performance might give an advantage over other players. Plyometrics, resisted sprinting, and high-intensity exercise are examples of neuromuscular training stimuli that have a particularly strong effect on speed development in young athletes (Rumpf et al., 2016).

Given the significance of both speed and endurance, coaches of adolescent athletes face the difficulty of finding training strategies that concurrently improve these abilities without overtaxing or exhausting young athletes.

Improvements in VO_2 max, mitochondrial density, capillarization, and glycolytic enzyme activity are just a few of the positive adaptations that HIIT has been demonstrated to produce (Hanafi and Hasanuddin, 2022; Michailidis et al., 2023). Furthermore, it has been shown that sprint-based HIIT therapies are effective in enhancing running economy and neuromuscular power, two factors that directly influence speed performance. Crucially, HIIT workouts are typically shorter than conventional training sessions, which lowers the time commitment overall and may lessen the likelihood of overuse issues (Laursen and Jenkins, 2002; Men et al., 2023).

Adolescent athletes may benefit from HIIT in other ways. Time management is especially important for young people who have to juggle social, athletic, and academic obligations. Furthermore, HIIT protocols' intensity and diversity may enhance motivation and enjoyment, two factors that are critical for young populations' long-term adherence (Helgerud et al., 2007). The safety and suitability of HIIT for teenagers are still up for debate, though, especially in light of the risks of overtraining, musculoskeletal strains, and cardiovascular stress. As a result, carefully crafted methods that are appropriate for adolescents' developmental stage are needed (Logan et al., 2014; Hottenrott et al., 2022).

Although HIIT has been shown to be beneficial for adults, its effects on teenage athletes have not been well studied in many controlled experiments. The few studies that do exist have frequently concentrated on sprint ability or endurance results separately, failing to take into account how HIIT affects both performance metrics (Rønnestad et al., 2015). Additionally, the findings' generalisability has been hampered by methodological flaws such varied training methods, limited sample sizes, and a lack of suitable control groups.

This gap in the literature is of particular importance not only for sports performance but also for adolescent health and clinical outcomes. High-intensity interval training (HIIT) is increasingly being implemented in youth training programs by coaches and practitioners; however, its effectiveness and safety in this population remain insufficiently established. Beyond performance enhancement, HIIT has the potential to improve cardiopulmonary fitness, which is a key indicator of overall health and a protective factor against future cardiovascular disease in adolescents (Armstrong and Barker, 2011; Costigan et al., 2015). Additionally, appropriately designed HIIT protocols may contribute to improved neuromuscular control and reduced risk of sports-related injuries (Rumpf et al., 2016). Therefore, a systematic investigation comparing HIIT with conventional training methods in adolescent athletes is warranted to better understand its role in both performance development and health promotion.

Therefore, more experimental studies are necessary to clarify how HIIT affects young athletes' development of endurance and speed. This study looked at how an eight-week HIIT intervention affected adolescent athletes' VO_2 max and 30 m sprint performance in comparison to a control group that received conventional training. It was predicted, based on previous studies, that the HIIT group would outperform the control group in terms of VO_2 max and sprint performance.

2 Methods

2.1 Study design

This study employed a randomized controlled trial design with pre- and post-intervention testing. Participants were randomly allocated to either:

1 HIIT Group (n=20): Completed an 8-week high-intensity interval training program in addition to their regular sport-specific training.

2 Control Group (n=20): Completed an 8-week traditional endurance and sprint training program alongside their regular sport-specific training.