



Clarifying the Impact of Small-Sided Games and HIIT on Anaerobic Endurance in Adolescent Hockey Players

Sohom Saha^{1ABCD}, Simran Obhrai^{2ACD}, Richa Vishwakarma^{1CDE}, Prabir Mondal^{1BDE}, Nagesh^{1BDE}, Bharat Prasad^{3CDE}, Kautilya Upadhyay^{1BDE} and Dev Karan Singh^{1BDE}

¹Lakshmbai National Institute of Physical Education

²Guru Nanak Dev University

³Central University of South Bihar

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Corresponding Author: Simran Obhrai, e-mail: simranobhrai.sj@gmail.com

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Abstract

Background. Given the sport's complex aerobic-anaerobic demands, optimizing training methodologies is crucial for improving players' repeated sprint ability, sustaining effort throughout matches, and enhancing overall performance. While hockey requires significant anaerobic power for explosive movements and sprints, the intermittent nature of the game also places considerable demands on aerobic systems for recovery between high-intensity efforts.

Objectives. This study aimed to evaluate and compare the effectiveness of Small-Sided Games (SSG) and High-Intensity Interval Training (HIIT) in enhancing anaerobic endurance among adolescent field hockey players.

Materials and methods. A total of 36 adolescent male hockey players (aged 15-17 years) participated in this study and were randomly assigned to three groups: SSG (n = 12), HIIT (n = 12), and an Active Control Group (ACG) (n = 12). The intervention lasted for six weeks, with each training group engaging in their respective training modalities three times per week. Anaerobic endurance was evaluated through the Running-Based Anaerobic Sprint Test (RAST) both prior to and following the intervention. A Two-Way Mixed ANOVA was conducted to analyze the interaction between time (pre-test vs. post-test) and group assignment.

Results. Both the SSG and HIIT groups demonstrated significant improvements in anaerobic endurance compared to the ACG. The SSG group exhibited a greater reduction in RAST values (5.03%) than the HIIT group (3.71%). Statistical analysis revealed a significant main effect of time and group ($F = 14.80, p < 0.001, \eta^2_p = 0.47$), indicating a meaningful impact of both interventions. Post hoc comparisons showed that the SSG group outperformed the HIIT group, though both significantly improved anaerobic endurance compared to the control.

Conclusions. This study confirms the efficacy of both SSG and HIIT in enhancing anaerobic endurance in adolescent hockey players, with SSG demonstrating slightly superior benefits. The findings suggest that integrating sport-specific drills, as seen in SSG, may yield greater physiological and tactical improvements than traditional HIIT protocols. Further research is needed to explore long-term adaptations, injury risk, and the potential benefits of combining both training methods for optimal performance enhancement.

Keywords: anaerobic endurance, adolescent athletes, field hockey, repeated sprint ability.

Introduction

Field hockey is an extremely demanding sport physically as it requires a mix of anaerobic endurance, technical skill, and tactical awareness. Players have to repeatedly perform high-intensity sprints, rapid changes of direction, and precise

decision-making under fatigue, making anaerobic endurance a critical component of performance (Ihsan et al., 2017). The physiological demands of hockey are well-documented, with contemporary studies showing that players cover approximately 5-8 km during a match, of which 1.5-2.5 km are high-intensity efforts, including sprints and accelerations (McGuinness et al., 2019; Noblett et al., 2023). These efforts are interspersed with brief recovery periods, highlighting the importance of repeated sprint ability (RSA) and the capacity to recover quickly between bouts of intense activity (Taylor & Jakeman, 2022). Additionally, the tactical demands of

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hockey, such as maintaining positional awareness, executing quick passes, and making split-second decisions, further compound the physical challenges (Weigel et al., 2015). In order to meet these demands, training programs have to be designed in a way that address both the physiological and tactical aspects of the game. However, many traditional training approaches fail to provide the intensity and specificity required to adequately improve both aerobic and anaerobic performance, particularly in adolescent athletes who are still developing physically and technically (Sulyma et al., 2017). This gap in training effectiveness underscores the need for well-designed, sport-specific programs that cater to the unique needs of young hockey players.

In recent years, two training modalities have emerged as promising tools for enhancing hockey performance: Small-Sided Games (SSGs) and High-Intensity Interval Training (HIIT). SSGs are modified versions of the game, typically involving fewer players, smaller playing areas, and adapted rules. These games are designed to replicate the intensity and tactical demands of match play while simultaneously developing technical skills and physical fitness (Arslan et al., 2020; Clemente et al., 2021). Recent studies have shown that SSGs can elicit heart rate responses between 88-96% of maximum heart rate, which aligns with the physiological demands observed during competitive matches (Noblett et al., 2023). This makes SSGs an effective tool for improving both physiological capabilities and sport-specific skills, such as agility and decision-making, which are crucial for hockey performance (Arslan et al., 2020; Clemente et al., 2022). On the other hand, HIIT involves short bursts of intense exercise followed by periods of rest or low-intensity activity. This training method has been widely recognized for its ability to improve both aerobic and anaerobic performance markers, such as maximal oxygen uptake (VO_{2max}), anaerobic threshold, and repeated sprint ability (Kunz et al., 2019; Ouertatani et al., 2022). For instance, Paul et al. (2016) found that HIIT protocols consistently produced superior improvements in VO_{2max} compared to traditional training methods in team sport athletes (Paul et al., 2016). In the context of hockey, structured HIIT programs have been shown to enhance players' ability to maintain high-intensity efforts during matches (Quezada et al., 2021). Despite the proven efficacy of both SSGs and HIIT, there is limited research directly comparing their effectiveness in developing anaerobic endurance, particularly among adolescent hockey players. While SSGs offer the advantage of integrating technical, tactical, and physiological demands, HIIT provides a more controlled environment for targeting specific physiological adaptations. This raises important questions about which training modality is more effective for improving anaerobic endurance in young athletes. Additionally, the influence of training modality on sport-specific performance measures, such as agility and decision-making, remains inadequately explored (Narayanan et al., 2025). Furthermore, optimal programming parameters for both SSGs and HIIT, including work-to-rest ratios and progression models, have yet to be empirically validated for adolescent athletes (Narayanan et al., 2025). Another critical consideration is the interaction between training modality and biological maturation status. Adolescence is a period of rapid physiological development, and the rate at which young athletes mature can significantly impact their

response to training (Lloyd et al., 2016). For example, early-maturing athletes may experience greater improvements in strength and power, while late-maturing athletes may benefit more from training that emphasizes technical and tactical development. Despite the importance of this factor, few studies have considered the developmental stage of adolescent athletes in their experimental design, leaving a gap in our understanding of how to optimize training for this population (Lloyd et al., 2016). This study aims to address these limitations by systematically comparing the effects of SSGs and HIIT on anaerobic endurance in adolescent hockey players. To evaluate anaerobic endurance, players were tested using the Running-Based Anaerobic Sprint Test (RAST) before and after a 6-week intervention program. Research validates the RAST as a reliable measure of anaerobic power and capacity, making it an effective tool for assessing the impact of training on repeated sprint ability, which time-motion analyses have established as a critical component of hockey performance (Zagatto et al., 2009). By focusing on this specific metric, the study provides a clear and objective comparison of how SSGs and HIIT influence anaerobic endurance in young athletes.

It is hypothesized that both SSGs and HIIT will significantly improve anaerobic endurance, as measured by the RAST, in adolescent hockey players. However, due to the sport-specific nature of SSGs, which integrate technical, tactical, and physiological demands, it is hypothesized that SSGs may lead to slightly greater improvements in anaerobic endurance compared to HIIT. As youth hockey continues to evolve with increasing physical and tactical demands, evidence-based training methods become crucial for optimal athlete development. This study aims to provide practitioners with validated guidelines for implementing training methods that effectively develop anaerobic endurance while considering the unique characteristics of adolescent athletes. Furthermore, the findings will contribute to the broader understanding of training specificity and transfer in youth team sports, potentially influencing future approaches to long-term athlete development.

Materials and methods

Participants

This study involved 36 adolescent hockey players aged 15-17 years, active members of a regional hockey training academy in Gwalior, Madhya Pradesh, India. The participants were divided into three groups: Small-Sided Games (SSG) ($n = 12$), High-Intensity Interval Training (HIIT) ($n = 12$), and an Active Control Group (ACG) ($n = 12$). The average age of the participants was 16.38 ± 0.76 years in the SSG group, 16.15 ± 0.89 years in the HIIT group, and 16.23 ± 0.83 years in the ACG group. The average weight of the participants was 53.53 ± 2.69 kg in the SSG group, 54.07 ± 2.84 kg in the HIIT group, and 53.07 ± 2.62 kg in the ACG group. The participants' average height was 159.92 ± 2.25 cm in the SSG group, 159.69 ± 2.28 cm in the HIIT group, and 159.46 ± 2.18 cm in the ACG group. All players had a minimum of three years of competitive experience. Prior to the commencement of the study, both adolescent athletes and their guardians were thoroughly informed about the study's objectives, procedures, potential risks, and

benefits. A comprehensive information sheet detailing the nature of the interventions and assessments was provided to ensure transparency. To secure informed consent, athletes and their guardians were encouraged to ask questions and seek clarification from the research team. Written informed consent was obtained from both the athletes and their legal guardians, who voluntarily signed consent forms after being assured of their right to withdraw from the study at any time without any impact on their training programs or athletic development. All personal data and performance outcomes were kept strictly confidential, with participants identified through unique codes for data collection and analysis. It adheres to the ethical guidelines specified in the Declaration of Helsinki, emphasizing respect for human participants, confidentiality, voluntary involvement, and the right to withdraw at any point without repercussion (World Medical Association, 2013).

Procedure

A pre-experimental design with two groups and a pre-test-posttest structure was utilized. Anaerobic endurance was measured using the Running-Based Anaerobic Sprint Test (RAST) both before and after a six-week intervention program. Data collection was conducted using precise and validated instruments. The RAST, with a validity coefficient of 0.897 and a reliability score of 0.919, was employed to assess anaerobic endurance performance (Bongers et al., 2015; Wibisana, 2020). The SSG group followed a structured small-sided games program, the HIIT group underwent a high-intensity interval training protocol, and the ACG continued with their regular activities without any specific training program. Post-intervention, the data were analyzed to compare the effectiveness of the two methods. Each group participated in the training program three times per week (Tuesday,

Thursday, and Saturday) for a duration of six weeks. Every session commenced with a warm-up, proceeded with the implementation of the program or game, incorporated a tactical phase, and concluded with a cool-down. The program was systematically followed throughout the study period. Table 1 outlines the SSG phase, and Table 2 details the HIIT phase. For the SSG group, the intensity, repetitions, distance, and rest time were adjusted weekly to reflect the progression of the program. Similarly, for the HIIT group, the intensity, repetitions, and rest periods were modified each week to align with the changing demands of competition. Intensity was carefully monitored using structured training protocols based on predetermined work-to-rest ratios, exercise duration, and intensity levels. However, real-time heart rate monitoring was not used during the sessions.

The athletes were not explicitly matched for fitness levels before the intervention. Instead, they were assigned to the three groups using stratified random sampling to ensure a balanced distribution of participants across the SSG, HIIT, and ACG groups. This approach helped minimize bias and ensured that each group had a similar mix of players in terms of age, experience, and baseline performance. By using this method, the study aimed to create comparable groups while maintaining the practicality of implementing the training programs in a real-world setting. This design allowed for a clear comparison of the effects of SSG and HIIT on anaerobic endurance, while the ACG served as a baseline to account for any external factors that might influence the results.

Each group trained three times per week for 45 minutes under controlled supervision. All sessions included a standardized warm-up and cool down phase. Players underwent the RAST again to evaluate changes in anaerobic endurance, comparing pre and post test scores.

Statistical Analysis. Statistical analyses were performed using SPSS version 26, with a significance threshold of p

Table 1. Small-Sided Games (SSG) Program

Week	Meeting	Type of SSG Activity	Training Description
1	1-3	5v5	5 repetitions, with each repetition lasting 2 minutes, followed by a 2-minute rest period (1:1 work-to-rest ratio). The training was structured into 3 sets, with a 4-minute rest interval between sets (1:2 ratio). The activity took place within a 25×20m area, performed at an intensity of 75%.
2	4-6	4v4	5 repetitions, each lasting 2 minutes, with a 2-minute rest period between repetitions, maintaining a 1:1 work-to-rest ratio. The program comprised 3 sets, with a 4-minute rest interval between sets, following a 1:2 ratio. The exercises were performed within a 20×15-meter area at an intensity of 80%.
3	7-10	3v3	5 repetitions, each lasting 2 minutes, with a 2-minute rest period between repetitions, maintaining a 1:1 work-to-rest ratio. A total of 4 sets were performed, with a 4-minute recovery time between sets, following a 1:2 ratio. The exercises were conducted within a 15×12-meter area at an intensity level of 80%.
4	11-13	2v2	5 repetitions, each lasting 1 minute, followed by a 1-minute rest period, maintaining a 1:1 work-to-rest ratio. A total of 3 sets were performed, with a 3-minute rest interval between sets, following a 1:3 ratio. The exercises were conducted within a 12×10-meter area at an intensity of 90%.
5	14-16	1v1	5 repetitions, each lasting 1 minute, with a 1-minute rest period between repetitions, maintaining a 1:1 work-to-rest ratio. The program comprised 3 sets, with a 3-minute rest interval between sets, following a 1:3 ratio. The exercises were conducted within an 8×6-meter area at an intensity of 95%.
6	17-20	3v3	5 repetitions, each lasting 2 minutes, with a 2-minute rest period between repetitions, maintaining a 1:1 work-to-rest ratio. A total of 3 sets were performed, with a 4-minute recovery time between sets, following a 1:2 ratio. The exercises were conducted within a 15×12-meter area at an intensity of 80%.

Table 2. High-Intensity Interval Training Program

Week	Meeting	Reps	Training Description
1	1-3	6	23m line sprints; Rest between reps: 1:2; Area: Between 23m lines; Intensity: 75 %
2	4-6	6	Baseline to halfway line; Rest between reps: 1:2; Area: Half field length; Intensity: 80 %
3	7-10	6	Diamond running pattern (cons); Rest between reps: 1:2; Area: 25×25m square; Intensity: 80 %
4	11-13	5	Full field shuttles; Rest between reps: 1:3; Area: Full field length; Intensity: 90 %
5	14-16	5	Circle-to-circle sprints; Rest between reps: 1:3; Area: Between Shooting circles; Intensity: 95 %
6	17-20	6	Zigzag sprints with ball; Rest between reps: 1:2; Area: 30×20m; intensity: 80 %

< 0.05. Descriptive statistics, including mean and standard deviation, were calculated for all measured variables. Before conducting inferential analysis, data normality was evaluated using the Shapiro-Wilk test. To examine the differential effects of training interventions, a Two-Way Mixed ANOVA was performed with time (pre-test vs. post-test) as a within-subject factor and group (SSG, HIIT, Control) as a between-subject factor. This approach enabled the assessment of (1) the main effect of time, indicating whether anaerobic endurance improved across all groups; (2) the main effect of group, determining whether training interventions differed in effectiveness; and (3) the interaction effect (time*group), evaluating whether training-induced adaptations varied across groups. Paired t-tests were applied within each group to assess intra-group changes from pre- to post-intervention. Effect sizes, represented by partial eta squared (η^2_p), were calculated to quantify the magnitude of observed differences (Cohen, 1988). For all statistical tests, results were interpreted in accordance with best practices for sports science research, ensuring methodological rigor and reproducibility.

Results

The findings of the study, as illustrated in Table 3, illustrate the impact of SSG and HIIT on anaerobic endurance, measured using the RAST in adolescent hockey athletes. The pre and post intervention data indicate that both experimental groups SSG and HIIT demonstrated improvements in anaerobic endurance, while the ACG showed negligible change.

Table 3 the SSG group exhibited a significant reduction in RAST values from 37.33 ± 0.89 to 35.45 ± 0.90 , reflecting a 5.03 % improvement. Similarly, the HIIT group showed a decrease from 36.62 ± 1.22 to 35.26 ± 1.09 , corresponding to a 3.71 % enhancement. In contrast, the ACG group maintained relatively stable values (36.35 ± 0.80 to 36.34 ± 0.82), with a negligible change of -0.02 %. Statistical analysis using Two-Way Mixed ANOVA revealed a significant main effect of training interventions on anaerobic endurance, with an F-value of 14.80 ($p < 0.001$), indicating a substantial difference between groups. The partial eta squared ($\eta^2_p = 0.47$) suggests a large effect size, confirming the meaningful impact of the

Table 3. Analysis of Small-Sided Games and High-Intensity Interval Training on Anaerobic Endurance (RAST) in Adolescent Hockey Athletes

Variable	Groups	Pre data M ± SD	Post data M ± SD	Δ (%)	SS	F	p	η^2_p
	SSG	37.33 ± .89	35.45 ± .90	-5.03				
RAST	HIIT	36.62 ± 1.22	35.26 ± 1.09	-3.71	11.17	14.80	<0.001	.47
	ACG	36.35 ± .80	36.34 ± .82	-0.02				

interventions. These findings support the efficacy of both SSG and HIIT in enhancing anaerobic endurance, with SSG demonstrating a slightly greater improvement.

The paired t-test analysis, as presented in Table 4, evaluates the within-group differences in anaerobic endurance (RAST) following the intervention period for each training group. The results indicate a significant improvement in anaerobic endurance in both the SSG and HIIT groups, while no meaningful change was observed in the ACG.

Table 4. Paired t-test Analysis of Small-Sided Games and High-Intensity Interval Training on Anaerobic Endurance (RAST) in Adolescent Hockey Athletes

Variable	Group	SE	t	p
	SSG	.32	5.84	<0.001
RAST	HIIT	.29	4.68	<0.001
	ACG	.02	.50	0.623

Table 4 for the SSG group, the paired t-test revealed a statistically significant reduction in RAST values ($t = 5.84$, $p < 0.001$), with a standard error (SE) of 0.32, confirming a substantial improvement in anaerobic endurance following the intervention. Similarly, the HIIT group exhibited a significant enhancement in anaerobic endurance, as evidenced by a t-value of 4.68 ($p = <0.001$) and an SE of 0.29. These findings suggest that both training modalities effectively enhanced anaerobic performance. In contrast, the ACG group did not demonstrate a statistically significant change in RAST values ($t = 0.50$, $p = 0.623$), with a minimal standard error of 0.02. This result indicates that participants in the active control group maintained their baseline anaerobic endurance levels without significant improvement.

Discussion

This study compared the effectiveness of SSG and HIIT in improving anaerobic endurance among youth hockey players. As hypothesized, the results showed that both training methods significantly boosted anaerobic performance, as measured by the RAST. These findings are consistent with

previous research on SSG and HIIT in team sports (Kunz et al., 2019) and support their use in structured hockey training programs. The improvements in anaerobic endurance can be linked to the physiological adaptations triggered by both SSG and HIIT (Iacono et al., 2015). Specifically, the SSG group saw a 5.03% reduction in RAST values, while the HIIT group showed a 3.71% reduction. This highlights the effectiveness of both approaches in enhancing short-duration, high-intensity performance, which is crucial for hockey, where repeated bursts of speed and power are essential. The novel contribution of this research lies in being the first to directly compare these training modalities in field hockey, particularly within the adolescent population. While studies have examined SSG and HIIT separately in various sports, our findings uniquely demonstrate their comparative efficacy for field hockey-specific anaerobic adaptations. Furthermore, this study advances the existing literature by identifying the parameters of SSG that yield optimal training stimuli for hockey, specifically the progression from 5v5 to 1v1 formats and their subsequent physiological impact. The established work-to-rest ratios (1:1 to 1:3) and spatial constraints (25×20m to 8×6m) documented here represent novel, evidence-based guidelines for field hockey coaches working with adolescent athletes. These results are consistent with trends reported by Ansori et al. (2024), who observed improvements in anaerobic endurance following both SSG and HIIT in young football players, with SSG showing a slightly stronger effect (Ansori et al., 2024). While football and field hockey differ in match structure and field size, the comparison provides a useful perspective on the potential effectiveness of SSG-based training.

One possible reason SSG led to slightly greater improvements could be the integration of neuromuscular adaptations, such as agility and coordination, alongside physiological conditioning (Clemente et al., 2021). Unlike HIIT, which primarily focuses on metabolic adaptations, SSG requires players to perform sport-specific movements, rapid changes of direction, and quick decision-making under fatigue. These demands likely stimulate neuromuscular pathways, enhancing motor skills and coordination, which are critical for hockey performance (Clemente et al., 2022). For example, the constant stop-and-go nature of SSG mimics the dynamic movements required during a game, potentially leading to better agility and faster reaction times (Arslan et al., 2020). This could explain why SSG had a slight edge over HIIT in improving anaerobic endurance, as it combines physical and tactical elements in a way that HIIT does not. A particularly innovative finding from our study is the identification of a potential "transfer advantage" in SSG training, where physiological adaptations appear to be more effectively translated into sport-specific performance gains. This suggests a new framework for understanding training specificity in field hockey, where the contextual similarity between training stimulus and competitive demands may amplify adaptation responses beyond what physiological markers alone would predict. The superior improvement in RAST performance following SSG training (5.03% vs. 3.71% in HIIT) presents new evidence that the neural and tactical learning occurring simultaneously with physiological conditioning may create a synergistic effect not previously quantified in hockey training literature.

From a physiological perspective, HIIT is known to heavily recruit fast-twitch muscle fibres, which are essential for explosive movements like sprinting, rapid accelerations,

and intense braking (MacInnis & Gibala, 2017). This type of training improves the efficiency of anaerobic glycolysis and enables muscles to resynthesize phosphocreatine, allowing players to sustain high-intensity efforts for longer periods (Ouertatani et al., 2022). However, while HIIT excels in building metabolic capacity, it doesn't fully replicate the tactical and decision-making demands of hockey. On the other hand, SSG not only triggers similar physiological responses but also enhances tactical awareness and decision-making. For instance, Arslan et al. (2020) found that SSG improves players' ability to read the game, anticipate opponents' moves, and execute skills under pressure (Arslan et al., 2020). These cognitive and tactical benefits may give SSG an edge when it comes to transferring improvements to actual game performance (Clemente et al., 2021). Our research makes a significant contribution to field hockey training periodization models by demonstrating that the established principles of progressive overload must incorporate not only physiological but also neurocognitive and sport-specific technical parameters. The findings suggest that training prescription in hockey should evolve beyond traditional models focused primarily on cardiovascular and metabolic adaptations to include considerations of tactical learning integration. This represents a paradigm shift in how training adaptations are conceptualized in intermittent team sports like field hockey, distinguishing our work from studies in continuous endurance sports or strength-power athletic domains.

The improvements seen in both SSG and HIIT can directly translate to better on-ground performance. For example, enhanced anaerobic endurance means players can recover faster between shifts, allowing them to maintain high-intensity efforts throughout the game. This is particularly important in hockey, where quick transitions and counterattacks are key to gaining an advantage. Faster recovery also means players can sustain their speed and power during critical moments, such as breakaways or defensive plays. Additionally, the agility and coordination developed through SSG can improve a player's ability to navigate tight spaces, evade opponents, and execute precise movements, all of which are essential for success in hockey (Budiman, 2022). While the findings of this study are promising, there are several limitations that need to be addressed. First, the study only included male participants, which limits its applicability to female athletes. Future research should explore whether similar results are observed in female hockey players, as physiological and tactical responses to training can vary between genders. Second, the six-week intervention period may not be sufficient to assess long-term adaptations. Longer studies are needed to determine whether the improvements in anaerobic endurance are sustained over time and how they impact overall performance in competitive settings. Another limitation is the reliance on RAST as the sole measure of anaerobic endurance. While RAST is a valid and reliable test, it doesn't capture other important aspects of performance, such as agility, reaction time, or technical skills. Incorporating additional measures, like time-motion analysis or lactate threshold testing, could provide a more comprehensive understanding of the physiological and tactical adaptations induced by SSG and HIIT (Ouertatani et al., 2022). Our study offers a methodological innovation through the structured progression of both training interventions, systematically manipulating variables such as

player numbers, spatial dimensions, work-to-rest ratios, and exercise intensity. This progressive approach represents a departure from many previous studies that employed static training parameters throughout the intervention period. By documenting both the acute and cumulative effects of this progressive overload model specifically tailored for adolescent hockey players, our research provides novel insights into age-appropriate training prescription that respects biological development while maximizing training adaptations.

Furthermore, the study didn't account for the potential injury risks associated with both training types. High intensity training, whether through SSG or HIIT, can increase the risk of overuse injuries, especially in young athletes. Future research should investigate injury rates and recovery patterns to better understand how to balance training intensity with athlete safety. Given that both SSG and HIIT yielded significant improvements, coaches might consider using a hybrid approach that combines the strengths of both methods. For instance, HIIT could be used to build foundational anaerobic capacity, while SSG could be incorporated to enhance sport-specific skills and tactical awareness. Periodization of training is also key coaches should gradually increase the intensity, volume, and complexity of SSG sessions to maximize physiological and tactical benefits. Variables like player numbers, field size, and game duration can be adjusted to keep the training challenging and engaging (Arslan et al., 2020). Additionally, monitoring tools like heart rate trackers and perceived exertion scales can help tailor training intensities to individual athletes' needs. This is especially important for youth players, who may have varying levels of physical and tactical development. Finally, since SSG is generally perceived as more enjoyable than HIIT (Selmi et al., 2020), incorporating game-like scenarios and competitive elements into training sessions could boost motivation and engagement. This is crucial for long-term athlete development, as enjoyment often plays a big role in keeping young players committed to the sport.

Conclusions

The results of this study confirm that both SSG and HIIT effectively improve anaerobic endurance in youth hockey players, with SSG providing slightly superior benefits. These findings align with existing research across multiple team sports, reinforcing the role of SSG in developing both anaerobic performance and sport-specific skills. While HIIT remains an effective method for conditioning, the integration of SSG into training programs may provide additional benefits in motivation, technical proficiency, and decision-making. Future studies should explore long-term adaptations, injury risk, and the potential effects of combining both methods in hockey training.

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Conflict of Interest

The authors declare no conflict of interest in relation to this study.

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З'ясування впливу ігор неповними складами та методу високоінтенсивного інтервального тренування на анаеробну витривалість у хокеїстів підліткового віку

Сохом Саха^{1ABCD}, Сімран Обхрай^{2ACD}, Річа Вішвакарма^{1CDE}, Прабір Мондал^{1BDE}, Нагеш^{1BDE}, Бхарат Прасад^{3CDE}, Каутілья Упадхьяй^{1BDE}, Дев Каран Сінгх^{1BDE}

¹Національний інститут фізичного виховання імені Лакшмі Бай

²Університет Гуру Нанак Діва

³Центральний університет Південного Біхара

Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

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Історія питання. Враховуючи складні аеробні й анаеробні навантаження в спорті, оптимізація тренувальних методологій має вирішальне значення для покращення здатності гравців до повторних спринтерських забігів, підтримання

зусиль впродовж матчів та підвищення загальної результативності. Попри те, що хокей потребує від гравців значної анаеробної потужності для виконання вибухових рухів і спринтерських забігів, переривчастий характер гри також висуває суттєві вимоги до аеробних систем задля відновлення організму між високоінтенсивними діями.

Мета дослідження. Метою цього дослідження було оцінити та порівняти ефективність використання ігор невеликими складами (ІНС) та методу високоінтенсивного інтервального тренування (ВІІТ) щодо підвищення анаеробної витривалості серед хокеїстів на траві підліткового віку.

Матеріали та методи. У дослідженні взяли участь 36 юнаків-хокеїстів (віком 15-17 років), яких було розподілено за методом рандомізації на три групи: ІНС (n=12), ВІІТ (n=12) та група активного контролю (ГАК) (n=12). Інтервенція тривала шість тижнів, кожна група тренувалася тричі на тиждень відповідно до свого режиму тренувань. Оцінювання рівня анаеробної витривалості проводилось за допомогою тесту анаеробного спринту на основі бігу (Running-Based Anaerobic Sprint Test, RAST) на перед- і постінтервенційному етапах дослідження. З метою аналізу взаємодії між часом (претест і посттест) та груповим розподілом проведено двофакторний змішаний дисперсійний аналіз.

Результати. В обох групах (ІНС та ВІІТ) спостерігалось значне поліпшення показників анаеробної витривалості порівняно з групою ГАК. Група ІНС продемонструвала істотніше зниження показників RAST (5.03%), ніж група ВІІТ (3.71%). Статистичний аналіз виявив суттєвий основний вплив часу та групи ($F = 14.80$, $p < 0.001$, $\eta^2p = 0.47$), що вказує на значущий вплив обох інтервенцій. Проведення *post hoc* порівнянь показало, що група ІНС перевершила групу ВІІТ, однак обидві групи значно покращили рівень анаеробної витривалості порівняно з контрольною групою.

Висновки. У цьому дослідженні підтверджено ефективність використання як ІНС, так і ВІІТ щодо підвищення анаеробної витривалості у хокеїстів-підлітків, причому в ІНС спостерігається незначна перевага. Результати дослідження свідчать про те, що інтеграція вправ, специфічних для певного виду спорту, як показано в ІНС, може призвести до суттєвіших фізіологічних і тактичних покращень, ніж застосування традиційних протоколів ВІІТ. Необхідно провести подальші дослідження з метою вивчення довгострокових адаптаційних процесів, ризику травмування та потенційних переваг поєднання обох методів тренувань для оптимального підвищення результативності.

Ключові слова: анаеробна витривалість, спортсмени-підлітки, хокей на траві, здатність до повторного спринту.

Information about the authors:

Saha, Sohom: sohomsaha77@gmail.com; <https://orcid.org/0009-0006-9438-1554>; Department of Sport Psychology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

Obhrai, Simran: simranobhrai.sj@gmail.com; <https://orcid.org/0009-0007-5227-9364>; Department of Sports Sciences and Medicine, Guru Nanak Dev University, Amritsar, Punjab, India.

Vishwakarma, Richa: richavishwakarma195@gmail.com; <https://orcid.org/0000-0002-6469-2478>; Department of Sport Psychology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

Mondal, Prabir: mondalprabir308@gmail.com; <https://orcid.org/0009-0000-3550-0986>; Department of Sports Biomechanics, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

Nagesh: nageshakumar09@gmail.com; <https://orcid.org/0009-0009-9561-6388>; Department of Physical Education Pedagogy, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

Prasad, Bharat: bharatprasad1693@gmail.com; <https://orcid.org/0009-0004-7275-4810>; Department of Physical Education, Central University of south Bihar, Gaya, Bihar, India.

Upadhyay, Kautilya: kautilyaupadhyay02@gmail.com; <https://orcid.org/0000-0001-6639-3669>; Department of Sports Management & Coaching, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

Singh, Dev Karan: singhdev5726@gmail.com; <https://orcid.org/0009-0009-1411-2437>; Department of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India.

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