

Combined futsal training: The combination of rotation play training with the HIIT protocol affects anaerobic endurance abilities

AYYALA HAQQI THORIQ AS-SAFA, I DEWA MADE ARYANANDA WIJAYA KUSUMA, IMAM SYAFII, DAVID AGUS PRIANTO, YANUAR ALFAN TRIARDHANA ✉, BAYU AGUNG PRAMONO

Department of Sport Coaching Education. Faculty of Sports and Health Sciences. State University of Surabaya. Indonesia.

ABSTRACT

A training model that combines physicality and tactics is really needed in futsal. This study aims to analyse the effect of rotation play training with HIIT Protocol on the anaerobic abilities of amateur futsal players. This research uses an experimental method with a two-group pre-test and post-test design. The sample in this study consisted of 30 amateur futsal players with an age of 19.23 ± 0.57 years, height of 165.60 ± 5.63 cm, body mass of 59.17 ± 5.24 kg, and BMI of 21.60 ± 1.93 . Samples were divided randomly into an experimental group (EG) and a control group (CG). Data analysis used a Paired Sample T-test and an Independent T-test with a significance level of .05 and used Cohen's ES to measure the magnitude of differences between groups. This study used the running anaerobic sprint test (RAST). The variables in RAST that will be analysed are Peak Power (W); Mean Power (W); Peak Power per Weight ($W.kg^{-1}$); Mean Power per Weight ($W.kg^{-1}$); Fatigue Index (%); Total effort time (s). The paired sample t-test resulted in a significant difference in EG with significance values of Peak Power $p = .010$, Mean Power $p = .007$, Peak Power per Weight $p = .011$, Mean Power per Weight $p = .008$, Fatigue Index $p = .045$, and total effort time $p = .011$, while in CG all variables do not have significant differences. The Independent T-test found that there was a significant difference between EG and CG with a significance value of $p < .05$. This research concludes that the rotation play training model with HIIT Protocol has a positive effect on the anaerobic endurance of amateur futsal players.

Keywords: Performance analysis, Rotation play, High-intensity interval training, Anaerobic, RAST.

Cite this article as:

As-Safa, A. H. T., Kusuma, I. D. M. A. W., Syafii, I., Syafii, D. A., Triardhana, Y. A., & Pramono, B. A. (2024). Combined futsal training: The combination of rotation play training with the HIIT protocol affects anaerobic endurance abilities. *Journal of Human Sport and Exercise*, 19(2), 600-607. <https://doi.org/10.14198/jhse.2024.192.14>

✉ **Corresponding author.** Department of Sport Coaching Education. Faculty of Sports and Health Sciences. Universitas Negeri Surabaya. Indonesia.

E-mail: yanuartriardhana@unesa.ac.id

Submitted for publication December 31, 2023.

Accepted for publication January 30, 2024.

Published April 01, 2024 (*in press* March 04, 2024).

JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202.

© Faculty of Education. University of Alicante.

doi: 10.14198/jhse.2024.192.14

INTRODUCTION

Rotation play is one of the important things in the game of futsal. Futsal is an intermittent and dynamic sport that involves fast actions and precise movements based on physical parameters, techniques and tactics (Castagna et al., 2009; Mendes et al., 2022; Naser et al., 2017). Rotation play is used to describe the performance of tactics indicated by variables, space, time or tasks that most determine team cooperation and effectiveness in controlling the ball in the sport of futsal (Garganta, 2009). According to Da Cruz et al. (2020); Ohmuro et al. (2020), futsal is a high-intensity game with a short recovery time and requires sound technical and tactical abilities. For this reason, each player must have good skills to carry out tactics and strategies during the match. Specifically, futsal is characterized by players who are constantly moving and rotating positions because by rotating, the players can damage the opponent's defence and create much space to be utilized to score goals.

Anaerobic endurance is a very important physical component to help players perform rotation play quickly and precisely in futsal games because futsal is a sport that involves high-intensity locomotor activity which requires aerobic and anaerobic fitness in matches (Claus et al., 2017; Ribeiro et al., 2020; Rico-González et al., 2022). There have been several previous studies on futsal physical training, but it has not been combined holistically with technical and tactical training Campos et al. (2021); Soares-Caldeira et al. (2014); training focuses only on the physical Paz-Franco et al. (2017); Teixeira et al. (2019). It cannot be denied that the results of this research have had a positive impact on improving the performance of futsal players. However, if reviewed at tactical needs, where futsal requires structured rotation play. It seems necessary to develop training in a holistic direction, namely combining tactical and physical training in one training model. This is supported by previous research, which found that futsal games have certain organizational patterns Zagatto et al. (2009), both attacking and defending, depending on the match situation (Bueno et al., 2018).

In sports coaching, High-intensity interval training (HIIT) is very popularly used to improve physical abilities, especially anaerobic endurance. Previous research has proven that HIIT has a positive effect on players' anaerobic endurance (Kunz et al., 2019; Yan et al., 2022). If we look at the very high physical demands when doing rotation play, combining rotation play with HIIT is crucial, so it is necessary to scientifically review the impact of combining these exercises so that specific futsal training needs can be achieved. The results of this research can help coaches and players create more targeted training programs that combine the tactical and physical elements required in the game of futsal. This research can also provide valuable insight into how the game of futsal at the amateur level can improve.

MATERIAL AND METHODS

Study participants

A total of 30 male futsal players at amateur futsal clubs participated in this research. He is 19.23 ± 0.57 years old, with a height of 165.60 ± 5.63 cm, a body mass of 59.17 ± 5.24 kg, and a BMI of 21.60 ± 1.93 . All samples involved have experience playing in amateur leagues. Then, all samples were divided randomly into an experimental group (EG) and a control group (CG).

Study protocol

The treatment and control groups were given a pre-test to determine their initial anaerobic endurance abilities. Next, the treatment group was given rotation play exercises with HIIT protocol for six weeks with a frequency of three times a week. The control group was not given special treatment but continued to undergo exercise with the same duration and frequency as the treatment group. After six weeks of carrying out the research,

in the final week, the treatment and control groups were given a post-test to determine the difference in anaerobic endurance ability with rotation play training with HIIT protocol. This study used RAST. The variables in RAST that will be analysed are Peak Power (W), Mean Power (W), Peak Power per Weight (W.kg^{-1}), Mean Power per Weight (W.kg^{-1}), Fatigue Index (FI) ($\text{peak power} - \text{minimum power} / \text{peak power} \times 100$), Total effort time (s) (Zagatto et al., 2009).

Treatment protocol

The treatment group is divided into three groups, which will then take turns carrying out rotation play with HIIT Protocol. Group 1 does rotation play with a predetermined movement pattern with an intensity of 90-95% of the maximum heart rate, while groups two and three wait their turn while passing with moderate intensity. Polar verity sense is used to monitor HR_{max} at a predetermined intensity. The interval used in this treatment is 1:3. Each group does rotation play at high intensity for 2 minutes before taking turns with the next group. In the first and second weeks, each group did eight sets of rotation play, ten sets in the third and fourth weeks, and twelve sets in the fifth and sixth weeks.

Data analysis

The data in this study are presented in the form of mean and standard deviation. The prerequisite tests in this study used the normality test and homogeneity test. The normality test uses the Shapiro-Wilk test, and the homogeneity test uses the Levene test. The percentage change ($\Delta\%$) between the results before (Pre) and after (Post) during the training period was calculated using the following formula: $\Delta\% = ((\text{Post} - \text{Pre}) / \text{Pre}) \times 100$. Next, the paired sample test was used to see the differences in the averages of each group and the independent sample test was used to compare the differences in the averages of the experimental group and the control group. Statistical significance was set at $p < .05$. The magnitude of the differences between groups, this study used Cohen's ES. An ES above 0.8 is considered large, between 0.8 and 0.5 is considered moderate, between 0.5 and 0.2 is considered small, and less than 0.2 is considered insignificant (Cohen, 2013).

RESULTS

Table 1 above describes the characteristics of the two research sample groups. Furthermore, the normality test carried out using the Shapiro-Wilk test showed that all variables in the EG group and CG group had a normal distribution with a significance value of $\text{Sig} > .05$. The same thing was also found in the homogeneity test using the Levene test, showing a significance result of $> .05$.

Table 1. Characteristic of group.

Group	Age (year)	Height (cm)	Body Mass (kg)	BMI
EG	19.00 ± 0.53	163.47 ± 5.38	60.47 ± 4.16	22.65 ± 1.60
CG	19.47 ± 0.52	167.73 ± 5.19	57.87 ± 6.00	20.55 ± 1.67

Note. Data are presented as mean \pm SD.

Table 2. The above shows the differences between the EG and CG pre-test and post-test. In the EG group there were significant differences in Peak Power ($p = .010$, $\text{ES} = 0.73$), Mean Power ($p = .007$, $\text{ES} = 0.79$), Peak Power per Weight ($p = .011$, $\text{ES} = 0.72$), Mean Power per Weight ($p = .008$, $\text{ES} = 0.77$), Fatigue Index ($p = .045$, $\text{ES} = 0.55$), and Total effort time ($p = .011$, $\text{ES} = 0.73$). In CG, all variables do not have significant differences.

Table 2. Results of RAST pre and post-test in both groups.

Variable	Group	Pre	Post	$\Delta\%$	p	ES
Peak Power (W)	EG	543.35 \pm 75.52	588.10 \pm 113.16	7.61	.010*	0.73
	CG	538.64 \pm 66.65	536.76 \pm 99.33	0.35	.699	-0.10
Mean Power (W)	EG	418.66 \pm 60.93	457.59 \pm 73.67	8.51	.007*	0.79
	CG	436.68 \pm 54.63	429.36 \pm 88.75	1.71	.633	-0.12
Peak Power per Weight (W.kg ⁻¹)	EG	9.02 \pm 1.37	9.74 \pm 1.84	7.36	.011*	0.72
	CG	9.31 \pm 0.62	9.28 \pm 1.41	0.31	.714	-0.09
Mean Power per Weight (W.kg ⁻¹)	EG	6.95 \pm 1.07	7.58 \pm 1.18	8.26	.008*	0.77
	CG	7.55 \pm 0.56	7.41 \pm 1.27	1.84	.602	-0.13
Fatigue Index (%)	EG	43.41 \pm 7.16	38.36 \pm 6.75	13.16	.045*	0.55
	CG	40.10 \pm 6.64	41.89 \pm 3.20	4.29	.863	-0.04
Total effort time (s)	EG	34.14 \pm 1.87	33.11 \pm 1.81	3.11	.011*	0.73
	CG	33.01 \pm 0.89	33.42 \pm 1.92	1.22	.298	-0.27

Note. Data are presented as mean \pm SD; Δ (%): percentage of change between pre and post-training performance; p : level of significance; ES: effect size; * Significant difference, $p < .05$.

Table 3. The above shows significant differences between EG and CG. All variables have a significance value of $p < .05$; this shows that there are significant differences between EG and CG. If viewed from the ES value, Peak Power has a medium effect, Mean Power has a large effect, Peak Power per Weight has a medium effect, Mean Power per Weight has a large effect, Fatigue Index has a large effect, and Total effort time has a large effect.

Table 3. Comparison RAST in both groups.

Variable	EG	CG	p	ES
Peak Power (W)	44.75 \pm 63.79	-1.88 \pm 54.87	.041*	0.78
Mean Power (W)	38.93 \pm 50.92	-7.33 \pm 48.27	.016*	0.93
Peak Power per Weight (W.kg ⁻¹)	0.72 \pm 1.04	-0.03 \pm 0.93	.046*	0.76
Mean Power per Weight (W.kg ⁻¹)	0.63 \pm 0.83	-0.14 \pm 0.84	.018*	0.92
Fatigue Index (%)	-5.05 \pm 7.65	1.80 \pm 7.79	.022*	0.89
Total effort time (s)	-1.03 \pm 1.46	0.41 \pm 1.27	.008*	1.05

Note. Data are presented as mean \pm SD; p : level of significance; ES: effect size; * Significant difference, $p < .05$.

DISCUSSION

Rotation play training with HIIT Protocol has a positive influence on increasing anaerobic endurance. Increasing anaerobic endurance is influenced by controlling the contribution of anaerobic energy during training sessions; this is crucial in planning training programs, adjusting training loads, session duration, and its relationship with lactic acid production in muscles, especially after undergoing high-intensity intermittent training (Buchheit & Laursen, 2013). Futsal is a sport that requires good physical condition, especially endurance, because it uses high intensity, so the players need intense training. In the sport of futsal, the intensity used in matches is 75% of playing action, while more than 83% of the rest interval is with a work-to-rest ratio of approximately 1:1, where half of the work is at high intensity, 83% of playing time has been spent above 85% maximum heart rate (HR_{max}) Amani-Shalamzari et al. (2019); Kunz et al. (2019); Therapy et al. (2011). The findings of this study are in line with research Avar et al. (2019), which states that high-intensity interval training (HIIT) is a time-saving strategy to increase anaerobic capacity. Therefore, HIIT has become a suitable resistance training method for anaerobically dominant sports such as futsal.

Intensive training is a routine that is usually carried out by elite athletes in order to improve their physical condition. HIIT may be useful for restoring body composition and quality of physical fitness. However, to optimize performance, intensive training and proper recovery are needed (Gómez et al., 2023). The effort required by each player depends on several factors, such as physical and individual performance, because every futsal sports training program involves aerobic and anaerobic training (Borges et al., 2022). By using 90%-95% intensity for six weeks, players can experience significant improvements in their anaerobic endurance. Intermittent exercise that achieves $\geq 90\%$ of maximum heart rate and maximum oxygen uptake (VO_{2max}), separated by recovery or rest periods, is an exercise model that is trending towards improving physical condition and fitness (Atakan et al., 2020; Engel & Sperlich, 2014; Faude et al., 2013). High-intensity interval training (HIIT) is defined as a 'near maximal' effort generally performed at an intensity that produces $\geq 80\%$ (but often 85-95%) of maximal heart rate (Macinnis & Gibala, 2016). The frequency of three times a week is important in this study. It is in line with previous research, which reports that HIIT is effective when performed for three sessions per week for at least six weeks to reduce the phenomenon of negative reactions caused by glycogen depletion, metabolite accumulation in muscles, and neuromuscular tension and so on increasing endurance and athlete performance (Yan et al., 2022).

Anaerobic endurance is continuous with the level of fatigue with a good anaerobic level, it influences the small risk of injury due to fatigue, which results in a decrease in an athlete's performance Güler et al. (2020); Lopes et al. (2019), in line with a significant reduction in the fatigue index of the experimental group who received rotation play training with HIIT Protocol. High-intensity interval training (HIIT) is an effective exercise regimen for improving several physiological parameters important for performance, including cardiometabolic function, oxygen uptake kinetics, strength and anaerobic capacity, ion transport capacity, and muscle fatigue resistance (Hostrup & Bangsbo, 2023).

CONCLUSION

Based on the results of research and discussions about rotation play training with HIIT Protocol, it was concluded that this training method had a positive effect on increasing Peak Power, Mean Power, Peak Power per Weight, Mean Power per Weight, as well as reducing Fatigue Index and Total effort time. Rotation play training with HIIT Protocol can be an alternative physical exercise without eliminating the characteristics of playing futsal.

AUTHOR CONTRIBUTIONS

As-Safa, Kusuma, Pramono conceived and designed the experiments. Syafii, Prianto and Triardhana performed the data collection and analysis. All the authors wrote the paper and approve the final submission.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest were reported by the authors.

REFERENCES

- Amani-Shalamzari, S., Khoshghadam, E., Doniaee, A., Parnow, A., Bayati, M., & Clemente, F. M. (2019). Generic vs. small-sided game training in futsal: Effects on aerobic capacity, anaerobic power and agility. *Physiology and Behavior*, 204, 347-354. <https://doi.org/10.1016/j.physbeh.2019.03.017>
- Atakan, M. M., Güzel, Y., Bulut, S., Koşar, N. Ş., Mcconell, G. K., & Turnagöl, H. H. (2020). Original article Six HIIT sessions over 5 days increases VO 2max , endurance capacity and sub-. *Journal of Sport and Health Science*, 0-27. <https://doi.org/10.1016/j.jshs.2020.06.008>
- Avar, M. I. L. E. C., Arsic, T. O. S. O. M., Orluka, M. A. C., Uljak, Z. O. C., Ovko, I. V. C. E. Z., Schakert, G. E. T., & Ofmann, P. E. H. (2019). Effects Of 6 Weeks Of Different High-Intensity Interval And Moderate Continuous Training On Aerobic And Anaerobic Performance. 45, 44-56. <https://doi.org/10.1519/JSC.0000000000002798>
- Borges, L., Dermargos, A., Gorjão, R., Cury-Boaventura, M. F., Hirabara, S. M., Abad, C. C., Pithon-Curi, T. C., Curi, R., Barros, M. P., & Hatanaka, E. (2022). Updating futsal physiology, immune system, and performance. *Research in Sports Medicine*, 30(6), 659-676. <https://doi.org/10.1080/15438627.2021.1929221>
- Buchheit, M., & Laursen, P. B. (2013). High-intensity interval training, solutions to the programming puzzle: Part II: Anaerobic energy, neuromuscular load and practical applications. *Sports Medicine*, 43(10), 927-954. <https://doi.org/10.1007/s40279-013-0066-5>
- Bueno, M. J. D. O., Caetano, F. G., Yonezawa, M. K., Grella, A. S., Cunha, S. A., & Moura, F. A. (2018). How do futsal players of different categories play during official matches? A tactical approach to players' organization on the court from positional data. *PLoS ONE*, 13(6), 1-13. <https://doi.org/10.1371/journal.pone.0199619>
- Campos, F. de S., Borszcz, F. K., Flores, L. J. F., Barazetti, L. K., Teixeira, A. S., Hartmann Nunes, R. F., & Guglielmo, L. G. A. (2021). HIIT Models in Addition to Training Load and Heart Rate Variability Are Related With Physiological and Performance Adaptations After 10-Weeks of Training in Young Futsal Players. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.636153>
- Castagna, C., Ottavio, S. D., Granda, J., & Alvarez, B. (2009). Match demands of professional Futsal : A case study. 12, 490-494. <https://doi.org/10.1016/j.jsams.2008.02.001>
- Claus, G. M., Redkva, P. E., Brisola, G. M. P., Malta, E. S., de Poli, R. de A. B., Miyagi, W. E., & Moura, A. (2017). Reliability and Validity of a Novel Futsal Special Performance Test Designed to Measure Skills and Anaerobic Performance. *Jsep*, 28, 588-595. <https://doi.org/10.1123/ijssp.2018-0850>
- Cohen, J. (2013). Statistical power analysis for the behavioral sciences. Academic press. <https://doi.org/10.4324/9780203771587>
- Da Cruz, J. P., Messias, L. H. D., Cetein, R. L., Rasteiro, F. M., Gobatto, C. A., & Manchado-Gobatto, F. B. (2020). Anaerobic and Agility Parameters of Salonists in Laboratory and Field Tests. *International Journal of Sports Medicine*, 41(7), 450-460. <https://doi.org/10.1055/a-1088-5429>
- Engel, F. A., & Sperlich, B. (2014). High-intensity interval training for young athletes. *Wiener Medizinische Wochenschrift*, 164(11-12), 228-238. <https://doi.org/10.1007/s10354-014-0277-x>
- Faude, O., Schnitker, R., Schulte-Zurhausen, R., Müller, F., & Meyer, T. (2013). High intensity interval training vs. high-volume running training during pre-season conditioning in high-level youth football: A cross-over trial. *Journal of Sports Sciences*, 31(13). <https://doi.org/10.1080/02640414.2013.792953>
- Garganta, J. (2009). Trends of tactical performance analysis in team sports : bridging the gap between research , training and competition. 9(1), 81-89. <https://doi.org/10.5628/rpcd.09.01.81>
- Gómez, E. M., Atef, H., Elsayed, S. H., Zakaria, H. M., Navarro, M. P., & Sulé, E. M. (2023). Effects of high-intensity interval training with an eccentric hamstring exercise program in futsal players: A

- randomized controlled trial. *Medicine (United States)*, 102(31), E34626. <https://doi.org/10.1097/MD.00000000000034626>
- Güler, Ö., Aras, D., Akça, F., Bianco, A., & Lavanço, G. (2020). Effects of Aerobic and Anaerobic Fatigue Exercises on Postural Control and Recovery Time in Female Soccer Players. <https://doi.org/10.3390/ijerph17176273>
- Hostrup, M., & Bangsbo, J. (2023). Performance Adaptations to Intensified Training in Top-Level Football. In *Sports Medicine* (Vol. 53, Issue 3). <https://doi.org/10.1007/s40279-022-01791-z>
- Kunz, P., Engel, F. A., Holmberg, H. C., & Sperlich, B. (2019). A Meta-Comparison of the Effects of High-Intensity Interval Training to Those of Small-Sided Games and Other Training Protocols on Parameters Related to the Physiology and Performance of Youth Soccer Players. In *Sports Medicine - Open* (Vol. 5, Issue 1). <https://doi.org/10.1186/s40798-019-0180-5>
- Lopes, M., Simões, D., Rodrigues, J. M., Costa, R., Oliveira, J., & Ribeiro, F. (2019). The FIFA 11+ does not alter physical performance of amateur futsal players. *Journal of Sports Medicine and Physical Fitness*, 59(5), 743-751. <https://doi.org/10.23736/S0022-4707.18.08532-8>
- MacInnis, M.J. and Gibala, M.J. (2017). Physiological adaptations to interval training and the role of exercise intensity. *J Physiol*, 595: 2915-2930. <https://doi.org/10.1113/JP273196>
- Mendes, D., Travassos, B., Carmo, J. M., Cardoso, F., Costa, I., & Sarmento, H. (2022). Talent Identification and Development in Male Futsal: A Systematic Review. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 17). <https://doi.org/10.3390/ijerph191710648>
- Naser, N., Ali, A., & Macadam, P. (2017). Physical and physiological demands of futsal. In *Journal of Exercise Science and Fitness*. <https://doi.org/10.1016/j.jesf.2017.09.001>
- Ohmuro, T., Iso, Y., Tobita, A., Hirose, S., Ishizaki, S., Sakaue, K., & Yasumatsu, M. (2020). Physical match performance of Japanese top-level futsal players in different categories and playing positions. *Biology of Sport*, 37(4), 359-365. <https://doi.org/10.5114/biolsport.2020.96322>
- Paz-Franco, A., Rey, E., & Barcala-Furelos, R. (2017). Effects of 3 different resistance training frequencies on jump, sprint, and repeated sprint ability performances in professional futsal players. *Journal of Strength and Conditioning Research*, 31(12). <https://doi.org/10.1519/JSC.0000000000001766>
- Ribeiro, J. N., Gonçalves, B., Coutinho, D., & Brito, J. (2020). Activity Profile and Physical Performance of Match Play in Elite Futsal Players. 11(July). <https://doi.org/10.3389/fpsyg.2020.01709>
- Rico-González, M., Puche-Ortuño, D., Clemente, F. M., Aquino, R., & Pino-Ortega, J. (2022). The Most Demanding Exercise in Different Training Tasks in Professional Female Futsal: A Mid-Season Study through Principal Component Analysis. *Healthcare (Switzerland)*, 10(5), 1-13. <https://doi.org/10.3390/healthcare10050838>
- Soares-Caldeira, L. F., De Souza, E. A., De Freitas, V. H., De Moraes, S. M. F., Leicht, A. S., & Nakamura, F. Y. (2014). Effects of additional repeated sprint training during preseason on performance, heart rate variability, and stress symptoms in futsal players: A randomized controlled trial. *Journal of Strength and Conditioning Research*, 28(10). <https://doi.org/10.1519/JSC.0000000000000461>
- Teixeira, A. S., Arins, F. B., De Lucas, R. D., Carminatti, L. J., Dittrich, N., Nakamura, F. Y., & Guglielmo, L. G. A. (2019). Comparative Effects of Two Interval Shuttle-Run Training Modes on Physiological and Performance Adaptations in Female Professional Futsal Players. *Journal of Strength and Conditioning Research*, 33(5). <https://doi.org/10.1519/JSC.0000000000002186>
- Therapy, O., Horizonte, B., & Gerais, M. (2011). Intensity Of Official Futsal Matches. *Strength And Conditioning*, 12. <https://doi.org/10.1519/JSC.0b013e3181fb4574>

- Yan, S., Kim, Y., & Choi, Y. (2022). Aerobic and Anaerobic Fitness according to High-Intensity Interval Training Frequency in Youth Soccer Players in the Last Stage of Rehabilitation. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 23). <https://doi.org/10.3390/ijerph192315573>
- Zagatto, A. M., Beck, W. R., & Gobatto, C. A. (2009). Validity of the running anaerobic sprint test for assessing anaerobic power and predicting short-distance performances. *Journal of Strength and Conditioning Research*, 23(6). <https://doi.org/10.1519/JSC.0b013e3181b3df32>

