INTERNATIONAL JOURNAL of IJSETS SPORT, EXERCISE & TRAINING SCIENCES

e-ISSN 2149-8229 | **Volume** 11, **Issue** 1, 47–53, (2025) | ***Research Article***

https://dergipark.org.tr/tr/pub/useeabd

The Effect of Soccer Specific and Traditional Warm-up Protocols on Endurance Performance

Ufuk YILDIRIM[1], Çağlar EDİS[2]

Abstract

Aim: The aim of this study was to investigate the effects of 3 different warm-up phases on endurance performance.

Method: The subjects in U-15 and U-17 soccer players participated in the study. Athletes were made to perform 3 different warm-up phases including traditional, 1x5 minutes 5:5 SSG and 1x5 minutes SSG plus 40+40 m sprint lasting 20 minutes in total. After each warm-up phase, the intensity of the warm-up was recorded with the degree of rate of perceived exertion (RPE) with a Borg scale of 20, and endurance performances of the athletes were determined by applying 30-15 intermittent fitness test (30-15$_{IFT}$). RPE, maximal aerobic running speed (MAS) and maximum oxygen consumption capacity (VO_{2max}) were determined after 30-15$_{IFT}$.

Results: While there was a significant difference between the RPE values after warm-up, MAS and VO_{2max} values after 30-15$_{IFT}$ ($p<0.05$), there was no significant difference between the RPE values obtained after 30-15$_{IFT}$ ($p>0.05$). In U-17 team athletes, statistical significance was obtained between RPE after 3 different warm-ups, RPE after 30-15$_{IFT}$, MAS and VO_{2max} values ($p<0.05$). Statistically, although SSG and SSG+sprint warm-ups were more difficult than traditional warm-ups, they were found to have a more positive effect on MAS and VO_{2max}. In addition, although the addition of 40+40 m sprint practice to the warm-ups applied with SSG caused the intensity of the warm-up to increase more, and positive effect on endurance performance.

Conclusion: The SSG game by adding 5 minutes of sprint practice in traditional warm-ups may have a positive effect on endurance performance.

Key words: *Endurance, Soccer Specific Games, Warm-up.*

Submission Date : 18.12.2024 **Acceptance Date** : 22.03.2025 **Online Publication Date** : 27.03.2025

https://doi.org/10.18826/useeabd.1603144

INTRODUCTION

In a soccer match, footballers cover a distance of approximately 10-12 km (Stølen et al., 2005). Athletes use both aerobic and anaerobic energy systems within these distances (Bangsbo, 1994). It is seen that the aerobic capacity utilization of athletes is important in a soccer competition. However, for the athletes to reflect this skill on the field in the best way, they should have a warm-up phase before the competition or training. Warm-up phases increase metabolic reaction, muscle temperature, heart rate, blood circulation, nerve conduction velocity and oxygen levels of athletes (Bishop, 2003; García-Pinillos et al., 2020). In this respect, a suitable warm-up phase for athletes helps to make them more ready. In the literature, warm-up sessions are at different speeds, durations and with other interventions before endurance skills. Information indicates that high intensity of the warm-up phases before endurance activities increase the athlete's performance (Alves et al., 2023). Thanks to the high intensity warm-up phases, aerobic and anaerobic energy metabolism is activated, the oxygenation level of the muscles increases and the level of phospho-creatine hydrolysis increases (Bailey et al., 2009; Burnley et al., 2006; Wittekind et al., 2012). This type of warm-up phase is usually applied with certain intensities of the maximum oxygen level. For example, it is stated that after the warm-up phase is applied with 46% or 120% of the maximum oxygen uptake level, there are positive effects on the endurance skills of the athletes (Fujii et al., 2019). However, in team sports, it may be difficult to apply a separate warm-up phase to each athlete at an intensity corresponding to a certain amount of maximum oxygen consumption capacity before training. At this point, it is seen that small-sided games specific to soccer are applied as a warm-up phase. After the warm-up phase with the small-sided game applied in soccer players, it is not stated that the athletes' change of direction running and vertical jump performances are more effective than the traditional warm-up (Thapa et al., 2023). Similarly, it is stated that the reactive agility skills of athletes are better applied after the small-sided games warm-up phase compared to traditional warm-up (Zois et al., 2011). Researchers shows that small-sided games have a positive effect on performance after they are used in the warm-up phase. However, there is no research on the effects on endurance skills after the warm-up phase including small-sided games. The aim of this study was to investigate the effects on the results of 30-15$_{IFT}$ after a warm-up phase consisting of a traditional, 1 set of 5:5 small-

[1] Trabzon University, Faculty of Sports Science, Department of Physical Education and Sports Teaching, Türkiye, ufuk_yildirim22@trabzon.edu.tr

[2] **Corresponding Author:** Trabzon University, Faculty of Sports Science, Department of Physical Education and Sports Teaching, Türkiye, cagaredis@trabzon.edu.tr

sided and 5:5 small-sided lasting 5 minutes and 40+40 mt sprint practice applied for each minute. In this study, the research was designed by hypothesizing that after the warm-up phase including small-sided games and 40+40 mt sprint practice, there would be higher rate of perceived exertion and 30-15$_{IFT}$ results compared to than traditional warm-up. Therefore, the aim of this study was to investigate the effects of 3 different warm-up phases on endurance performance.

METHOD

Research model

For the research, the acute effects of different warm-up protocols on endurance skills were investigated by experimental measurement method. Before the research, all possible benefits and disadvantages were explained to the athletes in detail and the research was carried out on the subjects who volunteered to participate in the research.

Population and sample

A total of 16 athletes from the U-15 team (age: 15, height: 172.12±0.00, weight: 68.81±6.72, BMI: 23.13±1.40) and 21 athletes from the U-17 team (age: 17, height: 174.90±7.75, weight: 69.38±6.76, BMI: 22.64±1.23) who were healthy and did not have any muscle injury participated in the study. The athletes regularly trained 5 times a week and participated in one official competition. The athletes did not have any sports injury and did not receive ergogenic support.

Data collection tools

Traditional warm-up: In the first stage, the athletes both of U-15 and U-17 teams were made to perform running exercises in the same soccer field, lasting 5 to 7 minutes at a low paces and dynamic activation of different muscle groups. During this time, movements used in general warm-up such as running technique, knee pull, arm rotation were applied. Then, the athletes continued with soccer-specific warm-up movements at medium and higher paces for 5-7 minutes to increase muscle activation with 2 players across each other with a soccer ball. At the end of this period, dynamic stretching movements lasting approximately 3 minutes were applied and immediately afterward, 3-5 times 5-10 mt maximum speed sprinting was performed. 4 to 5 minutes after this application, the athletes were taken to 30-15$_{IFT}$. The athletes were asked about their rate of perceived exertion after the warm-up and 30-15$_{IFT}$ and their rate of perceived exertion (RPE) was recorded.

SSG warm-up, SSG Plus 40+40 m Sprint: The athletes both of U-15 and U-17 teams performed low intensity dynamic warm-up movements to activate different muscle groups for 5-7 minutes as in dynamic warm-up in the same soccer field. Then, a 3-minute dynamic stretching movements were applied to the athletes. Then, a small-sided game was played randomly 5:5 in a 40x25 m area (100 m^2 per person) with a single set of 5 min of free ball contact without a goalkeeper. In order for the game to be intense and continuous, many balls were kept ready, and coach motivation was provided continuously from outside. After the small-sided game, 3 minutes of dynamic stretching was applied to the athletes again and the warm-up session was terminated by performing 3-5 sprint applications with 5-10 m maximum effort and the RPE levels obtained from the warm-up session were recorded. After approximately 4-5 minutes, the athletes were taken to 30-15$_{IFT}$. At the end of the test, the athletes' RPE levels were asked and recorded. During the small-sided games, the 40+40 speed practice warm-up, was applied for every 1 minute as SSG warm-up. This warm-up phase was performed only during the game with extra speed application.

30-15 Intermittent Fitness Test: The 30-15$_{IFT}$ was applied to measure the endurance capacity of the athletes. In the test battery, a track was created with two parallel lines consisting of points A, B and C in a 40-meters area specific to soccer and drawn 3 meters apart before the A and C lines and 3 meters apart before the B line. A demo was shown to the athletes before the test. The test was started with a starting speed of 10 km/h. All athletes were warned that the test would be terminated when they failed to catch the warnings 3 times in a row during the test and 4 coaches controlled the athletes in equal numbers to carry out the tests in a healthy way. After this test, RPE levels, maximal aerobic running speed and maximum oxygen consumption capacity were recorded and included in the statistical analysis.

The maximal oxygen consumption capacities of the athletes obtained from the 30-15IFT final velocity were calculated by the following formula.

VO2max 30-15IFT (ml.-1min.kg-1) = 28.3 - 2.15 G - 0.741 A -0.0357 W + 0.0586 A x VIFT + 1.03 VIFT, where G stands for gender (female = 2; male = 1), A for age, and W for weight (Buchheit, 2010).

Data analysis

Statistical analyses were performed with SPSS software version 20, Chicago, USA, compatible with Windows 10. The conformity of the data to normal distribution was analyzed by the Shapiro-Wilk test. Repeated measures ANOVA test was used for comparison statistics after 3 different warm-ups and Bonferroni correction test was used. After 3 different warm-up phases, when it was determined that the data did not show normal distribution, the Friedman's statistical analysis was used as a comparison statistic. Wilcoxen signed-rank test and ANOVA test were used for pairwise comparison statistics. The significance level was accepted as $p<0.05$ for all analyses.

RESULTS

Table 1. Descriptive statistics of the athletes

Variables	U-15				U-17			
	n	Min.	Max.	Mean ± SD	n	Min.	Max.	Mean ± SD
Age (years)	16	15.00	15.00	15.00±.000	21	17.00	17.00	17.00±.00
Height (cm)	16	159.00	180.00	172.12±7.96	21	162.00	189.00	174.90±7.75
Body Weight (kg)	16	58.00	82.00	68.81±6.72	21	60.00	81.00	69.38±6.76
Bmi (kg/m^{-2})	16	20.60	25.30	23.13±1.40	21	20.70	25.50	22.64±1.23

Bmi: body mass index

Descriptive statistics of U-15 and U-17 team athletes are shown in Table 1. The minimum, maximum, mean and standard deviation values of age (years), body height (cm), body weight (kg) and body mass index (kg/m^{-2}) of the athletes are presented.

Table 2. Descriptive analyses of RPE and 30-15$_{IFT}$ results of U-15 and U-17 teams.

		n	min	Max	Mean ± SD	n	min	Max	Mean ± SD
Wu RPE	Traditional	16	8.00	10.00	8.93±.57	21	4.00	10.00	7.76±1.44
	SSG	16	15.00	20.00	17.25±1.06	21	8.00	15.00	12.28±2.28
	SSG + Sprint	16	15.00	17.00	16.37±.61	21	10.00	17.00	13.66±2.03
MAS	Traditional	16	16.00	20.00	18.50±1.26	21	17.50	20.50	19.28±.83
	SSG	16	17.00	21.00	18.90±1.14	21	17.00	21.00	19.42±1.17
	SSG + Sprint	16	16.50	22.00	19.84±1.44	21	18.00	22.00	20.14±.96
MAS RPE	Traditional	16	17.00	20.00	18.62±1.20	21	17.00	19.00	18.28±.56
	SSG	16	18.00	20.00	19.00±.89	21	14.00	19.00	16.76±1.67
	SSG + Sprint	16	17.00	20.00	18.87±1.08	21	14.00	19.00	17.76±1.33
VO_{2max}	Traditional	16	42.65	50.89	48.22±2.21	21	46.08	52.87	50.08±1.92
	SSG	16	44.56	52.80	48.94±2.02	21	45.10	53.88	50.37±2.63
	SSG + Sprint	16	43.60	54.71	50.61±2.68	21	47.45	55.59	51.82±2.14

Wu: warm-up, MAS: maximal aerobic speed, RPE: rate of exertion perceived, VO_{2max}: maximal oxygen consumption capacity, SSG: small-sided games, SSG+Sprint: small-sided games plus 40+40 m sprint

Table 2 shows the descriptive analyses of RPE obtained after warm-up, MAS RPE, MAS and VO_{2max} levels obtained after 30-15$_{IFT}$ from U-15 and U17 team athletes.

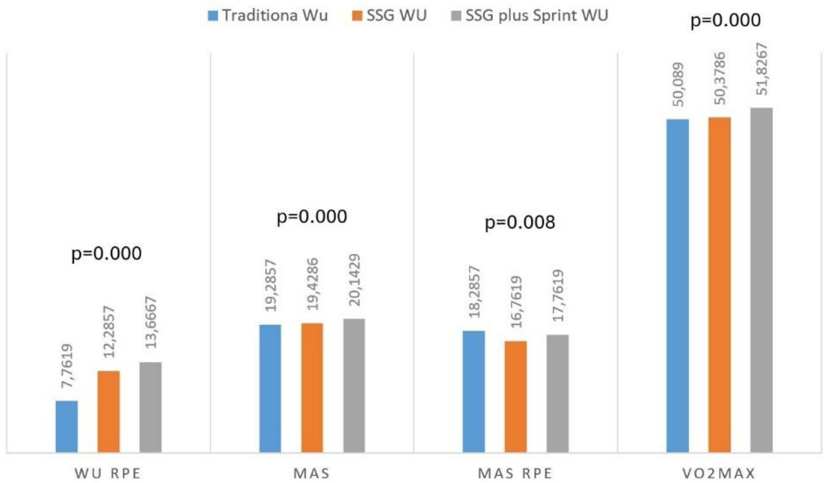
Graphic 1. RPE, MAS and VO_{2max} analyses of U-15 team after 3 different warm-up phases

In graphic 1, the results of the statistical analyses of Friedman and ANOVA tests of the mean values of RPE, MAS, MAS RPE and VO_{2max} obtained after 30-15_{IFT} of the U-15 team after 3 different warm-ups are shown. It was found that the post-warm-up RPE, MAS and VO_{2max} levels except MAS RPE were statistically significant after 3 different warm-up phases (p=0.000). In pairwise comparison analyses, Wilcoxen signed test results showed that there were significant differences between the rate of perceived exertion after the warm-up phase of SSG and traditional warm-up (z=-3.559, p=0.000), SSG+sprint and traditional warm-up (z=-3.602, p=0.000) and SGG+sprint and RPE (z=-2.336, p=0.019). In the Wilcoxen signed ranks test analyses of the MAS values obtained after 30-15_{IFT}, no statistical significance was found between SSG and Traditional warm-up (z=-1.895, p=0.058), while statistically significant differences were found between SSG+Srint and Traditional warm-up (z=-3.541, p=0.000) and SSG+Sprint and SSG (z=-3.271, p=0.001). A one-way repeated measures ANOVA was conducted to determine whether there were statistically significant differences in VO_{2max} values across three different exercise protocols (traditional VO_{2max}, SSG VO_{2max}, and SSG+Sprint VO_{2max}). Values are mean ± standard deviation, unless otherwise stated. There were no outliers, and the data was normally distributed, as assessed by boxplot and Shapiro-Wilk test (p>.05), respectively. The assumption of sphericity was not violated, as assessed by Mauchly's test of sphericity, $\chi^2(2) = 2.11$, p = .348. Therefore, sphericity was assumed, and no correction was applied.

The warm-up protocols elicited statistically significant differences in VO_{2max} values, F(2, 30) = 23.69, p<.0005, partial η2 = 0.612. VO_{2max} values increased progressively across the protocols, from 48.23 ± 2.22 mL/kg/min in traditional warm-up VO_{2max} to 48.94 ± 2.02 mL/kg/min in SSG warm-up VO_{2max} and 50.62 ± 2.69 mL/kg/min in SSG plus Sprint VO_{2max}.

Planned contrasts showed that VO_{2max} statistically significantly increased from traditional warm-up VO_{2max} to SSG plus Spirnt VO_{2max}, with a mean difference of 2.39 mL/kg/min (95% CI, 1.36 to 3.41), p<.0005. Additionally, there was a statistically significant increase in VO_{2max} from SSG VO_{2max} to SSG plus sprint VO_{2max}, with a mean difference of 1.67 mL/kg/min (95% CI, 0.91 to 2.43), p<.0005. However, the difference between traditional warm-up VO_{2max} and SSG warm-up VO_{2max} was not statistically significant (p>.270).

These results suggest that the SSG plus sprint warm-up VO_{2max} protocol was the most effective in eliciting an increase in VO_{2max} values, indicating its potential for improving aerobic capacity.



Graphic 2. RPE, MAS and VO_{2max} analyses of U-17 team after 3 different warm-up phases

Graph 2 shows the Friedman statistical analyses of the RPE obtained after 3 different warm-up phases, and MAS, MAS RPE and VO_{2max} levels obtained after 30-15_{IFT} of U-17 team athletes. According to the results of Friedman statistical analyzed of the obtained data, it was determined that there was statistical significance between MAS (p=0.000), MAS RPE (p=0.008), MAS and VO_{2max} (p=0.000) values obtained after 3 different warm-ups.

In the paired comparison analyses, there was a difference between SSG RPE and traditional warm-up (z=-4,026, p=0.000), RPE of SSG+Sprint and traditional warm-up (z=-4,041, p=0.000), but there was no statistical significance between RPE of SSG+Sprint and SSG of RPE (z=-1,813, p=0.070). In maximal aerobic running speeds, there was no statistical significance between SSG and traditional warm-up (z=-958, p=0.338), whereas there was a statistical significance level after SSG+Sprint warm-up compared to traditional (z=-3.316, p=0.001) and SSG warm-up (z=-3.128, p=0.002).

In the RPE values obtained after 3015_{IFT}, there was statistical significance between SSG and Traditional (z=-2.998, p=0.003), while no statistical significance was found between SSG+Sprint and Traditional (z=-1.424, p=0.154) and between SSG+Sprint and SSG (z=-1.935, p=0.053). In addition, no statistical significance was found between SSG and Traditional (z=-.917, p=0.359), while statistical significance was found between SSG+Sprint and Traditional (z=-3.418, p=0.001) and SSG (z=-3.223, p=0.001) in VO_{2max} levels.

DISCUSSION

In this study, the effects of traditional warm-up phase lasting 20 minutes, 5:5 small-sided game 1x5 min within the traditional warm-up phase and speed applications including 40 mt going and 40 mt return at the end of each 1 minute during the small-sided game on the rate of perceived exertion of the warm-up phases and endurance skills were analyzed. According to the statistical results of the study, SSG plus 40+40 mt warm-up phase and SSG warm-up phase are more intense than traditional warm-up and have a more positive effect on the endurance performance of the athletes acutely.

High-intensity pre-exercises performed before endurance exercises increase Vo2 kinetics and decrease oxygen debt levels (Hajoglou et al., 2005). In the literature, the warm-up phase, called pre-exercise in this respect, increases the metabolic functions of athletes, and increases their tolerance to exercise (Jones et al., 2003; Carter et al., 2005), and that their average power production increases (Burnley et al., 2005). However, it is seen that a warm-up phase applied at this intensity is generally controllable and is carried out by following a controlled load with a certain proportion of the maximal oxygen consumption capacity of the athletes (Fujii et al., 2023). In team sports such as soccer, it may require both equipment and an extended period of time to perform warm-up phases before endurance tests or exercises in a controlled manner or at certain rates of maximal oxygen consumption capacity. At this point, it is seen in the literature that there is research in which athletes perform warm-up phases with sport-specific small-sided games. They found that the rate of perceived exertion obtained from the warm-up phase of handball athletes after 3 sets of 2 minutes of 3 vs 3 player small-sided games and 8 minutes of general warm-up was not different. The reason for this seems to be the game rules that cause small-sided games to be played at low intensity (Iacono et al., 2021). In the results of this study, it was found that the warm-up phase, which included 40+40 m sprint practice in every 1 minute of the small-sided games played for 5 minutes, revealed higher rate of perceived exertion levels compared to the small-sided games without sprint and traditional warm-up. The fact that it has a different result from the literature may have caused the rate of perceived exertion levels to have different results after including coach motivation and speed applications in the format of small-sided games specific to soccer in this study.

Research shows that performance is acutely enhanced following high intensity warm-up phases before anaerobic activities (Burnley et al., 2005; Mujika et al., 2012). In the literature, it is stated that after the traditional and small-sided games warm-up phases applied on a total of 10 athletes with an average age of 19.3 years, it is more effective on the countermovement jump abilities of the athletes with change of running after the small-sided games warm-up phase (Thapa et al., 2023). A different study shows, it is shown that amateur soccer players with an average age of 23.3 years have statistical results indicating that Countermovement jump height is a more effective warm-up method after the small-sided games warm-up phase with 5 repetitions of leg press (Zois et al., 2011). However, there is no research on the endurance skills of athletes after warm-up phases of high intensity or small-sided games. Nevertheless, studies show that small field games offer more positive effects on some motor skills. In this study, unlike the literature, the effects of traditional and small-sided games on the endurance skills of athletes after the warm-up phase were investigated. Like the literature, according to the statistical results of the study, it was determined that the endurance skills of the athletes were more positively affected after the small-sided games and the sprint skill applied during the small-sided games. At this point, the fact that the warm-ups were more intense after small-sided games due to the perceived difficulty levels had a more positive effect on the endurance test results and maximal oxygen consumption capacities of the athletes reveals similar results with the literature.

CONCLUSION

According to the results of the study, it is seen that endurance performances are positively affected after high intensity warm-up phases that increase the REP by athletes in the warm-up phase. In this respect, it was determined that the endurance performance was acutely affected more positively with the increase in the intensity of the warm-up thanks to the addition of 5:5 SSG to the warm-up phase of the athletes and the 40+40 m sprint application to be applied every 1 minute to the SSG applied for 5 minutes.

SUGGESTIONS

Coaches may be advised to implement small-sided games in the last part of a 20-minute warm-up phase prior to competition or endurance training, taking into consideration that small-sided games may positively affect athletes' acute endurance skills. In addition, by increasing the rate of perceived exertion in the warm-up before such activities, they may positively affect the endurance performances of the athletes.

Etical Approval and Permission Information

Ethics Committee:	Trabzon University Social and Human Sciences Scientific Research and Publication Ethics Committee
Protocol/Number:	2024-11/2.27

KAYNAKÇA

Alves, M. D., Knechtle, B., Silva, D. D., Fernandes, M. S., Gomes, J. H., Thuany, M., ... De Souza, R. F. (2023). Effects of high-intensity warm-up on 5000-meter performance time in trained long-distance runners. *Journal of Sports Science & Medicine, 22*(2), 254.

Bailey, S. J., Vanhatalo, A., Wilkerson, D. P., DiMenna, F. J., & Jones, A. M. (2009). Optimizing the “priming” effect: influence of prior exercise intensity and recovery duration on O2 uptake kinetics and severe-intensity exercise tolerance. *Journal of Applied Physiology, 107*(6), 1743-1756.

Bangsbo, J. (1994). The physiology of soccer--with special reference to intense intermittent exercise. *Acta Physiologica Scandinavica*, *Supplementum*, 619, 1-155.

Bishop, D. (2003). Warm up II: Performance changes following active warm up and how to structure the warm up. *Sports medicine*, 33, 483-498.

Burnley, M., Doust, J. H., & Jones, A. M. (2005). Effects of prior warm-up regime on severe-intensity cycling performance. *Medicine & Science in Sports & Exercise*, *37*(5), 838-845.

Burnley, M., Doust, J. H., & Jones, A. M. (2006). Time required for the restoration of normal heavy exercise VO2 kinetics following prior heavy exercise. *Journal of Applied Physiology*, *101*(5), 1320-1327.

Buchheit, M. (2010). The 30–15 intermittent fitness test: 10 year review. *Myorobie Journal*, *1*(9), 278.

Carter, H., Grice, Y., Dekerle, J., Brickley, G., Hammond, A. J., & Pringle, J. S. (2005). Effect of prior exercise above and below critical power on exercise to exhaustion. *Medicine & Science in Sports & Exercise*, *37*(5), 775-781.

Fujii, N., Fujisawa, K., Dobashi, K., Cao, Y., Matsutake, R., Lai, Y. F., & Nishiyasu, T. (2023). Effects of high-intensity exercise repetition number during warm-up on physiological responses, perceptions, readiness, and performance. *Research Quarterly for Exercise and Sport, 94*(1), 163-172.

Fujii, N., Hara, H., Enomoto, Y., Tanigawa, S., & Nishiyasu, T. (2019). Effects of work-matched supramaximal intermittent vs. submaximal constant-workload warm-up on all-out effort power output at the end of 2 minutes of maximal cycling. *European Journal of Sport Science, 19*(3), 336-344.

García-Pinillos, F., Lago-Fuentes, C., Latorre-Román, P. A., Pantoja-Vallejo, A., & Ramirez-Campillo, R. (2020). Jump-rope training: Improved 3-km time-trial performance in endurance runners via enhanced lower-limb reactivity and foot-arch stiffness. *International Journal of Sports Physiology and Performance, 15*(7), 927-933.

Hajoglou, A., Foster, C., De Koning, J. J., Lucia, A., Kernozek, T. W., & Porcari, J. P. (2005). Effect of warm-up on cycle time trial performance. *Medicine & Science in Sports & Exercise, 37*(9), 1608-1614.

Iacono, A. D., Vigotsky, A. D., Laver, L., & Halperin, I. (2021). Beneficial effects of small-sided games as a conclusive part of warm-up routines in young elite handball players. *The Journal of Strength & Conditioning Research, 35*(6), 1724-1731.

Jones, A. M., Wilkerson, D. P., Burnley, M., & Koppo, K. (2003). Prior heavy exercise enhances performance during subsequent perimaximal exercise. *Medicine & Science in Sports & Exercise*, *35*(12), 2085-2092.

Mujika, I., de Txabarri, R. G., Maldonado-Martín, S., & Pyne, D. B. (2012). Warm-up intensity and duration’s effect on traditional rowing time-trial performance. *International Journal of Sports Physiology and Performance, 7*(2), 186-188.

Stølen, T., Chamari, K., Castagna, C., & Wisløff, U. (2005). Physiology of soccer: An update. *Sports medicine,* 35, 501-536.

Thapa, R., Clemente, F., Moran, J., Garcia-Pinillos, F., Scanlan, A. T., & Ramirez-Campillo, R. (2023). Warm-up optimization in amateur male soccer players: A comparison of small-sided games and traditional warm-up routines on physical fitness qualities. *Biology of Sport, 40*(1), 321-329.

Wittekind, A., Cooper, C. E., Elwell, C. E., Leung, T. S., & Beneke, R. (2012). Warm-up effects on muscle oxygenation, metabolism and sprint cycling performance. *European Journal of Applied Physiology*, 112, 3129-3139.

Zois, J., Bishop, D. J., Ball, K., & Aughey, R. J. (2011). High-intensity warm-ups elicit superior performance to a current soccer warm-up routine. *Journal of Science and Medicine in Sport, 14*(6), 522-528.

CITATION

YILDIRIM, U., & Edis, Ç. (2025). The Effect of Soccer Specific and Traditional Warm-up Protocols on Endurance Performance. *International Journal of Sport Exercise and Training Sciences - IJSETS, 11*(1), 47-53. https://doi.org/10.18826/useeabd.1603144