PSYCHOLOGICAL PROFILE OF BRAZILIAN JIU-JITSU ATHLETES

by

Leandro de Lorenco-Lima

Liberty University

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

Liberty University

July, 2024

PSYCHOLOGICAL PROFILE OF BRAZILIAN JIU-JITSU ATHLETES

by

Leandro de Lorenco-Lima

Liberty University

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

Liberty University

July, 2024

APPROVED BY:

Stacey Gaines, Ph.D., Committee Chair

Elisabeth Waterbury, Ph.D., Committee Member

ABSTRACT

Martial arts and combat sports have been shown to influence several desirable psychological factors positively. This quantitative study aimed to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt ranks in Brazilian Jiu-Jitsu (BJJ) athletes. A sample of 410 BJJ participants (323 males and 87 females) from 18 to 60 years of age was included in this study. Data was collected anonymously via Google Form and included the Mental Strength Scale, Brief Resilience Scale, Grit Scale, General Self-Efficacy Scale, Brief Self-Control Scale, Brief Aggression Questionnaire, Satisfaction with Life Scale, Mental Health Disorders Screening Instrument for Athletes, and additional demographic information. Analyses of variance with Tukey post-hoc were performed to compare the psychological profile among BJJ belt ranks. Independent samples *t*-tests were performed to access the differences between white and black belts, and biological sexes. ANOVA revealed significantly higher grit in black belts than white and blue belts, in addition to higher grit in purple than white belts. Black belts reported significantly higher mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and better mental health than white belts. Moreover, significantly higher mental strength, resilience, and aggression were found in males than females. In conclusion, this study's findings provide evidence of the positive impact of BJJ training on mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and mental health, with no significant differences in aggression after short-, mid-, and long-term engagement with BJJ.

Keywords: BJJ, martial arts, combat sports, mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, mental health

Dedication

This work is dedicated to the most important people in my life: my mom, Marcia; my dad, Camilo; my wife, Thaisa; and my son, Alex. Your love, support, and encouragement have fueled my journey every step of the way. I love you all very much.

I also want to extend my gratitude to all my current and former students. You have been a constant source of inspiration and learning throughout my career. The invaluable lessons you have taught me have contributed to both my personal and professional life.

Acknowledgments

I am deeply grateful for the guidance and support Dr. Stacey Gaines provided throughout my dissertation journey. Your feedback consistently challenged me to refine my work and pushed me to be better. Your constant encouragement was critical in motivating me during the dissertation process. I am truly fortunate to have you as my dissertation chair, and I am deeply grateful for your mentorship.

I am also incredibly grateful for Dr. Elisabeth Waterbury for serving as my dissertation member, and for your guidance and support throughout my dissertation process. Your expertise in the scale development area was instrumental in helping me develop the Mental Strength Scale used in my dissertation. Your expertise in statistics allowed me to take my analyses a step further and make my dissertation more robust. Thank you so much for your guidance.

TABLE OF CONTENTS

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION TO THE STUDY

Introduction

Brazilian Jiu-Jitsu (BJJ) has gained great popularity worldwide over the past decades (Andreato et al., 2017; Øvretveit, 2020). Although some research has investigated the physiological peculiarities of BJJ matches (Oliveira et al., 2009; Andreato et al., 2015; Andreato et al., 2016; Øvretveit, 2018; Almeida Junior et al., 2019; Andreato et al., 2017; Øvretveit et al., 2019; Lorenco-Lima et al., 2020; Belo et al., 2021), there is a growing, but limited, body of studies exploring the different psychological changes resulting from over time BJJ engagement (Blomqvist-Mickelsson, 2019a; Farrer, 2019; Willing et al., 2019; Wojdat & Ossowski, 2019; Faro et al., 2020; Øvretveit, 2020; Blomqvist-Mickelsson, 2021; Brandt et al., 2021; Sugden, 2021; Weinberger & Burraston, 2021; Bueno et al., 2023; Williams & Smith, 2023). The available literature has highlighted BJJ's effectiveness in decreasing post-traumatic stress disorder symptoms (Willing et al., 2019; Weinberger & Burraston, 2021), psychopathology symptoms (Willing et al., 2019), emotional symptoms, hyperactivity/inattention, total difficulties, externalizing problems (Bueno et al., 2023), and aggression and increasing self-control (Blomqvist-Mickelsson, 2019b).

This study aimed to add to the existing literature by presenting a performance and mental health-related psychological profile of BJJ athletes and compare the profile among belt ranks. The study was conducted relying on a diverse and self-selected sample across the United States. The results of this study can close an existing gap in the literature by describing the psychological characteristics of BJJ athletes. This non-existent knowledge can serve as the baseline for mental performance professionals to

prescribe psychological plans to optimize sports engagement, longevity, performance, and mental health-related outcomes.

Background

Historically, strong individuals have been respected for their exceptional ability to overcome obstacles and recover from failure (Brown et al., 2023; Lorenco-Lima, 2024b). The search for strategies to improve mental performance-related skills has been ongoing for over 200 years (Lochbaum et al., 2022), and it remains just as relevant in contemporary society.

Martial arts are supported by centuries of tradition and are regarded as educational systems promoting several coveted moral values (Kostorz & Sas-Nowosielski, 2021), including courage and respect. This fact makes martial arts a popular choice for parents seeking the improvement of their children's self-defense and anti-bullying skills, self-confidence and self-esteem, discipline and self-control, pro-social and community interactions, physical health and fitness, overall character development, focus and attention, mental health, and respect for others (Garcia & Spencer, 2013; Moise et al., 2023; Lorenco-Lima, 2023).

Combat Sports and Martial Arts

Combat sports and martial arts have been found to positively influence various psychological and cognitive skills, including mental strength and toughness (Chen & Cheesman, 2013; Killy et al., 2017; Khodabandelou & Salehian, 2023; Lorenco-Lima, 2024b), resilience (Greco et al., 2019; Moore et al., 2019; Moore et al., 2021), grit (Sawyer et al., 2018; Lee et al., 2021; Lorenco-Lima, 2024a), self-efficacy (Fabio &

Towey, 2018; Greco et al., 2019; Moore et al., 2019), self-control (Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Potoczny et al., 2022; Invernizzi et al., 2023), aggression (Fabio & Towey, 2018; Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Wojdat & Ossowsky, 2019; Gorner et al., 2021; Potoczny et al., 2022; Linder-Postigo et al., 2023), self-regulation (Lakes & Hoyt, 2004), self-esteem (Fabio & Towey, 2018; Pujszo et al., 2019a), prosocial behavior (Lakes & Hoyt, 2004; Blomqvist-Mickelsson, 2019b), attention (Fabio & Towey, 2018), academic performance (Lakes & Hoyt, 2004; Giordano et al., 2021), executive function (Giordano et al., 2021; Linder-Postigo et al., 2023), life satisfaction (Potoczny et al., 2022), well-being (Moore et al., 2020), and mental health (Willing et al., 2019; Weinberger & Burraston, 2021; Bueno et al., 2023). Although numerous benefits can be attributed to martial arts and combat sports engagement, no study has presented a performance-related psychological profile (mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health), or the psychological profile differences resulting from continued BJJ training (belt rank comparison).

Brazilian Jiu-Jitsu (BJJ)

Under combat sports or modern martial arts, Brazilian Jiu-Jitsu (BJJ) is noticeably one of the most popular grappling-based styles among adult athletes in the United States and has been rising in popularity worldwide over the past decades (Andreato et al., 2017; Øvretveit, 2020). BJJ matches focus on taking an opponent to the ground via throws, takedowns, or pulling guard, controlling the adversary, and executing submissions such as strangles and joint locks (Williams & Smith, 2023).

Physical fitness highly influences BJJ performance and is potentially associated with the athletes' psychological skills (Øvretveit, 2020). The ability to persist is critical in BJJ, especially due to the vigorous nature of sparring (Lorenco-Lima et al., 2020) and the numerous defeats and obstacles athletes face during training (Øvretveit, 2020). During BJJ matches, two athletes battle for victory, which is determined by points, loss of consciousness, submission, or disqualification (Lorenco-Lima et al., 2010; Santos et al., 2024). Therefore, making failure in BJJ unavoidable based on the very nature of two individuals competing against one another (Williams & Smith, 2023). These characteristics require certain psychological skills from participants or, at a minimum, the willingness to develop them (Øvretveit, 2020). Unfortunately, due to the very harsh and vigorous nature at the beginning of a person's BJJ involvement, many athletes exit the sport before benefiting from the several positive outcomes (Williams & Smith, 2023). Moreover, Williams and Smith (2023) explain that the BJJ community plays a critical role in helping athletes keep failure in the proper perspective and distinguish perception from reality, aiming to optimize personal and community growth (Williams & Smith, 2023).

As presented in verse "And not only so, but we glory in tribulations also: knowing that tribulation worketh patience; And patience, experience; and experience, hope" (King James Bible, 2017, Romans 5:3-4), BJJ may offer controlled tribulations to ignite the development of positive outcomes, such as patience and experience, and potentially all variable investigated in the current study.

While still in its infancy, there has been a rising number of publications investigating the psychological effects of BJJ training over the past decade. BJJ is a

promising intervention to develop resilience and promote meaningful social connections and self-growth (Williams & Smith, 2023). Blomqvist-Mickelsson (2019b) found improvements in self-control after five months of BJJ training (≥2 classes per week) in adolescents and young adults. In this same study, the author observed a decrease in aggression after the same period and frequency of BJJ training (Blomqvist-Mickelsson, 2019b). Conversely, Wojdat and Ossowsky (2019) found a lower total aggression in BJJ practitioners than non-practitioners (men and women), with women presenting lower aggression than men. Moreover, total aggression decreased, followed by a simultaneous increase in training experience, with significant differences observed in the first 2-3 years of BJJ training (Wojdat & Ossowsky, 2019).

Investigating the psychophysiological characteristics of BJJ athletes, Øvretveit et al. (2020) found a significant relationship between physical self-efficacy and performance parameters (VO_2 max and pull-ups). Faro et al. (2020) suggest that self-efficacy in experienced BJJ athletes can be fundamental in sustaining focus and competitiveness, especially when fatigued. Faro et al. (2020) found that BJJ competitors in different belt ranks demonstrate similar self-confidence and anxiety after the first match in a competition. However, after victory, anxiety decreases in the less experienced athletes (blue, purple, and brown belts), and self-confidence increases in the most experienced athletes (black belts), indicating variability in psychological skills among belt ranks in BJJ.

Some studies have explored the utility of BJJ as a mental health intervention. Willing et al. (2019) found a significant decrease in post-traumatic stress disorder symptoms (large effect) in armed service personnel and veterans after five months of BJJ

engagement. The author also showed a significant decrease in psychopathology symptoms after two and a half and five months of BJJ engagement, both with large effects (Willing et al., 2019). Therefore, BJJ training provides opportunities for social engagement and social support from like-minded individuals (Willing et al., 2019). Conversely, Farrer (2019) and Sugden (2021) pointed out BJJ's therapy-like characteristic, suggesting that much of its benefits are drawn from the social environment and a general emphasis on self-development and personal growth (Farrer, 2019; Sugden, 2021).

Although studies including BJJ athletes in their sample have shown positive correlations between combat sports experience and resilience (Pujzo et al., 2019a), grit (Lorenco-Lima, 2024a), and mental strength (Lorenco-Lima, 2024b), no distinctions were made between styles (i.e., BJJ, judo, kickboxing, and aikido). Therefore, as a highly popular style, understanding the psychological specificities of BJJ training is critical for coaches, sports psychologists, and athletes.

Problem Statement

Combat sports and martial arts have been shown to positively influence several psychological skills, including mental strength (Lorenco-Lima, 2024b), resilience (Greco et al., 2019; Moore et al., 2019; Moore et al., 2021), grit (Sawyer et al., 2018; Lee et al., 2021; Lorenco-Lima, 2024a), self-efficacy (Fabio & Towey, 2018; Greco et al., 2019; Moore et al., 2019), self-control (Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Potoczny et al., 2022; Invernizzi et al., 2023), aggression (Fabio & Towey, 2018; Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Wojdat & Ossowsky,

2019; Gorner et al., 2021; Potoczny et al., 2022; Linder-Postigo et al., 2023), self-regulation (Lakes & Hoyt, 2004), self-esteem (Fabio & Towey, 2018; Pujszo et al., 2019a), prosocial behavior (Lakes & Hoyt, 2004; Blomqvist-Mickelsson, 2019b), attention (Fabio & Towey, 2018), academic performance (Lakes & Hoyt, 2004; Giordano et al., 2021), executive function (Giordano et al., 2021; Linder-Postigo et al., 2023), life satisfaction (Kuśnierz et al., 2020; Kanupriya et al., 2022Potoczny et al., 2022; Bai et al., 2023; Sivan & Zeba, 2023), and mental health (Willing et al., 2019; Weinberger & Burraston, 2021; Bueno et al., 2023). Time spent in vigorous exercise was found to correlate positively with resilience and grit (Daniels et al., 2021; Dunston et al., 2022). Characterized as a vigorous activity (Lorenco-Lima, 2020), BJJ has the potential to influence various psychological skills. BJJ has been shown to decrease aggressiveness (Blomqvist-Mickelsson, 2019b), and despite being categorized as a modern martial art, it converges with traditional martial arts aggressiveness outcomes (Lafuente et al., 2021). Despite these general martial arts and combat sports findings, most studies included martial arts other than BJJ (Greco et al., 2019; Moore et al., 2021) and investigated these effects and associations among children, adolescents, and adults (Lee et al., 2021; Yu, 2022). No study was found addressing a comprehensive psychological profile (mental strength, resilience, grit self-efficacy, self-control, aggression, life satisfaction, and mental health) among the BJJ athletes. As one of the most practiced martial arts among adults in the United States, and due to its vigorous physiological demands (Lorenco-Lima, 2020), it is critical to understand the psychological implications resulting from BJJ practice. This study aimed to provide valuable evidence of potential effects (i.e., the

Dunning-Kruger effect) and reveal whether a potential ceiling to the psychological benefits exists.

Purpose of the Study

The purpose of this quantitative study was to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt ranks in BJJ athletes.

Research Questions and Hypotheses

Research Questions

RQ1: Is there a difference in self-reported mental strength, as measured by the Mental Strength Scale, among belt ranks in BJJ athletes?

RQ 2: Is there a difference in self-reported resilience, as measured by the Brief Resilience Scale, among belt ranks in BJJ athletes?

RQ 3: Is there a difference in self-reported grit, as measured by the Grit Scale, among belt ranks in BJJ athletes?

RQ 4: Is there a difference in self-reported self-efficacy, as measured by the General Self-Efficacy Scale, among belt ranks in BJJ athletes?

RQ 5: Is there a difference in self-reported self-control, as measured by the Brief Self-Control Scale, among belt ranks in BJJ athletes?

RQ 6: Is there a difference in self-reported aggression, as measured by the Brief Aggression Questionnaire, among belt ranks in BJJ athletes?

RQ 7: Is there a difference in life satisfaction, as measured by the Satisfaction with Life Scale, among belt ranks in BJJ athletes?

RQ 8: Is there a difference in mental health, as measured by the Mental Health Disorders Screening Instrument for Athletes, among belt ranks in BJJ athletes?

Hypotheses

H1: Mental strength will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H2: Resilience will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H3: Grit will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H4: Self-efficacy will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H5: Self-control will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H6: Aggression will be lower in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H7: Life satisfaction will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

H8: Mental health will be better in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

Delimitations, Assumptions and Limitations of the Study

Participants must engage in at least one BJJ class per week as an inclusion criterion for data analysis. Despite most studies exploring the physiological (Lorenco-Lima et al., 2020) and psychological effects of martial arts and combat sports training using a design with two or more classes per week (Greco et al., 2019; Moore et al., 2019; Moore et al., 2020; Moore et al., 2021; Willing et al., 2019; Harwood-Gross et al., 2021; Salchow et al., 2021; Lindell-Postigo et al., 2023), the author speculated that one BJJ class per week should suffice to positively impact the athletes' psychological profile over time, based on BJJ's therapy-like characteristic as suggested by Farrer (2019) and Sugden, (2021).

A major challenge was to collect data from upper belts (brown and black) due to the smaller pool of athletes in these ranks compared to those of lower ranks (white and blue belts). To overcome this obstacle data collection was conducted nationwide, aiming to expand the reach of the study, include an acceptable number of higher ranks, and sustain an adequate statistical power.

This research is not free of limitations and should be acknowledged. First, the study's cross-sectional nature prevents any causality assumptions or the observation of psychological changes over time. This study can observe differences between subjects rather than within subjects, providing initial evidence of the non-causal long-term effects of BJJ practice. Second, the study relied on self-reported answers, which could have led to social desirability bias. This study was conducted anonymously to decrease social desirability bias. Third, self-selection bias may restrict the generalizability of the results. Recruitment was conducted across the United States to generate a diverse database and

mitigate generalizability issues. Fourth, the small amount of previous research investigating the psychological effects of BJJ engagement may have limited the development of a robust background for the current research. This study's research questions and hypotheses were construed based on previous evidence from martial arts and combat sports with similar characteristics to BJJ.

Theoretical Foundations of the Study

This study investigated the psychological profile of BJJ athletes and compared the existing differences between athletes of different belt ranks. Social learning theory served as a theoretical foundation for the current study. This theory explains the learning process and behaviors adopted throughout an individual's engagement with BJJ.

Social Learning Theory

Initially proposed by Albert Bandura (Bandura, 1977), social learning theory is based on the notion that people learn by observing and imitating others. Since its proposal, there has been an increasing and robust body of publications supporting Bandura's theory (Kruis et al., 2020; Powers et al., 2020; Solakoglu & Yuksek, 2020; Hahlbeck & Vito, 2022). For the most part, publications exploring this theory have been developed in negative contexts, such as intimate partner violence (Powers et al., 2020; Li, 2022), substance use, and dependence (Kruis et al., 2020; Hahlbeck & Vito, 2022), and criminal involvement and delinquency (Solakoglu & Yuksek, 2020).

Few studies have explored the role of social learning in developing positive psychological outcomes (i.e., prosocial behavior and executive function) through sports (Latorre-Román et al., 2020; Kabiri et al., 2021; Yen, 2022). For instance, Yen (2022)

argues that emotional intelligence can change to produce expected behavior and performance. He explains that based on social learning theory, subordinates can passively learn how to manage emotions based on the leaders' behavior (Yen, 2022). In a group context, individuals are motivated to follow expected behaviors aiming at rewards and avoid certain behaviors to avoid punishment. In social learning theory, punishment is not considered a behavior but a learning instrument designed to mitigate and abolish undesired behaviors (Bandura, 1977).

The present study is based on the understanding that psychological skills change over time due to BJJ engagement. After becoming part of a community, athletes are expected to learn and abide by the existing guidelines and rules. Generally, attitudes toward training (i.e., dealing with failure) are transmitted via social interactions where instructor and experienced athletes can provide support and guidance to beginners (Williams & Smith, 2023), as theorized by Bandura, and through observation and imitation (Kabiri et al., 2021). Farrer (2019) and Sugden (2021) discuss that BJJ's benefits can be credited to the role of the social environment in encouraging self-development and personal growth among its athletes.

From beginning to end, BJJ classes generally follow a standard model (warm-up, drilling, and sparring) with expectations attached to each segment. For example, during competitive sparring (submission-focused with full use of force), participants are expected to do their best to challenge their partner rather than allow their partner to move freely. Others would perceive a partner quitting during the round as undesired behavior. Since partners rely on one another to be challenged, improve their skills, and eventually belt rank (reward), partners not fulfilling their roles may be left aside (punishment).

Still during sparring, two participants attempt to impose effective techniques (i.e., takedowns, joint locks, and chokes) on a resisting partner. Selecting an effective technique may result in a reward (avoiding pain followed by victory). In contrast, selecting an ineffective action may result in punishment (physical pain followed by loss). During BJJ sparring, this non-cyclical reward/punishment dynamic molds the athletes' technical skills. Therefore, the social learning and reward/punishment dynamic in BJJ can potentially explain the athletes' psychological changes over time.

Biblical Foundation

Psychology and Christianity seek to comprehend and explain human behaviors and motivations (Johnson, 2010). Epistemologically, psychology seeks truth via observation and Christianity via revelations (Johnson, 2010). Despite the methodological variances, the common goal is to optimize human experiences and well-being.

The Bible emphasized the relevance of fostering mental strength, resilience, grit, and self-efficacy in verse "Be strong and of a good courage, fear not, nor be afraid of them: for the LORD thy God, he it is that doth go with thee; he will not fail thee, nor forsake thee" *(King James Bible,* 2017, Deuteronomy 31:6). It explicitly encourages Christians to be stronger (physically and mentally), more courageous, and overall better. The Bible also encourages Christians to overcome the challenges faced during the path for personal growth in verses such as "I can do all things through Christ which strengtheneth me" (*King James Bible,* 2017, Philippians 4:13) and "For with God nothing shall be impossible" (*King James Bible,* 2017, Luke 1:37). The need for self-control is observed in "He that hath no rule over his own spirit is like a city that is broken down, and without walls" (*King James Bible,* 2017, Proverbs 25:28). Self-control is crucial in

sustaining peace and managing aggression being supported by "Blessed are the peacemakers: for they shall be called the children of God" (*King James Bible,* 2017, Matthew 5:9).

In the applied context, the Bible explicitly guides Christian how to become stronger and courageous in verses "And not only so, but we glory in tribulations also: knowing that tribulation worketh patience; And patience, experience; and experience, hope" (*King James Bible,* 2017, Romans 5:3-4). These verses comparably illustrate the tribulations and all physical, cognitive, and psychological obstacles faced during BJJ engagement. Patience (as self-control) is critical for the development of experience (mental strength, resilience, grit, self-efficacy, and aggression). Tribulations ignite personal growth (patience and experience) and, therefore, consequential better life expressed as hope. There can be no experience, growth, and hope without tribulations.

BJJ offers critical tribulations, especially during sparring, to trigger an individual's growth and potentially a better life. Moreover, during one's path toward betterment, BJJ provides an optimistic social network compatible with the verse, "He that walketh with wise men shall be wise: but a companion of fools shall be destroyed" (*King James Bible,* 2017; Proverbs 13:20). This verse is in harmony with the social learning theory, which emphasizes the role of social interactions in individual learning. Conversely with this verse, Williams and Smith (2023) also emphasize the role of the BJJ social network (coaches, teammates, and the overall BJJ community) in helping athletes to overcome challenges and differentiate unreasonable perceptions from reality.

For instance, BJJ sparring may impose various physical (i.e., fatigue) and psychological (i.e., fear of failure) challenges and tribulations. Beginner athletes learn

how to manage these situations by observing and communicating with teammates (Williams & Smith, 2023). Generally, beginners will be encouraged to persevere through fatigue and understand that failure is a natural process while learning something new. This acceptance of failure and how to bounce back throughout the initial learning phase may impact one's level of resilience. In this example, by facing tribulations in BJJ sparring, athletes may obtain new perspectives with potential effects on their mental strength, resilience, and grit.

In short, BJJ provides critical obstacles (tribulations) to initiate the development of self-control (patience), followed by positive mental strength, resilience, grit, self-efficacy, and aggression outcomes (experience), and the ensuing of a better (mental health) and happier (life satisfaction) life (hope).

Definition of Terms

The following is a list of definitions of terms that are used in this study.

Mental Strength –Mental strength is defined as an individual's ability to persevere through challenging situations and to recover from failures (Lorenco-Lima, 2024b).

Resilience –Resilience is defined as a person's ability to recover from hardships and misfortunes (Smith et al., 2008).

Grit - Grit is defined as passion and perseverance for long-term goals (Duckworth et al., 2007).

Self-Efficacy - Self-efficacy represents a person's belief in competently coping with adversity or performing a new or challenging task (Schwarzer & Jerusalem, 1995).

Self-Control - Self-control is defined as a person's ability to restrain undesirable impulses by regulating attention, behavior, and emotion when faced with temptations (Duckworth & Gross, 2014).

Aggression - Aggression is defined as individual differences in thoughts (hostility), emotions (anger), and behavior (verbal and physical) intended to harm another person (Webster et al., 2014).

Life Satisfaction – Life Satisfaction is defined as a subjective perception of personal well-being based on a cognitive judgement and overall comparison between their own circumstances and appropriate social standards (Diener et al., 1985).

Mental Health Disorders - Mental Health Disorders are defined as changes in cognition, emotion, or behavior leading to functional impairment in developmental, biological, or psychological processes underlying mental functioning (American Psychiatric Association, 2013).

Significance of the Study

BJJ is a modern martial art gaining rising interest regarding its physiological characteristics. This study contributes to the limited literature exploring psychological parameters throughout the different belt ranks in BJJ. As a highly popular martial art among adults in the United States, the findings can serve as guiding knowledge for coaches, sports psychologists, and athletes. In practice, drawing a psychological profile of BJJ athletes across the different belt ranks can facilitate understanding common characteristics and acceptance of belt rank-related challenges, potentially decreasing turnover rates. Due to the potential transferability of the psychological skills developed

through BJJ to everyday life (Willing et al., 2019), this study may impact athletes far beyond the mats.

The current study's theoretical contribution may be associated with the long-term effects of BJJ engagement. Although no causal relationship can be established, this study provides primary evidence of the existing differences resulting from continued BJJ engagement. Moreover, results can indicate common effects (i.e., the Dunning-Kruger effect) and reveal whether potential ceilings exist to the psychological benefits promoted by BJJ.

Summary

Chapter 1 introduced the present study and discussed the existing background studies investigating the psychological changes resulting from martial arts, combat sports, and BJJ engagement. Although several studies have shown the effectiveness of martial arts and combat sports in improving several psychological parameters, the number of studies exploring the specificities of BJJ engagement still needs to be increased.

Furthermore, Chapter 1 outlined the problem statement with the significant gap in the literature, the purpose of the study with the converging research questions and hypotheses, and the assumptions and limitations encountered. The theoretical foundations of the study explained the role of the social learning theory in improving psychological skills via BJJ engagement. A biblical foundation was provided in support of BJJ as a tool with potential for personal growth. Lastly, this chapter presented a definition of terms, followed by the significance of the study.

CHAPTER 2: LITERATURE REVIEW

Overview

This study aimed to describe the psychological profiles of BJJ athletes (recreational students and competitive athletes) and explore potential differences among belt ranks. The variables include mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health. This study was prompted by the limited research addressing the psychological characteristics of adult BJJ athletes. Most studies investigating the psychological changes resulting from martial arts and combat sports engagement were conducted with children and adolescents. Therefore, this study aims to expand the BJJ-related literature by describing, comparing, and contrasting the investigated variable among BJJ athletes of different belt ranks.

Description of Search Strategy

The articles included in the current dissertation were selected through a database search in the Jerry Falwell Library, PubMed, and Google Scholar. Search terms included a combination of keywords from group 1 (martial arts, combat sports, Brazilian Jiu-Jitsu) and group 2 (mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health). All selected articles were peer-reviewed, with a minimum of 80% being published within the last five years. Older articles were also included to provide context, definitions of terms, and validation of instruments. Biblical research was conducted through the website King James Bible with the following keywords: mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health.

Review of Literature

Throughout history, strong and successful individuals have been respected and commended for their outstanding ability to overcome challenges and recover from hardships (Lorenco-Lima, 2024b). Over the past two centuries, there has been a rising interest in psychological variables related to performance, such as the effect of hypnosis on muscular endurance, and mental fatigue on physical performance (Lochbaum et al., 2022). Yerkes (1918) proposed for the military, over 100 years ago, the development of psychological centers to address mental strength in soldiers.

The search for activities and strategies for improving mental strength and related skills in contemporary society remains just as relevant. Martial arts are backed by centuries of tradition and are regarded as an educational system champion of several desired moral values (Kostorz & Sas-Nowosielski, 2021). They are also a popular choice among parents reporting as primary reasons for enrolling children in martial arts classes the improvement of self-defense and anti-bullying skills, self-confidence and self-esteem, discipline and self-control, pro-social and community interactions, physical health and fitness, overall character development, focus and attention, mental health, and respect for others (Lorenco-Lima, 2023). More recently, martial arts have surfaced as a therapy-like strategy (Farrer, 2019; Sugden, 2021) with a significant positive impact on well-being, symptoms related to internalizing mental health (Moore et al., 2020), post-traumatic stress disorder and psychopathologies (Willing et al., 2019).

Combat Sports and Martial Arts

As subgroups of sports, combat sports and martial arts have been shown to positively influence several psychological and cognitive traits and skills, including

resilience (Greco et al., 2019; Moore et al., 2019; Moore et al., 2021), grit (Sawyer et al., 2018; Lee et al., 2021; Lorenco-Lima, 2024a), self-regulation (Lakes & Hoyt, 2004), self-control (Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Potoczny et al., 2022; Invernizzi et al., 2023), self-efficacy (Fabio & Towey, 2018; Greco et al., 2019; Moore et al., 2019), self-esteem (Fabio & Towey, 2018; Pujszo et al., 2019a), prosocial behavior (Lakes & Hoyt, 2004; Blomqvist-Mickelsson, 2019b), aggression (Fabio & Towey, 2018; Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Wojdat & Ossowsky, 2019; Gorner et al., 2021; Potoczny et al., 2022; Linder-Postigo et al., 2023), mental strength (Lorenco-Lima, 2024b), attention (Fabio & Towey, 2018), academic performance (Lakes & Hoyt, 2004; Giordano et al., 2021), executive function (Giordano et al., 2021; Linder-Postigo et al., 2023), life satisfaction (Kuśnierz et al., 2020; Kanupriya et al., 2022Potoczny et al., 2022; Bai et al., 2023; Sivan & Zeba, 2023), and mental health (Willing et al., 2019).

Over time, martial artists become competent in managing emotions and resolving conflicts by combining cooperation, competition, and rivalry (Wojdat & Ossowsky, 2019). A common feature of martial arts training includes threat identification and aggressive response based on the identified level of threat (Wojdat & Ossowsky, 2019).

Despite the many supporting studies, martial arts and combat sports are constantly the subject of dispute (Kotarska et al., 2019). For instance, while some studies have considered them ideal means to improve emotional self-control, others have questioned whether their aggressive practices may encourage violent behaviors (Lafuente et al., 2021). However, martial arts and combat sports vary tremendously regarding their traditional or modern approach, their striking- or grappling-based predominance, and the

sparring versus no-sparring characteristic, making the generalization of the findings a great topic for debate.

Combat sports encompass various disciplines (grappling and striking) in which two athletes battle for victory, which is determined by points, loss of consciousness, submission, or disqualification (Lorenco-Lima et al., 2010). Grappling sports such as BJJ and judo are characterized as vigorous activities that improve various physical fitness parameters (Franchini et al., 2017; Lorenco-Lima et al., 2020). Dunston et al. (2022) suggest psychophysiological intertwinement as individuals who reported engagement in more than 300 minutes of vigorous physical activity per week show higher grit and resilience than individuals not meeting this level. Moreover, Daniels et al. (2021) found grit to be positively associated with domestic and leisure physical activity.

Overall, martial arts, like judo continue to be credited as a great instrument for developing emotional intelligence (Acebes-Sánchez et al., 2021). Acebes-Sánchez et al. (2021) compared the differences in emotional intelligence among 3,425 college students. The sample was categorized as not meeting the physical activity recommendations (13.8%) as proposed by the World Health Organization, those meeting the physical activity recommendations (20.3%), those meeting the physical activity recommendations practicing sports (51.7%), judo athletes (10.5%) and high-level judo athletes (3.8%). Findings revealed that judo athletes and high-level judo athletes presented significantly higher emotional intelligence (emotional attention, emotional clarity, and emotional repair) than participants who did not meet the physical activity recommendations, those who met physical activity recommendations, and those who met the physical activity recommendations practicing sports (Acebes-Sánchez et al., 2021).

In children, Pavlova et al. (2019) explored the effectiveness of a karate program on the psychophysical development of preschool girls. Forty-eight girls from 5 to 6 years of age participated in this study (Pavlova et al., 2019). Twenty-one participants comprised the experimental group, and 27 comprised the control group (Pavlova et al., 2019). The experimental group engaged in 3 karate classes per week for 12 months, and the control participated in regular physical education classes of the same frequency and length (Pavlova et al., 2019). Results revealed significantly higher psychophysical posttest for the experimental group compared to the control group in several tests, including writing the letter "o," squats in 10 seconds, claps in 10 seconds, numeral digits scoring in 10 seconds, keeping the "flamingo" pose, standing long jump, throwing and catching of a ball for 30 seconds, throwing and catching of a ball for 30 seconds, jumping with the rope, lifting the body, two-leg squats (Pavlova et al., 2019). The authors concluded that karate training is more beneficial than traditional physical education in preschool girls' psychophysical and mental development (Pavlova et al., 2019). Furthermore, the authors suggest that martial arts should be considered a developmental tool before traditional school education begins (Pavlova et al., 2019).

Participation in martial arts was found to be connected to genetic and physiological factors (Tartar et al., 2020; Rassovsky et al., 2019). Tartar et al. (2020) investigated the catechol-O-methyltransferase (COMT) Val/Met genotype in professional mixed martial arts fighters. A functional single-nucleotide polymorphism in the COMT gene (rs4680) is a gene variant shown to predict the capacity to sustain cognitive agility during stressful situations such as combat and competitions (Tartar et al., 2020). COMT Met allele carriers (low-activity and high dopamine) were found to outperform Val allele

carriers (high-activity and low dopamine) in cognitive tasks (Tartar et al., 2020). However, the relationship between cognitive performance and genotype seems to be reversed under stressful situations where the prefrontal cortex dopamine is increased. Met allele carriers were shown to underperform Val allele carriers (Tartar et al., 2020). This Val allele benefit under stressful events is addressed as COMT "warrior/worrier" model (Tartar et al., 2020). Tartar et al. (2020) found a significantly higher frequency in the GG genotype (warrior) in mixed martial arts fighters compared to the control. What is yet to be determined is whether this variance can be attributed exclusively to genetics or unexplored epigenetic factors.

Rassovsky et al. (2019) explored the effect of martial arts training on the oxytocin response. Oxytocin is a peptide hormone crucial in regulating social behavior, including romantic and filial relationships, parent-infant attachment, and trust and cooperation (Rassovsky et al., 2019). The authors found significant differences between salivary oxytocin at baseline versus peak training and peak training versus post-cooldown, with peak training presenting significantly higher values (Rassovsky et al., 2019). No differences were found between beginners and advanced practitioners (Rassovsky et al., 2019). While there were no statistically significant differences when comparing grappling versus "punch-kick sparring" at baseline and peak training, post-cooldown oxytocin was higher in the grappling group than the "punch-kick sparring" (Rassovsky et al., 2019).

Brazilian Jiu-Jitsu

BJJ stands out as one of the most popular grappling-based combat sports among adult athletes, gaining significant popularity worldwide in recent decades (Andreato et al., 2017; Øvretveit, 2020). The term "Jiu-Jitsu" originated from the Japanese term

"jujutsu," which is composed of two characters: "ju," meaning "gentleness," and "jutsu," meaning "art." Consequently, the term "Jiu-Jitsu" can be translated as "gentle art" (Lorenco-Lima et al., 2020). The origins of Brazilian Jiu-Jitsu can be traced back to Belém in 1917 when the Japanese master Mitsuyo Maeda introduced the principles of Japanese Jiu-Jitsu (Kano Jiu-Jitsu) to the Gracie family (Almeida Junior et al., 2019). Carlos and Hélio Gracie subsequently began practicing Japanese Jiu-Jitsu and transformed the art into what is now recognized as BJJ. They popularized BJJ in Brazil by challenging other martial arts athletes in timeless combats (Lorenco-Lima et al., 2020). BJJ gained significance in the United States around the early 1980s and exponential popularity after the first Ultimate Fighting Championship in 1993 (Gracie & Danaher, 2003).

BJJ emphasizes taking an opponent to the ground via takedown or throws, controlling the opponent, and executing submissions via strangle or joint lock (Williams & Smith, 2023). Matches are known for their acyclic and vigorous nature (Lorenco-Lima et al., 2020), including different movement sequences and critical reliance on strength, speed, power, anaerobic endurance, and flexibility (Oliveira et al., 2009). A systematic review revealed that BJJ matches present an effort/pause ratio from 6:1 to 13:1, with effort periods lasting from 85 to 290 seconds and pauses lasting from 5 to 44 seconds (Andreato et al., 2016). A low-/high-intensity ratio of 8:1 was observed during matches, with high-intensity actions lasting an average of 3 seconds (Andreato et al., 2015). The acyclic and high-intensity nature of BJJ matches lead to the reduction of intramuscular phosphocreatine and glycogen (Andreato et al., 2015; Balson et al., 1999; Hargreaves et al., 1997; Oliveira et al., 2009). BJJ's physiological demands may promote central

nervous system fatigue with potential changes in the athletes' psychological state (Tornero-Aguilera et al., 2022).

BJJ classes generally comprise warmups, technical drills, and sparring (Øvretveit, 2018). Sparring is a critical part of combat training where two participants attempt to execute learned techniques on a resisting partner (Øvretveit et al., 2019). BJJ's sparring can be subdivided into competitive (full use of muscular force) and technical (gentle movements with controlled use of muscular force), with the latter being less prone to injuries and more suitable for regular practice (Belo et al., 2021). Compared to striking-based combat sports, grappling-based sports (i.e., BJJ) can be performed at a higher intensity with a lower risk of significant injuries (Øvretveit et al., 2019). Pujszo et al. (2019a) speculate that the inclusion of sparring during martial arts classes may be the key component to optimizing psychological changes in variables such as resilience and self-esteem.

Lorenco-Lima et al. (2020) investigated the effect of a short-term BJJ program, including warmup, technical drills, and sparring, performed twice a week (1 hour/day) for six weeks. Results demonstrated significant increases in several physiological parameters, including maximum oxygen consumption (men and women), time to exhaustion (men and women), maximum heart rate (men), absolute and relative maximum anaerobic power (men and women), absolute and relative average anaerobic power (men) values, one-repetition maximum test values for lower limbs (men and women), nondominant hand grip strength (women) and flexibility (men). Furthermore, Belo et al. (2021) found that BJJ matches significantly decreased the participants' blood

pressure post-training, suggesting BJJ's non-pharmacological contribution to preventing and managing hypertension.

Although still in its infancy, there has been a rising interest in the psychological effects of BJJ training over the past decade. BJJ has shown promise as an intervention to develop resilience, create meaningful social connections, and promote self-growth (Williams & Smith, 2023). Farrer (2019) and Sugden (2021) have called attention to BJJ's therapy-like characteristics. The authors discuss that BJJ's mental health benefits can be attributed to the role of the social environment in encouraging self-development and personal growth (Farrer, 2019; Sugden, 2021).

Willing et al. (2019) found a significant decrease in post-traumatic stress disorder symptoms (large effect) in armed service personnel and veterans after five months of BJJ practice. The study also found a significant decrease in psychopathology symptoms after two and a half and five months of BJJ training, both with large effects (Willing et al., 2019). The authors speculated that these improvements may be associated with the existing problem-solving opportunity during BJJ classes and the concurrent development of resilience that can be translated to everyday life (Willing et al., 2019). Moreover, BJJ classes provide opportunities for social engagement and social support from like-minded individuals (Willing et al., 2019). Unfortunately, due to the very harsh and physical nature at the beginning of one's BJJ journey, many athletes leave the sport before seeing the consequential positive outcomes (Williams & Smith, 2023).

The ability to persist is critical in BJJ due to the numerous defeats and setbacks athletes face during training, requiring certain psychological skills or the ability and willingness to develop them (Øvretveit, 2020). Despite being a highly technical, BJJ

performance is greatly influenced by physical fitness and is potentially associated with the athletes' psychological skills (Øvretveit, 2020). Simultaneously, failure in BJJ is unavoidable due to the very nature of two individuals competing against each other (Williams & Smith, 2023).

BJJ abandonment can also be attributed to common fears among athletes, such as the devaluation of one's self-estimate, the experience of embarrassment and shame, and the disappointment of important others (Williams & Smith, 2023). In their study, Williams and Smith (2023) observed that these failures were recognized and addressed as individual perceptions rather than actual reality. The coaches, teammates, and BJJ community play a critical role in helping athletes to keep failure in the proper perspective and discriminate perception from reality to optimize individual and community growth (Williams & Smith, 2023).

This level of self-doubt, fear of failure, and anxiety can be exacerbated by competitive involvement with significant positive changes in self-confidence acquired with higher experience. Faro et al. (2020) explain that BJJ athletes of different belt ranks present similar self-confidence and anxiety after completing the first match in a competition. However, after victory, anxiety decreases in the less experienced athletes (blue, purple, and brown belts), and self-confidence increases in the most experienced athletes (black belts), indicating variability in psychological skills among belt ranks in BJJ. A decrease in performance jitters (somatic anxiety) and worry and doubt (cognitive anxiety) may be critical for optimal performances, particularly in less experienced competitors, who could present underdeveloped mental skills under pressure (Faro et al., 2020).

Therefore, understanding the connections between BJJ and the investigated psychological skills is critical for coaches and sports psychologists to optimally guide their students and athletes. It is also critical knowledge for recreational students concerned with the transferability of these skills and optimization of their everyday life (Willing et al., 2019). Nonetheless, the translation of the investigate variables can positively influence numerous consequential outcomes varying from optimal mental health to lower criminality (Duckworth & Gross, 2014; Moore et al., 2020).

Mental Strength

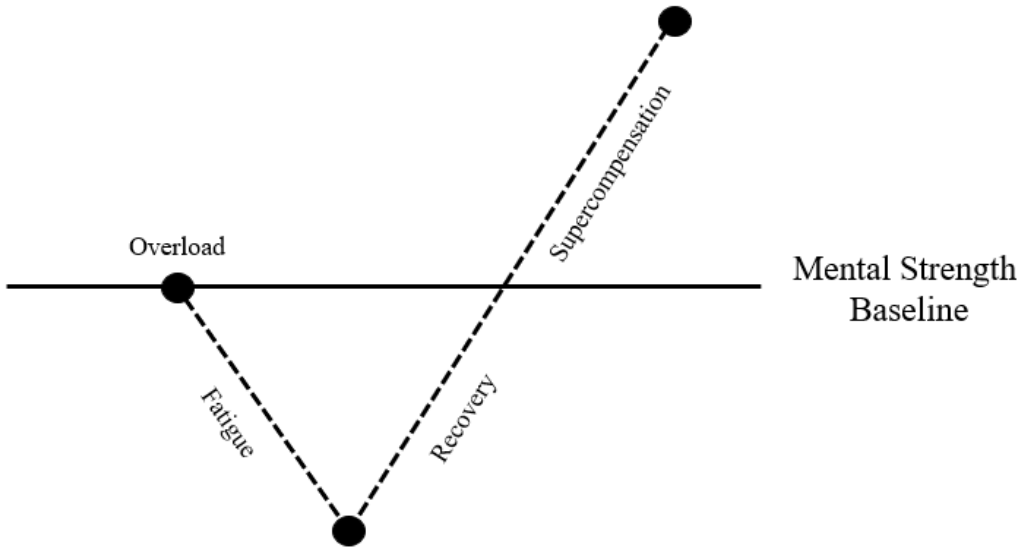
Fundamentally, mental strength addresses perseverance and resilience (Lorenco-Lima, 2024b). Perseverance represents one's ability to persist when pursuing a task despite difficulty (Dagnall et al., 2019). Resilience describes a person's ability to spring back and recover from hardships, misfortunes, and failures (Smith et al., 2008). Therefore, mental strength is defined as an individual's ability to persevere through challenges and to recover from failures (Lorenco-Lima, 2024b). Mental Strength Equation: Mental strength = perseverance + resilience (Lorenco-Lima, 2024b).

In physical fitness terms, perseverance can be comparable to a person's muscular strength and endurance, while resilience represents a person's capacity to recover. Just as muscular strength, mental strength also abides by the overload principle. Originally coined by American exercise physiologist Dr. Arthur Steinhaus in 1933, the overload principle explains one of the critical components required for muscular adaptations (Steinhaus, 1933; Kasper, 2019). To expand the size and functionality, muscle fibers must be stressed beyond the current capacity (Malm et al., 2019). The stress leading to muscular fatigue represents the term overload (Kasper, 2019).

Conversely, mental strength is developed in response to a stimulus (psychological overload). Adequate overload leads to psychological fatigue. The higher the individual's perseverance, the longer the person can prolong work under psychological fatigue. Resilience represents one's ability to recover after psychological fatigue. With proper rest and nutrition, the supercompensation surpasses the initial mental strength baseline (Figure 1).

Figure 1

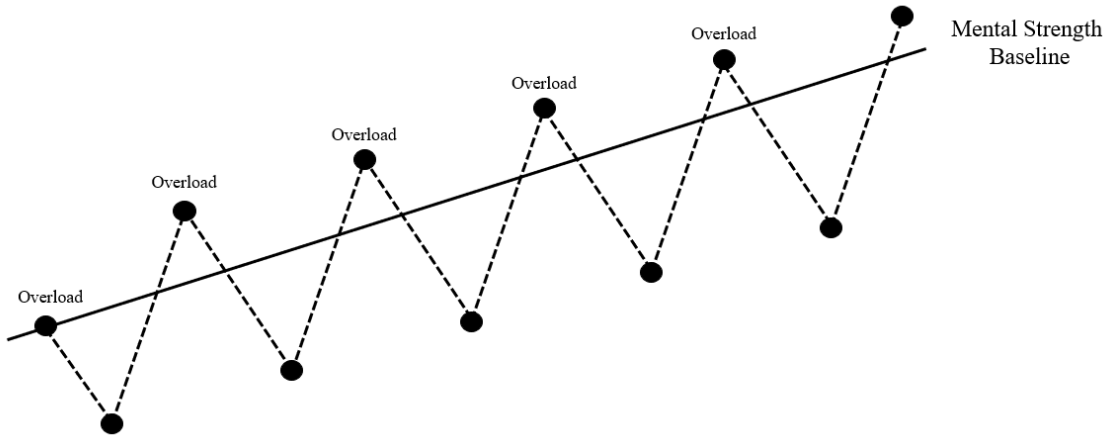
Overload, fatigue, recovery, and supercompensation.



The adaptation principle explains the process occurring after overloads are systematically applied over time during the supercompensation curve, leading to chronic adaptation (Figure 2).

Figure 2

Chronic adaptation.



With the adaptation principle, overloads that were initially overwhelming become less challenging over time due to an increase in psychological efficiency. The principle of progression describes the increments in stimulus required to sustain overload and continued adaptation (Kasper, 2019). Progression must be managed through intensity, volume, and frequency appropriately to prevent injuries (mental health issues) resulting from rapid progression or goal postponement due to a slow progression (Kasper, 2019). Adequate nutrition and rest are crucial for optimal physiological and psychological adaptations and progression.

Injuries, diseases, and reduced performance can sometimes be explained by the overtraining principle when excessive overloads concerning a person's ability to adapt (principle of individuality) lead to detrimental effects (Schwellnus et al., 2016). Excessive psychological overloads can lead to burnout and psychological overtraining (mental health challenges).

A psychophysiological intertwinement was observed by Hoiosen et al. (2020), who found that in highly endurance-dependent sports such as cycling, 21-day mental strength training significantly improved performance in several physiological parameters.

This intertwinement was also observed by Lorenco-Lima (2024b) in a study with combat sports athletes from 18 to 67 years of age. The author found a significant positive correlation between combat sports experience and mental strength (Lorenco-Lima, 2024b). Mental strength was significantly higher in combat sports athletes than in non-practitioners. This difference can be explained by the additional psychological overload faced by combat sports athletes with the consequential higher potential for overcompensations and, therefore, mental strength development. Moreover, males presented higher mental strength than females, indicating a biological variance (e.g., testosterone role) in mental strength, similar to the variances observed in muscular strength and endurance.

Resilience

Resilience is defined as a person's ability to recover from hardships and misfortunes (Smith et al., 2008). Donnon (2010) found that individuals reporting higher levels of resilience are less likely to engage in bullying or be victimized by bullies. Song et al. (2020) demonstrated resilience's skill-like characteristic by improving total scores through a short-term coaching program in a medical intern sample. When discussed as a skill developed as a positive adaptation to adversities (Rich et al., 2022; Ingwerson, 2023), martial arts and combat sports can provide a controlled environment for developing resilience due to the physical and psychological challenges encountered during class. In addition to the short-term anti-bullying effect, resilience in the mid- and

long-term can positively impact mental wellness due to the findings that resilience is a great predictor of lower depression and higher life satisfaction (Ye et al., 2022). Furthermore, a study with graduate students revealed that resilience positively correlated with the students' GPAs (Montas et al., 2020).

Engagement with martial arts has been credited as a great alternative to improve several psychological outcomes (Lorenco-Lima, 2023). Sivan and Zeba (2023) investigated the differences in resilience between an adult sample of karate athletes, kalarippayattu (Indian martial arts) athletes, and sedentary individuals. Resilience was significantly higher in karate and kalarippayattu athletes than in the sedentary group (Sivan & Zeba, 2023). However, no differences were found in resilience between karate and kalarippayattu athletes (Sivan & Zeba, 2023).

In a randomized controlled trial, Moore et al. (2019) observed a significant improvement in total resilience after ten weeks of a martial arts-based intervention with children and adolescents. In a follow-up study, the intervention revealed a lasting effect through significantly higher resilience for the martial arts group compared to the control group at a 12-week follow-up (Moore et al., 2021). Similarly, Greco et al. (2019) found higher resilience after 12 weeks of martial arts training in an adolescent sample.

Recent studies have explored the impact of martial arts experience on resilience. Pujszo et al. (2019b) investigated the impact of martial arts experience on resilience in adult combat sports athletes (judo, BJJ, and kickboxing). A significant relationship was found between resilience and training experience in males and females (Pujszo et al., 2019b). Similarly, Küçük (2020) found a significantly positive correlation between training experience and resilience in adult karate athletes. Pujszo et al. (2019a) also

confirmed this relationship and found a positive relationship between training experience and total psychological resilience.

When comparing martial arts (aikido) and combat sports (judo and kickboxing), Pujszo et al. (2019a) found that combat sports athletes presented higher total psychological resilience, persistency/consistency, and self-esteem than martial arts athletes and non-practitioners (Pujszo et al., 2019a).

Convergent findings among combat sports athletes and martial artists indicate that resilience is higher in males than females (Pujszo et al., 2019b; Küçük, 2020). Pujszo et al. (2019b) proposed that this variance could be explained by the higher average training experience in males.

Regardless of the identified gender differences, martial arts and combat sports were found to optimize resilience in female athletes (Ozturk & Oz, 2022; Yu, 2022). Ozturk and Oz (2022) investigated the psychological resilience of adult female kickboxing athletes. The authors found that 95% of the participants presented very high or high psychological resilience (Ozturk & Oz, 2022;). Moreover, results showed that participants credited kickboxing with providing positive benefits beyond physical development, including psychological, social, and cognitive parameters (Ozturk & Oz, 2022). In a study with female college students, Yu (2022) investigated the effect of 12 weeks of Wushu classes on psychological resilience. Findings revealed that total psychological resilience was significantly higher post-intervention, with significant changes in the perseverance and strength subscales but not optimism (Yu, 2022). However, the rate of improvement in the post-experiment was higher in the freshman

group compared to the sophomore group, explained by the higher sophomore baseline (Yu, 2022).

Grit

Grit is defined as passion and perseverance for long-term goals (Duckworth et al., 2007). Applied grit is expressed as hard work aiming to conquer life challenges with enduring interest and effort throughout long periods and despite failures, adversities, and plateaus (Duckworth et al., 2007). As a measuring tool, the Grit Scale encompasses perseverance of effort and consistency of interest (Duckworth et al., 2007). Grit provides greater incremental predictive validity of success than IQ and conscientiousness (Duckworth et al., 2007).

A study with adolescents revealed a positive correlation between grit and life satisfaction and well-being (Datu et al., 2022). Liu et al. (2022) found a positive correlation between grit and life satisfaction, with stressful life events and depression mediating the relationship among college students. Moreover, Li et al. (2018) that grit positively correlated with life satisfaction during adulthood.

Dunston et al. (2022) explored the potential independent association between grit and physical activity levels in college students. Results revealed that grit (perseverance of effort) positively correlated with time spent in vigorous physical activity (Dunston et al., 2022). Moreover, the participants who engaged in >300 minutes/week of vigorous physical activity presented higher grit (perseverance of effort and consistency of interest than participants who did not meet this level (Dunston et al., 2022).

Daniels et al. (2021) examined the independent relationships between physical activity, grit, and academic achievement. The authors found that grit was positively

associated with walking, moderate physical activity, vigorous physical activity, and total physical activity (Daniels et al., 2021). Grit was also positively associated with leisure and domestic physical activity (Daniels et al., 2021). Furthermore, grit positively predicts GPA (Daniels et al., 2021). However, the participants' total physical activity did not predict GPA (Daniels et al., 2021). This study provides confirmatory support for previous research establishing the intertwinements between grit, physical activity, and academic success (Daniels et al., 2021).

Lee et al. (2021) investigated the effect of taekwondo classes (2x/week for one year) on grit and college students' academic achievement. Results demonstrated a significant increase in grit in taekwondo and non-taekwondo practitioners, with a higher rate of increase in the taekwondo group (Lee et al., 2021). Furthermore, the author determined that taekwondo ability positively correlated with academic achievement and grit (Lee et al., 2021).

Sawyer et al. (2018) examined the association between taekwondo-related outcomes (attrition, competition participation, and belt testing scores) and grit (instructor- and parent-rated). This study was conducted based on the premise that martial arts training plays a crucial role in fostering grit in children (Sawyer et al., 2018). Participants in this study were recruited from a small taekwondo school in the Midwest and included 102 students from 6 to 17 years old (Sawyer et al., 2018). Results revealed that parent and instructor-rated grit positively correlated with taekwondo testing scores (Sawyer et al., 2018). The instructor-rated grit in the tournament group was significantly higher than in the non-tournament group (Sawyer et al., 2018). The instructor-rated grit for the group

attending classes was higher than those not attending classes six months post-initial data collection (Sawyer et al., 2018).

A study by Shamshirian et al. (2021) investigated grit, passion, and mindset in wrestlers by comparing the scores of national and international level athletes and exploring the potential associations among variables. One hundred and twenty-four wrestlers (international level: 51.3%; national level: 48.7%) and one hundred and six non-wrestlers participated in this study (Shamshirian et al., 2021). Results revealed that wrestlers demonstrate higher grit, passion, and growth mindset than non-wrestlers (Shamshirian et al., 2021). No significant difference in grit was found between national and international-level wrestlers (Shamshirian et al., 2021).

Self-Efficacy

Self-efficacy is defined as an individual's belief in his or her ability to organize and execute specific behaviors required to generate specific outcomes (Bandura, 1977). It describes an individual’s confidence in achieving an objective regardless of obstacles, difficulties, and events (Bandura, 1986). General self-efficacy was found to be positively correlated with mental health (Huang et al., 2023) and mental well-being (Rippon et al., 2022). Moreover, self-efficacy positively predicts life satisfaction, hope (Ekinci & Koç, 2023), and psychological well-being (Millam et al., 2019). As a skill, Tikac et al. (2022) found regular exercise to be an effective intervention to improve self-efficacy and self-esteem in young adults.

Fabio and Towey (2018) found that martial artists presented significantly higher self-efficacy than non-martial artists. In a study with 140 young adult males, Stanković et al. (2022) compared self-efficacy levels between judokas and individuals engaged in

team sports. Significantly higher self-efficacy was found in judokas than in team sports. The authors propose that this difference in self-efficacy can be attributed to individual sports requiring exclusive self-reliance in pursuing a goal. In contrast, team sports share the credit for successes and the blame for failures (Stanković et al., 2022).

Greco et al. (2019) found a significant improvement in self-efficacy (academic, emotional, and social) after 12 weeks of martial arts training in an adolescent sample. Another randomized controlled trial study with children and adolescents observed a significant improvement in self-efficacy (academic, emotional, and social) after a 10-week martial arts-based intervention (Moore et al., 2019).

In a randomized controlled trial, Salchow et al. (2021) investigated the changes in self-efficacy after six months of Kyusho Jitsu practice on breast cancer survivors. Results indicated a significant increase in self-efficacy after six months of training in the intervention group, while no change was observed in the control group (Salchow et al., 2021).

Faro et al. (2020) suggest that self-efficacy in experienced BJJ athletes can be fundamental to sustaining focus and competitiveness, especially when fatigued (Faro et al., 2020). Øvretveit et al. (2020) explored the relationship between BJJ athletes' physical self-efficacy and their actual physical fitness assessed through laboratory measurements (strength, endurance, and body composition). Findings revealed a significant relationship between physical self-efficacy and VO_2max and pull-ups. The author concluded that aerobic and muscular endurance were associated with BJJ athletes perceived physical ability.

Among boxers, Chen et al. (2019) found a negative correlation between self-efficacy and aggressive behavior, establishing self-efficacy as a significant negative predictor of aggressive behavior. Moreover, the authors determined that self-efficacy increases with the simultaneous increase in training experience, age, and competitive level. No gender difference was found in self-efficacy in this study.

Self-Control

Previously addressed as self-denial, self-control is defined as a person's ability to restrain undesirable impulses by regulating attention, behavior, and emotion when faced with temptations (Galton, 2006; Duckworth & Gross, 2014). Cognitively, self-control acts by blocking one's impulses for immediate gratification and supplanting this desire with an option that ponders the long-term outcomes of each alternative (Mamayek et al., 2017). Individuals with low self-control tend to ascribe a higher value to behavior leading to immediate gratification and lower value to the potential long-term deferred benefits or costs of a particular choice (Mamayek et al., 2017). Applied self-control describes the action of deciding between alternatives with different temporal rewards in a now versus later timeframe (Rachlin, 1974). A person will exert higher immediate self-control when opting for a more significant reward in the future to a smaller reward in the present or to avoid substantial pain in the future in return for low pain in the present (Rachlin, 1974).

Self-control is a great predictor of future life success of several variables, including financial security, savings behavior, occupational prestige, future income, substance use, criminal conviction, and physical and mental health (Moffitt et al., 2011). As strong as general intelligence and socioeconomic status, self-control is a reliable predictor of consequential outcomes (Duckworth & Gross, 2014). Those incapable of

exerting adequate self-control are bound to personal catastrophe (Mamayek et al., 2017). Xu et al. (2022) found significant negative correlations between self-control and negative affect, aggression, and bullying behavior. On the other hand, those capable of restraining undesired impulses when faced with temptation or challenges are more likely to demonstrate improved physiological and psychological well-being (Willems et al., 2019).

Martial arts engagement is recognized as a great strategy for improving self-control in children and adolescents (Lakes & Hoyt, 2004; Hardwood-Gross et al., 2021; Ng-Knight et al., 2022; Xu et al., 2022; Lorenco-Lima, 2023) and adults (Blomqvist-Mickelsson, 2019b; Potoczny, 2022; Invernizzi et al., 2023).

In a randomized study with children, Lakes and Hoyt (2004) found significant improvements in affective self-regulation, cognitive self-regulation, and physical self-regulation after two to three 45-minute martial arts classes for four months. Similarly, after two 45-minute taekwondo classes a week for 11 weeks, Ng-Knight et al. (2022) found lower teacher-rated conduct problems, higher teacher-rated attentional focus, and higher executive attention post-taekwondo intervention. Moreover, 89% of the children in the taekwondo group enjoyed the lessons, with 67% stating that they would like to continue with the lessons (Ng-Knight et al., 2022). The authors concluded that students received taekwondo classes well, improved attentional self-regulation, and reduced conduct problems (Ng-Knight et al., 2022), therefore making martial arts a viable alternative to help children develop self-regulatory skills in a fun yet effective manner (Lakes & Hoyt, 2004).

The consequences of lack of self-control can vary from individual attention problems (Ng-Knight et al., 2022) to more serious issues such as bullying (Xu et al.,

2022). Xu et al. (2022) explored the internal interactions between self-control and bullying in adolescent martial arts practitioners and non-practitioners. The authors found that martial arts practitioners presented higher self-control and lower bullying behavior than non-practitioners, with males presenting higher bullying behavior than females (Xu et al., 2022). These results complement the findings by Hardwood-Gross et al. (2021), who determined that engagement in two 50-minute classes a week for six months significantly improved self-control and inhibition in at-risk adolescents.

Acutely, Invernizzi et al. (2023) explored the effect of judo sparring on self-control. Participants were highly skilled (black belts) and engaged in five 5-minute bouts with a 2-minute rest period between bouts and a resting session (seven days apart), where participants remained seated for 33 minutes. Results demonstrated a significant improvement in inhibitory control with participants recording more correct responses in the Flanker Task (assessment of attention and inhibitory function) for congruent and incongruent conditions post-sparring. The results indicated that an acute judo randori session effectively improved judokas' inhibitory control and self-control ability (Invernizzi et al., 2023).

In a longitudinal study, Blomqvist-Mickelsson (2019b) investigated the effect of BJJ and mixed martial arts on self-control in adolescents and young adults. Participants engaged in at least two classes a week for five months (Blomqvist-Mickelsson, 2019b). The author found improvements in self-control post-intervention in both combat styles (Blomqvist-Mickelsson, 2019b). In boxers, Chen et al. (2019) found self-control to increase simultaneously with the advancement in age, competitive level, and training

experience. This study also revealed a negative association between self-control and aggressive behavior (Chen et al., 2019).

Potoczny (2022) explored the intermediary effect of self-control and emotional regulation in the relationship between karate training and life satisfaction. Karate practice did not directly affect life satisfaction. However, an indirect association between karate practice and life satisfaction was found through reappraisal and self-control pathways. Karate practitioners demonstrated higher levels of reappraisal and self-control than not-practitioners. Female practitioners had higher emotional regulation and self-control than male practitioners. Furthermore, participants between 25 and 45 years old presented higher self-control and emotional regulation than younger groups (Potoczny, 2022).

Aggression

As a broad concept, aggression is defined as a behavior aiming to harm another individual physically or psychologically (Lafuente et al., 2021). Every individual presents a greater or lesser level of aggression (Gorner et al., 2021). Biologically, aggression is controlled by the amygdala and regulated by neurotransmitters (i.e., serotonin) and hormones (i.e., testosterone) (Wojdat & Ossowsky, 2019). As a trait, aggression is determined by inheritance (biologically), learning (cognitively), and emotional and environmental influence (psychosocially) (Gorner et al., 2021). Although often instinctive, aggressive behaviors can be modified via learning processes (Wojdat & Ossowsky, 2019). Aggression can be divided into emotional, determined by fight or flight behaviors, and rational, by engaging the intellect to improve one’s effectiveness (Wojdat & Ossowsky, 2019).

Physical activity and sports are generally perceived as socially accepted alternatives to clear oneself of aggression (Kostorz & Sas-Nowosielski, 2021). Competitive sports are generally recommended to prevent or treat excessive aggressive behaviors (Wojdat & Ossowsky, 2019). Aggression may be critical for optimal performance in many sports, with research presenting diverging evidence regarding the sports' role in decreasing or increasing aggressiveness (Gorner et al., 2021). This disparity can be potentially explained by the distinct rulesets and objectives of different sports (i.e., contact versus non-contact, modern versus traditional, and combat versus non-combat).

The very nature of combat sports allows deliberate physical aggression against an opponent within the rules guiding the combat (Basiaga-Pasternak et al., 2020). This characteristic makes the psychological development of combat sports athletes critical. Athletes must be fully aware of the consequences of using learned techniques and the role of aggressiveness throughout different areas of life (Basiaga-Pasternak et al., 2020). Some authors express concern about the non-educational and unreliable pedagogical nature of many combat sports, potentially negatively affecting their athletes (Linder-Postigo et al., 2023).

As supportive evidence in favor of martial arts, Fabio and Towey (2018) found that martial artists presented lower aggressiveness than non-martial artists (Fabio & Towey, 2018). Stanković et al. (2022) compared aggression levels between male judokas and individuals engaged in team sports. Findings revealed significantly lower overall aggressiveness and lower indirect and physical aggression in judokas than in team sports (Stanković et al., 2022). Regardless of the documented benefits, the general public often

associates combat sports and martial arts with aggressiveness (Stanković et al., 2022). This notion is drawn based on the martial arts incorporation of fighting techniques and unclear data regarding students' social and psychological well-being (Stanković et al., 2022). Gorner et al. (2021) explored the difference in aggression between martial arts, non-combat team sports, and individual sports and control. Results indicated that martial arts training experience negatively correlated with medium effect size with verbal aggression, suspicion, negativism, irritability, and assault. The authors concluded that martial arts are effective tools to lower aggression levels. These findings serve as evidence of the contribution of combat sports in reducing aggressiveness in athletes (Gorner et al., 2021; Stanković et al., 2022).

In a systematic review, Lafuente et al. (2021) suggest an unclear relationship between martial arts and aggressiveness. Some studies have observed increased aggression after engagement with certain combat sports and modern martial arts, such as mixed martial arts (Blomqvist-Mickelsson, 2019b; Lafuente et al., 2021). While this increase may be true in some instances for some combat sports (Blomqvist-Mickelsson, 2019b), traditional martial arts with philosophical and kata teaching were less likely to increase aggressiveness (Lafuente et al., 2021).

Kostorz and Sas-Nowosielski (2021) compared aggression levels between adult martial arts (capoeira, aikido, and Pszczynska martial arts) and combat sports athletes (wrestling, judo, Kyokushin karate, taekwondo, and fencing). Results revealed significantly lower hostility and general aggression levels in martial artists than in combat sports athletes (Kostorz & Sas-Nowosielsk, 2021). Females presented lower physical aggression, verbal aggression, and hostility than males. No effect was observed among

training experience, training rank, and aggression. Compared to normative values, lower hostility was found among men and lower hostility and general aggression in women athletes of martial arts or combat sports. The authors emphasize that levels of aggression are not constant and are characterized by dynamism and variability over a lifetime (Kostorz & Sas-Nowosielsk, 2021). Chen et al. (2019) study with national-level boxers also found significantly higher aggressive behavior and physical aggression in males. However, verbal aggression was significantly higher in females than in males (Chen et al., 2019).

In a quasi-experiment, Lindell-Postigo et al. (2023) explored the influence of a judo program on aggressive behavior in adolescents (50.4% males). Results demonstrated that three months of judo practice (24 classes) led to a non-significant trend of decrease in reactive over aggression, pure over aggressiveness, instrumental relational aggression, reactive relational aggression, instrumental relational aggression, and a significant decrease in pure relational aggression ($p \leq 0.05$). Previous studies have shown that children presenting higher emotional intelligence are less likely to present aggressive behaviors (Alvarado et al., 2020; Segura et al., 2020). These findings are somewhat congruent with Lindell-Postigo et al. (2023), who also found a non-significant increase in self-emotional management, emotional perception, emotional utilization, and hetero-emotional management.

Blomqvist-Mickelsson (2019b) found an increase in aggression after five months of mixed martial arts training (Blomqvist-Mickelsson, 2019b). However, despite the increase in aggression, this study also revealed an increase in self-control and, therefore, neutralizing the potential "negative" effects of mixed martial arts training (Blomqvist-

Mickelsson, 2019b). On the other hand, five months of BJJ training caused a decrease in aggression. Wojdat and Ossowsky (2019) compared the level of aggression between men and women BJJ athletes and non-practitioners. The authors found a lower level of total aggression in BJJ athletes than non-practitioners (men and women), with women presenting lower aggression than men. Moreover, lower total aggression was found following the simultaneous increase in training experience, with a greater decrease occurring between the first 2-3 years of BJJ training (Wojdat & Ossowsky, 2019). The authors support using BJJ training as an effective intervention to reduce aggression.

Blomqvist-Mickelsson (2019a) explored the interactions and predictions between self-control and aggression in mixed martial artists. Participants completed 2.56 ± 0.41 mixed martial arts sessions per week with data collected and baseline and after five months of training. Baseline self-control significantly predicted post-test aggression. Baseline aggression was found to predict post-test self-control significantly. The author explains that mixed martial arts athletes increased both traits: aggression and self-control. However, these traits increase depended on the opposing trait's baseline levels (Blomqvist-Mickelsson, 2019a).

Basiaga-Pasternak et al. (2020) explored the potential differences in aggression between combat sports competitors and non-competitors. Although not statistically significant, results revealed that competitors' aggression was slightly lower than non-competitors. Overall, combat sports athletes presented relatively low physical aggression, opposing the stereotype that fighters settle all conflicts with their fists. The authors explain that regular and committed combat sports training, when supervised by a coach

who emphasizes educational aspects and conformity to the rules, can reduce aggressive behaviors (Basiaga-Pasternak et al., 2020).

Despite many researchers addressing aggressiveness as a negative trait, aggressiveness has several practical and positive benefits in business. For instance, aggressive entrepreneurs are often more capable of obtaining better outcomes than less aggressive entrepreneurs (Paulus & Hermanto, 2022). Furthermore, the potentially detrimental effects of the increase in aggressiveness promoted by some martial arts can be offset by the simultaneous increase in self-control throughout practice.

Life Satisfaction

Sports in general as well as martial arts have been shown to positively influence life satisfaction among athletes (Kuśnierz et al., 2020; Bai et al., 2023; Sivan & Zeba, 2023). Kuśnierz et al. (2020) explored life satisfaction among karate and team sports athletes. The authors found that both groups presented high levels of life satisfaction. No statistically significant difference was observed between karate athletes and team sports players.

As a measure of well-being, life satisfaction was found to be significantly improved with a large effect after 12 weeks of Tai Chi training (Bai et al., 2023). Moreover, karate and kalaripayattu athletes were found to present significantly higher life satisfaction than the general population (Sivan & Zeba, 2023).

In BJJ athletes, Wojdat et al. (2017) found that BJJ athletes reported significantly higher levels of life satisfaction than non-practitioners. Life satisfaction was found to be strongly associated with the length and the quality of the athletes' sports career (Kanupriya et al., 2022).

Mental Health

Sports can provide substantial short- and long-term physical and mental health benefits for adults (Eather et al., 2023). Some authors found that sports' social and mental health benefits exceed those acquired through other recreational and leisure activities (Mills et al., 2019; Howie et al., 2020).

In addition to physical fitness improvements, martial arts, and combat sports have been credited as great avenues for improving mental and spiritual health (Weinberger & Burraston, 2021). Sugden (2021) suggests that, in Western societies, the overall number of men affected by poor mental health has been under-reported. Poor mental health can lead to increased aggression, inattentiveness/hyperactivity, and emotional challenges, including anxiety and depression (Waddell et al., 2005).

Over the past years, BJJ has been highly advertised as a form of social and psychological therapy (Blomqvist-Mickelsson, 2021). Some authors have proposed that BJJ is a highly beneficial type of therapy (Farrer, 2019; Sugden, 2021; Weinberger & Burraston, 2021). This therapeutic characteristic is observed as athletes regularly place themselves under mental and physical stress, stimulating them to access numerous resources to facilitate mental health development (Sugden, 2021).

Recent studies have supported BJJ as an effective instrument to decrease post-traumatic stress disorder (Willing et al., 2019; Weinberger & Burraston, 2021) and psychopathological symptoms (Willing et al., 2019). Moreover, Blomqvist-Mickelsson (2021) suggests that the BJJ community may serve as a buffer against mental health disorders and stimulate well-being.

Through a randomized control experiment, Bueno et al. (2023) investigated the effect of 12 weeks of BJJ training (2 classes per week) on children's mental health. The results revealed that BJJ significantly decreased emotional symptoms, hyperactivity/inattention, total difficulties score, and externalizing problems compared to children engaged in regular physical education (Bueno et al., 2023). The finding suggests the utility of BJJ in improving mental health.

Although still limited, initial evidence suggests a therapy-like characteristic of BJJ with significant improvement in post-traumatic stress disorders, psychopathological symptoms, emotional symptoms, hyperactivity/inattention, total difficulties score, externalizing problems, and well-being (Willing et al., 2019; Blomqvist-Mickelsson, 2021; Weinberger & Burraston, 2021; Bueno et al., 2023).

Biblical Foundations of the Study

Through distinct epistemological grounds, Christianity and psychology attempt to understand and explain human motivations and behaviors (Johnson, 2010). Christianity seeks truth via revelations and psychology via observation (Johnson, 2010). Despite the methodological differences, their common goal is to improve human well-being. As the biblical foundation for this research, the Bible does not save words about the relevance of fostering mental strength, resilience, grit, and self-efficacy, such as in verse "Be strong and of a good courage, fear not, nor be afraid of them: for the LORD thy God, he it is that doth go with thee; he will not fail thee, nor forsake thee" (*King James Bible*, 2017, Deuteronomy 31:6). This verse encourages Christians to be better, stronger (physically and mentally) and more courageous. In the path to personal growth, the Bible offers hope

to overcome the obstacles faced during personal growth through verses like "For with God nothing shall be impossible" (*King James Bible, 2017,* Luke 1:37) and "I can do all things through Christ which strengtheneth me." (*King James Bible,* 2017, Philippians 4:13).

The relevance of self-control is explained in "He that hath no rule over his own spirit is like a city that is broken down, and without walls" (*King James Bible,* 2017, Proverbs 25:28). Sproul (2000) explains that God's gift of free will is an excellent illustration of a person's natural ability to sin (posse peccare) or not to sin (*posse non peccare*). With free will comes the responsibility of self-control. Self-control is critical in making peace and controlling one's aggression and is supported by "Blessed are the peacemakers: for they shall be called the children of God" (*King James Bible,* 2017, Matthew 5:9).

An explicit guide on how to become stronger and more courageous, and therefore develop the psychological variable investigated in the current study, is found in verses "And not only so, but we glory in tribulations also: knowing that tribulation worketh patience; And patience, experience; and experience, hope" (*King James Bible,* 2017, Romans 5:3-4). A parallel can be drawn between tribulations and all physical, cognitive, and psychological challenges occurring during a person's involvement with BJJ. Patience (addressed as self-control) is of the essence for a person to develop experience (mental strength, resilience, grit, self-efficacy, and aggression). Tribulations are the starting point to ignite a person's growth, with the consequential better life expressed in the Bible as hope. There can be no experience and, therefore, growth and hope without tribulations.

BJJ provides the necessary tribulations, particularly during sparring, in a controlled environment to ignite the athletes' personal growth and the consequential better life. Moreover, during a person's path to betterment, BJJ provides social support compatible with the verse, "He that walketh with wise men shall be wise: but a companion of fools shall be destroyed" (*King James Bible*, 2017; Proverbs 13:20). This verse goes together with the social learning theory, emphasizing the social role in molding an individual. Parallel to this verse, Williams and Smith (2023) highlight the role of the social (coaches, teammates, and the overall BJJ community) as critical facilitators for helping athletes overcome obstacles and discriminate unreasonable perceptions from reality.

For example, BJJ sparring imposes various physical (i.e., fatigue) and psychological (i.e., fear of failure) obstacles and tribulations. Beginner athletes learn how to approach these situations by observing and communicating with teammates. Normally, beginners will be motivated to persevere through fatigue and accept that failure is only natural while learning a new skill. This new perspective about failure and how to recover may impact the athletes' resilience. In this example, athletes may obtain new worldviews that could improve mental strength, resilience, and grit by facing tribulations during BJJ sparring.

Therefore, BJJ provides the necessary challenges (tribulations) to ignite the development of self-control (patience), the consequential mental strength, resilience, grit, self-efficacy, and aggression outcomes (experience), and the consequential better life (hope).

Summary

The literature review in Chapter 2 discussed the findings from previous studies. The independent and dependent variables were defined, explored, and reviewed to provide the background for the present study. The discussion was started through a broad exploration of the general characteristics and psychological benefits of sports in general, narrowing down to combat sports and, when available, to the specificities of BJJ.

Martial arts and combat sports have long been recognized as effective interventions for enhancing various psychological, cognitive, and physiological variables. As a martial art readily available throughout the United States, BJJ has shown initial evidence of effectiveness in developing some desirable psychological variables. The findings of this study serve as additional evidence to support BJJ-based interventions to foster mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, mental health and lower aggression, which in turn can lead to increased well-being, and overall achievement. By supplementing the existing literature, this research aims to deepen the understanding of the long-term effects associated with cultivating the investigated variables through BJJ.

In Chapter 3, the methodology for the present study is thoroughly outlined. It begins by presenting the research questions guiding the study, accompanied by the study hypotheses, followed by the research design, participants' characteristics, study procedures, instrumentation and measurement, operationalization of variables, data analysis, delimitations, assumptions, and limitations.

CHAPTER 3: RESEARCH METHOD

Overview

Chapter 3 introduces the specificities of the methodology of the present quantitative research. This study aims to compare the psychological differences among belt ranks in BJJ athletes (recreational students and competitive athletes). The study's quantitative design was developed to examine the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between BJJ belt ranks.

Chapter 3 includes an in-depth presentation of the research questions and hypotheses, research design, participant characteristics, study procedures, instrumentation and measurement, operationalization of variables, data analysis, delimitations, assumptions, and limitations.

Research Questions and Hypotheses

RQ1: Is there a difference in self-reported mental strength, as measured by the Mental Strength Scale, among belt ranks in BJJ athletes?

RQ 2: Is there a difference in self-reported resilience, as measured by the Brief Resilience Scale, among belt ranks in BJJ athletes?

RQ 3: Is there a difference in self-reported grit, as measured by the Grit Scale, among belt ranks in BJJ athletes?

RQ 4: Is there a difference in self-reported self-efficacy, as measured by the General Self-Efficacy Scale, among belt ranks in BJJ athletes?

RQ 5: Is there a difference in self-reported self-control, as measured by the Brief Self-Control Scale, among belt ranks in BJJ athletes?

RQ 6: Is there a difference in self-reported aggression, as measured by the Brief Aggression Questionnaire, among ranks in BJJ athletes?

RQ 7: Is there a difference in life satisfaction, as measured by the Satisfaction with Life Scale, among belt ranks in BJJ athletes?

RQ 8: Is there a difference in mental health, as measured by the Mental Health Disorders Screening Instrument for Athletes, among belt ranks in BJJ athletes?

It is hypothesized that:

H1: Mental strength will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H2: Resilience will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H3: Grit will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H4: Self-efficacy will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H5: Self-control will be higher in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H6: Aggression will be lower in more experienced BJJ athletes (e.g., black belts) than less experienced athletes (e.g., white belts).

H7: Life satisfaction will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

H8: Mental health will be better in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

Research Design

This quantitative study aims to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health among belt ranks in BJJ athletes. All questionnaires and scales used in this research have been previously validated as a quantitative instrument by their authors. The selected instruments used in this research have been shown to be reliable and valid in previous research. Despite the limited number of studies investigating psychological skills in BJJ, hypotheses 1 through 8 were motivated and developed based on the findings of previous BJJ studies and different combat sports and martial arts (Fabio & Towey, 2018; Sawyer et al., 2018; Blomqvist-Mickelsson, 2019a; Blomqvist-Mickelsson, 2019b; Greco et al., 2019; Moore et al., 2019; Wojdat & Ossowsky, 2019; Gorner et al., 2021; Lee et al., 2021; Moore et al., 2021; Potoczny et al., 2022; Invernizzi et al., 2023; Linder-Postigo et al., 2023; Lorenco-Lima, 2024a; Lorenco-Lima, 2024b).

Primary analyses were performed via analyses of variance. In addition to the presented hypotheses, secondary analyses were performed through independent *t*-tests to explore the differences between white and black belts as well as biological sex differences; and multiple linear regression was used to explore the relationship between the dependent variables and age, BJJ experience, competitive engagement, and hours and days of BJJ practice per week.

Participants

A sample of 410 BJJ athletes (323 males and 87 females) from 18 to 60 years of age was included in this study. Participants were currently engaged in BJJ classes for at

least one class per week (minimum of 52 per year). Participants were recruited using a social media flyer linked to the online research form. The flyer was posted on Facebook and Instagram (Appendix A) and distributed to BJJ clubs across the United States.

An *a priori* power analysis was performed with a medium effect size (.25), α = .05, and power criterion of .80. The analysis revealed a need for 200 participants as the minimum sample for group comparison (5 groups). The current sample of 410 BJJ athletes fulfilled the *a priori* power analysis requirement.

Study Procedures

In the present quantitative research, a Google search was performed to identify the social media (Facebook and Instagram) and email of the two best BJJ schools in all 50 states in the United States. A combination of the name of the state and "Brazilian Jiu-Jitsu" or "BJJ" was used to identify the best schools. The two schools with the highest Google Business reviews were included in a contact list (name of the school, Facebook, Instagram, and email). The higher number of reviews was considered as a tiebreaker when required. Using the author's Facebook, Instagram, and email accounts, the schools were contacted individually and invited to support the study by sharing the flyer on their school's social media (Facebook and Instagram) and email list. In case any of the selected schools refuse participation, the next best school was contacted in an attempt to include two participating schools from each state. After sharing the flyer across the United States, self-selected participants followed the online link to read the study information sheet (Appendix B), respond to BJJ-related questions (Appendix C), and the questionnaires and scales in the Google Form (Appendices D-K). This study was

anonymous, and no compensation was offered for participation. Data collection was conducted from April 19 to May 20, 2024.

The Google Form contained the Mental Strength Scale (Lorenco-Lima, 2024b), Brief Resilience Scale (Smith et al., 2008), Grit Scale (Duckworth et al., 2007), General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995), Brief Self-Control Scale (Tangney et al., 2004), Brief Aggression Questionnaire (Webster et al., 2014), Satisfaction with Life Scale (Diener et al., 1985), Mental Health Disorders Screening Instrument for Athletes (Donohue et al., 2023), and questions about the participants' age, biological sex, state of residency, BJJ experience (years and months), training frequency (days per week) and volume (hours per week), belt rank (white, blue, purple, brown, and black), sparring engagement (technical, competitive, both, or none), competitive engagement (competitions over the previous 12 months), and engagement with other sport, martial arts, or physical activity (yes/no).

Prior to data collection the present research received an exempt status by the Liberty University Institutional Review Board.

Instrumentation and Measurement

Mental Strength Scale

The Mental Strength Scale (MSS) is a 10-item, 5-point Likert Scale with Cronbach's alpha of .80 (Lorenco-Lima, 2024). Participants were asked to mark the box that best represents their thoughts over the past month while thinking about their athletic engagement. Items 3, 6, 7, and 10 are positively worded, varying from 1 for "strongly disagree" to 5 for "strongly agree." Items 1, 2, 4, 5, 8, and 9 are negatively worded and

reverse coded. Total scores were determined by the average of the ten items, with 5 representing high mental strength and 1 representing low mental strength.

Brief Resilience Scale

The Brief Resilience Scale (BRS) is a 6-item, 5-point Likert scale, with Cronbach's alpha ranging from .80 to .91 in four studies (Smith et al., 2008). Participants were asked to mark one box per row that best describes them, with answers varying from 1 for "strongly disagree" to 5 for "strongly agree" (Smith et al., 2008). Statements 1, 3, and 5 are positively worded, and statements 2, 4, and 6 are negatively worded and reverse coded, with total scores determined by the average of the six items (Smith et al., 2008). Scores between 1.00 and 2.99 represent low resilience, 3.00 and 4.30 represent normal resilience, and 4.31 and 5.00 represent high resilience (Smith et al., 2013).

Grit Scale

The Grit Scale (GS) is a 12-item, 5-point Likert scale, with Cronbach's alpha of .85 (Duckworth et al., 2007). Participants were asked to mark the statement that best describes them compared to most people (Duckworth et al., 2007). Answers for items 1, 4, 6, 9, 10, and 12 vary from 1 for "not like me at all" to 5 for "very much like me" (Duckworth et al., 2007). Items 2, 3, 5, 7, 8, and 11 are reverse coded. The total scores were determined by the average of the 12 items (Duckworth et al., 2007). The maximum possible score is 5, representing extremely gritty individuals, and the lowest is 1 for not at all gritty (Duckworth et al., 2007).

General Self-Efficacy Scale

The General Self-Efficacy Scale (GSE) is a 10-item, 4-point Likert Scale with Cronbach's alpha between .76 and .90 (Schwarzer & Jerusalem, 1995). Answers vary

from 1 for “not at all true” to 4 for “exactly true.” Total scores were calculated by the sum of the 10 items, with higher scores indicating higher self-efficacy.

Brief Self-Control Scale

The Brief Self-Control Scale (BSCS) is a 13-item, 5-point Likert scale, with Cronbach’s alpha of .83 and .85 in two different studies (Tangney et al., 2004). Participants were asked to indicate the statement reflecting how they typically are, with answers varying from 1 for “not at all like me” to 5 for “very much like me” (Tangney et al., 2004). Statements 1, 6, 8, and 11 are positively worded, and statements 2, 3, 4, 5, 7, 9, 10, 12 and 13 are negatively worded and reverse coded. Total scores were determined by the sum of the 13 items with higher scores indicating higher self-control (Tangney et al., 2004).

Brief Aggression Questionnaire

The Brief Aggression Questionnaire (BAQ) is a 12-item, 7-point Likert Scale with strong and significant test–retest reliability, varying from .68 to .80 among the four subscales, and going as high as .81 for the total BAQ (Webster et al., 2014: Webster et al., 2015). Questions represent four subscales, including physical aggression (items 2, 5, and 6), anger (items 4, 6, and 7), verbal aggression (items 1, 3, and 5), and hostility (items 3, 7, and 8). Participants were asked to indicate the answer that best represents them, varying from 1 for “extremely uncharacteristic of me” to 7 for “extremely characteristic of me,” with item 4 being reverse coded (Webster et al., 2014). Total scores were calculated by the average of the 12 items with higher scores indicating higher aggression.

Satisfaction with Life Scale

The Satisfaction with Life Scale (SWLS) is a 5-item, 7-point Likert Scale with Cronbach's alpha of .87. Participants were asked to indicate the statement that most represents their thoughts varying from 1 for "strongly disagree" to 7 for "strongly agree" (Diener et al., 1985). Total scores were calculated by the sum of the 5 items with higher scores indicating higher life satisfaction. Scores between 5 and 9 are interpreted as extremely dissatisfied, 10 and 14 as dissatisfied, 15 and 19 as slightly dissatisfied, 20 and 24 as slightly satisfied, 25 and 29 as satisfied, and 30 and 35 as extremely satisfied (Pavot & Diener, 2008).

Mental Health Disorders Screening Instrument for Athletes

The Mental Health Disorders Screening Instrument for Athletes (MHDSIA) is a 14-item, 7-point Likert scale with Cronbach's alpha of .86 (Donohue et al., 2023). From a list of scenarios that can occur with athletes, participants were asked to select the number that best represents how often these items interfere with their lives outside of sports. Answers vary from 1 for "never" to 7 for "always" (Donohue et al., 2023). Total scores were determined by the sum of the 14 items, with higher scores indicating higher levels of mental health disorders (Donohue et al., 2023).

Operationalization of Variables

Mental Strength – is an interval variable and was measured by the total score on the Mental Strength Scale (Lorenco-Lima, 2024b). Mental strength is defined as an individual's ability to persevere through challenging situations and to recover from failures (Lorenco-Lima, 2024b).

Resilience – is an interval variable and was measured by the total score on the Brief Resilience Scale (Smith et al., 2008). Resilience is defined as a person's ability to recover from hardships and misfortunes (Smith et al., 2008).

Grit - is an interval variable and was measured by the total score on the Grit Scale (Duckworth et al., 2007). Grit is defined as passion and perseverance for long-term goals (Duckworth et al., 2007).

Self-Efficacy - is an interval variable and was measured by the total score on the General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). Self-efficacy represents a person's belief in competently coping with adversity or performing a new or challenging task (Schwarzer & Jerusalem, 1995).

Self-Control - is an interval variable and was measured by the total score on the Brief Self-Control Scale (Tangney et al., 2004). Self-control is defined as a person's ability to restrain undesirable impulses by regulating attention, behavior, and emotion when faced with temptations (Duckworth & Gross, 2014).

Aggression - is an interval variable and was measured by the total score on the Brief Aggression Questionnaire (Webster et al., 2014). Aggression is defined as individual differences in thoughts (hostility), emotions (anger), and behavior (verbal and physical) intended to harm another person (Webster et al., 2014).

Life Satisfaction - is an interval variable and was measured by the total score on the Satisfaction with Life Scale (Diener et al., 1985). Life satisfaction is defined as a subjective perception of personal well-being based on cognitive judgement and overall comparison between their own circumstances and appropriate social standards (Diener et al., 1985).

Mental health disorders – is an interval variable and was measured by the total score on the Mental Health Disorders Screening Instrument for Athletes (Donohue et al., 2023). Mental health disorders are defined as changes in cognition, emotion, or behavior leading to functional impairment in developmental, biological, or psychological processes underlying mental functioning (American Psychiatric Association, 2013).

Data Analysis

The normality assumption associated with the analyses (ANOVA, *t*-tests, and regression) was assessed by examining skewness and kurtosis values, histograms, Q-Q plots, and Shapiro-Wilk significance tests for all dependent variables (mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health) by belt group. Although most dependent variables had one or more groups with significant Shapiro-Wilk tests, the other metrics suggested sufficient normality to conduct an ANOVA for most scales. For SWLS and MHDSIA, slightly more non-normality was observed. However, the extent of the non-normality was deemed to be mild to moderate, and since ANOVA is known to be robust to some assumption violation, ANOVA was still used for data analysis with these scales.

For the primary analysis, analyses of variance (ANOVA) with Tukey post-hoc tests were performed to compare mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health among BJJ belt groups. Additionally, η^2 was used as an effect size to determine practical significance.

For the secondary analysis, mean differences in the dependent variables between white belt versus black belt, and biological sex, were assessed using independent samples

t-tests, with Cohen's *d* effect sizes providing information about practical significance. Additionally, relationships between the dependent variables and continuous demographic characteristics were assessed via multiple linear regression. Specifically, regression was conducted to examine the relationships between the psychological variables and age, BJJ experience, competitive engagement, and days and hours of BJJ practice per week. IBM SPSS Statistics (Version 29) was used for data analyses with an alpha level of .05 to determine statistical significance.

Delimitations, Assumptions, and Limitations

Delimitations

Only participants engaged in at least one BJJ class per week were included in the study. Although most studies investigating the physiological (Lorenco-Lima et al., 2020) and psychological changes resulting from martial arts and combat sports engagement held classes twice a week or more (Greco et al., 2019; Moore et al., 2019; Moore et al., 2020; Moore et al., 2021; Willing et al., 2019; Harwood-Gross et al., 2021; Salchow et al., 2021; Lindell-Postigo et al., 2023), the author speculates that due to BJJ's therapy-like characteristic (Farrer, 2019; Sugden, 2021), one BJJ class per week should be enough to positively influence psychological skills overtime.

Assumptions

A major challenge was the data collection from upper belts (brown and black). This obstacle arose from the smaller pool of athletes available in these ranks compared to those in lower ranks, such as white and blue belts. To overcome this challenge, data collection was conducted nationwide, aiming to reach a larger pool of athletes, include an

acceptable number of higher ranks, and secure adequate power in this study. The final sample was composed of an uneven number of participants across the different belt ranks, but enough to provide acceptable statistical power.

Limitations

This research has certain limitations that should be acknowledged. First, its cross-sectional nature precludes any causality assumptions or the observation of changes over time. Second, the reliance on self-reported answers may have led to social desirability bias. Third, the self-selection bias may have limited the generalizability of the study. Fourth, the limited number of studies investigating the psychological aspects of BJJ practice limited the theoretical foundation of the current research.

This study was anonymous, aiming to decrease social desirability bias. The sample was recruited across the United States to obtain data from a diverse group and mitigate any generalizability issues. Due to the limited research exploring psychological variables in BJJ, this study's research questions and hypotheses were developed based on evidence from martial arts and combat sports with similar characteristics to BJJ. In this study, differences between subjects were observed rather than changes within subjects, providing initial evidence of non-causal long-term effects of BJJ practice.

Summary

Chapter 3 presented the research questions and hypotheses, research design, participants characteristics, study procedures, instrumentation and measurement, operationalization of variables, data analysis, delimitations, assumptions, and limitations. A total of 410 BJJ athletes were recruited through social media and email campaigns.

Participants will respond to a Google Form containing the Mental Strength Scale, Brief Resilience Scale, Grit Scale, General Self-Efficacy Scale, Brief Self-Control Scale, Brief Aggression Questionnaire, and additional demographic and BJJ-related information. Primary data analyses were performed through analyses of variance (ANOVA) with Tukey post-hoc to compare mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt groups (white, blue, purple, brown, and black). Secondary analyses were performed through an independent *t*-test to explore white versus black belt, and biological sex differences, and via multiple linear regressions to explore the relationship between the dependent variables and the demographic- and BJJ-related characteristics.

In Chapter 4, results are presented as primary and secondary analyses. The primary analyses included the belt rank group comparisons via ANOVA. Secondary analyses included the white versus black belt, biological sex differences and relationships.

CHAPTER 4: RESULTS

Overview

The purpose of this quantitative survey study was to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt ranks in BJJ athletes. Data was collected via an anonymous online survey to answer the following research questions:

RQ1: Is there a difference in self-reported mental strength, as measured by the Mental Strength Scale, among belt ranks in BJJ athletes?

RQ 2: Is there a difference in self-reported resilience, as measured by the Brief Resilience Scale, among belt ranks in BJJ athletes?

RQ 3: Is there a difference in self-reported grit, as measured by the Grit Scale, among belt ranks in BJJ athletes?

RQ 4: Is there a difference in self-reported self-efficacy, as measured by the General Self-Efficacy Scale, among belt ranks in BJJ athletes?

RQ 5: Is there a difference in self-reported self-control, as measured by the Brief Self-Control Scale, among belt ranks in BJJ athletes?

RQ 6: Is there a difference in self-reported aggression, as measured by the Brief Aggression Questionnaire, among belt ranks in BJJ athletes?

RQ 7: Is there a difference in life satisfaction, as measured by the Satisfaction with Life Scale, among belt ranks in BJJ athletes?

RQ 8: Is there a difference in mental health, as measured by the Mental Health Disorders Screening Instrument for Athletes, among belt ranks in BJJ athletes?

Descriptive Results, Correlations, and Scale Reliabilities

A total of 410 surveys were collected representing 323 males (78.8%) and 87 females (21.2%) from 18 to 60 years of age, including 118 white belts (28.8%), 114 blue belts (27.8%), 75 purple belts (18.3%), 46 brown belts (11.2%) and 57 black belts (13.9%). Three hundred and fifteen athletes (76.8%) reported also practicing other sport(s), martial arts(s), or physical activity (i.e., running, weightlifting, volleyball, and Muay Thai). Table 1 presents the demographic characteristics of the sample.

Table 1
Descriptive Statistics of the Sample: Mean (SD)

	N	Age	Experience	Day/Week	Hours/Week	Competitions
Biological Sex						
Male	323	38.43 (8.75)	6.86 (6.23)	3.54 (1.36)	6.27 (4.22)	1.04 (1.97)
Female	87	37.21 (8.58)	5.15 (4.52)	3.78 (1.32)	6.13 (3.51)	1.18 (1.71)
Belt Rank						
White	118	35.81 (9.08)	1.92 (2.52)	3.06 (1.13)	4.87 (3.79)	0.66 (0.97)
Blue	114	37.22 (8.39)	4.23 (2.90)	3.53 (1.31)	5.72 (3.37)	1.35 (2.43)
Purple	75	38.88 (8.58)	7.25 (3.36)	3.72 (1.16)	6.55 (3.56)	1.28 (1.96)
Brown	46	40.11 (7.54)	10.17 (3.09)	4.04 (1.53)	7.41 (3.92)	1.22 (2.01)
Black	57	42.44 (7.93)	16.53 (6.50)	4.30 (1.49)	8.79 (5.17)	0.93 (2.02)

Note. N = 410

The sample included participants from forty-seven states and the District of Columbia. Table 2 presents the number of athletes per state and their corresponding representation. Nevada (19.5%), Pennsylvania (9.3%), and California (7.3%) were the states with the highest number of participants in the present study. Rhode Island, West Virginia, and Wyoming had no representatives in this study.

Table 2
Participants per State

	N	Percentage	Cumulative Percentage
Alabama	2	0.5	0.5
Alaska	2	0.5	1.0
Arizona	8	2.0	2.9
Arkansas	5	1.2	4.1
California	30	7.3	11.5
Colorado	10	2.4	13.9
Connecticut	5	1.2	15.1
Delaware	1	0.2	15.4
District of Columbia	1	0.2	15.6

Florida	8	2.0	17.6
Georgia	12	2.9	20.5
Hawaii	5	1.2	21.7
Idaho	2	0.5	22.2
Illinois	11	2.7	24.9
Indiana	3	0.7	25.6
Iowa	5	1.2	26.8
Kansas	2	0.5	27.3
Kentucky	2	0.5	27.8
Louisiana	2	0.5	28.3
Maine	2	0.5	28.8
Maryland	19	4.6	33.4
Massachusetts	8	2.0	35.4
Michigan	3	0.7	36.1
Minnesota	14	3.4	39.5
Mississippi	1	0.2	39.8
Missouri	5	1.2	41.0
Montana	1	0.2	41.2
Nebraska	1	0.2	41.5
Nevada	80	19.5	61.0
New Hampshire	4	1.0	62.0
New Jersey	3	0.7	62.7
New Mexico	2	0.5	63.2
New York	14	3.4	66.6
North Carolina	6	1.5	68.0
North Dakota	1	0.2	68.3
Ohio	5	1.2	69.5
Oklahoma	7	1.7	71.2
Oregon	3	0.7	72.0
Pennsylvania	38	9.3	81.2
South Carolina	2	0.5	81.7
South Dakota	1	0.2	82.0
Tennessee	8	2.0	83.9
Texas	26	6.3	90.2
Utah	2	0.5	90.7
Vermont	1	0.2	91.0
Virginia	19	4.6	95.6
Washington	13	3.2	98.8
Wisconsin	5	1.2	100.0

Note. N = 410

Table 3 presents the means and standard deviations for the main study variables. Overall, participants reported high levels of mental strength, normal levels of resilience (Smith et al., 2013), high levels of grit, high levels of self-efficacy, moderate levels of self-control, moderate levels of aggression, to be satisfied with life (Pavot & Diener, 2008), and low levels of mental health disorders.

Table 3

Means and Standard Deviations of the Main Study Variables

	M	*SD*
Mental Strength	4.05	0.51
Resilience	3.74	0.64
Grit	3.81	0.54
Self-Efficacy	34.22	3.70
Self-Control	46.65	8.01
Aggression	3.06	0.88
Life Satisfaction	26.24	6.01
Mental Health	33.62	10.21

Note. N = 410

Correlations

Correlations for all study variables were calculated and were, for the most part, in expected directions (Table 4).

Table 4

Correlations Among Main Study Variables

Measures	1	2	3	4	5	6	7
1.Mental Strength	-						
2. Resilience	.569**	-					
3. Grit	.577**	.444**	-				
4. Self-Efficacy	.524**	.531**	.533**	-			
5. Self-Control	.484**	.340**	.628**	.492**	-		
6. Aggression	-.204**	-.215**	-.182**	-.189**	-.364**	-	
7. Life Satisfaction	.333**	.316**	.311**	.331**	.293**	-.219**	-
8. Mental Health Disorder	-.351**	-.394**	-.378**	-.349**	-.549**	.502**	-.431**

Note. **$p < .001$; N = 410

Mental strength was positively correlated with resilience, grit, self-efficacy, self-control, and life satisfaction (r = .333 to .577, $p < .001$), and negatively correlated with aggression and mental health disorders (r = -.204 to -.351, $p < .001$).

Resilience was positively correlated with mental strength, grit, self-efficacy, self-control, and life satisfaction (r = .316 to .569, $p < .001$), and negatively correlated with aggression and mental health disorders (r = -.215 to -.394, $p < .001$).

Grit was positively correlated with mental strength, resilience, self-efficacy, self-control, and life satisfaction (r = .311 to .628, p < .001), and negatively correlated with aggression and mental health disorders (r = -.182 to -.378, p < .001).

Self-efficacy was positively correlated with mental strength, resilience, grit, self-control, and life satisfaction (r = .331 to .533, p < .001), and negatively correlated with aggression and mental health disorders (r = -.189 to -.349, p < .001).

Self-control was positively correlated with mental strength, resilience, grit, self-efficacy, and life satisfaction (r = .331 to .628, p < .001), and negatively correlated with aggression and mental health disorders (r = -.364 to -.549, p < .001).

Aggression was positively correlated with mental health disorders (r = .502, p < .001), and negatively correlated mental strength, resilience, grit, self-efficacy, self-control, and life satisfaction (r = -.182 to -.364, p < .001).

Life satisfaction was positively correlated with mental strength, resilience, grit, self-efficacy, and self-control (r = .239 to .333, p < .001), and negatively correlated with aggression and mental health disorders (r = -.219 to -.431, p < .001).

Mental health disorder was positively correlated with aggression (r = .502, p < .001), and negatively correlated mental strength, resilience, grit, self-efficacy, self-control, and life satisfaction (r = -.349 to -.549, p < .001).

Scale Reliabilities

Internal consistency reliability for all scales was calculated and Cronbach (1951) alpha coefficients ranged from .761 to .867 (Table 5). Values exceeding .70 indicate acceptable to very good reliability (Nunnally, 1978).

Table 5
Scale Reliabilities

	N	Items	Cronbach's α
Mental Strength (MSS)	410	10	.785
Resilience (BRS)	410	6	.817
Grit (GS)	410	12	.841
Self-Efficacy (GSES)	410	10	.866
Self-Control (BSCS)	410	13	.840
Aggression (BAQ)	410	12	.761
Life Satisfaction (SWLS)	410	5	.867
Mental Health (MHDSIA)	410	14	.817

Study Findings

Belt Rank Comparisons

Eight analyses of variance were performed to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health among belt ranks in 410 BJJ athletes.

RQ1: Is there a difference in self-reported mental strength, as measured by the Mental Strength Scale, among belt ranks in BJJ athletes?

H1: Mental strength will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in mental strength among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in mental strength between BJJ belt ranks $F(4, 405) = 1.702$, $p = .149$, $\eta^2 = .017$ (Table 6).

Table 6
Descriptive Statistics of Mental Strength

	N	*M*	*SD*
White Belt	118	4.01	0.54
Blue Belt	114	4.01	0.48
Purple Belt	75	4.03	0.47

Brown Belt	46	4.11	0.47
Black Belt	57	4.19	0.55
Total	410	4.05	0.51

RQ 2: Is there a difference in self-reported resilience, as measured by the Brief Resilience Scale, among belt ranks in BJJ athletes?

H2: Resilience will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in resilience among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in resilience between BJJ belt ranks $F(4, 405) = 1.933$, $p = .104$, $\eta^2 = .019$ (Table 7).

Table 7
Descriptive Statistics of Resilience

	N	*M*	*SD*
White Belt	118	3.69	0.62
Blue Belt	114	3.67	0.66
Purple Belt	75	3.85	0.62
Brown Belt	46	3.74	0.61
Black Belt	57	3.89	0.69
Total	410	3.75	0.64

RQ 3: Is there a difference in self-reported grit, as measured by the Grit Scale, among belt ranks in BJJ athletes?

H3: Grit will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in grit among BJJ belt ranks (white, blue, purple, brown, and black). There was a statistically and practically significant difference in grit between BJJ belt ranks $F(4, 405) = 4.415$, $p = .002$, $\eta^2 = .042$ (Table 8). Tukey post hoc analyses revealed

higher grit in black belts (M = 3.99; SD = 0.52) than in white (p = .005; M = 3.70; SD = 0.56) and blue belts (p = .027; M = 3.74; SD = 0.55). Moreover, purple belts (M = 3.92; SD = .049) presented statistically significantly higher grit (p = .034) than white belts (M = 3.70; SD = .056). No other post hoc comparison was significant (p > .05).

Table 8
Descriptive Statistics of Grit

	N	*M*	*SD*
White Belt	118	3.70*,a	0.56
Blue Belt	114	3.74b	0.55
Purple Belt	75	3.92*	0.49
Brown Belt	46	3.84	0.46
Black Belt	57	3.99a,b	0.52
Total	410	3.81	0.54

Note. *,a,b $p < .05$

RQ 4: Is there a difference in self-reported self-efficacy, as measured by the General Self-Efficacy Scale, among belt ranks in BJJ athletes?

H4: Self-efficacy will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in self-efficacy among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in self-efficacy between BJJ belt ranks $F(4, 405) = 1.296$, $p = .271$, $\eta^2 = .013$ (Table 9).

Table 9
Descriptive Statistics of Self-Efficacy

	N	*M*	*SD*
White Belt	118	33.67	3.78
Blue Belt	114	34.28	3.82
Purple Belt	75	34.49	3.68
Brown Belt	46	34.13	3.48
Black Belt	57	34.93	3.46
Total	410	34.22	3.70

RQ 5: Is there a difference in self-reported self-control, as measured by the Brief Self-Control Scale, among belt ranks in BJJ athletes?

H5: Self-control will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in self-control among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in self-control between BJJ belt ranks $F(4, 405) = 2.096$, $p = .081$, $\eta^2 = .020$ (Table 10).

Table 10
Descriptive Statistics of Self-Control

	N	*M*	*SD*
White Belt	118	45.31	7.26
Blue Belt	114	46.75	8.48
Purple Belt	75	47.01	7.63
Brown Belt	46	46.33	7.89
Black Belt	57	48.96	8.78
Total	410	46.65	8.01

RQ 6: Is there a difference in self-reported aggression, as measured by the Brief Aggression Questionnaire, among belt ranks in BJJ athletes?

H6: Aggression will be lower in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in aggression among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in aggression between BJJ belt ranks $F(4, 405) = 1.194$, $p = .313$, $\eta^2 = .012$ (Table 11).

Table 11
Descriptive Statistics of Aggression

	N	*M*	*SD*
White Belt	118	3.12	0.82
Blue Belt	114	2.93	0.91
Purple Belt	75	3.01	0.86
Brown Belt	46	3.17	0.83
Black Belt	57	3.16	1.02
Total	410	3.06	0.88

RQ 7: Is there a difference in life satisfaction, as measured by the Satisfaction with Life Scale, among belt ranks in BJJ athletes?

H7: Life satisfaction will be higher in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in life satisfaction among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in life satisfaction between BJJ belt ranks $F(4, 405) = 2.307$, $p = .058$, $\eta^2 = .022$ (Table 12).

Table 12
Descriptive Statistics of Life Satisfaction

	N	*M*	*SD*
White Belt	118	25.23	5.75
Blue Belt	114	25.77	6.76
Purple Belt	75	27.05	5.56
Brown Belt	46	26.91	5.38
Black Belt	57	27.65	5.70
Total	410	26.24	6.01

RQ 8: Is there a difference in mental health, as measured by the Mental Health Disorders Screening Instrument for Athletes, among belt ranks in BJJ athletes?

H8: Mental health will be better in more experienced BJJ athletes (e.g., black belts) than in less experienced athletes (e.g., white belts).

A one-way ANOVA was conducted to examine whether there was a significant difference in mental health among BJJ belt ranks (white, blue, purple, brown, and black). There was no statistically or practically significant difference in mental health between BJJ belt ranks $F(4, 405) = 1.211$, $p = .306$, $\eta^2 = .012$ (Table 13).

Table 13
Descriptive Statistics of Mental Health

	N	*M*	*SD*
White Belt	118	35.33	9.73
Blue Belt	114	32.90	9.98
Purple Belt	75	32.96	10.98
Brown Belt	46	33.46	9.74
Black Belt	57	32.54	10.85
Total	410	33.62	10.21

White Versus Black Belt Comparison

Independent samples *t*-tests were performed to investigate whether there was a significant difference (one-tailed) in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between white and black belts (Table 14).

Table 14
Comparison Between White and Black Belts

	White Belts	Black Belts	*t*	*df*	Cohen's *d*	*p*
Mental Strength	4.01 (0.54)	4.19 (0.55)	-2.081	173	-.336	.019*
Resilience	3.69 (0.62)	3.89 (0.68)	-1.947	173	-.314	.027*
Grit	3.70 (0.56)	3.99 (0.52)	-3.331	173	-.537	< .001*
Self-Efficacy	33.67 (3.78)	34.93 (3.46)	-2.124	173	-.343	.018*
Self-Control	45.31 (7.26)	48.96 (8.78)	-2.907	173	-.469	.002*
Aggression	3.12 (0.82)	3.16 (1.02)	-0.309	173	-.050	.379
Life Satisfaction	25.23 (5.75)	27.65 (5.70)	-2.616	173	-.422	.005*
Mental Health	35.33 (9.73)	32.54 (10.85)	1.709	173	.246	.045*

Note. *$p < .05$; 118 white belts and 57 black belts

Results indicated a statistically significant difference in mental strength between white and black belts $t(173) = -2.081$, $p = .019$, Cohen's $d = -.336$ (small effect size), 95% CI [-.35598, -.00941]. Black belts presented higher mental strength ($M = 4.19$; $SD = 0.55$) than white belts ($M = 4.01$; $SD = 0.54$).

Results revealed a statistically significant difference in resilience between white and black belts $t(173) = -1.947$, $p = .027$, Cohen's $d = -.314$ (small effect size), 95% CI [-.40772, .00282]. Black belts presented higher resilience ($M = 3.89$; $SD = 0.68$) than white belts ($M = 3.69$; $SD = 0.62$).

Results showed a statistically significant difference in grit between white and black belts $t(173) = -3.331$, $p < .001$, Cohen's $d = -.537$ (small effect size), 95% CI [-.47083, -.12048]. Black belts presented higher grit ($M = 3.99$; $SD = 0.52$) than white belts ($M = 3.70$; $SD = 0.56$).

Results indicated a statistically significant difference in self-efficacy between white and black belts $t(173) = -2.124$, $p = .018$, Cohen's $d = -.343$ (small effect size), 95% CI [-2.43170, -.08897]. Black belts presented higher self-efficacy ($M = 34.93$; $SD = 3.46$) than white belts ($M = 33.67$; $SD = 3.78$).

Results demonstrated a statistically significant difference in self-control between white and black belts $t(173) = -2.907$, $p = .002$, Cohen's $d = -.469$ (small effect size), 95% CI [-6.13018, -1.17252]. Black belts presented higher self-control ($M = 48.96$; $SD = 8.78$) than white belts ($M = 45.31$; $SD = 7.26$).

Results showed a statistically significant difference in life satisfaction between white and black belts $t(173) = -2.616$, $p = .005$, Cohen's $d = -.422$ (small effect size),

95% CI [-4.24647, -.59415]. Black belts presented higher life satisfaction (*M* = 27.65; *SD* = 5.70) than white belts (*M* = 25.23; *SD* = 5.75).

Results indicated a statistically significant difference in mental health between white and black belts *t*(173) = 1.709, *p* = .045, Cohen's *d* = .246 (small effect size), 95% CI [-.43152. 6.00482]. Black belts presented better mental health (*M* = 32.54; *SD* = 10.85) than white belts (*M* = 35.33; *SD* = 9.73).

No statistically significant difference was found in aggression between white and black belts *t*(173) = -0.309, *p* = .379, Cohen's *d* = -.050, 95% CI [-.32802, .239293].

Biological Sex Comparison

Independent samples *t*-tests were performed to investigate whether there was a significant difference (one-tailed) in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health, between males and females (Table 15).

Results indicated a statistically significant difference in mental strength between males and females *t*(408) = 1.706, *p* = .044, Cohen's *d* = .206 (small effect size), 95% CI [-.01594, .22502]. Males demonstrated higher mental strength (*M* = 4.07; *SD* = 0.51) than females (*M* = 3.97; *SD* = 0.50).

Additionally, results indicated a statistically significant difference in resilience between males and females *t*(408) = 3.115, *p* < .001, Cohen's *d* = .376 (small effect size), 95% CI [.08824, .39022]. Males demonstrated higher resilience (*M* = 3.80; *SD* = 0.62) than females (*M* = 3.56 ; *SD* = 0.68).

Moreover, results indicated a statistically significant difference in aggression between males and females *t*(408) = 3.140, *p* < .001, Cohen's *d* = .379 (small effect size),

95% CI [.12406, .53955]. Males demonstrated higher aggression (M = 3.13; SD = 0.88) than females (M = 2.80 ; SD = 0.85).

Table 15

Comparison Between Biological Sex Groups

	Male	Female	*t*	*df*	Cohen's *d*	*p*
Mental Strength	4.07 (0.51)	3.97 (0.50)	1.706	408	.206	.044*
Resilience	3.80 (0.62)	3.56 (0.68)	3.115	408	.376	< .001*
Grit	3.81 (0.54)	3.81 (0.55)	-0.52	408	-.006	.479
Self-Efficacy	34.36 (3.69)	33.69 (3.70)	1.499	408	.181	.067
Self-Control	46.52 (8.11)	47.11 (7.63)	-0.614	408	-.074	.270
Aggression	3.13 (0.88)	2.80 (0.85)	3.140	408	.379	< .001*
Life Satisfaction	26.20 (6.04)	26.38 (5.94)	-0.245	408	-.030	.403
Mental Health	33.36 (10.53)	34.61 (8.90)	-1.014	408	-.122	.156

Note. *p < .05; 323 males and 87 females

No statistically significant difference was found in grit between males and females $t(408) = -0.52$, $p = .479$, Cohen's $d = -.006$, 95% CI [-.13163, .12483].

No statistically significant difference was found in self-efficacy between males and females $t(408) = 1.499$, $p = .067$, Cohen's $d = .181$, 95% CI [-.20825, 1.54721].

No statistically significant difference was found in self-control between males and females $t(408) = -0.614$, $p = .270$, Cohen's $d = -.074$, 95% CI [-2.49831, 1.30867].

No statistically significant difference was found in life satisfaction between males and females $t(408) = -0.245$, $p = .403$, Cohen's $d = -.030$, 95% CI [-1.60714, 1.25100].

No statistically significant difference was found in mental health between males and females $t(408) = -1.014$, $p = .156$, Cohen's $d = -.122$, 95% CI [-3.67400, 1.17387].

Linear Regressions

Linear regressions analyses were conducted to explore the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week could

predict mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health.

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict mental strength (Table 16). The result was statistically significant, $F(5, 404) = 2.513$, $p = .029$. Approximately 3% of the variance in mental strength is accounted for by its linear relationship with the IVs as a unit, which is a small to moderate effect, lacking practical significance. Of the IVs, days of BJJ training per week explained the most unique variance in mental strength, explaining 1.02% of the variance in mental strength above and beyond what was explained by the other variables.

Table 16

Multiple Linear Regression with Mental Strength

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Mental Strength				2.513 (5, 404)	.029*	.030
Intercept	3.803					
Age	.000	.145 (.885)	0.0001			
Experience	.008	1.755(.080)	0.0074			
Days/Week	.054	2.066 (.039*)	0.0102			
Hours/Week	-.001	-.168 (.867)	0.0001			
Competitions	.007	-.474 (.636)	0.0005			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict resilience (Table 17). The result was statistically significant, $F(5, 404) = 2.432$, $p = .034$. Approximately 2.9% of the variance in resilience is accounted for by its linear relationship with the IVs as a unit, which is a small to moderate effect, lacking practical significance. Of the IVs, days of BJJ experience explained the most unique

variance in resilience, explaining 1.28% of the variance in resilience above and beyond what was explained by the other variables.

Table 17
Multiple Linear Regression with Resilience

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Resilience				2.432 (5, 404)	.034*	.029
Intercept	3.413					
Age	.005	1.258 (.209)	0.0038			
Experience	.013	2.310 (.021*)	0.0128			
Days/Week	.013	0.382 (.703)	0.0003			
Hours/Week	.005	0.427 (.670)	0.0004			
Competitions	-.008	-0.471 (.038)	0.0005			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict grit (Table 18). The result was statistically significant, $F(5, 404) = 6.034$, $p < .001$. Approximately 7% of the variance in grit is accounted for by its linear relationship with the IVs as a unit, which is a moderate, practically significant effect. Of the IVs, the participant's age explained the most unique variance in grit, explaining 1.55% of the variance in grit above and beyond what was explained by the other variables.

Table 18
Multiple Linear Regression with Grit

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Grit				6.037 (5, 404)	< .001*	.070
Intercept	3.224					
Age	0.008	2.594 (.010*)	0.0155			
Experience	0.012	2.478 (.014*)	0.0141			
Days/Week	0.057	2.087 (.037*)	0.0100			
Hours/Week	-0.001	-0.131 (.896)	0.0000			
Competitions	0.003	0.222 (.824)	0.0001			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs)

could predict self-efficacy (Table 19). The result was not statistically significant, $F(5, 404) = 2.191$, $p = .054$. Approximately 2.6% of the variance in self-efficacy is accounted for by its linear relationship with the IVs as a unit, which is a small to moderate effect, lacking practical significance. Of the IVs, the participants' age explained the most unique variance in self-efficacy, explaining 1.09% of the variance in self-efficacy above and beyond what was explained by the other variables.

Table 19

Multiple Linear Regression with Self-Efficacy

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Self-Efficacy				2.191 (5, 404)	.054	.026
Intercept	31.811					
Age	0.047	2.130 (.034*)	0.0109			
Experience	0.049	1.487 (.138)	0.0053			
Days/Week	0.097	0.510 (.610)	0.0006			
Hours/Week	0.002	0.030 (.976)	0.0000			
Competitions	-0.047	-0.468 (.640)	0.0005			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict self-control (Table 20). The result was not statistically significant, $F(5, 404) = 1.633$, $p = .150$. Approximately 2% of the variance in self-control is accounted for by its linear relationship with the IVs as a unit, which is a small effect, lacking practical significance. Of the IVs, the participants' age explained the most unique variance in self-control, explaining 0.67% of the variance in self-control above and beyond what was explained by the other variables.

Table 20
Multiple Linear Regression with Self-Control

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Self-Control				1.633 (5, 404)	.150	.020
Intercept	42.356					
Age	0.079	1.664 (.097)	0.0067			
Experience	0.102	1.439 (.151)	0.0050			
Days/Week	0.428	1.036 (.301)	0.0026			
Hours/Week	-0.154	-1.131 (.259)	0.0031			
Competitions	0.032	0.149 (.882)	0.0001			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict aggression (Table 21). The result was not statistically significant, $F(5, 404) = 1.619$, $p = .154$. Approximately 2% of the variance in aggression is accounted for by its linear relationship with the IVs as a unit, which is a small effect, lacking practical significance. Of the IVs, BJJ experience explained the most unique variance in aggression, explaining 0.84% of the variance in aggression above and beyond what was explained by the other variables.

Table 21
Multiple Linear Regression with Aggression

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Aggression				1.619 (5, 404)	.154	.020
Intercept	2.984					
Age	0.001	0.264 (.792)	0.0002			
Experience	0.015	1.866 (.063)	0.0084			
Days/Week	-0.057	-1.259 (.209)	0.0038			
Hours/Week	0.015	0.988 (.324)	0.0024			
Competitions	0.037	1.554 (.121)	0.0059			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict life satisfaction (Tables 22). The result was statistically significant, $F(5, 404) = 2.493$, $p = .031$. Approximately 3% of the variance in life satisfaction is accounted for by its linear relationship with the IVs as a unit, which is a small to moderate effect, lacking practical significance. Of the IVs, the participant's age explained the most unique variance in life satisfaction, explaining 0.88% of the variance in life satisfaction above and beyond what was explained by the other variables.

Table 22

Multiple Linear Regression with Life Satisfaction

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Life Satisfaction				2.493 (5, 404)	.031*	.030
Intercept	22.454					
Age	0.068	1.911 (.057)	0.0088			
Experience	0.091	1.718 (.087)	0.0071			
Days/Week	0.357	1.157 (.248)	0.0032			
Hours/Week	-0.079	-0.773 (.440)	0.0014			
Competitions	-0.174	-1.073 (.284)	0.0028			

Note. p< .05

A linear regression analysis was conducted to evaluate the extent to which age, BJJ experience, competitive engagement, and days and hours of BJJ per week (IVs) could predict mental health (Table 23). The result was not statistically significant, $F(5, 404) = .679$, $p = .640$. Approximately 0.8% of the variance in mental health is accounted for by its linear relationship with the IVs as a unit, lacking practical significance. Of the IVs, hours of BJJ training per week explained the most unique variance in mental health, explaining 0.45% of the variance in mental health above and beyond what was explained by the other variables.

Table 23
Multiple Linear Regression with Mental Health

	b	*t*-value (*p*)	sr^2	*F*-Value (df)	*p*	R^2
Mental Health				.679 (5, 404)	.640	.008
Intercept	33.891					
Age	-0.009	-0.150 (.881)	0.0001			
Experience	-0.043	-0.469 (.639)	0.0005			
Days/Week	-0.390	-0.737 (.462)	0.0013			
Hours/Week	0.237	1.357 (.176)	0.0045			
Competitions	0.263	0.943 (.346)	0.0022			

Note. p< .05

Collectively, these analyses provide evidence that BJJ positively influences the athletes' mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health. Significant differences were mostly found following the athletes' development and recognition as having black belt skills (versus white belt). The engagement in competitions had no impact on the improvement of the investigated variables. Moreover, no significant increase or decrease in aggression was found between ranks.

Summary

Chapter 4 examined the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt ranks in BJJ athletes. It explored the differences in dependent variable between white and black belts, and males and females. Moreover, it investigated the extent to which BJJ experience predicted mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health.

ANOVA results revealed significantly higher grit in black belts than in white and blue belts. Additionally, purple belts presented higher grit than white belts. Independent *t*-test results found significantly higher mental strength, resilience, grit, self-efficacy, self-

control, life satisfaction, and better mental health in black belts than in white belts. Independent *t*-test results found significantly higher mental strength, resilience, and aggression in males than females. No differences were observed in aggression among belt ranks. Moreover, multiple linear regressions with age, BJJ experience, competitive engagement, and days and hours of BJJ per week as independent variables positively predicted (lacking practical significance), mental strength, resilience, grit, and life satisfaction. Engagement in competitions had no impact on the improvement of the investigated variables. In Chapter 5, the current findings will be discussed based on the literature review.

CHAPTER 5: DISCUSSION

Overview

This quantitative survey study aimed to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health among belt ranks in BJJ athletes. The results of this study contribute to the limited literature exploring the psychological profile of BJJ athletes. Chapter 5 will summarize the current findings, contrast with the existing literature, present the study's implications and limitations, and provide recommendations for future research.

Summary of Findings

The primary results of this study were somewhat unexpected, as ANOVA results only revealed significantly higher grit in black belts than in white and blue belts, in addition to significantly higher grit in purple belts than white belts. No other significant differences were found through the ANOVA tests. However, significant differences were found when exploring the extreme belt ranks (white versus black belt) via independent samples *t*-tests. Black belts reported higher mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and better mental health than white belts. No significant difference was found in aggression among ranks via ANOVA or independent samples *t*-tests.

Moreover, when comparing biological sex groups, males presented significantly higher mental strength, resilience, and aggression than females. No significant differences were found between biological sex groups in grit, self-efficacy, self-control, life satisfaction, and mental health. Lastly, liner regressions revealed that age, BJJ

experience, competitive engagement, and days and hours of BJJ per week as independent variables positively predicted (lacking practical significance), mental strength, resilience, grit, and life satisfaction.

Discussion of Findings

When designed, this research aimed to determine whether there were significant differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, life satisfaction, and mental health between belt ranks in BJJ athletes. It was hypothesized that the higher belt rank groups (e.g., black belts) would demonstrate higher mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, mental health, and lower aggression than lower belt rank groups (e.g., white belts). No assumptions were made regarding how the middle belt rank groups (i.e., blue, purple, and brown belts) would diverge.

The expected differences were based on the social learning theory, as beginner athletes would learn by observing and imitating experienced athletes (Bandura, 1977). BJJ has been credited with providing a social network (coaches, teammates, and the overall BJJ community) and helping athletes overcome challenges and differentiate unreasonable perceptions from reality (Williams & Smith, 2023). Yen (2022) explains that subordinates can passively learn how to manage emotions based on the leaders' behavior (Yen, 2022). This study supports BJJ as a positive influence for the athletes to improve the investigated psychological variables, as discussed below.

Research question 1 explored whether mental strength would significantly diverge among BJJ belt ranks. The question was answered as results presented significantly

higher mental strength in black belts than in white belts. This result somewhat converges with previous findings by Lorenco-Lima (2024b), who found that engagement with combat sports and the increase in combat sports experience positively impacted the athletes' mental strength. This result suggests that the development of mental strength in BJJ may follow the development of skill (represented by belt ranks), as seen by the limited significant differences among the middle belt rank groups and the significant difference between extreme belt ranks. Additionally, this difference in mental strength seems primarily related to the athletes' skill level and is independent of the years of BJJ experience, as the semi-partial correlation between mental strength and BJJ experience was non-significant. The regression coefficient associated with the relationship between days of BJJ training per week and mental strength was significant but explained only 1.02% of the variance. Moreover, as found by Lorenco-Lima (2024b), current results also found higher mental strength in males than females, suggesting a biological variance (e.g., testosterone role) in mental strength, similar to the variances observed in muscular strength and endurance.

Research question 2 investigated whether there was a significant difference in resilience among belt ranks. The question was answered as results showed significantly higher resilience in black belts than in white belts. Similarly, previous studies found a significant improvement in resilience after 10 – 12 weeks of martial arts programs (non-BJJ) in children, adolescents, and adults (Greco et al., 2019; Moore et al., 2021; Yu, 2022). This difference in resilience in BJJ athletes seems to depend on the athlete's skill and BJJ experience, as the regression coefficient associated with the relationship between resilience and BJJ experience was significant, and BJJ experience explained

1.28% of the variance. This finding is supported by previous studies, which have shown positive correlations between combats sports experience and resilience (Pujszo et al., 2019a; Pujszo et al., 2019b; Küçük, 2020). Furthermore, convergent to the current findings, male combats sports athletes and martial artists presented higher resilience than females (Pujszo et al., 2019b; Küçük, 2020). Regardless of the identified gender differences, Ozturk and Oz (2022) and Yu (2022) found a positive impact of martial arts and combat sports in optimizing resilience in female athletes.

Research question 3 assessed whether there was a significant difference in grit among belt ranks. Significantly higher grit was found in black belts than in blue and white belts, and higher grit was also found in purple belts than in white belts. Similarly, Lee et al. (2021) determined that taekwondo ability positively correlated with grit. In children and adolescents, Sawyer et al. (2018) revealed that parent and instructor-rated grit positively correlated with taekwondo skills (testing scores). Significant regression coefficients associated with the relationships between age (explaining 1.55% of the variance), BJJ experience (explaining 1.41% of the variance), days of BJJ practice per week (explaining 1.00% of the variance), and grit were found. Drawing a parallel between BJJ and wrestling, Shamshirian et al. (2021) found higher grit in wrestlers than in non-wrestlers, with no significant difference between national and international-level wrestlers. National and international levels in wrestling can be compared to the belt ranks in BJJ, which represent the athletes' skill level. Therefore, if national and international level wrestlers are equated to BJJ brown and black belts, the finding converges with the Shamshirian et al. (2021) study, as no significant differences were found between brown and black belts. Furthermore, the statistically significant regression coefficients converge

with a previous study that showed a significant correlation between grit and combat sports experience, as well as grit and age (Lorenco-Lima, 2024a).

Research question 4 explored whether there was a significant difference in self-efficacy between belt ranks. Significantly higher self-efficacy was found in black belts than in white belts. Similarly, Greco et al. (2019) found a significant increase in self-efficacy (academic, emotional, and social) after 12 weeks of martial arts training in an adolescent sample. Salchow et al. (2021) found significantly higher self-efficacy after six months of Kyusho Jitsu practice in breast cancer survivors. The current study revealed that only age (1.09% of the variance) presented a significant regression coefficient in the self-efficacy regression analysis. Previous studies have reported higher self-efficacy in martial artists than in non-martial artists (Fabio & Towey, 2018) or individuals engaged in team sports (Stanković et al., 2022). Faro et al. (2020) explain that self-efficacy in experienced BJJ athletes can be fundamental to sustaining focus and competitiveness, especially when fatigued (Faro et al., 2020). In boxers, Chen et al. (2019) showed increased self-efficacy with a simultaneous increase in training experience, age, and competitive level. These findings are somewhat divergent from the present study in which only age and belt rank were found to influence self-efficacy. No gender difference was found in self-efficacy by Chen et al. (2019) or the present study.

Research question 5 investigated whether there was a significant difference in self-control among belt ranks. Significantly higher self-control was found in black belts than in white belts. Similarly, previous studies found significantly higher self-regulation and self-control after 4 - 6 months of martial arts classes with children and at-risk youth (Lakes & Hoyt, 2004; Hardwood-Gross et al., 2021). In addition, Blomqvist-Mickelsson

(2019b) found that five months of BJJ training significantly increased self-control in adolescents and young adults. Xu et al. (2022) found that martial arts athletes presented higher self-control and lower bullying behavior than non-practitioners. Invernizzi et al. (2023) demonstrated that an acute Judo session effectively improved judokas' inhibitory control and self-control ability. In boxers, Chen et al. (2019) found self-control to increase simultaneously with the advancement in age, competitive level, and training experience, diverging from the current findings.

Research question 6 explored whether there was a difference in aggression among belt ranks in BJJ athletes. Results showed no significant difference in aggression among belt ranks. This result contrasts the finding by Blomqvist-Mickelsson (2019b), who showed a decrease in aggression after five months of BJJ training in adolescents and young adults (Blomqvist-Mickelsson, 2019b). Wojdat and Ossowsky (2019) found lower total aggression in BJJ athletes than non-practitioners, with women presenting lower aggression than men. Converging with the current findings, women also presented lower aggression than men in the current study. On the other hand, and diverging from the current results, Wojdat and Ossowsky (2019) found that total aggression decreased, following a simultaneous increase in training experience, with significant differences observed in the first 2-3 years of BJJ training. It also contrasts studies that have observed increased aggression after engagement with certain combats sports or modern martial arts, such as mixed martial arts (Blomqvist-Mickelsson, 2019b; Lafuente et al., 2021). Moreover, the present study diverges from Gorner et al. (2021), who found that martial arts training experience negatively correlated (medium effect size) with verbal aggression, suspicion, negativism, irritability, and assault. This study found no difference

in aggression among belt rank groups or a significant regression coefficient BJJ experience. Kostorz and Sas-Nowosielski (2021) also found this lack of difference in aggression based on combat sports and martial arts training experience and the training rank in an adolescent and adult sample. Despite the lack of positive effects, the present study safeguards the BJJ's approach to the concern expressed by Linder-Postigo et al. (2023), in which the non-educational and unreliable pedagogical nature of many combat sports could negatively affect their athletes. Although no positive effect was found in aggression due to BJJ engagement, no detrimental effect was found either.

Research question 7 assessed the difference in life satisfaction among belt ranks in BJJ athletes. A significant difference in life satisfaction was found solely in the extremes (white versus black belt). Black belts reported higher life satisfaction than white belts. Similarly, Bai et al. (2023) found life satisfaction to be significantly improved with a large effect after 12 weeks of Tai Chi training. Potoczny (2022) reported no direct effect of karate practice on life satisfaction. However, an indirect association between karate practice and life satisfaction was found through reappraisal and self-control pathways. Kanupriya et al. (2022) discussed that in BJJ athletes, life satisfaction was found to be strongly associated with the length and the quality of the athletes' sports careers. The present study found no significant regression coefficient for the relationship between life satisfaction and the length of BJJ engagement.

Research question 8 assessed the difference in mental health among belt ranks in BJJ athletes. A significant difference in mental health was found solely in the extremes (white versus black belt). Black belts reported better mental health than white belts. Similarly, short-term longitudinal studies have shown BJJ's effectiveness in improving

mental health variables such as post-traumatic stress disorder (Willing et al., 2019; Weinberger & Burraston, 2021) and psychopathological symptoms (Willing et al., 2019). In children, 12 weeks of BJJ training significantly decreased emotional symptoms, hyperactivity/inattention, total difficulties score, and externalizing problems (Bueno et al., 2023). The lack of significant differences in mental health among middle belts in the current study may be due to the reliance on independent sample groups. The white belt group had great variability with 1.92 ± 2.52 years of experience, perhaps diminishing the initial effects of BJJ training as found in previous short-term studies (Willing et al., 2019; Weinberger & Burraston, 2021; Bueno et al., 2023). In the long-term, BJJ training provides opportunities for social engagement and support from like-minded individuals (Willing et al., 2019). Farrer (2019) and Sugden (2021) suggest that much of BJJ's benefits are drawn from the social environment and the emphasis on self-development and personal growth (Farrer, 2019; Sugden, 2021).

Overall, this study showed the potential of BJJ engagement to improve the variables investigated in this study. Significant differences were observed mainly after BJJ mastery (black belts) compared to beginners (white belts). The recognition as a black belt comes after the development of grappling mastery and several years of training. In this study, black belts had 16.53 ± 6.50 years of experience, whereas white belts had 1.92 ± 2.52. However, due to the very harsh and vigorous nature at the beginning of an athlete's involvement with BJJ, many athletes exit the sport before benefiting from the several positive outcomes (Williams & Smith, 2023).

This study's theoretical contribution regards the deeper understanding of BJJ athletes' psychological profile in a national sample. It adds to the limited existing BJJ

literature by showing that social interactions, where instructors and experienced athletes can provide support and guidance to beginners (Williams & Smith, 2023), positively influence the athletes' psychological skills through observation and imitation (Kabiri et al., 2021). It also sheds light on how the BJJ community influences athletes as per the verse, "He that walketh with wise men shall be wise: but a companion of fools shall be destroyed" (*King James Bible*, 2017; Proverbs 13:20).

A great explanation of how BJJ may have positively influenced the investigated outcomes is found in verse, "And not only so, but we glory in tribulations also: knowing that tribulation worketh patience; And patience, experience; and experience, hope" (*King James Bible*, 2017, Romans 5:3-4). The tribulations found in BJJ classes (e.g., fatigue and fear of failure) may ignite improvements in mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and mental health.

Implications

The current results suggest that although limited significant differences (solely in grit) could be observed between middle belt ranks (via ANOVA), the acquisition of BJJ skills analyzed through a white versus black belts comparison (via independent samples *t*-tests) revealed significant positive differences in mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and mental health. No increase or decrease in aggression was found in the current study, safeguarding concerns expressed by some authors (Linder-Postigo et al., 2023) that combat sports engagement could increase aggression.

Although improvements were found in the investigated variables, it seems clear that these differences are primarily dependent on the athletes' skill level (i.e., extreme belt ranks). Additionally, an unexpected finding was the lack of significance found in the regression coefficient associated with the relationships between competition engagement and each dependent variable. This result suggests that the benefits of BJJ engagement can be attributed to the BJJ skills developed during classes regardless of the athlete's competitive involvement.

These findings can serve as normative data to inform sports and clinical psychologists about the mental performance and mental health-related mean scores found throughout the BJJ belt ranks. They can also serve as a baseline for clinical professionals to develop plans aiming to optimize their patients' mental health. Furthermore, they can serve as foundational knowledge for coaches to develop plans aiming to optimize their athletes' mental performance.

Theoretically, these findings converge with the premises of social learning theory (Bandura, 1977), with the BJJ network positively influencing the athletes' psychological variables. It supports Williams and Smith's (2023) discussion that BJJ provides a social network (coaches, teammates, and community) to help athletes overcome challenges and optimize their perceptions of reality. Furthermore, it accurately represents the verse, "He that walketh with wise men shall be wise: but a companion of fools shall be destroyed" (*King James Bible,* 2017; Proverbs 13:20). For instance, wise men (BJJ network) positively influence the development of wise men (improved psychological skills). Lastly, this study adds to the limited theoretical BJJ literature by suggesting a positive role of BJJ engagement in the athlete's life.

Limitations

This research has certain limitations that should be acknowledged. First, its cross-sectional nature prevents any causality assumptions or the observation of changes over time. In this study, differences between subjects were observed rather than changes within subjects, providing initial but limited evidence of non-causal long-term effects of BJJ practice.

Second, although anonymous data collection was used to mitigate the issue, the reliance on self-reported answers may have led to social desirability bias. Despite the impossibility of identifying the participants' answers, it is possible that their responses reflected their own implicit attitudes or personal desires and objectives towards the situations asked in the questions.

Third, despite the inclusion of a diverse group of representatives from 47 states and the District of Columbia, the self-selection bias led to a large variability of representativeness among states, potentially limiting the generalizability of the study.

Fourth, the limited number of studies investigating the psychological aspects of BJJ practice limited the theoretical foundation and discussion of the current research. The current sampling inclusion criteria, research questions, and hypotheses were developed mostly based on evidence from martial arts and combat sports with diverging physiological demands to BJJ.

Recommendations for Future Research

Although differences were seen from white to black belt (via independent samples *t*-tests) in mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and

mental health, most of these differences were not observed when analyzing all five belt ranks (via ANOVA). This finding prompts the question of whether a longitudinal study could reveal a diverging result following within-subject analyses.

Therefore, future studies are recommended to investigate the trajectory of BJJ athletes starting at the beginning of their journey and accessing the participants' psychological profile at each belt rank until the black belt. Moreover, data collection may follow a shorter period schedule (i.e., six months) to identify potential short-, mid- and long-term effects in the explored variables.

Moreover, due to the presence of diverging intensities and physiological demands, future studies may contrast and compare the psychological profile of BJJ athletes with other combat sports, martial arts, sports, physical activity, and sedentary groups.

Although many positive differences were found, the mechanism of improvements is still unclear. Future studies may explore how BJJ engagement may contribute to these differences, particularly in mental health and life satisfaction, due to its contributions to the athletes' well-being.

After interpreting the present findings through the existing literature, it seems clear that additional studies are needed. The present findings may provide future research with BJJ-specific data for authors to develop optimal sampling inclusion criteria, research questions, and hypotheses. More psychology-related BJJ research is deemed necessary to provide robust evidence to serve as the foundation for developing deep conclusions.

Summary

In conclusion, the present study revealed significant differences in the psychological profile of BJJ athletes (white versus black belts). Black belts reported significantly higher mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and better mental health than white belts. Analysis of variance also revealed significantly higher grit in black belts than white and blue belts, in addition to higher grit in purple than white belts. Moreover, significantly higher mental strength, resilience, and aggression were found in males than females.

Results suggest that although limited significant differences could be observed between middle belt ranks, the degree of BJJ skills analyzed through a white versus black belt comparison revealed significant positive differences in mental strength, resilience, grit, self-efficacy, self-control, life satisfaction, and mental health. Lastly, no significant positive or negative differences were observed in aggression among belt ranks, safeguarding BJJ against concerns of aggression improvement due to BJJ engagement.

REFERENCES

Acebes-Sánchez, J., Blanco-García, C., Diez-Vega, I., Mon-López, D., & Rodriguez-Romo, G. (2021). Emotional intelligence in physical activity, sports and judo: A global approach. *International Journal of Environmental Research and Public Health, 18*(16), 8695. https://doi.org/10.3390/ijerph18168695

Almeida Junior, H., Bastos, A.A., Martins, F.J.A., Souza, R.F., Martins, C.O.D., Silva, A.G., Souza, T.A., & Regi, R.P. (2019). Comparison of the thermal profile of judokas and Brazilian Jiu-Jitsu athletes. *Journal of Physical Education and Sport, 19*(4), 3-7. https://doi.org/10.7752/jpes.2019.s1001

Alvarado, J. M., Jiménez-Blanco, A., Artola, T., Sastre, S., & Azañedo, C. M. (2020). Emotional intelligence and the different manifestations of bullying in children. *International Journal of Environmental Research and Public Health, 17*(23), 8842. https://doi.org/10.3390/ijerph17238842

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Andreato, L.V., Julio, U.F., Panissa, V.L.G., Esteves, J.V.D.C., Hardt, F., Franzói-De-Moraes, S.M., Souza, C.O., & Franchini E. (2015). Brazilian jiu-jitsu simulated competition part II: Physical performance, time-motion, technical-tactical analyses, and perceptual responses. *Journal of Strength and Conditioning Research, 29*(7), 2015–2025. http://www.doi.org/10.1519/JSC.0000000000000819

Andreato, L. V., Follmer, B., Celidonio, C. L., & da Silva Honorato, A. (2016). Brazilian Jiu-Jitsu combat among different categories: time-motion and physiology. A

systematic review. *Strength & Conditioning Journal, 38*(6), 44-54. https://doi.org/10.1519/SSC.0000000000000256

Andreato, L.V., Lara, F.J.D., Andrade, A., & Branco, B.H.M. (2017). Physical and physiological profiles of Brazilian jiu-jitsu athletes: A systematic review. *Sports Medicine – Open, 3*(9), 1-17. https://doi.org/10.1186/s40798-016-0069-5

Bai, X., Xiao, W., Soh, K. G., Agudamu, & Zhang, Y. (2023). 12-week concurrent brisk walking and Taijiquan (Tai Chi) improve balance, flexibility, and muscular strength of Chinese older women. *PloS One, 18*(10), e0293483. https://doi.org/10.1371/journal.pone.0293483

Balsom, P. D., Gaitanos, G. C., Söderlund, K., & Ekblom, B. (1999). High-intensity exercise and muscle glycogen availability in humans. *Acta Physiologica Scandinavica, 165*(4), 337–345. https://doi.org/10.1046/j.1365-201x.1999.00517.x

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1977). *Social learning theory* (1st ed.). Prentice Hall.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology, 4*(3), 359–373. https://doi.org/10.1521/jscp.1986.4.3.359

Basiaga-Pasternak, J., Szafraniec, Ł., Jaworski, J., & Ambroży, T. (2020). Aggression in competitive and non-competitive combat sports athletes. *Ido Movement for*

Culture. Journal of Martial Arts Anthropology, 20(2), 17-23. https://doi.org/10.14589/ido.20.2.3

Belo, W. R., De Castro, L. F., Palmieri, D. C., dos Santos, L. G. D., Herrera-Valenzuela, T., dos Santos, M. A. F., Øvretveit, K., & Simão, R. (2021). Post-exercise hypotension in Brazilian Jiu-Jitsu. *Sport Mont, 19*(1), 39-43. https://doi.org/10.26773/smj.210208

Blomqvist-Mickelsson, T. (2019a). Self-Control and aggression amongst mixed martial arts practitioners: Trajectories and mitigating mechanisms. *Journal of Martial Arts Research, 2*(1). https://doi.org/10.15495/ojs_25678221_21_128

Blomqvist-Mickelsson, T. (2019b). Modern unexplored martial arts – what can mixed martial arts and Brazilian Jiu-Jitsu do for youth development? *European Journal of Sport Science, 20*(3), 386-393. https://doi.org/10.1080/17461391.2019.1629180

Blomqvist-Mickelsson, T. (2021). Brazilian jiu-jitsu as social and psychological therapy: A systematic review. *Journal of Physical Education and Sport, 21*(3), 1544-1552. https://doi.org/10.7752/jpes.2021.03196

Brandt, R., Bevilacqua, G. G., Crocetta, T. B., Monteiro, C. B. D. M., Guarnieri, R., Hobold, E., Flores, L. J. F., Miarka, B., & Andrade, A. (2021). Comparisons of mood states associated with outcomes achieved by female and male athletes in high-level judo and Brazilian jiu-jitsu championships: Psychological factors associated with the probability of success. *Journal of Strength and Conditioning Research, 35*(9), 2518–2524. https://doi.org/10.1519/JSC.0000000000003218

Brown, M., Tracy, R. E., & Neiswender, P. R. (2023). Men's expectations for post conflict reconciliation with physically strong opponents. *Evolutionary*

Psychological Science, 9(2), 177-185. https://doi.org/10.1007/s40806-022-00350-z

Bueno, J. C. B., Andreato, L. V., Silva, R. B., & Andrade, A. (2023). Effects of a school-based Brazilian jiu-jitsu programme on mental health and classroom behaviour of children from Abu Dhabi: A randomised trial. *International Journal of Sport and Exercise Psychology,* 21(6), 1091-1106. https://doi.org/10.1080/1612197X.2022.2109184

Chen, M. A., & Cheesman, D. J. (2013). Mental toughness of mixed martial arts athletes at different levels of competition. *Perceptual and Motor Skills, 116*(3), 905–917. https://doi.org/10.2466/29.30.PMS.116.3.905-917

Chen, X., Zhang, G., Yin, X., Li, Y., Cao, G., Gutiérrez-García, C., & Guo, L. (2019). The relationship between self-efficacy and aggressive behavior in boxers: The mediating role of self-control. *Frontiers in Psychology, 10*, 212. https://doi.org/10.3389/fpsyg.2019.00212

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297-334.

Dagnall, N., Denovan, A., Papageorgiou, K. A., Clough, P. J., Parker, A., & Drinkwater, K. G. (2019). Psychometric assessment of shortened Mental Toughness Questionnaires (MTQ): Factor structure of the MTQ-18 and the MTQ-10. *Frontiers in Psychology, 10*, 1933. https://doi.org/10.3389/fpsyg.2019.01933

Daniels, B. T., Human, A. E., Gallagher, K. M., & Howie, E. K. (2021). Relationships between grit, physical activity, and academic success in university students:

Domains of physical activity matter. *Journal of American College Health,* 1-9. https://doi.org/10.1080/07448481.2021.1950163

Datu, J. A. D., Yuen, M., Fung, E., Zhang, J., Chan, S., & Wu, F. (2022). The satisfied lives of gifted and gritty adolescents: Linking grit to career self-efficacy and life satisfaction. *The Journal of Early Adolescence, 42*(8) 1052–1072. https://doi.org/10.1177/02724316221096082

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment, 49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Donnon, T. (2010). Understanding how resiliency development influences adolescent bullying and victimization. *Canadian Journal of School Psychology, 25*(1), 101–113. https://doi.org/10.1177/0829573509345481

Donohue, B., Scott, J., Goodwin, G., Barchard, K. A., Bohall, G., & Allen, D. N. (2023). Initial examination of the mental health disorders: Screening instrument for athletes. *Frontiers in Psychology, 14,* 1029229. https://doi.org/10.3389/fpsyg.2023.1029229

Duckworth, A. L., & Gross, J. J. (2014). Self-control and grit: Related but separable determinants of success. *Current Directions in Psychological Science, 23*(5), 319-325. https://doi.org/10.1177/0963721414541462

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087

Dunston, E. R., Messina, E. S., Coelho, A. J., Chriest, S. N., Waldrip, M. P., Vahk, A., & Taylor, K. (2022). Physical activity is associated with grit and resilience in college students: Is intensity the key to success? *Journal of American College Health, 70*(1), 216-222. https://doi.org/10.1080/07448481.2020.1740229

Ekinci, N., & Koç, H. (2023). Grit, general self-efficacy, and life satisfaction: The mediating role of hope. *Journal of Community Psychology, 51*(3), 1288-1299. https://doi.org/10.1002/jcop.22962

Eather, N., Wade, L., Pankowiak, A., & Eime, R. (2023). The impact of sports participation on mental health and social outcomes in adults: a systematic review and the 'Mental Health through Sport' conceptual model. *Systematic Reviews, 12*(1), 102. https://doi.org/10.1186/s13643-023-02264-8

Fabio, R. A., & Towey, G. E. (2018). Cognitive and personality factors in the regular practice of martial arts. *The Journal of Sports Medicine and Physical Fitness, 58*(6), 933–943. https://doi.org/10.23736/S0022-4707.17.07245-0

Faro, H. K., Tavares, M. P., Gantois, P., Pereira, D. C., de Lima, M. N., de Lima-Junior, D., Machado, D.S., & Fortes, L. S. (2020). Comparison of competitive anxiety and self-confidence in Brazilian Jiu-Jitsu skills levels: a cross-sectional in-event study. *Ido Movement for Culture. Journal of Martial Arts Anthropology, 20*(1), 30-39. https://doi.org/10.14589/ido.20.1.4

Farrer, D. S. (2019). Brazilian jiu-jitsu is therapy. Shifting subjectivities on Guam. *Etnografia e Ricerca Qualitativa, 12*(3), 407-428. https://doi.org/10.3240/95531

Franchini, E., Brito, C. J., Fukuda, D. H., & Artioli, G. G. (2014). The physiology of judo-specific training modalities. *The Journal of Strength & Conditioning Research*, *28*(5), 1474-1481. https://doi.org/10.1080/24748668.2013.11868676

Galton, F. (2006). *Hereditary genius: An inquiry into its laws and consequences.* Prometheus Books.

García, R. S., & Spencer, D. C. (Eds.). (2013). *Fighting scholars: Habitus and ethnographies of martial arts and combat sports*. Anthem Press.

Giordano, G., Gómez-López, M., & Alesi, M. (2021). Sports, executive functions and academic performance: A comparison between martial arts, team sports, and sedentary children. *International Journal of Environmental Research and Public Health, 18*(22), 11745. http://dx.doi.org/10.3390/ijerph182211745

Gorner, K., Makarowski, R., & Roskova, M. (2021). Aggression among Slovak males training in martial arts versus other sports disciplines. *Ido Movement for Culture. Journal of Martial Arts Anthropology, 21(*2). https://doi.org/10.14589/ido.21.2.7

Gracie, R., & Danaher, J. (2003). *Mastering juijitsu*. Human Kinetics.

Greco, G., Cataldi, S., & Fischetti, F. (2019). Karate as anti-bullying strategy by improvement resilience and self-efficacy in school-age youth. *Journal of Physical Education and Sport, 19*, 1863-1870. https://doi.org/10.7752/jpes.2019.s5276

Hahlbeck, S. M., & Vito, A. G. (2022). Adolescent marijuana dependence: The role of social bonds and social learning theory. *Journal of Psychoactive Drugs*, *54*(1), 43–53. https://doi.org/10.1080/02791072.2021.1903122

Harwood-Gross, A., Lambez, B., Feldman, R., Zagoory-Sharon, O., & Rassovsky, Y. (2021). The effect of martial arts training on cognitive and psychological

functions in at-risk youths. *Frontiers in Pediatrics, 9*, 707047. https://doi.org/10.3389/fped.2021.707047

Hargreaves, M., Finn, J. P., Withers, R. T., Halbert, J. A., Scroop, G. C., Mackay, M., Snow, R. J., & Carey, M. F. (1997). Effect of muscle glycogen availability on maximal exercise performance. *European Journal of Applied Physiology and Occupational Physiology, 75(*2), 188–192. https://doi.org/10.1007/s004210050146

Hoiosen, G.E., Oldach, M.C., Kajitani, S.H., Gabriano, E., Gonzalez, S.P., VanHaitsma, T.A. (2020). Three weeks of mental strength training improves cycling performance by changing key physiological parameters. *Medicine & Science in Sports & Exercise*, *52*(7S), 628. https://doi.org/10.1249/01.mss.0000681128.56105.6c

Howie, E. K., Guagliano, J. M., Milton, K., Vella, S. A., Gomersall, S. R., Kolbe-Alexander, T. L., Richards, J., & Pate, R. R. (2020). Ten research priorities related to youth sport, physical activity, and health. *Journal of Physical Activity and Health, 17*(9), 920-929. https://doi.org/10.1123/jpah.2020-0151

Huang, Q., Wang, X., Ge, Y., & Cai, D. (2023). Relationship between self-efficacy, social rhythm, and mental health among college students: A 3-year longitudinal study. *Current Psychology*, *42*(11), 9053-9062. https://doi.org/10.1007/s12144-021-02160-1

Ingwerson, J. (2023). *Resilience, mindfulness and sports performance optimization*. In The Youth Athlete (pp. 561-565). Academic Press. https://doi.org/10.1016/B978-0-323-99992-2.00050-5

Invernizzi, P. L., Trecroci, A., Scurati, R., Signorini, G., Formenti, D., Bosio, A., Rigon, M., & Benedini, S. (2023). Acute effects of a combat sport environment on self-control and pain perception inhibition: A preliminary study in a new ecological framework. *Sustainability, 15*(10), 8418. https://doi.org/10.3390/su15108418

Johnson, E. L. (2010). *Psychology & Christianity: Five views*. IVP Academic.

Johnson, S. B., Voegtline, K. M., Ialongo, N., Hill, K. G., & Musci, R. J. (2022). Self-control in first grade predicts success in the transition to adulthood. *Development and Psychopathology*, 1-13. http://www.doi.org/10.1017/S0954579421001255

Kabiri, S., Choi, J., Shadmanfaat, S. M., Ponnet, K., Lee, J., Lee, S., & Donner, C. M. (2021). Learning to play through pain and injury: An examination of social learning theory among Iranian athletes. *Social Science Quarterly, 102*(1), 343-361. https://doi.org/10.1111/ssqu.12878

Kasper, K. (2019). Sports training principles. *Current Sports Medicine Reports, 18*(4), 95-96. https://doi.org/10.1249/JSR.0000000000000576

Khodabandelou, M., & Salehian, M. H. (2023). The effect of psychological toughness and self-efficacy in the acquisition of the martial arts leg kick skill. *Ido Movement for Culture. Journal of Martial Arts Anthropology, 23*(2), 6-12. https://doi.org/10.14589/ido.23.2.2

Killy, A.K., Van Nieuwerburg, C., & Clough, P. J. (2017). Coaching to enhance the mental toughness of people learning kickboxing. *International Journal of Evidence Based Coaching and Mentoring, 15*(2), 111-123. https://doi.org/10.24384/000253

King James Bible. (2017). King James Bible Online. https://www.kingjamesbibleonline.org/ (Original work published 1769)

Kostorz, K., & Sas-Nowosielski, K. (2021). Aggression dimensions among athletes practicing martial arts and combat sports. *Frontiers in Psychology, 12*, 696943. https://doi.org/10.3389/fpsyg.2021.696943

Kotarska, K., Nowak, L., Szark-Eckardt, M., & Nowak, M. (2019). Selected healthy behaviors and quality of life in people who practice combat sports and martial arts. *International Journal of Environmental Research and Public Health, 16*(5), 875. https://doi.org/10.3390/ijerph16050875

Kruis, N. E., Seo, C., & Kim, B. (2020). Revisiting the empirical status of social learning theory on substance use: A systematic review and meta-analysis. *Substance Use & Misuse*, *55*(4), 666–683. https://doi.org/10.1080/10826084.2019.1696821

Küçük, K. S. (2020). Relationship between psychological resilience and stress coping strategies in karate athletes. *Revista de Artes Marciales Asiáticas, 15*(2), 59-58. https://doi.org/10.18002/rama.v15i2.6257

Kuśnierz, C., Nowak, P., & Görner, K. (2020). Determinants of life satisfaction in martial arts practitioners and team-sports players. *Archives of Budo, 16*, 83-89.

Lafuente, J. C., Zubiaur, M., & Gutiérrez-García, C. (2021). Effects of martial arts and combat sports training on anger and aggression: A systematic review. *Aggression and Violent Behavior, 58*, 101611. https://doi.org/10.1016/j.avb.2021.101611

Lakes, K. D., & Hoyt, W. T. (2004). Promoting self-regulation through school-based martial arts training. *Journal of Applied Developmental Psychology, 25*(3), 283-302. https://doi.org/10.1016/j.appdev.2004.04.002

Latorre-Román, P. Á., Bueno-Cruz, M. T., Martínez-Redondo, M., & Salas-Sánchez, J. (2020). Prosocialand antisocial behaviour in school sports. *Apunts. Educación Física y Deportes*, 139, 10-18. https://doi.org/10.5672/apunts.2014-0983.es.(2020/1).139.02

Lee, J. H., Cho, J. H., Kwak, Y. S., Ko, B. G., & Cho, E. H. (2021). The relationship between changes in grit, taekwondo ability, and academic achievement of university students majoring in science and engineering and participating in taekwondo class. *International Journal of Environmental Research And Public Health*, *18*(10), 5361. https://doi.org/10.3390/ijerph18105361

Li C. K. W. (2022). The applicability of social structure and social learning theory to explain intimate partner violence perpetration across national contexts. *Journal of Interpersonal Violence*, *37*(23-24), NP22475–NP22500. https://doi.org/10.1177/08862605211072166

Li, J., Fang, M., Wang, W., Sun, G., & Cheng, Z. (2018). The influence of grit on life satisfaction: Self-esteem as a mediator. *Psychologica Belgica*, *58*(1), 51-66. https://doi.org/10.5334/pb.400

Lindell-Postigo, D., Zurita-Ortega, F., Melguizo-Ibáñez, E., González-Valero, G., Ortiz-Franco, M., & Ubago-Jiménez, J. L. (2023). Effectiveness of a judo intervention programme on the psychosocial area in secondary school education students. *Sports (Basel, Switzerland)*, *11*(8), 140. https://doi.org/10.3390/sports11080140

Liu, H., Yu, Z., Ye, B., & Yang, Q. (2022). Grit and life satisfaction among college students during the recurrent outbreak of COVID-19 in China: The mediating role

of depression and the moderating role of stressful life events. *Frontiers in Public Health, 10,* 895510. https://doi.org/10.3389/fpubh.2022.895510

Lochbaum, M., Stoner, E., Hefner, T., Cooper, S., Lane, A. M., & Terry, P. C. (2022). Sport psychology and performance meta-analyses: A systematic review of the literature. *PloS One, 17*(2), e0263408. https://doi.org/10.1371/journal.pone.0263408

Lorenço-Lima, L., Monteiro, T.S., Joel, G.B., Hatanaka, E., & Hirabara, S.M. (2010). *Muscle damage changes after a simulated Jiu-Jitsu competition* [Conference presentation abstract]. In Annals of the II International Congress of Physical Education, Sports and Leisure UNESP, Presidente Prudente, SP, Brazil. https://doi.org/10.13140/RG.2.2.29074.02246

Lorenco-Lima, L. (2023). Developing a martial arts program to meet the expectations of contemporary parents. *International Journal of Martial Arts, 8,* 96-112. https://doi.org/10.51222/injoma.2023.03.8.96

Lorenco-Lima, L. (2024a). The effect of combat sports experience, competition engagement, sex, and age on grit. *Journal of Human Sport and Exercise, 19*(1), 130-138. https://doi.org/10.14198/jhse.2024.191.11

Lorenco-Lima, L. (2024b). Mental strength assessment in combat sports practitioners and non-practitioners. *Journal of Human Sport and Exercise*, *19*(2). https://doi.org/10.55860/gr2sf103

Lorenco-Lima, L., Souza-Junior, T. P., Okuyama, A. R., Mcanulty, S. R., Utter, A. C., Monteiro, T. S., Barquilha, G., Bortolon, J. R., Geraldo, T. P., & Hirabara, S. (2020). Characterization of Brazilian Jiu-Jitsu training effects on the physical

fitness of men and women. *Journal of Physical Education & Sport, 20*, 2990-2995. https://doi.org/10.7752/jpes.2020.s5406

Malm, C., Jakobsson, J., & Isaksson, A. (2019). Physical activity and sports—real health benefits: A review with insight into the public health of Sweden. *Sports, 7*(5), 127. https://doi.org/10.3390/sports7050127

Mamayek, C., Paternoster, R., & Loughran, T. A. (2017). Self-control as self-regulation: A return to control theory. *Deviant Behavior, 38*(8), 895-916. https://doi.org/10.1080/01639625.2016.1206730

Milam, L. A., Cohen, G. L., Mueller, C., & Salles, A. (2019). The relationship between self-efficacy and well-being among surgical residents. *Journal of Surgical Education, 76*(2), 321–328. https://doi.org/10.1016/j.jsurg.2018.07.028

Mills, K., Dudley, D., & Collins, N. J. (2019). Do the benefits of participation in sport and exercise outweigh the negatives? An academic review. *Best Practice & Research. Clinical rheumatology, 33*(1), 172–187. https://doi.org/10.1016/j.berh.2019.01.015

Moffitt, T.E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., Houts, R., Poulton, R., Roberts, B. W., Ross, S., Sears, M. R., Thomson, W. M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences, 108*(7), 2693-2698. https://doi.org/10.1073/pnas.1010076108

Moise, D., Diaconu, A., Dobre, F., & Svetlana, P.G. (2023). The parents perception of martial arts practiced by their children. In: R. Pamfilie, V. Dinu, C. Vasiliu, D. Pleșea, L. Tăchiciu (Eds.), *9th BASIQ International Conference on New Trends in*

Sustainable Business and Consumption, 8(10), 334-341. https://doi.org/10.24818/BASIQ/2023/09/026

Montas, M., Rao, S. R., Atassi, H. A., Shapiro, M. C., Dean, J., & Salama, A. R. (2021). Relationship of grit and resilience to dental students' academic success. *Journal of Dental Education, 85*(2), 176-186. https://doi.org/10.1002/jdd.12414

Moore, B., Woodcock, S., & Dudley, D. (2019). Developing wellbeing through a randomized controlled trial of a martial arts-based intervention: an alternative to the anti-bullying approach. *International Journal of Environmental Research And Public Health, 16*(1), 81. https://doi.org/10.3390/ijerph16010081

Moore, B., Dudley, D., & Woodcock, S. (2020). The effect of martial arts training on mental health outcomes: A systematic review and meta-analysis. *Journal of Bodywork and Movement Therapies, 24*(4), 402–412. https://doi.org/10.1016/j.jbmt.2020.06.017

Moore, B., Woodcock, S., & Dudley, D. (2021). Well-being warriors: A randomized controlled trial examining the effects of martial arts training on secondary students' resilience. *The British Journal of Educational Psychology, 91*(4), 1369–1394. https://doi.org/10.1111/bjep.12422

Ng-Knight, T., Gilligan-Lee, K. A., Massonnié, J., Gaspard, H., Gooch, D., Querstret, D., & Johnstone, N. (2022). Does taekwondo improve children's self-regulation? If so, how? A randomized field experiment. *Developmental Psychology, 5*8(3), 522–534. https://doi.org/10.1037/dev0001307

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). McGraw-Hill.

Oliveira, J.F., Silva, F.M.M., Navarro, A.C., Navarro, F., & Ornellas, F.H. (2009). Effects of different carbohydrates supplements on glycemia of Jiu-Jitsu athletes. *Revista Brasileira de Fisiologia do Exercicio, 8(*2), 65-70. https://doi.org/10.33233/rbfe.v8i2

Ozturk, A., & Oz, K. (2022). The Analysis of female kickboxers' achievements and psychological resilience levels. *Journal of Educational Issues, 8*(3), 98-114. https://doi.org/10.5296/jei.v8i3.20194

Øvretveit, K., Sæther, S.A., & Mehus, A.I. (2019). Mastery goals are associated with training effort in Brazilian Jiu-Jitsu. *Journal of Physical Education and Sport, 19*(4): 1294-1299. https://doi.org/10.7752/jpes.2019.s4188

Øvretveit, K. (2018). Acute physiological and perceptual responses to Brazilian jiu-jitsu sparring: the role of maximal oxygen uptake. *International Journal of Performance Analysis in Sport, 18*, 481-494. https://doi.org/10.1080/24748668.2018.1493634

Øvretveit, K. (2020). Capacity and confidence: What can be gleaned from the link between perceived and actual physical ability in Brazilian jiu-jitsu practitioners? *Martial Arts Studies, 10,* 119-127. https://doi.org/10.18573/mas.110

Paulus, A. L., & Hermanto, Y. B. (2022). The competitive advantage of furniture SMEs in East Java: The role of aggressiveness in entrepreneurship orientation. *Economies, 10*(6), 139. https://doi.org/10.3390/economies10060139

Pavlova, J., Bodnar, I., Mosler, D., Ortenburger, D., & Wąski, J. (2019). The influence of karate training on preparing preschool girls for school education. *Ido Movement*

for Culture Journal of Martial Arts Anthropology, *19*(2), 12-20. https://doi.org/10.14589/ido.19.2.3

Pavot, W., & Diener, E. (2008). The satisfaction with life scale and the emerging construct of life satisfaction. *The Journal of Positive Psychology, 3*(2), 137-152. https://doi.org/10.1080/17439760701756946

Potoczny, W., Herzog-Krzywoszanska, R., & Krzywoszanski, L. (2022). Self-control and emotion regulation mediate the impact of karate training on satisfaction with life. *Frontiers in Behavioral Neuroscience*, *15*, 802564. https://doi.org/10.3389/fnbeh.2021.802564

Powers, R. A., Cochran, J. K., Maskaly, J., & Sellers, C. S. (2020). Social learning theory, gender, and intimate partner violent victimization: A structural equations approach. *Journal of interpersonal violence, 35*(17-18), 3554–3580. https://doi.org/10.1177/0886260517710486

Pujszo, M., Janowska, P., & Stępniak, R. (2019a). The psychic resilience on an example of some martial arts fighters. *Journal of Education, Health and Sport, 9*(7), 467-478. http://dx.doi.org/10.5281/zenodo.3372128

Pujszo, M., Jasińska, N., Wyżlic, P., Duda, J., & Stępniak, R. (2019b). Comparative analysis of psychic resilience of men and women training combat sports. *Quality in Sports, 5*(2), 58-65. https://doi.org/10.12775/QS.2019.012

Rachlin, H. (1974). Self-Control. *Behaviorism, 2*(1), 94–107. http://www.jstor.org/stable/27758811

Rassovsky, Y., Harwood, A., Zagoory-Sharon, O., & Feldman, R. (2019). Martial arts increase oxytocin production. *Scientific Reports, 9*(1), 12980. https://doi.org/10.1038/s41598-019-49620-0

Rawat, K., Pujszo, R., Wojdat, M., & Zając, M. (2022). A comparative analysis of the sense of optimism and life satisfaction among judo and Brazilian jiu jitsu fighters. *Journal of Education, Health and Sport, 12*(2), 34-47. http://dx.doi.org/10.12775/JEHS.2022.12.02.004

Rich, B. A., Starin, N. S., Senior, C. J., Zarger, M. M., Cummings, C. M., Collado, A., & Alvord, M. K. (2023). Improved resilience and academics following a school-based resilience intervention: A randomized controlled trial. *Evidence-Based Practice in Child and Adolescent Mental Health, 8*(2), 252-268. https://doi.org/10.1080/23794925.2022.2025630

Rippon, D., Shepherd, J., Wakefield, S., Lee, A., & Pollet, T. V. (2022). The role of self-efficacy and self-esteem in mediating positive associations between functional social support and psychological wellbeing in people with a mental health diagnosis. *Journal of Mental Health*, 1-10. https://doi.org/10.1080/09638237.2022.2069695

Salchow, J. L., Strunk, M. A., Niels, T., Steck, J., Minto, C. A., & Baumann, F. T. (2021). A Randomized controlled pilot trial about the influence of Kyushu jitsu exercise on self-efficacy, fear, depression, and distress of breast cancer patients within follow-up care. *Integrative Cancer Therapies, 20*, https://doi.org/10.1177/15347354211037955

Santos, M. A. F., de Albuquerque Maurício, C., Soto, D. A. S., Aedo-Muñoz, E., Brito, C. J., Pierantozzi, E., & Miarka, B. (2024). The dynamics of victory: Exploring the movement patterns of female Brazilian jiu-jitsu athletes in winning and losing combats through time-motion analysis. *Retos, 51*, 1687-1696.

Sawyer, T. P., Hollis-Sawyer, L., & Wade, J. (2018). Grit and children's taekwondo performance. *International Journal of Martial Arts, 4*, 1-12. https://doi.org/10.51222/injoma.2018.04.4.1

Schwellnus, M., Soligard, T., Alonso, J. M., Bahr, R., Clarsen, B., Dijkstra, H. P., ... & Engebretsen, L. (2016). How much is too much?(Part 2) International Olympic Committee consensus statement on load in sport and risk of illness. *British Journal of Sports Medicine, 50*(17), 1043-1052. http://dx.doi.org/10.1136/bjsports-2016-096572

Segura, L., Estévez, J. F., & Estévez, E. (2020). Empathy and emotional intelligence in adolescent cyberaggressors and cybervictims. *International Journal of Environmental Research and Public Health, 17*(13), 4681. https://doi.org/10.3390/ijerph17134681

Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio*. NFER-Nelson.

Shamshirian, S., Halldorsson, V., & Sigmundsson, H. (2021). Passion, grit and mindset of Iranian wrestlers: A socio-psychological approach. *New Ideas in Psychology, 62*, 100871. https://doi.org/10.1016/j.newideapsych.2021.100871

Sivan, A., & Zeba K. H. F. (2023). Resilience and life satisfaction among karate and Kalaripayattu practitioners. *Journal of Psychosocial Research, 18*(1). https://doi.org/10.32381/JPR.2023.18.01.7

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15*(3), 194–200. https://doi.org/10.1080/10705500802222972

Smith, B.W., Epstein, E.E., Oritz, J.A., Christopher, P.K., & Tooley, E.M. (2013). The Foundations of Resilience: What are the critical resources for bouncing back from stress? In Prince-Embury, S. & Saklofske, D.H. (Eds.), *Resilience in children, adolescents, and adults: Translating research into practice, The Springer series on human exceptionality* (pp. 167-187). Springer.

Solakoglu, O., & Yuksek, D. A. (2020). Delinquency among turkish adolescents: Testing akers' social structure and social learning theory. *International Journal of Offender Therapy and Comparative Criminology, 64*(5), 539–563. https://doi.org/10.1177/0306624X19897400

Song, Y., Swendiman, R. A., Shannon, A. B., Torres-Landa, S., Khan, F. N., Williams, N. N., Dumond, K. R., Brooks, A. D., DeMatteo, R. P., & Aarons, C. B. (2020). Can we coach resilience? An evaluation of professional resilience coaching as a well-being initiative for surgical interns. *Journal of Surgical Education, 77*(6), 1481-1489. https://doi.org/10.1016/j.jsurg.2020.04.014

Sproul, R.C. (2000). *The consequences of ideas: Understanding the concepts that shaped our world*. Crossway.

Stanković, N., Todorović, D., Milošević, N., Mitrović, M., & Stojiljković, N. (2022). Aggressiveness in judokas and team athletes: predictive value of personality traits, emotional intelligence and self-efficacy. *Frontiers in Psychology, 12*, 824123. https://doi.org/10.3389/fpsyg.2021.824123

Steinhaus, A. H. (1933). Chronic effects of exercise. *Physiological Reviews, 13*(1), 103-147. https://doi.org/10.1152/physrev.1933.13.1.103

Sugden, J. T. (2021). Jiu-jitsu and society: Male mental health on the mats. *Sociology of Sport Journal, 38*(3), 218-230. https://doi.org/10.1123/ssj.2020-0051

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271–322. doi:10.1111/j.0022-3506.2004.00263.x

Tartar, J. L., Cabrera, D., Knafo, S., Thomas, J. D., Antonio, J., & Peacock, C. A. (2020). The "Warrior" COMT Val/Met genotype occurs in greater frequencies in mixed martial arts fighters relative to controls. *Journal of Sports Science & Medicine, 19*(1), 38–42.

Tikac, G., Unal, A., & Altug, F. (2022). Regular exercise improves the levels of self-efficacy, self-esteem and body awareness of young adults. *The Journal of Sports Medicine and Physical Fitness, 62*(1), 157–161. https://doi.org/10.23736/S0022-4707.21.12143-7

Tornero-Aguilera, J. F., Jimenez-Morcillo, J., Rubio-Zarapuz, A., & Clemente-Suárez, V. J. (2022). Central and peripheral fatigue in physical exercise explained: A narrative review. *International Journal ff Environmental Research and Public Health, 19*(7), 3909. https://doi.org/10.3390/ijerph19073909

Waddell, C., McEwan, K., Shepherd, C. A., Offord, D. R., & Hua, J. M. (2005). A public health strategy to improve the mental health of Canadian children. *The Canadian Journal of Psychiatry, 50*(4), 226–233. https://doi.org/10.1177/070674370505000406

Webster, G. D., DeWall, C. N., Pond, R. S., Jr., Deckman, T., Jonason, P. K., Le, B. M., Bator, R. J. (2014). The Brief Aggression Questionnaire: Psychometric and behavioral evidence for an efficient measure of trait aggression. *Aggressive Behavior, 40*, 120–139. https://doi.org/doi:10.1002/ab.21507

Webster, G. D., DeWall, C. N., Pond, R. S., Jr, Deckman, T., Jonason, P. K., Le, B. M., Nichols, A. L., Schember, T. O., Crysel, L. C., Crosier, B. S., Smith, C. V., Paddock, E. L., Nezlek, J. B., Kirkpatrick, L. A., Bryan, A. D., & Bator, R. J. (2015). The brief aggression questionnaire: Structure, validity, reliability, and generalizability. *Journal of Personality Assessment, 97*(6), 638–649. https://doi.org/10.1080/00223891.2015.1044093

Weinberger, K., & Burraston, T. (2021). Benefits of Brazilian Jiu-Jitsu in Managing Post-Traumatic Stress Disorder: A Longitudinal Study. *Journal of Community Engagement and Scholarship, 13*(1). https://doi.org/10.54656/MSFA1684

Willems, Y. E., Boesen, N., Li, J., Finkenauer, C., & Bartels, M. (2019). The heritability of self-control: A meta-analysis. *Neuroscience & Biobehavioral Reviews, 100*, 324-334. https://doi.org/10.1016/j.neubiorev.2019.02.012

Williams, F., & Smith, A. B. (2023). The downward spiral of fear of failure in Brazilian jiu jitsu practitioners. *Leisure Sciences*. Advance online publication. https://doi.org/10.1080/01490400.2023.2287105

Willing, A. E., Girling, S. A., Deichert, R., Wood-Deichert, R., Gonzalez, J., Hernandez, D., Foran, E., Sanberg, P. R., & Kip, K. E. (2019). Brazilian jiu jitsu training for us service members and veterans with symptoms of PTSD. *Military Medicine, 184*(11-12), e626–e631. https://doi.org/10.1093/milmed/usz074

Wojdat, M., & Ossowski, R. (2019). Comparative analysis of the level's aggression of women and men training Brazilian Jiu-Jitsu in the light of the possibilities for therapeutic purposes. *Journal of Education, Health and Sport, 9*(5), 319-338. http://dx.doi.org/10.5281/zenodo.3158258

Ye, Y. C., Wu, C. H., Huang, T. Y., & Yang, C. T. (2022). The difference between the Connor-Davidson Resilience Scale and the Brief Resilience Scale when assessing resilience: Confirmatory factor analysis and predictive effects. *Global Mental Health (Cambridge, England), 9*, 339–346. https://doi.org/10.1017/gmh.2022.38

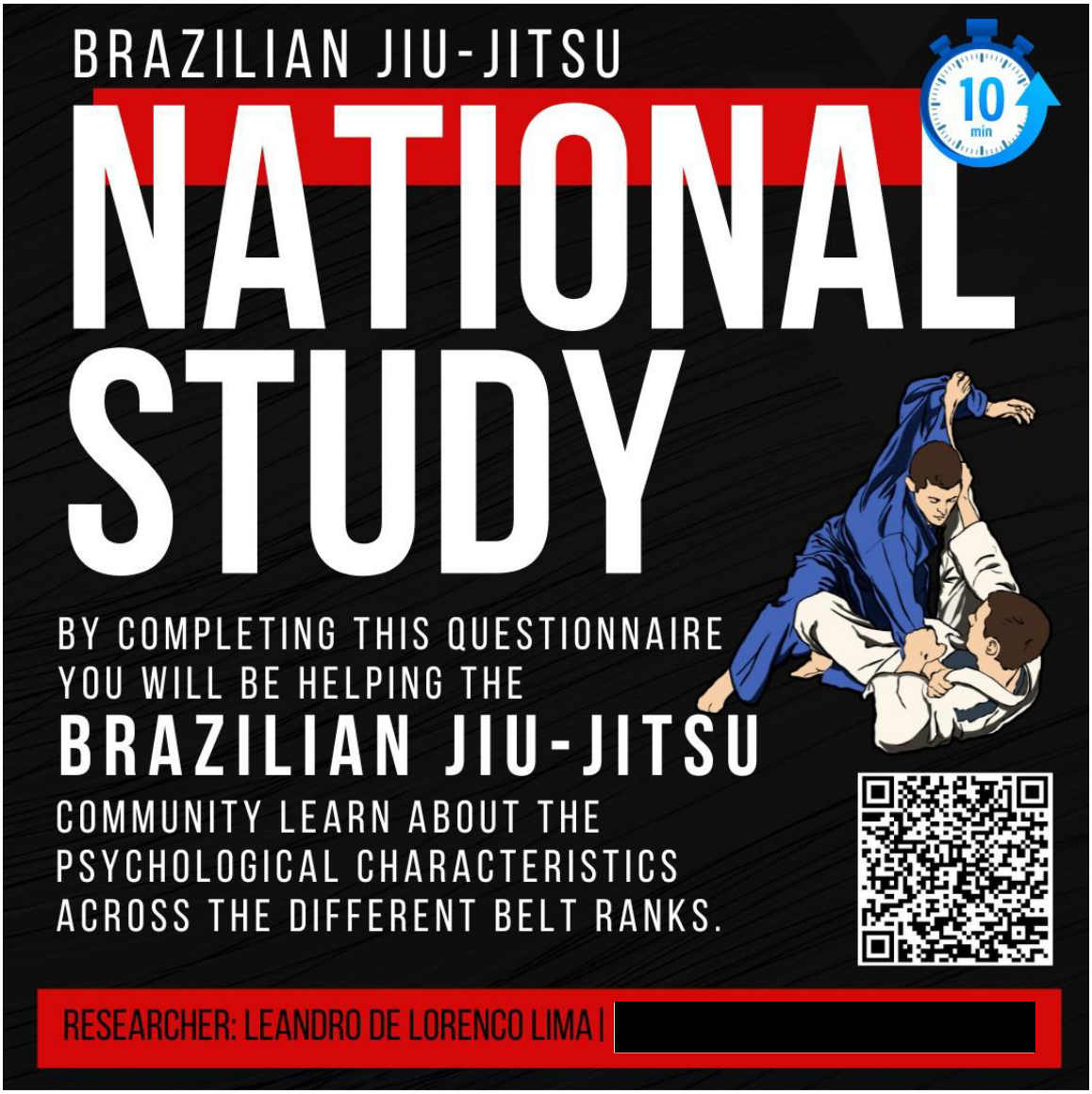
Yen S. J. (2022). Can emotional intelligence be fostered? The perspective of social learning theory. *Frontiers in Behavioral Neuroscience, 16*, 862360. https://doi.org/10.3389/fnbeh.2022.862360

Yerkes R. M. (1918). Measuring the Mental Strength of an Army. *Proceedings of the National Academy of Sciences of the United States of America, 4*(10), 295–297. https://doi.org/10.1073/pnas.4.10.295

Yu, J. (2022). Health is the first: research on the influence of wushu class on psychological resilience of female college students. *Frontiers in Educational Research, 5*(11), 16-24. https://doi.org/10.25236/FER.2022.051104

Xu, T., Li, H., Yan, Z., & Zhang, G. (2022). The effects of self-control on bullying behaviour among martial arts practicing adolescents: based on the analyses of multiple mediation effects. *International Journal of Sport and Exercise Psychology,* 1-14. https://doi.org/10.1080/1612197X.2022.2116470

APPENDIX A: SOCIAL MEDIA FLYER



APPENDIX B: STUDY INFORMATION SHEET

Title of the Project: Psychological Profile of Brazilian Jiu-Jitsu Practitioners
Principal Investigator: Leandro de Lorenco-Lima, Ph.D. Candidate, Psychology Department, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be a Brazilian Jiu-Jitsu practitioner (males and females) from 18 to 60 years of age and currently engaged in Brazilian Jiu-Jitsu classes for at least one class per week (minimum of 52 per year). Taking part in this research project is voluntary. You do not have to participate, and you can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to take part in this research.

What is the study about and why is it being done?

The purpose of this study is to explore the differences in mental strength, resilience, grit, self-efficacy, self-control, aggression, mental health, and life satisfaction between belt ranks in Brazilian Jiu-Jitsu practitioners.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following:

1. Participate in an online, anonymous survey, which will take 10-15 minutes to complete.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include the determination of performance related psychological characteristics related to Brazilian Jiu-Jitsu engagement (i.e., mental strength, resilience, grit, self-efficacy, self-control, aggression, mental health, and life satisfaction).

What risks might you experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks you would encounter in everyday life. In rare instances, a participant may be uncomfortable with answering the questions. We minimize the possibility of this discomfort by a) clearly stating the voluntary and confidential nature of participation, b) assuring you that a wide range of responses to questions is typical (i.e., there are no

"right" or "wrong" answers), and c) reminding you that you may stop participating at any time.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses will be anonymous.
- Data will be stored on a password-locked computer. The researcher will have access to the data. After five years all electronic records will be deleted.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to withdraw at any time prior to submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your internet browser. Your responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Leandro de Lorenco-Lima. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] You may also contact the researcher's faculty sponsor, Dr. Stacey Gaines, at [redacted]

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

APPENDIX C: BJJ-RELATED QUESTIONS

- **Question:** Age (close-ended)
- **Question:** Biological Sex (close-ended)
  - *Option 1:* Male
  - *Option 2:* Female
- **Question:** In which **s**tate do you train BJJ? (close-ended)
- **Question:** I currently also practice other sport(s), martial arts(s) or physical activity (close-ended)
  - *Option 1:* Yes
  - *Option 2:* No
- **Question:** How many YEARS have you been practicing BJJ? (close-ended)
- **Question:** How many DAYS a week do you practice BJJ? (close-ended)
- **Question:** How many HOURS a week do you practice BJJ? (close-ended)
- **Question:** What is your belt rank in BJJ? (close-ended)
  - *Option 1:* White belt
  - *Option 2:* Blue belt
  - *Option 3:* Purple belt
  - *Option 4:*Brown belt
  - *Option 5:* Black belt
  - *Option 6:* Other
- **Question:** In BJJ classes I regularly engage in (close-ended)
  - *Option 1:* Technical Rolling (flow grappling with limited use of force)
  - *Option 2:* Competitive Rolling (submission-focused grappling with full use of force)
  - *Option 3:* Both Technical and Competitive Rolling
  - *Option 4:* I do not engage in rolling or live grappling
- **Question:** In how many tournaments have you competed in BJJ over the last 12 months? (close-ended)

APPENDIX D: MENTAL STRENGTH SCALE

Thinking about your athletic journey, mark the box that best represents your thoughts over the past month. There is no right or wrong answer, just answer it to the best of your ability!

Mark one box per row that best describes your thoughts		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
MSS1	Challenges make me doubt myself*	5	4	3	2	1
MSS2	I hate challenges*	5	4	3	2	1
MSS3	I enjoy opportunities to challenge myself	1	2	3	4	5
MSS4	I am scared of failing*	5	4	3	2	1
MSS5	It's hard to recover from failure*	5	4	3	2	1
MSS6	Challenges make me stronger	1	2	3	4	5
MSS7	I have overcome challenges in the past	1	2	3	4	5
MSS8	I don't like to get out of my comfort zone*	5	4	3	2	1
MSS9	If it's hard, I may not finish it*	5	4	3	2	1
MSS10	I work hard to overcome challenges	1	2	3	4	5
* Reverse scored						

APPENDIX E: BRIEF RESILIENCE SCALE

Please respond to each item by marking one box per row

		Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
BRS1	I tend to bounce back quickly after hard times	1	2	3	4	5
BRS2	I have a hard time making it through stressful events*	5	4	3	2	1
BRS3	It does not take me long to recover from a stressful event	1	2	3	4	5
BRS4	It is hard for me to snap back when something bad happens*	5	4	3	2	1
BRS5	I usually come through difficult times with little trouble	1	2	3	4	5
BRS6	I tend to take a long time to get over setbacks in my life*	5	4	3	2	1
* Reverse scored						

APPENDIX F: GRIT SCALE

Here are a few statements that may or may not apply to you. For the most accurate score, when responding, think of how you compare to most people -- not just the people you know well, but most people in the world. There are no right or wrong answers, so just answer honestly!

		Not Like Me At All	**Not Much Like Me**	**Somewhat Like Me**	**Mostly Like Me**	**Very Much Like Me**
GS1	I have overcome setbacks to conquer an important challenge	1	2	3	4	5
GS2	New ideas and projects sometimes distract me from previous ones*	5	4	3	2	1
GS3	My interests change from year to year*	5	4	3	2	1
GS4	Setbacks don't discourage me	1	2	3	4	5
GS5	I have been obsessed with a certain idea or project for a short time but later lost interest*	5	4	3	2	1
GS6	I am a hard worker	1	2	3	4	5
GS7	I often set a goal but later choose to pursue a different one*	5	4	3	2	1
GS8	I have difficulty maintaining my focus on projects that take more than a few months to complete*	5	4	3	2	1
GS9	I finish whatever I begin	1	2	3	4	5
GS10	I have achieved a goal that took years of work	1	2	3	4	5
GS11	I become interested in new pursuits every few months*	5	4	3	2	1
GS12	I am diligent	1	2	3	4	5
* Reverse scored						

APPENDIX G: GENERAL SELF-EFFICACY SCALE

Please, rate yourself on the items below using a scale of 1 (not at all true) to 4 (extremely true)

		Not True at All	Hardly True	Moderately True	Exactly True
GSES1	I can always manage to solve difficult problems if I try hard enough	1	2	3	4
GSES2	If someone opposes me, I can find the means and ways to get what I want	1	2	3	4
GSES3	It is easy for me to stick to my aims and accomplish my goals	1	2	3	4
GSES4	I am confident that I could deal efficiently with unexpected events	1	2	3	4
GSES5	Thanks to my resourcefulness, I know how to handle unforeseen situations	1	2	3	4
GSES6	I can solve most problems if I invest the necessary effort	1	2	3	4
GSES7	I can remain calm when facing difficulties because I can rely on my coping abilities	1	2	3	4
GSES8	When I am confronted with a problem, I can usually find several solutions	1	2	3	4
GSES9	If I am in trouble, I can usually think of a solution	1	2	3	4
GSES10	I can usually handle whatever comes my way	1	2	3	4

APPENDIX H: BRIEF SELF-CONTROL SCALE

Indicate how much of each of the following statements reflects how you typically are.

		Not Like Me At All	Not Much Like Me	Somewhat Like Me	Mostly Like Me	Very Much Like Me
BSCS1	I am good at resisting temptation	1	2	3	4	5
BSCS2	I have a hard time breaking bad habits*	5	4	3	2	1
BSCS3	I am lazy*	5	4	3	2	1
BSCS4	I say inappropriate things*	5	4	3	2	1
BSCS5	I do certain things that are bad for me, if they are fun*	5	4	3	2	1
BSCS6	I refuse things that are bad for me	1	2	3	4	5
BSCS7	I wish I had more self-discipline*	5	4	3	2	1
BSCS8	People would say that I have iron self-discipline	1	2	3	4	5
BSCS9	Pleasure and fun sometimes keep me from getting work done*	5	4	3	2	1
BSCS10	I have trouble concentrating*	5	4	3	2	1
BSCS11	I am able to work effectively toward long-term goals	1	2	3	4	5
BSCS12	Sometimes I can't stop myself from doing something, even if I know it is wrong*	5	4	3	2	1
BSCS13	I often act without thinking through all the alternatives*	5	4	3	2	1
* Reverse scored						

APPENDIX I: BRIEF AGGRESSION QUESTIONNAIRE

Please, rate yourself on the items below.

		Extremely Uncharacteristic of Me						**Extremely Characteristic of Me**
BAQ1	Given enough provocation, I may hit another person	1	2	3	4	5	6	7
BAQ2	If I have to resort to violence to protect my rights, I will	1	2	3	4	5	6	7
BAQ3	There are people who pushed me so far that we came to blows	1	2	3	4	5	6	7
BAQ4	I am an even-tempered (calm) person*	7	6	5	4	3	2	1
BAQ5	Sometimes I fly off the handle for no good reason	1	2	3	4	5	6	7
BAQ6	I have trouble controlling my temper	1	2	3	4	5	6	7
BAQ7	I tell my friends openly when I disagree with them	1	2	3	4	5	6	7
BAQ8	When people annoy me, I may tell them what I think of them	1	2	3	4	5	6	7
BAQ9	My friends say that I'm somewhat argumentative	1	2	3	4	5	6	7
BAQ10	Other people always seem to get the breaks (get good opportunity or treatment)	1	2	3	4	5	6	7
BAQ11	I sometimes feel that people are laughing at me behind my back	1	2	3	4	5	6	7
BAQ12	When people are especially nice, I wonder what they want	1	2	3	4	5	6	7
* Reverse scored								

APPENDIX J: SATISFACTION WITH LIFE SCALE

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your response.

		Strongly Disagree	**Disagree**	**Slightly Disagree**	**Neither Agree nor Disagree**	**Slightly Agree**	**Agree**	**Strongly Agree**
SWLS1	In most ways my life is close to my ideal	1	2	3	4	5	6	7
SWLS2	The conditions of my life are excellent	1	2	3	4	5	6	7
SWLS3	I am satisfied with my life	1	2	3	4	5	6	7
SWLS4	So far, I have gotten the important things I want in life	1	2	3	4	5	6	7
SWLS5	If I could live my life over, I would change almost nothing	1	2	3	4	5	6	7

APPENDIX K: MENTAL HEALTH DISORDERS SCREENING INSTRUMENT FOR ATHLETES

Below is a list of things that sometimes occur with athletes during their lives outside of sports. Please select the number that represents how often each of these things interferes with your life outside of sports.

		Never	Very Seldom	Seldom	Sometimes	Often	Very Often	Always
MHDSIA1	Too impulsive	1	2	3	4	5	6	7
MHDSIA2	Feeling depressed	1	2	3	4	5	6	7
MHDSIA3	Severe anxiety, panic attacks, doing senseless behavior repeatedly	1	2	3	4	5	6	7
MHDSIA4	Alcohol use	1	2	3	4	5	6	7
MHDSIA5	Drug use, or use of prescribed drugs more than a medical doctor's recommendation	1	2	3	4	5	6	7
MHDSIA6	Difficulty maintaining weight at an acceptable level to me or others	1	2	3	4	5	6	7
MHDSIA7	Difficulty sleeping	1	2	3	4	5	6	7
MHDSIA8	Doing things that get me into trouble with others	1	2	3	4	5	6	7
MHDSIA9	Poor relationships with others	1	2	3	4	5	6	7
MHDSIA10	Tics or sudden and uncontrollable jerks of body parts	1	2	3	4	5	6	7
MHDSIA11	Hearing, smelling, or seeing things that others do not	1	2	3	4	5	6	7
MHDSIA12	Difficulties remembering things	1	2	3	4	5	6	7
MHDSIA13	Sudden mood swings	1	2	3	4	5	6	7
MHDSIA14	Sexual disorders (pain during sex, premature ejaculation, problems with arousal)	1	2	3	4	5	6	7