

Analysis of the Contribution of HIIT Training to Increasing Vo2max of Football Athletes: A Literature Review



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ABSTRACT: One of the important physical conditionings that football players must have is endurance. The indicator to determine the level of endurance is vo2max. Vo2max is the maximum level of oxygen consumed by athletes at a certain time. The purpose of this study was to determine how HIIT training can increase the vo2max of football athletes. The method used is literature review. Literature searches were conducted through the google scholar database. With a range of years 2019-2023. The keywords used were "HIIT" AND "training" AND "vo2max" AND "football" OR "soccer". The article screening process in writing this literature review uses the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses literature search extension) flow reference. The screening results obtained 511 articles then, eliminated according to the criteria. The criteria used are (1) HIIT research that uses experimental research methodology used for vo2max and football (2) Can be accessed online or for download articles. From the screening results using the criteria, 10 articles from international and national sources were obtained that were ready to be used for research. The information obtained in this literature review shows that HIIT training can increase the vo2max of football players by means of maximum pulse intensity up to 90% with relatively short active intervals which results in increased oxygen demand so that the heart muscle and skeletal muscles work very hard.

KEYWORDS: HIIT, traning, Vo2Max, football, soccer

I. INTRODUCTION

Physical condition is one of the factors that determine achievement in sports, as well as in football. One of the important physical conditionings that football players must have is endurance. Endurance is the main element or foundation in the sport of football. A long match (2x45 minutes) will drain a lot of energy, so it requires excellent endurance. Good endurance will help players to maximise football games during the match (Bahtra et al., 2021). One indicator to see a person's endurance is VO2Max capacity. VO2Max represents the aerobic endurance ability of an athlete. Maximal oxygen uptake (VO2max) is a parameter of aerobic capacity in humans. VO2max represents the maximum level of oxygen that can be consumed at a given time (Stojković et al., 2017). Football requires excellent physical fitness, including cardiorespiratory endurance known as maximum oxygen volume (VO2max) (Budijanto et al., 2020).

For each playing position it was found that in general VO max values reported in the scientific literature varied between 48.4 and 57.5 ml/kg/min for goalkeepers, between 53.2 and 62.8 ml/kg/min for defenders, between 54.7 and 63 ml/kg/min for midfielders, 54.5 and 62.9 ml/kg/min for forwards (Slimani et al., 2019). In football, high VO2max and good skills are needed to compete at the international level. Because, if you only have good skills or skills in managing the ball, but do not have a high VO2max, then the player will not be able to compete at the international and professional levels (Bahtra et al., 2020). Therefore, appropriate training is needed to increase the vo2max of football players. One of the exercises that is often used is HIIT.

HIIT is a cardiovascular exercise method that uses high intensity at a pace or exercise load above the anaerobic threshold in a short period of time and interspersed with interval active recovery periods (Albaitomi et al., 2022). High Intensity Interval Training can be considered a hybrid of aerobic and anaerobic training. It consists of intense exercise of approximately 30/45 seconds, alternating with 15/30 seconds of rest. This continuous variation in intensity allows both anaerobic and aerobic energy systems to be exploited (Rago et al., 2017). Many studies have said that HIIT training can increase Vo2max. However, to find out how HIIT training can increase the Vo2max of football athletes, an in-depth analysis using literature review is treated.

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II. METHOD

Literature searches were conducted through the google scholar database. The keywords used to obtain articles to be reviewed were "HIIT" AND "training" AND "v02max" AND "football" OR "soccer". Searches were limited from 2019 to 2023. The results of searching for articles from the google scholar database are 511 articles. The next step is screening.

The article screening process in writing this literature review uses the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses literature search extension) flow reference. PRISMA is a form of reporting systematic reviews and meta-analyses literature search extensions. The literature search, not only informs the results of the systematic review, but also the underlying process that established the data available for analysis. Additional components of the systematic review process such as screening, data extraction, and qualitative or quantitative synthesis procedures depend on the identification of eligible studies. As such, the literature search should be designed to be robust and reproducible to ensure minimisation of bias (Rethlefsen et al., 2021).

A total of 511 articles were still removed because they included literature reviews or meta-analyses, correlations, surveys. Eight research articles that became the topic of discussion after pruning according to the criteria: (1) HIIT research using experimental research methodologies used for vo2max and football (2) Accessible online or for download articles. There were 25 articles that underwent screening, and 10 international and national publications. Detailed data can be seen in figure 1.

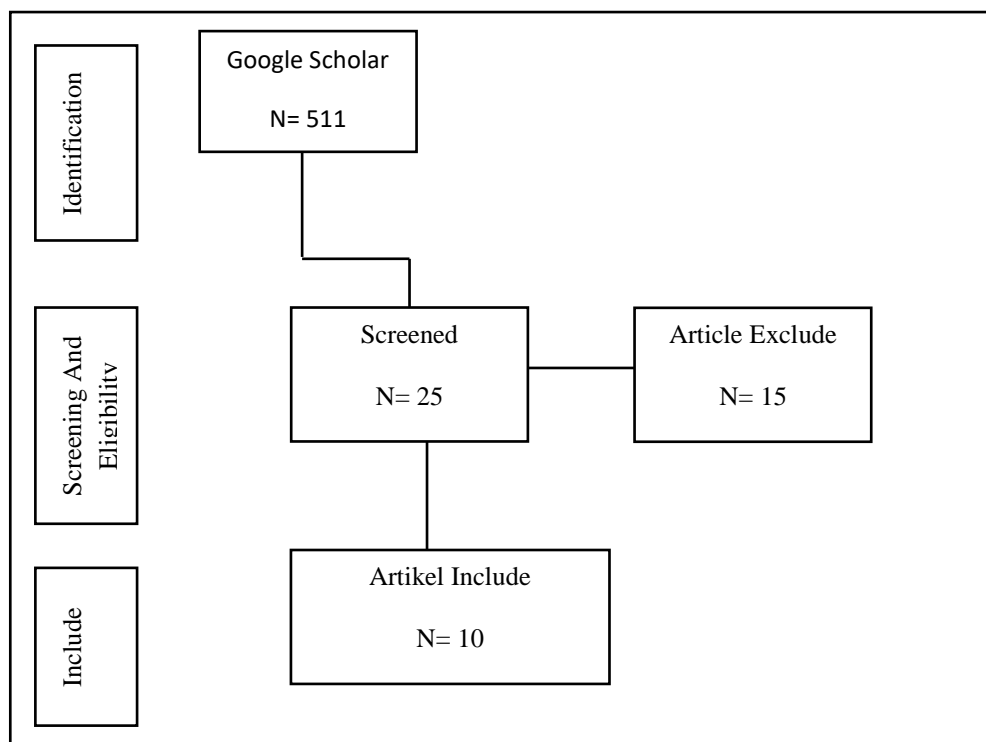


Figure 1. Literature Review Search Method

III. RESULT

This literature review gathers data from Google Scholar. The keywords used for search include "HIIT", "training", "Vo2Max", "football", "soccer". The data are categorized into four groups, which are summarize in Table 1.

Table 1. Result of national and international journal data synthesis

Author and year	Method	Jurnal	Conclusion
Tiziana D'Isanto, Felice Di Domenico, Italo Sannicandro, Francesca D'Elia (2022)	Experiment	Physical Education Theory and Methodology	This study has increased knowledge of the effects of the HIIT protocol on the performance of young football players
Veysel Böge, Suleyman Patlar (2022)	Experiment	Turkish Journal of Sport and Exercise	Three measurements were made for aerobic performance (VO2max), lactate levels and rating of perceived exertion (RPE). And also, two measurements

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			were applied for respiratory parameters. As a result, significantly increased the VO ₂ max levels of the other groups except the SSG group. LICT significantly decreased lactate levels. RPE were found to be significantly higher in the HIIT in all three measures. It provided significant increases in force vital capacity (FVC) and the forced expiratory volume in 1 second (FEV ₁) levels of LICT and HIIT groups
Pieros Thomakos, Konstantinos Spyrou, Christos Katsikas, Nikolaos D. Geladas, Gregory C. Bogdanis (2023)	Experiment	Sports	The current study showed that a short pre-season training period using intense sessions of aerobic training, either with or without the ball, (i.e., BallTrain and HIITTrain) may significantly improve aerobic fitness in elite young soccer players. However, HIITTrain was more effective in improving Yo-Yo IR 1 test performance
S. Perween, M.E. Hussain, I.I. Hejazi, M.Y.S. Siddiqui, A. Saif, A. Parveen (2020)	Experiment	Comparative Exercise Physiology	The present study showed the significant improvement of antioxidant defence response, as well as improvement in aerobic capacity and leg strength, against the two popular modes of soccer training, i.e., RST and HIIT
Michał T. Boraczyński, James J. Laskin, Jan Gajewski, Robert S. Podstawski, Mariusz A. Brodnicki, Tomasz W. Boraczyński (2023)	Experiment	The Journal of Sports Medicine and Physical Fitness	Comparable effects of SIT and SSG protocols were noted, however the aerobic capacity benefits provided by SSG warrant this HIIT protocol as a highly recommended training modality in the professional soccer
Michaelides, Marcos A., Parpa, Koulla M., Zacharia, Anthos I. (2019)	Experiment	Journal of Strength and Conditioning Research	In conclusion, the results of this study, as expected, demonstrated that the proposed 8 weeks of pre-season training program was sufficient to cause significant improvements on the aerobic performance indices of professional soccer player
Nipaldi Hernawan, Andang Rohendi, Gani Kardani (2021)	Experiment	Jurnal Keolahragaan	the HIIT (high intensity interval training) method has a significant effect on the cardiovascular endurance results of soccer players
Moh. Amrullah Albaitomi, Ali Maksum, Irmantara Subagio, Achmad Widodo (2022)	Experiment	Budapest International Research and Critics Institute-Journal (BIRCI-Journal)	There is a significant effect of Shuttle run High Intensity Interval training on changes in basal pulse rate and Vo ₂ max in adolescent athletes aged 16-18. There is a significant effect of High Intensity Interval around Rectangle on changes in basal pulse rate and Vo ₂ max in adolescent athletes aged 16-18
Irfan & Kasman (2021)	Experiment	Musamus Journal of Physical Education and Sport (MJ PES)	So it can be concluded that there is an influence of HIIT on the VO ₂ Max of the soccer players at STKIP Taman Siswa Bima. Based on the results of the calculation of the percentage, it is found that the increase in VO ₂ Max of the soccer players at STKIP Taman Siswa Bima is 7.26%.
Taufiq Rahman, Nurkholis, Rini Ismalasari (2020)	Experiment	Jurnal Ilmiah Mandala Education	Based on the analysis above, it can be concluded that there is an effect of speed, agility and Vo ₂ max for each experimental group after being given treatment seen from the results of the t test.

IV. DISCUSSION

This study examines how HIIT can improve the endurance of football athletes. Seeing the fact that the main energy used by soccer athletes is produced by aerobic metabolism (Garcia-Tabar et al., 2019). Aerobic endurance is seen as a player's ability to

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consume and process more oxygen to continue different intermittent activities over long periods of play effectively and efficiently (Stojković et al., 2017). Therefore, it is stated that the athlete's maximum oxygen absorption (VO₂max) is very important for high-intensity team games to maintain performance from the start to the end of the game (Bhagat & Singh, 2021). VO₂max is the most important factor in modern football because players are required and required maximum aerobic capacity for the long term by showing better performance (Singh & Singh, 2021). On that basis, training is appropriate to improve the aerobic performance of football athletes. One form of exercise that can improve aerobic performance is HIIT (High-Intensity Interval Training). HIIT training is one of the most effective ways to improve cardio-respiratory and metabolic function and physical performance of athletes. HIIT training includes a series of intensive physical exercises (e.g. running to 90% of the maximum possible pulse rate), with intermittent periods of rest. Active intervals can range between 45 and 240 seconds and alternate with periods of light exercise or even periods of rest (Pfungstgraf et al., 2019). HIIT training improves endurance exercise performance in part through cardiac and skeletal muscle re-modelling which increases the whole-body aerobic capacity of energy metabolism (Gibala et al., 2019). Endurance refers to the capacity to perform prolonged exercise, and is usually characterised in terms of the highest speed or power that can be sustained for a specified period of time, or over a specified distance. One of the key determinants of endurance is maximal oxygen uptake (VO₂max), which largely reflects the capacity of the cardiovascular system to deliver oxygenated blood to working skeletal muscles (Lundby et al., 2015). An example of HIIT training is fartlek training which can improve VO₂max and physical condition by walking, jogging and sprinting. Fartlek training can be done for those who want to feel a challenge because those who usually only jog with a slow and continuous rhythm, try another alternative with fartlek training which combines walking-jogging-sprinting (Festiawan, et al., 2021). Apart from running and cycling, one form of activity that can be used for HIIT training is swimming (Sousa et al., 2016). Swimming is a form of exercise activity that can improve overall body fitness, namely endurance, strength, agility, speed and other components of physical condition.

V. CONCLUSIONS

The findings from this literature confirms that HIIT training has a big influence on increasing vo2max of football athletes. The explanation above shows information that HIIT training can increase the vo2max of football players by means of maximum pulse intensity up to 90% with a relatively short active interval which results in increased oxygen demand so that the heart muscle and skeletal muscles work very hard.

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