CHAPTER 7

7.0 DISCUSSION

The study utilized a randomized allocation design involving 300 adolescent students to investigate the impact of various aspects of yoga and physical exercise on their development and academic performance. While yoga is often viewed solely as physical exercise, its significant potential for regulating and transforming human personalities is frequently underestimated. This study incorporated principles of hatha yoga and jnana yoga to examine their influence on developing learning skills, cognitive abilities, academic self-efficacy, and addressing emotional and behavioral issues. It underscores the importance of recognizing adolescents' multifaceted needs across physical, psycho-emotional, and intellectual dimensions, significant for academic success. Consequently, the study advocates for a holistic approach to fully optimize the potential of adolescent students. Interestingly, yoga with its blend of theoretical and practical dimensions, enhances physical health, mental well-being, development of cognition abilities, and enhancement of non-cognitive aspects of learning. It not only promotes mind-body regulation but also cultivates discriminative intelligence through intellectual inquiry and self-awareness.

The findings showed improvements in academic performance and fundamental academic skills across all three groups. Notably, Group B, which received hatha yoga training along with academic intervention based on jnana yoga principles, exhibited the most significant enhancements, particularly in creative writing, reading skills, and overall academic proficiency. While physical activities are known to boost cognitive functions and overall health, which are crucial for academic success, the learning process involves complex cognitive processing (McPherson et al., 2018; WHO, 2022). Integrating jnana yoga concepts enriched students' receptivity to information, reflective-learning, and inquiry, which promoted comprehension and

cognitive restructuring. Additionally, repeated writing and practice allowed students to achieve deeper, more insightful understanding. This method aligns with the learning principles of ancient knowledge systems, fostering motivation and encouraging self-regulated learning (NEP, 2020). Interestingly, the impact of hatha yoga on academic performance surpassed that of physical exercise, supporting the finding that hatha yoga practices lead to preparatory steps for learning through mental focus and awareness (Barbosa et al., 2020; Brunner et al., 2017).

Group B achieves significant results by achieving a calm body-mind state through hatha yoga and consistently participating in academic tasks using the learning processes of jnana yoga to enhance academic proficiency. The learning cycle, progressing from surface-level learning to deep-level learning, concludes with the internalization of knowledge. This process involves reflective contemplation, aligning methods and outcomes with the dynamic learning environment to create an adaptive and progressive learning strategy. In the realm of learning and development, practice, known as *Nidhidhyasana*, remains the primary method for acquiring knowledge. Rooted in the principles of jnana yoga, actual learning begins with receptivity to information (*Shravanam*), followed by reflective contemplation (*Mananam*), and intellectual exploration (*Pariprashna*). Additionally, physical conditioning, coupled with breath regulation in hatha yoga extends to the mental dimensions of yogic practices. Therefore, mental readiness, openness to knowledge, and intellectual inquiry begins only after the culmination of hatha yoga. The study's findings highlight the superior impact of combined hatha and jnana yoga practices, with group B surpassing the results of independent hatha yoga (group A) and physical exercise (group C).

Abhinavgupta (1985, pp.80) explains in his commentary that internalizing explicit knowledge requires a learning process infused with humility (*Pranipaata*) and service-oriented

attitude to acquire knowledge (*Seva*). These essential qualities develop attention (*Shraddha*) which improves receptivity to knowledge. The attitude of service to acquire knowledge also optimizes self-efficacy by cultivating a sense of duty towards learning and taking responsibility for the learning process and outcomes. Academic self-efficacy motivates learners to be self-regulated in pursuing their learning objectives. The transition from surface-level to deep-level learning occurs through guided instructions from teachers in response to student inquiries (*Pariprashna*). Subsequently, learners progress through stages such as right perception (Shravanam) through focused attention, reflection on processed information (*Mananam*), and crystallization of knowledge through rigorous practice (*Nidhidhyasana*). The learning curve leads to an in-depth understanding and internalizing explicit knowledge (Jnaneshwar, 1994, pp.101; Madhusudana, 1936, pp.231; Ramsukhdas, 1985, pp.338-340). This knowledge transfer process involves cognitive-based learning activities through focused attention, reflection, critical thinking, and rigorously resolving intellectual doubts, resulting in the creation of new knowledge (Chang, 2019; Deng, 2020). The meta-cognitive elements developed through an attitude of humility and service towards knowledge acquisition improves academic self-efficacy and self-regulated learning, which keep learners motivated and aligned with the learning objectives (Chinmayananda, 1976; Harris & Clayton, 2019).

In terms of muscular fitness, cognitive abilities, and emotional and behavioral problems, combined hatha yoga and jnana yoga practices had a greater impact compared to either hatha yoga or physical exercise alone. While both the hatha yoga and physical exercise groups showed positive effects on these factors, their impacts were similar, highlighting the shared benefits of these practices. However, each modality exerts unique influences through different mechanisms.

Physical exercise positively affects cardiovascular risk factors, whereas yoga improves lung capacity, cardiorespiratory endurance, and muscle strength. Additionally, awareness and attention play a crucial role in the effectiveness of these practices. The cognitive benefits of physical exercise are associated with structural brain changes, whereas yoga practitioners exhibit increased blood flow to the dorsolateral prefrontal cortex, indicating unique brain alterations for each practice (Telles et al., 2013). The reduction in emotional and behavioral problems in the yoga groups is linked to improved psychological and emotional processing, which enhances insight and focus and aids in emotional regulation. Yoga promotes an attitude of acceptance, encouraging a non-judgmental stance toward one's immediate emotional responses and feelings, thereby improving socio-emotional skills, classroom performance, and behavior (Hagen et al., 2021). Furthermore, previous research indicates that yoga in schools leads to improvements in students' mood and self-regulation skills for emotions and stress, enhancing their resilience (Deb et al., 2022). Better mood and emotional management skills help students cope with stress, developing essential life mastery skills and overall well-being. Studies on the impact of yoga on the brain reveal that structural and functional changes occur in regions such as the amygdala, anterior cingulate, anterior insula, and prefrontal cortex, which are activated and interconnected in processing emotions after yoga (Rathore et al., 2022).

Additional benefits of hatha yoga, as highlighted by (Subramanya & Telles, 2009), include reduced oxygen consumption and metabolic demand. (Gopal & Lakshmanan, 1972) noted lower sympathetic activation compared to non-practitioners. Long-term practice of hatha yoga avoids lactic acid buildup and post-exercise fatigue, offering additional mental benefits, while exercise routines mainly target neuromuscular and cardiorespiratory fitness (Govindaraj et al., 2016). Studies in neuromuscular physiology indicate that holding hatha yoga postures (*Asanas*) mindfully

synchronized with breathing can alter mental attitudes by allowing intentional control over subconscious activities (Kuvalayananda S & Vinekar S. L, 1963). *Pranayama*, or breath regulation, is an integral part of hatha yoga. Research has shown that it reduces stress, improves cardiorespiratory functions, and enhances cognition among practitioners (Jayawardena et al., 2020). It is suggested as a significant practice for adolescents, as it enhances cognitive abilities related to memory load and improves cardiac autonomic activity, which are necessary for successfully completing mental tasks and enhancing listening and reading comprehension (Deepeshwar & Budhi, 2022; Tasan et al., 2021).

The non-cognitive factor which motivates the students to take up the academic challenges and gain mastery over academic tasks was found to be more impactful for students' practicing hatha yoga and jnana yoga in combination. Academic self-efficacy encourages learners to self-regulate and pursue their learning goals. Developing meta-cognitive elements, such as an attitude of humility and service, enhances academic self-efficacy and self-regulated learning. Furthermore, guided by the instructions of the preceptor helps them navigate from surface-learning to deep-level learning, progressing through the stages through the support of enhanced attention, reflection, and rigorous practice. This process leads to a deep understanding and the internalization of explicit knowledge (Madhusudana, 1936, pp.231). The learning process, as described in the Brihadaranyak Upanishad and Bhagavad Gita and elaborated upon by commentators, plays a significant role in the learning journey. Moreover, academic self-efficacy is influenced by factors such as personality traits and socio-economic status, which are crucial for academic success (Affuso et al., 2023b; Cheng, 2020). Yoga improves self-regulated learning through cognitive, emotional, and behavioral self-regulation, thereby promoting awareness and response inhibition (Rashedi et al., 2021).

Performance anxiety or fear of failure can have severe impact on students' ability to perform in examination effectively. However, both the yoga practices significantly reduced performance anxiety among students, with hatha yoga and jnana yoga group showing the most substantial effect. These findings align with previous research done by Khalsa et al. (2009) on performance anxiety among young professional musicians. Study done by (Szaszkó et al., 2023) further substantiates the findings and support the use of yoga as an adjunct treatment modality to alleviate performance anxiety among adolescents. Moreover, the effect of hatha yoga practices showed larger effect on internalizing and externalizing factors compared to the physical exercise group. Furthermore, the students practicing hatha yoga along with jnana yoga in combination showed larger effect and significant improvement in the difficulty scores compared to the other two groups. The results align to the findings of a systematic review on the benefits of yoga on the mental health symptoms of school-children and it was further suggested that yoga can be considered as a preventive and therapeutic intervention in school-setups for promoting positive mental health (Khunti et al., 2023). Similarly, promoting positive behavior by developing coping skills reduce the risk of behavioral issues can be achieved through yoga practices in school settings for pre-adolescent students (Sivashankar et al., 2022). Further findings related to the difficulties and distress which may impair day-to-day classroom learning, home-life, friendship, and leisure activities were statistically non-significant between groups, indicating similar impact of the three different interventions and the intricate nature of the factors contributing to home-life and peer-relationship.

The significant aspects of the study were revealed through the findings from multiple regression analysis. The findings underscore the distinct impacts of different practices on academic performance: hatha yoga significantly enhances reading skills, jnana yoga boosts creative writing

skills and general intelligence, and both yoga practices significantly improve academic self-efficacy. In the physical exercise group, academic scores were strongly predicted by working memory and general intelligence. The enhancements in academic skills can be attributed to yogic breathing techniques which regulates thoughts and emotions, resulting in improved focus and keen receptivity required for reading engagement and comprehension (Rice et al., 2023; Sanchez et al., 2022). These practices increase regional cerebral oxygenation in the prefrontal regions, which are crucial for intelligence, mental clarity, and creative thinking. Yoga-based mindfulness training reduces stress and cognitive conflicts, enhancing coping abilities through a positive mindset and confidence, thereby cultivating mindfulness self-efficacy. Academic performance significantly predicted by working memory and general intelligence is due to physical exercise-induced cardiorespiratory fitness is linked to the release of brain-derived neurotrophic factor (BDNF), a key molecule in neural plasticity related to learning and memory. Physical exercise also effectively reverses hippocampal volume loss and increases basal ganglia capacities, indicators of cognitive control and improved memory function, particularly working memory.

The findings of mediation analyses give further insights. The mediation effect of intrinsic goal orientation and task value on self-efficacy for learning demonstrates that when students find value and motivation in their academic tasks, their confidence in their abilities significantly improves. These factors can be key targets for educational strategies aiming to enhance learning outcomes, especially among students who may struggle with self-confidence or find certain subjects challenging. The role of self-esteem as a mediator between mindfulness and emotional outcomes is particularly noteworthy. Higher self-esteem, cultivated through yoga-based mindfulness practices, was associated with reduced emotional and behavioral difficulties and increased pro-social behavior. This reinforces the psychological benefits of mindfulness, not just

in improving resilience or coping strategies against academic challenges and stressors, but also in promoting positive social interactions and emotional stability.

The correlation analysis underscores the nuanced impacts of different parenting styles and socio-economic status (SES) on adolescents' academic performance, peer relationships, and pro-social behavior. Authoritative parenting, characterized by warmth and structure, was not significantly linked to academic performance but showed a significant positive effect on reducing peer problems and overall difficulties while promoting pro-social behavior. This suggests that while authoritative parenting may not directly influence academic outcomes, it promotes a supportive social environment that enhances peer interactions and reduces behavioral issues (Castillo-Parra et al., 2022). Conversely, authoritarian parenting, which emphasizes strict discipline, was positively correlated with academic scores and negatively associated with peer problems and total difficulties, indicating that a structured environment may benefit academic performance and social behavior, though emotional support may also be necessary (Pinquart & Kauser, 2018). Permissive parenting, lacking in strict boundaries, did not significantly impact academic performance but was associated with enhanced pro-social behavior and increased conduct problems. This duality suggests that while permissive parenting can develop social skills, it may also lead to behavioral issues due to insufficient discipline (Baumrind, 2013).

Findings regarding socio-economic status (SES) reveal intricate patterns in its impact on adolescent development. Adolescents from the upper-lower SES category experience adverse effects on emotional well-being and psychological functioning, reflecting the challenges associated with financial instability and limited access to resources. In contrast, those from the lower-middle SES category show a negative impact on pro-social behavior, indicating difficulties in developing positive social skills and behaviors due to various environmental factors. In the

upper-middle SES category, while there's no direct link between SES and academic performance, adolescents may still face peer problems despite academic success. Additionally, a positive correlation between SES and conduct problems suggests that higher socio-economic status may be associated with an increased likelihood of engaging in disruptive behaviors. These complex relationships underscore the need for comprehensive support systems addressing academic, social, and behavioral challenges among adolescents from different socio-economic backgrounds (Bradley & Corwyn, 2002; Sirin, 2005). These results imply that interventions should promote authoritative parenting to enhance social outcomes and address the emotional challenges associated with lower SES backgrounds through targeted support programs. Policies should consider the broader socio-economic context to develop comprehensive strategies that support the holistic development of adolescents, ultimately improving academic, social, and emotional outcomes. Further research is necessary to continue exploring these relationships and refine intervention strategies.