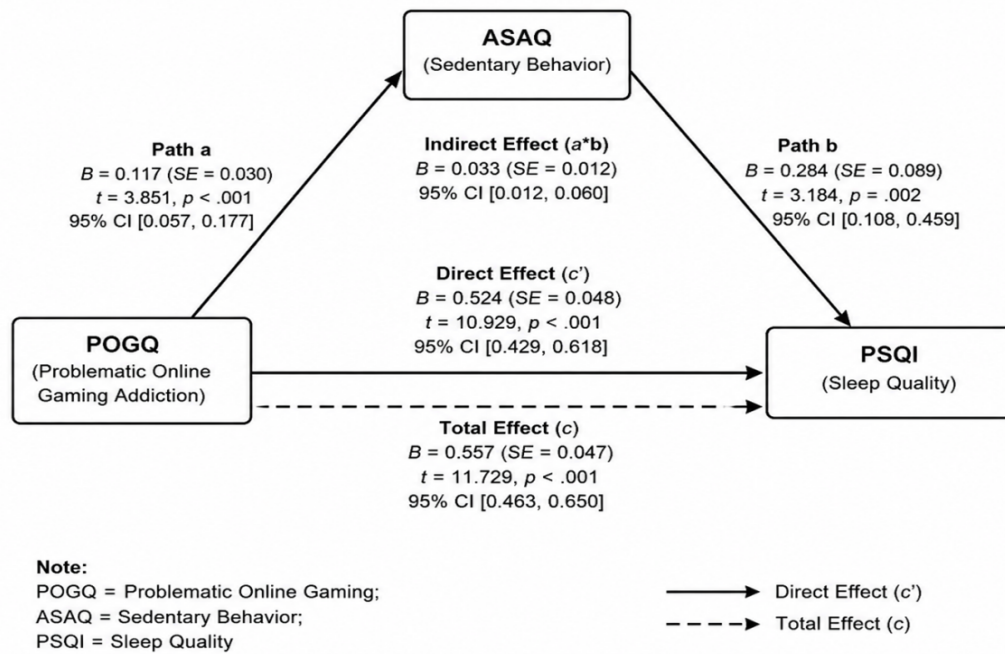


FIGURE 4.3: Path Diagram of Sedentary Behavior in the Relationship between Problematic Online Gaming Addiction and Sleep Quality

The mediation analysis examined whether aggression (ASAQ_TOT) mediated the relationship between gaming addiction (POGQ_TOT) and sleep quality (PSQI_TOT) among adolescents ($N = 300$). The total effect of gaming addiction on sleep quality (path c) was significant ($B = 0.557$, $SE = 0.047$, $t = 11.729$, $p < .001$, 95% CI [0.463, 0.650]), indicating that higher gaming addiction is associated with poorer sleep quality. When aggression was included as a mediator, the direct effect of gaming addiction on sleep quality (path c') remained significant ($B = 0.524$, $SE = 0.048$, $t = 10.929$, $p < .001$, 95% CI [0.429, 0.618]), while the indirect effect through aggression (path a*b) was small but significant ($B = 0.033$, $BootSE = 0.012$, 95% CI [0.012, 0.060]). The mediator paths showed that gaming addiction significantly predicted aggression (patha: $B = 0.117$, $SE = 0.030$, $t = 3.851$, $p < .001$, 95% CI [0.057, 0.177]), and aggression turn, significantly predicted poorer sleep quality (pathb: $B = 0.284$, $SE = 0.089$, $t = 3.184$, $p = .002$, 95% CI [0.108, 0.459]). These results indicate that aggression partially mediates the relationship between gaming addiction and sleep quality, suggesting that gaming addiction contributes to poorer sleep both directly and indirectly by increasing aggressive tendencies. Overall, aggression accounts for a modest but significant portion of the effect,

highlighting the role of emotional and behavioral factors in sleep disturbances associated with gaming addiction.

Table 4.6 shows that gaming addiction had a significant total effect on sleep quality ($B = .557, p < .001$), indicating that higher gaming addiction was associated with poorer sleep quality. After including sedentary behavior as a mediator, the direct effect remained significant but decreased in magnitude ($B = .524, p < .001$), suggesting partial mediation. Gaming addiction significantly predicted sedentary behavior ($B = .117, p < .001$), and sedentary behavior significantly predicted poorer sleep quality ($B = .284, p = .002$). The indirect effect of gaming addiction on sleep quality through sedentary behavior was significant ($B = .033$), with a 95% bootstrap confidence interval [.012, .060] that did not include zero. These results indicate that sedentary behavior partially mediates the association between gaming addiction and sleep quality among adolescents.

Chapter 5

Discussion and Conclusion

5.1 Discussion

The present study aimed to investigate the psychological and behavioral consequences of gaming addiction among adolescents, particularly examining its relationship with sedentary behaviors, aggression, and sleep quality. The focus of present study was to determine whether sedentary behaviors act as a mediating mechanism through which gaming addiction influences psychological outcomes. Moreover, the study also sought to explore how excessive gaming contributes to emotional dysregulation and disturbed daily functioning in adolescents within the local Pakistani context (PJNS, 2024).

The first hypothesis examined that gaming addiction would be positively associated with sedentary behavior. The results supported this hypothesis, showing a significant positive correlation ($\rho = .286$, $p < .01$). This indicates that adolescents with higher tendencies toward problematic gaming spend more time engaged in low-energy, screen-based activities, thereby reducing participation in physical activity. This finding is consistent with prior studies demonstrating that prolonged gaming contributes to sedentary lifestyles, which are risk factors for obesity, poor cardiovascular health, and reduced psychosocial well-being in adolescents (Stiglic & Viner, 2019; Saunders et al., 2020). From a theoretical perspective, this finding aligns with the displacement hypothesis, which suggests that time spent on digital activities such as gaming may replace other health-promoting behaviors, including

physical exercise and outdoor play (Sigman, 2012). In the Pakistani context, where urban adolescents often have limited opportunities for structured recreational activities, excessive gaming may exacerbate sedentary patterns, further contributing to health risks.

The second hypothesis examined whether gaming addiction would be positively associated with aggression. The findings indicated a moderate positive correlation ($\rho = .511$, $p < .01$), confirming that adolescents with higher levels of gaming addiction are more likely to exhibit aggressive behaviors. These results are consistent with the General Aggression Model (GAM; Anderson & Bushman, 2002), which posits that exposure to violent or competitive gaming environments can increase aggressive thoughts, feelings, and behaviors through heightened arousal, desensitization, and impaired self-regulation. Previous empirical studies support this relationship, suggesting that problematic gaming is linked to both reactive and proactive aggression in adolescents (Anderson et al., 2017; Gentile et al., 2019). Within the present sample, the moderate correlation suggests that while gaming is a significant predictor of aggression, other contextual and individual factors—such as family environment, peer influences, and personality traits—may also contribute. These findings highlight the importance of addressing behavioral regulation in adolescents who engage in high levels of gaming.

The third hypothesis proposed a negative association between gaming addiction and sleep quality. Consistent with this hypothesis, gaming addiction showed a strong positive correlation with poor sleep quality ($\rho = .566$, $p < .01$), indicating that adolescents with higher levels of gaming addiction experience more sleep disturbances. This finding corroborates previous research showing that prolonged screen exposure, particularly before bedtime, delays sleep onset, reduces total sleep time, and disrupts circadian rhythms (Hale & Guan, 2015; Chaput et al., 2019). The mechanisms underlying this relationship may include heightened physiological and cognitive arousal due to stimulating gaming content, exposure to blue light affecting melatonin production, and displacement of bedtime routines. Poor sleep, in turn, is associated with a range of negative outcomes, including impaired cognitive functioning, emotional dysregulation, and increased risk of depressive and

anxiety symptoms (Lo et al., 2016). These results suggest that interventions targeting gaming behaviors should also consider strategies to improve sleep hygiene among adolescents.

The fourth hypothesis (H4a) examined whether sedentary behavior mediates the relationship between gaming addiction and aggression. Mediation analyses indicated partial mediation, suggesting that gaming addiction contributes to aggression both directly and indirectly through increased sedentary behavior. Specifically, adolescents with higher gaming addiction engaged in more sedentary behaviors, which in turn were associated with higher aggression levels. This finding is consistent with research demonstrating that sedentary lifestyles are linked with poor mood regulation, irritability, and increased externalizing behaviors in youth (Biddle & Asare, 2011). Sedentary behavior may reduce opportunities for physical activity that help regulate arousal and stress, exacerbating aggressive tendencies. In the Pakistani context, adolescents may face structural barriers to engaging in outdoor physical activities, such as limited recreational spaces, parental restrictions, or high academic demands, which may amplify the negative impact of gaming-related sedentary behavior on aggression.

The fifth hypothesis (H4b) proposed that sedentary behavior would mediate the relationship between gaming addiction and sleep quality. Mediation analyses revealed partial mediation, with sedentary behavior significantly linking gaming addiction to poorer sleep outcomes. Adolescents with higher gaming addiction tended to spend more time in sedentary activities, which was associated with greater sleep disturbances. These results support evidence suggesting that physical inactivity negatively affects sleep quality by reducing sleep drive and altering circadian patterns (Kredlow et al., 2015).

Sedentary behavior may also indirectly affect sleep by increasing daytime fatigue, disrupting energy balance, and reinforcing irregular sleep-wake patterns. The findings underscore the role of lifestyle behaviors as mechanisms linking gaming addiction with sleep impairment and highlight the importance of encouraging physical activity to promote better sleep in adolescents.

Collectively, the findings indicate that gaming addiction is associated with multiple interrelated behavioral and psychological outcomes, including increased aggression, poorer sleep quality, and higher sedentary behavior. The mediation results highlight sedentary behavior as a critical behavioral mechanism linking gaming addiction with aggression and sleep disturbances. These results emphasize that the consequences of problematic gaming extend beyond emotional and cognitive domains, affecting adolescents' daily routines, physical activity levels, and overall health. The study also provides valuable context for Pakistani adolescents, a population for which research on gaming-related behavioral outcomes is limited. The findings suggest that interventions aimed at reducing gaming addiction should simultaneously address sedentary behavior, aggression, and sleep hygiene to maximize effectiveness. Strategies may include promoting structured recreational activities, encouraging regular physical activity, implementing school-based awareness programs, and providing guidance for healthy gaming habits.

5.2 Conclusion

The present study investigated the psychological and behavioral consequences of gaming addiction among adolescents, with particular emphasis on the mediating role of sedentary behavior in the relationships between gaming addiction, aggression, and sleep quality. The findings provide substantial empirical support for the growing body of literature suggesting that excessive and uncontrolled engagement in digital gaming is not merely a recreational concern but a significant public health issue affecting adolescents' emotional, behavioral, and physiological well-being (Pakistan Journal of Neurological Sciences [PJNS], 2024; Stiglic & Viner, 2019).

The results demonstrated a significant positive association between gaming addiction and sedentary behavior, reinforcing existing evidence that screen-based activities displace physical movement and active lifestyles among young individuals (Saunders et al., 2020). Adolescents who spend prolonged hours gaming are more likely to engage in low-energy, prolonged sitting behaviors, which contribute

to broader health concerns such as reduced physical fitness, metabolic risks, and psychological distress.

A strong positive relationship was also found between gaming addiction and aggression. This finding aligns with the General Aggression Model (GAM) proposed by Anderson and Bushman (2002), which explains how repeated exposure to violent or competitive gaming environments may influence cognitive scripts, emotional arousal, and behavioral responses, ultimately increasing aggressive tendencies. Similar findings reported by Gentile et al. (2019) further support the notion that excessive gaming can shape maladaptive behavioral patterns through repeated reinforcement of aggressive thoughts and reactions.

Moreover, the study revealed a significant association between gaming addiction and poor sleep quality. This supports earlier research demonstrating that prolonged screen exposure, particularly before bedtime, disrupts circadian rhythms, suppresses melatonin production, and leads to delayed sleep onset and poor sleep hygiene among adolescents (Hale & Guan, 2015; Chaput et al., 2019). Poor sleep, in turn, has been linked to emotional dysregulation, irritability, and impaired cognitive functioning, thereby compounding the psychological risks associated with excessive gaming.

A key contribution of this study lies in identifying sedentary behavior as a mediating variable that explains how gaming addiction indirectly contributes to increased aggression and sleep disturbances. This mediating role is consistent with the literature emphasizing how physical inactivity contributes to psychological distress, mood disturbances, and sleep problems (Biddle & Asare, 2011; Kredlow et al., 2015). By establishing this mediational pathway, the study highlights that gaming addiction affects adolescents not only directly but also indirectly through lifestyle patterns characterized by inactivity and prolonged sitting.

Furthermore, the findings were interpreted through the lens of Self-Determination Theory (SDT) (Deci & Ryan, 2000), which posits that unmet psychological needs for autonomy, competence, and relatedness may drive adolescents toward excessive gaming as a compensatory behavior. This theoretical integration strengthens the

understanding of gaming addiction as a multidimensional phenomenon influenced by psychological needs, behavioral patterns, and physiological outcomes.

5.3 Limitations

Despite its contributions, several limitations must be acknowledged:

- i. The use of self-report measures may introduce recall bias and social desirability bias.
- ii. The sample was limited to Rawalpindi and Islamabad, affecting generalizability.
- iii. The cross-sectional design restricts causal interpretations.

Future research should incorporate longitudinal designs, larger and more diverse samples, and qualitative approaches to gain deeper insights into adolescents' gaming experiences.

5.4 Research Implications

This study will provide valuable insights into how online gaming affects adolescents' mental health and behavioral patterns, including aggression, sleep quality, and sedentary lifestyles. It highlights the importance of balancing screen time with physical activity and adequate sleep to maintain emotional and psychological well-being. The research also aims to increase awareness among adolescents, parents, and educators regarding responsible gaming habits. Based on the findings, preventive strategies can be developed by identifying key risk factors such as excessive gaming and prolonged inactivity. Schools and families can implement structured programs to limit gaming, promote physical activity, and encourage healthy sleep routines, while mental health professionals can design targeted behavioral or educational interventions to address aggression and poor sleep. The study also contributes to theoretical understanding by applying Self-Determination Theory (SDT), demonstrating how unmet needs for autonomy, competence, and relatedness may drive excessive gaming. Examining sedentary behavior as a mediating factor clarifies the underlying mechanisms linking gaming addiction to

psychological and physical outcomes, laying the groundwork for future research on adolescent gaming in Pakistan.

5.5 Recommendations

Based on the findings and limitations of the present study, several recommendations can be proposed for future research related to gaming addiction, aggression, sleep quality, and sedentary behavior.

- i. Future research should adopt longitudinal and multi-method research designs to examine the temporal and developmental relationships between gaming addiction, aggression, sleep quality, and sedentary behavior. Following adolescents and young adults over extended periods would help clarify causal pathways and reciprocal effects, offering stronger evidence than cross-sectional associations regarding how excessive gaming influences emotional regulation, sleep patterns, and behavioral outcomes over time.
- ii. Subsequent studies should incorporate qualitative methodologies, such as in-depth interviews, focus groups, or narrative approaches, to capture culturally grounded experiences of gaming behavior in Pakistan. Given that gaming practices, family supervision, and leisure norms are culturally embedded, qualitative data may enhance contextual sensitivity and provide richer insights into motivations, perceived benefits, and psychosocial consequences of excessive gaming that may not be fully captured through self-report scales alone.
- iii. The demographic scope of future research should be broadened to include participants from rural areas, diverse socioeconomic backgrounds, and different educational settings. Including underrepresented populations would offer a more comprehensive understanding of how sociocultural and economic factors shape gaming behavior, physical activity levels, sleep habits, and aggression. Comparative studies across urban–rural contexts or provinces may further identify context-specific risk and protective factors.
- iv. Future studies should examine potential psychological mediators and moderators in the relationship between gaming addiction and behavioral outcomes.

Variables such as emotion regulation, impulsivity, coping strategies, peer influence, parental monitoring, and social support may help explain individual differences in vulnerability or resilience. Identifying these mechanisms can contribute to theoretical refinement and inform more targeted intervention strategies.

- v. The clinical implications of the findings warrant particular attention. Mental health professionals working with adolescents and young adults should routinely assess gaming habits, sleep quality, and physical activity levels during psychological evaluations. Integrating psychoeducation about healthy gaming limits, sleep hygiene, and emotional regulation into counseling and school-based mental health services may help reduce aggression and improve overall well-being.
- vi. Intervention programs should move beyond individual-level approaches and consider family- and school-based strategies. The interconnectedness observed among gaming addiction, sleep disruption, sedentary behavior, and aggression suggests that collaborative interventions involving parents, teachers, and peers may be more effective.
- vii. Future research should explore resilience and protective factors among individuals who engage in gaming but do not exhibit problematic behaviors or adverse psychological outcomes. Factors such as balanced leisure routines, strong family bonds, religious or cultural values, physical activity engagement, and emotional intelligence may buffer against the negative effects of excessive gaming. Understanding these strengths can support the development of culturally congruent prevention programs.
- viii. Academic, clinical, and policy-level collaboration is recommended to design culturally sensitive guidelines and intervention manuals addressing gaming addiction in Pakistan. Such resources may integrate research evidence with practical strategies for promoting healthy digital habits, physical activity, sleep regulation, and emotional well-being. These initiatives could be implemented in schools, universities, and community mental health settings to mitigate the rising impact of problematic gaming behaviors.

Bibliography

- Ahmer, Z., Shafique, M. A., Haseeb, A., Mazhar, R., Khan, L., and Ahmed, F. (2023). How common is internet gaming addiction among undergraduates of health sciences programs? *Pakistan Journal of Medical Sciences*, 39(1):142–147.
- Alghamdi, M. (2014a). The relationship between gaming addiction and sleep quality among adolescents. *International Journal of Psychology and Behavioral Sciences*, 4(6):223–230.
- Alghamdi, S. (2014b). The effect of screen use on sleep quality among adolescents. *Journal of Sleep Research*, 23(4):1–8.
- Alimoradi, Z., Broström, A., Tsang, H. W., Griffiths, M. D., Haghayegh, S., Ohayon, M. M., Lin, C.-Y., and Pakpour, A. H. (2021). Sleep problems during covid-19 pandemic and its association to psychological distress: A systematic review and meta-analysis. *EClinicalMedicine*, 36:100916.
- Ambreen, F., Fatima, A., and Amin, R. (2024). Internet gaming disorder and mental health of pakistani adolescents: A cross-sectional study. *Qlantic Journal of Social Sciences*, 5(2):13–25.
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders*. American Psychiatric Publishing, 5th edition.
- American Psychiatric Association (2022). *Diagnostic and statistical manual of mental disorders*. American Psychiatric Publishing, 5th ed., text rev. edition.
- Anderson, C. A. and Bushman, B. J. (2001). Effects of violent video games on aggressive behaviour, aggressive cognition, aggressive affect, physiological

- arousal, and prosocial behaviour: A meta-analytic review. *Psychological Science*, 12(5):353–359.
- Anderson, C. A. and Bushman, B. J. (2002). Human aggression. *Annual Review of Psychology*, 53(1):27–51.
- Anderson, C. A., Gentile, D. A., and Buckley, K. E. (2017). *Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review*. Springer.
- Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., Rothstein, H. R., and Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychological Bulletin*, 136(2):151–173.
- Baron, R. A. and Branscombe, N. R. (2012). *Social psychology*. Pearson, 13th edition.
- Baum, K. T., Desai, A., Field, J., Miller, L. E., Rausch, J., and Beebe, D. W. (2014). Sleep restriction worsens mood and emotion regulation in adolescents. *Journal of Child Psychology and Psychiatry*, 55(2):180–190.
- Biddle, S. J. H. and Asare, M. (2011). Physical activity and mental health in children and adolescents: A review of reviews. *British Journal of Sports Medicine*, 45(11):886–895.
- Buss, A. H. and Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, 63(3):452–459.
- Buyse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., and Kupfer, D. J. (1989). The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2):193–213.
- Cain, N. and Gradisar, M. (2010). Electronic media use and sleep in adolescents. *Sleep Medicine*, 11(8):735–742.
- Carskadon, M. A. (2011). Sleep in adolescents. *Sleep Medicine Clinics*, 6(1):1–11.

- Carson, V., Hunter, S., Kuzik, N., Gray, C. E., Poitras, V. J., Chaput, J.-P., and Tremblay, M. S. (2016). Systematic review of sedentary behaviour and health indicators. *Applied Physiology, Nutrition, and Metabolism*, 41(6 Suppl 3):S240–S265.
- Casey, B. J., Duhoux, S., and Cohen, M. M. (2010). Adolescence: What do transmission, transition, and translation have to do with it? *Neuron*, 67(5):749–760.
- Chaput, J.-P., Gray, C. E., Poitras, V. J., Carson, V., Gruber, R., Olds, T., Weiss, S. K., and Tremblay, M. S. (2019). Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism*, 44(6):617–632.
- Crowley, S. J., Acebo, C., and Carskadon, M. A. (2018). Sleep, circadian rhythms, and delayed phase in adolescence. *Sleep Medicine*, 1(2):29–38.
- Cudney, R., Alghamdi, M., and Smith, L. (2022a). Digital media use and adolescent sleep and daytime functioning. *Journal of Adolescent Health*, 70(6):882–895.
- Cudney, S. A. et al. (2022b). Sleep quality and emotional regulation in adolescents. *Journal of Adolescent Health*, 70(3):456–463.
- Deci, E. L. and Ryan, R. M. (2000). The what and why of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4):227–268.
- Deci, E. L. and Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation. *Canadian Psychology*, 49(3):182–185.
- Demetrovics, Z., Urbán, R., Nagygyörgy, K., Farkas, J., Zilahy, D., Mervó, B., and Harmath, E. (2012). The development of the problematic online gaming questionnaire. *Cyberpsychology, Behavior, and Social Networking*, 15(3):141–149.
- Exelmans, L. and Van den Bulck, J. (2015). Sleep research and media use: A review. *Sleep Medicine Reviews*, 21:50–58.

- Exelmans, L. and Van den Bulck, J. (2017). Bedtime mobile gaming and sleep. *Journal of Sleep Research*, 26(4):480–488.
- Fabbri, M., Beracci, A., Martoni, M., Meneo, D., Tonetti, L., and Natale, V. (2021). Measuring sleep quality in adolescents: A review. *Sleep Medicine*, 80:198–210.
- Fabbri, M. e. a. (2021). Sleep deprivation and cognitive-emotional functioning. *Nature Reviews Neuroscience*, 22(1):1–15.
- Gentile, D. A., Coyne, S., and Walsh, D. A. (2011). Media violence, physical aggression, and relational aggression in adolescents. *Aggressive Behavior*, 37(2):193–206.
- Griffiths, M. D. (2018). Conceptual issues concerning internet addiction and internet gaming disorder: Further critique on ryding and kaye (2017). *International Journal of Mental Health and Addiction*, 16(1):233–239.
- Hale, L. and Guan, S. (2015). Screen time and sleep among school-aged children and adolescents: A systematic literature review. *Sleep Medicine Reviews*, 21:50–58.
- Hardy, L. L., Booth, M. L., and Okely, A. D. (2007). The reliability of the adolescent sedentary activity questionnaire (asaq). *Preventive Medicine*, 45(1):71–74.
- Hoare, E., Milton, K., Foster, C., and Allender, S. (2016). The associations between sedentary behavior and mental health among adolescents: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 13:108.
- Håkansson, A. and Widinghoff, C. (2020). Gaming disorder, sleep, and mental health. *Psychiatry Research*, 287:112960.
- Imran, H., Mujtaba, B., Waheed, H., and Ibrahim, M. (2024). Video gaming addiction in pakistani adolescents: A growing concern. *Pakistan Journal of Neurological Sciences*, 19(2):67–74.

- Kardefelt-Winther, D. (2014). A conceptual critique of internet addiction research. *Computers in Human Behavior*, 31:351–354.
- Kardefelt-Winther, D. et al. (2017). How can we conceptualize behavioral addiction? *Addiction*, 112(10):1709–1715.
- Kausar, R., Rana, H., Nouman, S., and Faisal, A. (2024). Pubg game addiction, social connectedness and aggression in young adults. *Pakistan Journal of Humanities and Social Sciences*, 12(3):2439–2446.
- Kaya, A., Türk, N., Batmaz, H., and Griffiths, M. D. (2023). Online gaming addiction and basic psychological needs among adolescents: The mediating roles of meaning in life and responsibility. *International Journal of Mental Health and Addiction*, 22(4):2413–2437. Published online: 10 January 2023.
- Khalid, L., Javed, A., and Javed, M. (2025). Effects of video gaming on sleep quality, social inhibition, and mental health among young adults. *The Research of Medical Science Review*, 3(1):560–569. ISSN: 3007-1208 (Print), 3007-1216 (Online). Published by Innovative Education Research Institute. Open access available via journal site or repositories like Academia.edu.
- Khan, A. and Burton, N. W. (2021). Electronic games, television, and psychological wellbeing of adolescents: Mediating role of sleep and physical activity. *International Journal of Environmental Research and Public Health*, 18(16):8877.
- Khan, S., Riaz, M., and Ahmed, S. (2023). Gaming addiction and lifestyle behaviors among adolescents. *Pakistan Journal of Health Sciences*, 4(2):55–63.
- King, D. L., Gradisar, M., Drummond, A., Lovato, N., Wessel, J., Micic, G., and Delfabbro, P. (2013). The impact of prolonged gaming on adolescent sleep. *Journal of Clinical Sleep Medicine*, 9(12):1259–1265.
- Kuss, D. J. and Billieux, J. (2017). Technological addictions: Conceptualization and prevalence. *Addictive Behaviors*, 64:231–233.
- Kuss, D. J. and Griffiths, M. D. (2012). Online gaming addiction in children and adolescents. *Journal of Behavioral Addictions*, 1(1):3–22.

- LeBlanc, A. G. and et al. (2018). Sedentary behavior and health. *Applied Physiology, Nutrition, and Metabolism*, 43(3):197–203.
- Lemmens, J. S., Valkenburg, P. M., and Gentile, D. A. (2015). The internet gaming disorder scale: Psychometric evaluation and norms. *Psychological Assessment*, 27(2):567–582.
- Lemmens, J. S., Valkenburg, P. M., and Peter, J. (2011). Psychosocial causes and consequences of pathological gaming. *Computers in Human Behavior*, 27(1):144–152.
- Lemola, S., Perkinson-Gloor, N., Brand, S., Dewald-Kaufmann, J. F., and Grob, A. (2015). Adolescents’ electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *Journal of Youth and Adolescence*, 44(2):405–418.
- Li, L., Liu, L., Niu, Z., Zhong, H., Mei, S., and Griffiths, M. D. (2023). Gender differences and left-behind experiences in the relationship between gaming disorder, rumination and sleep quality among a sample of chinese university students during the late stage of the covid-19 pandemic. *Frontiers in Psychiatry*, 14:1108016.
- Macur, M. and Pontes, H. M. (2021). Internet gaming disorder in adolescence: Investigating profiles and associated risk factors. *BMC Public Health*, 21(1):1547.
- Maden, M. and Bayramlar, K. (2022). Gaming disorder and physical inactivity: A systematic review. *International Journal of Mental Health and Addiction*, 20:123–140.
- Malik, N., Arshad, M., and Muazzam, A. (2024). Diabetes distress, depression and coping strategies in adults with type 2 diabetes: Diabetes distress, depression and coping. *Pakistan BioMedical Journal*, 7(04):24–29.
- Muazzam, A., Raza, S., and Ahmed, R. (2024). Sleep disturbances and gaming behavior among pakistani youth. *Journal of Behavioral Sciences*, 34(1):77–91.

- Männikkö, N., Billieux, J., and Kääriäinen, M. (2017). Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. *Journal of Behavioral Addictions*, 6(2):154–162.
- Müller, K. W. et al. (2015). Regular gaming and aggression in adolescents. *Journal of Behavioral Addictions*, 4(3):1–8.
- Ohayon, M. M. et al. (2017). Sleep and health in adolescents. *Sleep Medicine Reviews*, 32:1–15.
- Owens, J. and Weiss, M. (2017). Insufficient sleep in adolescents. *Nature and Science of Sleep*, 9:73–80.
- Peng, P., Jin, J., Chen, Z., Ren, S., He, Y., Li, J., Liao, A., Zhao, L., Shao, X., Chen, S., He, R., Liang, Y., Tan, Y., Chen, X., Tang, J., and Liao, Y. (2025). Impaired sleep quality mediates the relationship between internet gaming disorder and conduct problems among adolescents: a three-wave longitudinal study. *Child and Adolescent Psychiatry and Mental Health*, 19:26.
- Przybylski, A. K., Rigby, C. S., and Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, 14(2):154–166.
- Riaz, A., Ahmad, R., and Batool, S. S. (2021). Problematic gaming behavior and its psychological correlates among pakistani adolescents. *Pakistan Journal of Psychological Research*, 36(3):421–438.
- Ryan, R. M. and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1):68–78.
- Ryan, R. M. and Deci, E. L. (2017). *Self-determination theory*. Guilford Press.
- Ryan, R. M. and Deci, E. L. (2020a). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61:101860.

- Ryan, R. M. and Deci, E. L. (2020b). *Intrinsic motivation and self-determination in human behavior*. Guilford Press, 2 edition.
- Saleem, S., Awan, S., Rafiq, I., Shaikh, M. H., Farooq, A., Siddiqui, M., Memon, Z. A. S., and Siddiqui, A. I. (2024). Burden of vascular neurological disorders: A cross-sectional multicenter study. *Pakistan Journal of Neurological Sciences*, 19(3). Article 386 (pages not specified in standard format; open access PDF available).
- Saunders, T. J., Chaput, J. P., and Tremblay, M. S. (2016). Sedentary behaviour as an emerging risk factor for health in children and youth. *Canadian Journal of Diabetes*, 40(4):291–297.
- Saunders, T. J. et al. (2020). Sedentary behavior and health outcomes. *Applied Physiology, Nutrition, and Metabolism*, 45(10):1–10.
- Shabih, F., Gohar, A., Ahmed, F., and Danish, H. (2022). Effect of video game addiction on the physical and mental wellbeing of adolescents of karachi. *Journal of Fatima Jinnah Medical University*, 15(3):106–111.
- Shahid, M. S., Bashir, S., and Fatima, S. (2024). Social media addiction and aggression in pakistani young adults: Social connectedness as a moderator. *Journal of Professional & Applied Psychology*, 5(3):424–433.
- Shochat, T., Cohen-Zion, M., and Tzischinsky, O. (2014). Functional consequences of insufficient sleep. *Nature and Science of Sleep*, 6:21–34.
- Short, M. A., Gradisar, M., Gill, J., and Camfferman, D. (2013). Identifying adolescent sleep problems. *Sleep Medicine Reviews*, 17(4):237–245.
- Silva, F. G., Silva, C. R., Braga, L. B., and Neto, A. S. (2014). Portuguese children’s sleep habits questionnaire - validation and cross-cultural comparison. *Jornal de Pediatria*, 90(1):78–84.
- Staiano, A. E. and Calvert, S. L. (2011). Exergames and health. *Child Development Perspectives*, 5(2):93–98.

- Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, 28(1):78–106.
- Steinberg, L. D. (2014). *Age of Opportunity: Lessons from the New Science of Adolescence*. Houghton Mifflin Harcourt, Boston, MA.
- Stiglic, N. and Viner, R. M. (2019). Effects of screen time on the health and well-being of children and adolescents. *BMJ Open*, 9(1):e023191.
- Taş, , Bilgin, O., and Eker, H. (2025). The mediating role of resilience in the relationship between game addiction and sleep disorders in college students.
- Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., and Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9:78.
- Tremblay, M. S. et al. (2017). Sedentary behavior and health in youth. *Applied Physiology, Nutrition, and Metabolism*, 42(6):S1–S8.
- Tremblay, M. S., LeBlanc, A. G., Kho, M. E., Saunders, T. J., Larouche, R., Colley, R. C., Goldfield, G., and Gorber, S. C. (2011). Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1):98.
- Turabi, R. F., Rozi, S., Sawani, S., Kazi, M., and Asad, N. (2025). Internet gaming disorder and violent video gameplay among higher secondary school-going adolescents in karachi, pakistan—a cross-sectional study. *PLOS Mental Health*, 2(1):e0000179.
- Weinstein, A. and Lejoyeux, M. (2010). Internet addiction or excessive internet use. *The American Journal of Drug and Alcohol Abuse*, 36(5):277–283.
- Wong, H. Y., Mo, H. Y., Potenza, M. N., Chan, M. N. M., Lau, W. M., Chui, T. K., Pakpour, A. H., and Lin, C.-Y. (2020). Relationships between severity of internet gaming disorder, severity of problematic social media use, sleep quality and psychological distress. *International Journal of Environmental Research and Public Health*, 17(6):1879.

World Health Organization (2019). Gaming disorder.

Zahra, S., Ahsan, S., Kiani, S., and Shahbaz, K. (2019). Internet gaming disorder: An emerging addiction among pakistani university students. *NUST Journal of Social Sciences and Humanities*, 5(1):87–104.

Zaman, M., Babar, M. S., Babar, M., Sabir, F., Ashraf, F., Tahir, M. J., Ullah, I., Griffiths, M. D., Lin, C.-Y., and Pakpour, A. H. (2022). Prevalence of gaming addiction and its impact on sleep quality: A cross-sectional study from pakistan. *Annals of Medicine and Surgery*, 78:103641.

Zeiler, X. and Mukherjee, S. (2022). Video game development in india: A cultural and creative industry embracing regional cultural heritage(s). *Games and Culture*, 17(4):509–527.

Appendix A

88

ASSENT FORM

I Adeena Arzoo student of MS Psychology at Capital University of Science and Technology (CUST), Islamabad, I am conducting a research study as part of my academic requirements. Participants will be asked to complete a questionnaire, which will take approximately 20–30 minutes to complete. All information obtained during this research will be kept strictly confidential and will be analyzed anonymously. The identity of the participants and any personal information will not be disclosed or used for any purpose other than this research. There are no anticipated risks associated with participation in this study. This research aims to contribute to bridging the existing knowledge gap in the relevant area. Participation in the study is entirely voluntary, and participants have the right to withdraw from the study at any time without any penalty.

Contact Information

MSP241015@cust.pk

Adeena Arzoo

Capital University of Science and Technology

Parent/Guardian Consent

I have read/understood this form discussed it with my child, and consent to their participation.

Signature: _____

Date: _____

Demographic Information Sheet:

Please tick (✓) the appropriate option or fill in the blank.

1. Age:
_____ Years

2. Gender:
☐ Male ☐ Female

3. City:
☐ Rawalpindi ☐ Islamabad

4. Family Structure:
☐ Nuclear ☐ Joint ☐ Single Parent

5. Socioeconomic Status:
☐ Lower ☐ Middle ☐ Upper

Questionnaire no 01:

Instructions: Read each sentence. Choose how true it is for you.

Rating Scale:

1 = Not at all | 2 = Rarely | 3 = Sometimes | 4 = Most times | 5 = Every time

No.	Statement	Not at all	Rarely	Sometimes	Most times	Every time
1	When you are not gaming, how often do you think about playing a game or how it would feel to play at that moment?					
2	How often do you play longer than originally planned?					
3	How often do you feel depressed or irritable when not gaming, only for these feelings to disappear when you start playing?					
4	How often do you feel that you should reduce the amount of time you spend gaming?					
5	How often do the people around you complain that you are gaming too much?					
6	How often do you fail to meet up with a friend because you were gaming?					
7	How often do you daydream about gaming?					
8	How often do you lose track of time when gaming?					
9	How often do you get restless or irritable if you are unable to play games for a few days?					
10	How often do you unsuccessfully try to reduce the time you spend on gaming?					
11	How often do you argue with your parents and/or your partner because of gaming?					
12	How often do you neglect other activities because you would rather game?					

Questionnaire no: 2

Think about a normal school week, and write down how long you spend doing the following activities before and after school each day

1	Watching TV					
2	Watching videos/DVDs					
3	Using the computer for fun		.			
4	Using the computer for doing homework		.	.		
5	Doing homework not on the computer	.	.	.		
6	Reading for fun	.	.	.		
7	Being tutored	.	.	.		
8	Travel (car/bus/train)	.	.	.		
9	Doing crafts or hobbies	.	.	.		
10	Sitting around (chatting with friends/on the phone/chilling)	.	.	.		
11	Playing/practicing a musical instrument	.	.	.	.	.

Think about a normal weekend and write down how long you spend doing the following activities on the weekend.

No.	Activity	Saturday (Hours\Minutes)	Sunday (Hours\Minutes)
1	Watching TV	.	.
2	Watching videos/DVDs	.	.
3	Using the computer for fun	.	.
4	Using the computer for doing homework	.	.

5	Doing homework not on the computer	.	.
6	Reading for fun	.	.
7	Being tutored	.	.
8	Travel (car/bus/train)	.	.
9	Doing crafts or hobbies	.	.
10	Sitting around (chatting with friends/on the phone/chilling)	.	.
11	Playing/practicing a musical instrument	.	.
12	Going to church or Saturday school	.	.

Questionnaire No. 3

Instructions: Read each sentence. Choose how true it is for you.

- **Not true** → 0 ☐ **A little true** → 1 ☐ **Sometimes true** → 2 ☐ **Mostly true** → 3 ☐ **Always true** → 4 ☐

No.	Statement	Not true	A little true	Sometimes true	Mostly true	Always true
1	My friends think I get angry quickly					
2	I think hitting is okay to protect myself					
3	When people are very nice to me, I feel something is wrong					
4	I tell my friends when I do not agree with them					
5	I have broken things when I was very angry					
6	I argue a lot when people disagree with me					
7	I often feel angry or upset inside					
8	Sometimes I feel like hitting someone					
9	I usually stay calm					
10	I do not trust strangers who are too friendly					
11	I have scared or threatened people					
12	I get angry fast but calm down fast					
13	If someone makes me very angry, I may hit them					

14	When people annoy me, I say what I feel					
15	I feel jealous of others					
16	I believe hitting someone is never okay					
17	I feel life is unfair to me					
18	I cannot control my anger easily					
19	People can see when I am upset					
20	I think people talk about me behind my back					
21	I disagree with people a lot					
22	If someone hits me, I hit back					
23	I feel like I might explode with anger					
24	Others get better chances than me					
25	Some people made me so angry that we fought					
26	I feel my friends talk about me					
27	My friends say I argue a lot					
28	I get angry for no clear reason					
29	I fight more than others my age					

Questionnaire No: 04

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for most days and nights in the past month. **Please answer all questions.**

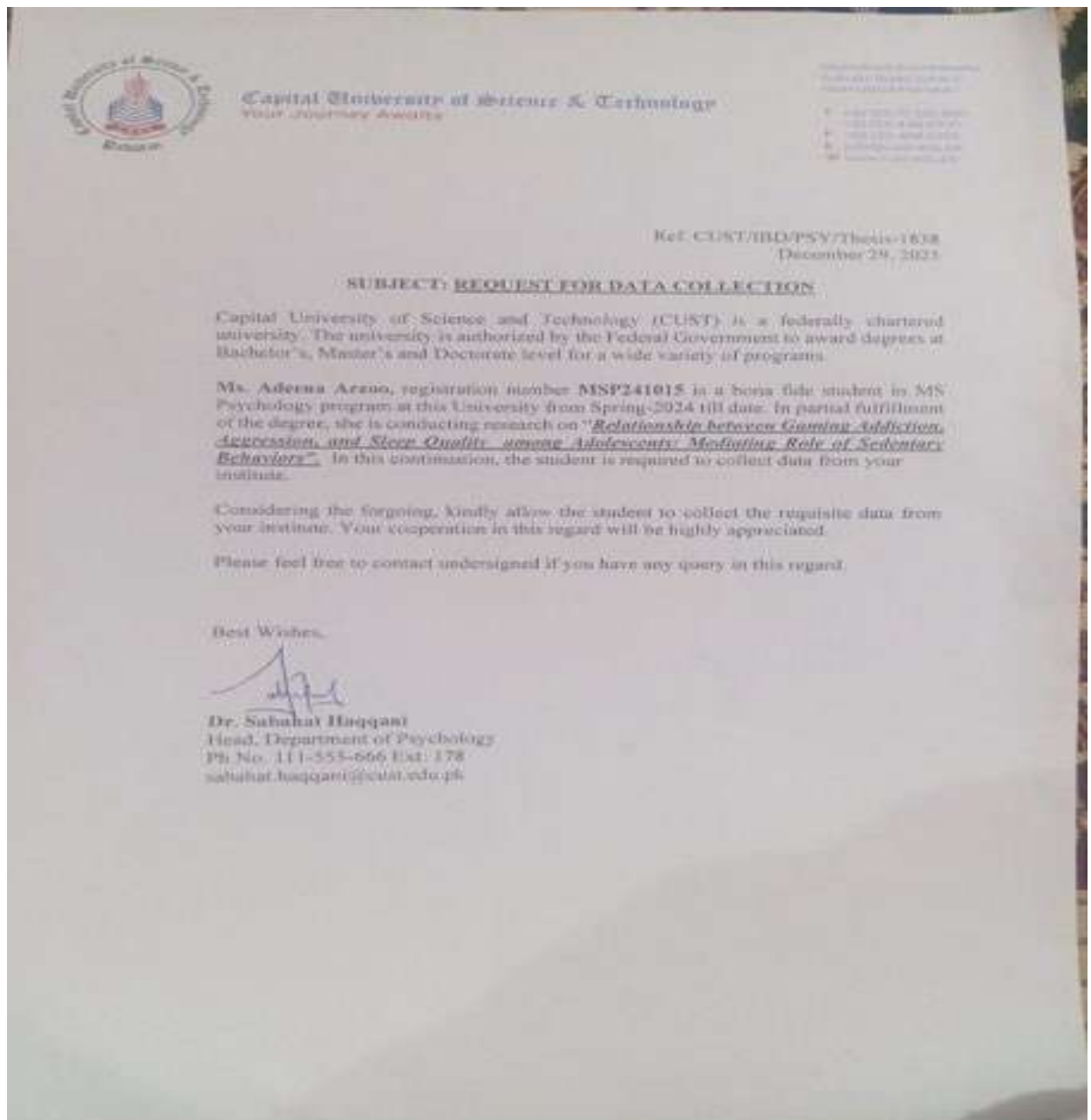
1. During the past month, what time have you usually gone to bed at night? _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? _____
3. During the past month, what time have you usually gotten up in the morning? _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.) _____

5. During the <u>past month</u> , how often have you had trouble sleeping because you...	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or "sleep soundly."				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe:				

6. During the past month, how often have you taken medicine to help you sleep (Doctor's medicine or store medicine)				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				
	No roommate	roommate in other room	same room but not same bed	Roommate in same bed
10. Do you have a roommate?				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
If you have a roommate or, ask him/her how often in the past month you have had:				
a. making sound while sleeping				
b. Stopping breathing for a little while sleeping				

c. Legs moving while you sleep”				
d. Feeling confused or mixed up while sleeping”				
e. Any other moving around or trouble staying still while sleeping, explain here”				

Appendix B





Capital University of Science & Technology
Your Journey Awaits

Copyright © 2025 Capital University of Science & Technology. All rights reserved.

1. No part of this document may be reproduced without prior written permission from the University.

2. For more information, visit: www.cust.edu.pk

Ref: CUST/FMSS/REC/2025-78
December 29, 2025

RESEARCH ETHICS COMMITTEE CERTIFICATE OF REVIEW AND SUPPORT

This is to certify that Project titled: *"Relationship between Gaming Addiction, Aggression, and Sleep Quality among Adolescents: Mediating Role of Sedentary Behaviors"* submitted by Scholar: **Adeena Arzoo MSP241015** and supervised by: **Dr. Ishrat Yousaf** 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