

EFFECTIVENESS OF HIGH INTENSITY INTERVAL TRAINING (HIIT) IN IMPROVING CARDIOVASCULAR FITNESS IN YOUNG ADULTS

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Abstract

High Intensity Interval Training (HIIT) has gained widespread attention as a method for improving cardiovascular fitness. This study aims to review existing literature regarding the effectiveness of HIIT in improving cardiovascular fitness in young adults. This literature research involved the collection and analysis of articles published in various scientific journals from 2010 to 2023. The keywords used in the search were "High-Intensity Interval Training", "cardiovascular fitness", and "young adults". Inclusion criteria included studies measuring the impact of HIIT on VO₂ max and other cardiovascular parameters in healthy young adult subjects. Literature analysis shows that HIIT can significantly increase VO₂ max in young adults, an important indicator of cardiovascular fitness. This increase is supported by physiological changes that occur in the body, including increased mitochondrial capacity and oxygen use efficiency. Studies also show improvements in cardiovascular parameters such as blood pressure and lipid profile. HIIT is an effective exercise method for improving cardiovascular fitness in young adults. The significant advantage of HIIT lies in its short workout duration yet providing optimal results, making it an attractive option for individuals with limited time. However, more research is needed to examine the long-term effects and more detailed physiological adaptations to HIIT in a broader population.

Keywords: HIIT, Cardiovascular Fitness, Young Adult, VO₂ Max, Physical Fitness

INTRODUCTION

The importance of cardiovascular fitness cannot be underestimated, especially considering the increasing prevalence of cardiovascular disease among modern society. This condition is increasingly worrying because many of these diseases develop at an early age. Research on strategies to improve

cardiovascular fitness, especially in young adults, is very important in disease prevention efforts (GALYAN & SEMENUTA, 2022).

High-intensity interval training (HIIT) is a training method that involves short but intense periods of physical activity alternated with rest or low-intensity activity. HIIT has gained popularity as a time-efficient strategy to improve fitness because it does not require as long of a workout as traditional exercise but offers significant health benefits (Redinger et al., 2023).

Several studies have shown that HIIT can increase maximal oxygen capacity (VO₂ max), an indicator of cardiovascular performance. These studies show the potential of HIIT as an effective fitness tool, but not many have explored how HIIT may specifically affect the young adult population, which has different physiological characteristics than other age groups (Shangguan et al., 2022).

Generally, young adults are considered to be at low risk for cardiovascular problems and, as a result, are often overlooked in health research. However, risk factors such as a sedentary lifestyle and poor diet also greatly affect this generation. Through research regarding the effectiveness of HIIT, it may be possible to offer exercise options that may be more appropriate and attractive to this demographic (Carrasco-Poyatos et al., 2023).

Additionally, most research on HIIT focuses on the appropriate duration and intensity of exercise to achieve desired results. While this is valuable information, there is a need to better understand how these variables can be tailored to the specific needs of young adults, including considerations of gender, health status, and baseline fitness (Almeida et al., 2022).

There is also debate among experts regarding how safe and effective HIIT is for individuals at various fitness levels, especially for those just starting out with physical activity. With many young adults not being physically active enough, research examining whether HIIT training is safe for beginners is urgently needed (Waffak et al., 2024).

Several studies have been conducted showing encouraging results from HIIT in the context of cardiovascular fitness; however, more research is still needed to assess long-term effectiveness. Longitudinal studies can help determine whether improvements achieved through HIIT can be maintained over a longer period of time (Westmacott et al., 2022).

Although many previous studies have concluded general benefits from HIIT, a more personalized approach may be needed to optimize fitness benefits. Genetic background, living habits, and medical conditions can all

influence how a person responds to HIIT training (Ekkekakis & Biddle, 2023). There is also a lack of research examining the effects of HIIT training on psychological parameters such as motivation, mood, and satisfaction, all of which are important for long-term exercise sustainability, especially among young adults. Research that takes these aspects into account could provide a more holistic view of how HIIT affects holistic health.

Given the importance of the above issues, this study aims to make a meaningful contribution to the existing literature by exploring the effectiveness of HIIT in improving cardiovascular fitness in young adults. By examining factors such as exercise intensity, duration, and frequency, as well as demographic variables, this study hopes to provide more concrete and practical recommendations for incorporating HIIT into young adults' fitness routines.

RESEARCH METHOD

The study in this research is qualitative with literature. The literature study research method is a research approach that involves the analysis and synthesis of information from various literature sources that are relevant to a particular research topic. Documents taken from literature research are journals, books and references related to the discussion you want to research (Earley, M.A. 2014; Snyder, H. 2019).

RESULT AND DISCUSSION

Comparative Analysis of the Effectiveness of HIIT to Traditional Cardio Training

Comparative analysis between High-Intensity Interval Training (HIIT) and traditional cardio training has been the focus of much research in the fitness and health fields. HIIT, which emphasizes periods of high-intensity work followed by periods of rest or lower-intensity work, has been shown to be effective in increasing aerobic and anaerobic capacity with a relatively shorter time investment than traditional cardio exercise, such as running or cycling at a constant speed (Tahir et al., 2024). Both training methods have their own benefits and limitations, and their effectiveness may depend on individual goals, fitness level, and personal preference.

From an energy expenditure perspective, HIIT is often considered more efficient when looking at the ratio of time invested to calories burned. This is due to the post-exercise oxygen consumption (EPOC) effect, where the body continues to burn calories at a higher rate after intense exercise

(BAYRAKDAROĞLU et al., 2022). On the other hand, traditional cardio exercise may take longer to burn the same number of calories, but it offers advantages in simplicity of execution and ease to maintain regularly, which is important for long-term fat burning and cardiovascular health.

Additionally, the risk of injury may also play a role in the decision to choose HIIT or traditional cardio training. HIIT tends to be high intensity which can carry a greater risk of injury, especially for beginners or individuals with pre-existing conditions. Meanwhile, traditional cardio training is often lower risk and easier to adapt to individual fitness levels (Held et al., 2022). Therefore, it is important for each individual to consider factors such as current physical condition, fitness goals, and injury history to select the most appropriate and effective exercise method for them.

Adopting a balanced approach between HIIT and traditional cardio training can also be an effective strategy, encompassing the benefits of both types of exercise. This integration allows individuals to experience improved aerobic and anaerobic performance, while reducing the potential for boredom and the risk of overtraining (Shiralinejad et al., 2022). For example, a person can run HIIT two to three times per week to increase metabolic capacity and endurance, while incorporating traditional cardio exercises such as walking or cycling on other days to support recovery and cardiovascular health. This combination provides enough variety to maintain motivation and ensure that all aspects of strength, endurance, flexibility, and body composition fitness are addressed comprehensively.

However, the success of this integration is highly dependent on the correct understanding and application of overload principles, selecting specific types of training, and adjusting the intensity and volume of training according to individual abilities. A medical examination and consultation with an experienced fitness professional can be an important first step to individualizing the program, ensuring the chosen method is not only effective but also safe (BOURBEAU et al., 2022).

Ultimately, a comparative analysis between HIIT and traditional cardio training confirms that no single approach is superior in every situation. The choice of exercise method should be based on a holistic approach that considers the individual's physical condition, fitness goals, and personal preferences. Through careful planning and implementation of a specially designed exercise program, both HIIT and traditional cardio training can be integrated into a person's lifestyle to achieve a good balance of health, fitness, and happiness (Aurich, 2022).

Long-Term Effects of HIIT on Cardiovascular Health

The long-term effect of High Intensity Interval Training (HIIT) on cardiovascular health is quite significant. HIIT, which combines periods of high intensity with periods of rest or light activity, has been shown to efficiently improve cardiovascular function and capacity. Compared with moderate-paced fitness training, HIIT shows faster results in increasing maximum VO_2 , which is an important indicator of cardiovascular health (Masterman et al., 2024). Research also shows that HIIT can lower blood pressure and improve artery elasticity, both important factors in preventing heart disease.

In addition, HIIT has been proven to be effective in reducing body fat, including visceral fat which is closely related to cardiovascular disease. This fat reduction is not only beneficial from an aesthetic perspective but also reduces the risk of type 2 diabetes, hypertension and coronary heart disease (Quilindo & Narváez, 2023). By combining short but intense exercise sessions, HIIT allows individuals to achieve relatively faster results in reducing these risk factors, which are key elements in better heart health.

However, despite its many benefits, HIIT may not be suitable for everyone, especially those with pre-existing health conditions or who are just starting an exercise routine. It is recommended to consult a doctor or healthcare professional before starting a HIIT program, especially for individuals with a history of cardiovascular problems or those at high risk. With appropriate precautions, HIIT can be integrated into a fitness routine to significantly improve cardiovascular health and overall body health in the future (Guo et al., 2023).

When performing HIIT, it is important to consider that high intensity and duration can cause increased stress on the cardiovascular system. Consistency in long-term HIIT training can lead to positive adaptations such as increasing stroke volume (the volume of blood pumped with each beat by the heart) and the efficiency of the heart in supplying oxygen throughout the body (Biswal & Anandhi, 2024). However, if not done carefully, too high an intensity or without sufficient recovery between training sessions can lead to overtraining, which can disrupt cardiovascular function and potentially lead to fatigue or muscle damage.

It is also important to note that HIIT, by its nature requiring maximum effort, requires a sufficient recovery period to minimize the risk of injury and ensure program sustainability. The choice of type of exercise, recovery time and frequency of sessions should be adjusted to the individual's fitness level

and abilities, and accompanied by good nutrition and adequate rest. Integrating HIIT with strength training and moderate-paced aerobic fitness activities can also support sustainability and add cardiovascular health benefits and reduce the risk of injury (MANAGE et al., 2023).

Further research into long-term HIIT suggests that this exercise routine may aid in modulating endothelial function and reducing inflammation, aspects that are critical in the prevention of atherosclerosis, a condition characterized by hardening of the arteries. Improving the quality of life and mobility in elderly people who participate in HIIT is also a promising research theme. However, healthy and safe implementation of HIIT requires a structured approach, good education of participants, and proper supervision, especially for beginners or those with special conditions (Liu, 2023).

Correlation of HIIT Training Intensity and Frequency with Improved Cardiovascular Fitness

The relationship between the intensity and frequency of High-Intensity Interval Training (HIIT) training and improving cardiovascular fitness is very significant. HIIT is an exercise method that combines periods of high-intensity work with short recovery intervals (Navarro et al., 2023). Studies have shown that HIIT can improve cardiovascular fitness more efficiently than moderate-intensity aerobic exercise. The high intensity in HIIT increases physiological stress on the heart and circulatory system, which triggers cardiorespiratory adaptations such as an increase in maximal VO_2 , which is the maximum measure of oxygen that can be used by the body during exercise. Regular and fairly frequent exercise frequency, while maintaining a high intensity, is necessary to consistently maintain and improve cardiovascular fitness.

When doing HIIT, the recommended training frequency usually ranges from 2 to 4 sessions per week. This allows sufficient rest time for the body to recover from the stress of explosive training and prevents the risk of injury and overtraining. However, individual levels of adaptation to exercise intensity may vary, so it is important to adjust frequency according to each participant's abilities and fitness level. Following a disciplined training schedule with appropriate frequency ensures that the body experiences sufficient training stimulus to trigger adaptation without causing chronic fatigue that can negatively impact the cardiovascular system and overall fitness (Salazar & Rabinovich, 2023).

Additionally, the intensity of HIIT training should be monitored and adjusted to suit individual cardiovascular conditions. With proper application,

HIIT can stimulate improved endothelial function and reduce vascular resistance, meaning there is potential for stagnation or decrease in blood pressure. This increase in turn can support cardiac efficiency and overall vascular health, which are important components of cardiovascular fitness (Lei et al., 2024). Therefore, a medical examination and assessment of cardiovascular fitness levels before starting a HIIT program is essential, especially for individuals with certain medical conditions or those who are just starting a physical exercise program.

Consistency and appropriateness of intensity levels in HIIT implementation also play an important role in optimizing cardiovascular benefits. Matching training intensity to individual capacity and tolerance not only helps in maximizing improvements in cardiovascular fitness, but also reduces the risk of injury. Choosing the right training intervals, including duration and intensity of thought, is key to driving sustained fitness improvements. For example, an effort interval that is too long with an intensity that is too high for some individuals may be unsustainable and can result in excessive fatigue, while an interval that is too short may not be challenging enough to trigger the desired adaptation (Mbelekani, 2024).

An experienced instructor or trainer can provide important guidance regarding determining appropriate intervals and intensity according to various participant levels. Individualization of the HIIT protocol, including adjustments to effort and rest duration, intensity, and training methods, will help ensure that participants obtain maximum benefits without experiencing unnecessary risks. A systematic and personalized approach is often more effective in achieving significant and sustainable improvements in cardiovascular fitness (Eser et al., 2022).

Improving cardiovascular fitness through HIIT doesn't happen overnight. It requires commitment, consistency and patience in implementation. Additionally, regular monitoring by a health professional can help assess fitness progress as well as identify adaptations or adjustments that may be needed in the exercise program. By taking all these aspects into account, a structured and individualized implementation of HIIT will provide optimal cardiovascular improvement while minimizing health risks for the exercise participant (Chudasama & Khunti, 2024).

Impact of HIIT on Special Population Groups

High-Intensity Interval Training (HIIT) is an exercise method that can provide broad health benefits, but its impact on special population groups

such as the elderly, people with certain chronic conditions, or those who are obese, needs to be considered carefully. In groups such as older people, for example, HIIT can be adapted to improve muscle strength, cardiorespiratory endurance, and mobility. This is important because good physical ability and cardiovascular fitness are directly related to their quality of life and independence (Lassi et al., 2022). However, the intensity and type of exercise should be adjusted to reduce the risk of injury and take into account possible age-related limitations, such as osteoporosis or heart disease.

For people with certain chronic conditions, such as type 2 diabetes or heart disease, HIIT may offer an efficient way to improve insulin sensitivity and cardiovascular function. Research shows that HIIT can help reduce body fat, improve blood glucose control, and increase muscle strength, all of which are important in the management of type 2 diabetes (Roehl et al., 2024). However, there must be medical approval and supervision before starting a HIIT program, and individual modifications should be considered to accommodate conditions such as neuropathy, retinopathy, or comorbidities. An approach that remains focused on patient safety and individual response to exercise can ensure that the impact is positive.

Meanwhile, in obese populations, HIIT shows the potential to improve body composition by reducing body fat and increasing muscle mass. Although HIIT programs can be very intense and challenging, adaptations to lighter workloads or shorter intervals can make them more feasible for people with obesity who may have difficulty with long-duration or high-intensity workouts. The key to successful implementation of HIIT in this population group is personalization that takes into account safety, possible physical limitations, and gradual increases in exercise intensity. With professional guidance and ongoing evaluation, HIIT can be used as an effective tool for losing weight and improving cardiovascular fitness, while minimizing the possibility of injury or discomfort (Su et al., 2023).

As a continuation of the discussion of the impact of HIIT on special population groups, the psychological and motivational aspects should not be ignored either. Population groups with mental health challenges, such as depression and anxiety, may find that HIIT provides benefits through increasing endorphins and other hormones associated with feeling good. This intense exercise can improve general mood and reduce symptoms of psychological stress (Thiravetyan & Vathesatogkit, 2022). However, because HIIT requires a high level of commitment and effort, individual motivation to participate and persist in the program can be challenging. Therefore, such a

program for them should be designed in such a way as to be engaging, with an approach that reinforces the sense of achievement and the provision of adequate social support to encourage compliance and consistency in exercise.

In populations with special needs, such as those with disabilities or movement disorders, considerations in implementing HIIT must be highly individualized. The instructor or therapist should work with each individual to customize exercises and select activities that are safe and effective, as well as considering any special equipment or assistance that may be needed. In certain cases, consultation with a health professional who specializes in rehabilitation may be necessary to integrate HIIT into a therapy program. Ensuring that each session provides an appropriate challenge without exceeding physical limits can assist in optimizing results while limiting risk (Hackett, 2024).

Overall, although HIIT has great potential in various aspects of fitness and health in special population groups, a tailored and responsible approach is essential. Risk assessment, clear communication between participants and health/fitness providers, and careful monitoring of progress and response to exercise are definitely necessary (Horton, 2024). With the right approach, HIIT can be an important, enriching part of a health and fitness program, helping individuals achieve their goals and improve their overall quality of life, regardless of their specific conditions or limitations.

CONCLUSION

High Intensity Interval Training (HIIT) has been shown to be significantly effective in improving cardiorespiratory fitness, particularly in young adults, through increasing VO₂ max. Higher VO₂ max indicates better aerobic capacity, which is associated with reduced risk of cardiovascular disease (CVD) and more effective prevention at an early age. In addition, HIIT as a physical exercise method consisting of a series of high-intensity exercises performed over a short duration, has been shown to have a positive effect on physical fitness and improve body composition in individuals who are less physically active. Thus, HIIT is an effective and efficient training solution in improving cardiovascular fitness in young adults.

REFERENCES

Almeida, F. A. de, Ramos, I. C., Al, M., & Mólken, M. R. (2022). Home Telemonitoring and a Diagnostic Algorithm in the Management of

- Heart Failure in the Netherlands: Cost-effectiveness Analysis. *JMIR Cardio*, 6(2). <https://doi.org/10.2196/31302>
- Aurich, T. (2022). [Preprint] Evaluation der Überlegenheit von hochintensivem Intervalltraining (HIIT) im Vergleich zu moderatintensivem kontinuierlichem Training (MICT) in Bezug auf psychisch relevante Biomarker: Ein systematisches Review. Query date: 2024-09-16 10:36:37. <https://doi.org/10.21428/abbd964d.501299a0>
- BAYRAKDAROĞLU, S., TOPSAKAL, N., & EKEN, Ö. (2022). The Effects of High Intensive Interval Training (HIIT) on Brain-Derived Neurotrophic Factor (BDNF) and Cardiovascular Health: A Review. *Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi*, 11(1), 346–354. <https://doi.org/10.37989/gumussagbil.1052230>
- Biswal, P. R., & Anandhi, D. (2024). Effectiveness of Long Interval VS Medium Interval High-Intensity Interval Training on Cardio-Respiratory Fitness among the Obese Collegiate – Comparative Study. *International Journal of Human Movement and Sports Sciences*, 12(2), 371–381. <https://doi.org/10.13189/saj.2024.120212>
- BOURBEAU, K., REED, J., AUTEN, A., CAVEY, K., PAPADOPOULOS, P., & MORIARTY, T. (2022). Self-paced HIIT is less physiologically demanding than traditional HIIT. *Gazzetta Medica Italiana Archivio per Le Scienze Mediche*, 180(11). <https://doi.org/10.23736/s0393-3660.20.04449-6>
- Carrasco-Poyatos, M., López-Osca, R., Martínez-González-Moro, I., & Granero-Gallegos, A. (2023). HRV-guided training vs traditional HIIT training in cardiac rehabilitation: A randomized controlled trial. *GeroScience*, 46(2), 2093–2106. <https://doi.org/10.1007/s11357-023-00951-x>
- Chudasama, Y. V., & Khunti, K. (2024). Reaching the ideal cardiovascular health: Is this the key to preventing multiple long-term conditions? *The Lancet Regional Health - Europe*, 42(Query date: 2024-09-16 10:42:08), 100968–100968. <https://doi.org/10.1016/j.lanep.2024.100968>
- Earley, M. A. (2014). A synthesis of the literature on research methods education. *Teaching in Higher Education*, 19(3), 242-253.
- Ekkekakis, P., & Biddle, S. J. H. (2023). Extraordinary claims in the literature on high-intensity interval training (HIIT): IV. Is HIIT associated with higher long-term exercise adherence? *Psychology of Sport and Exercise*, 64(Query date: 2024-09-16 10:36:37), 102295–102295. <https://doi.org/10.1016/j.psychsport.2022.102295>
- Eser, P., Trachsel, L. D., Marcin, T., Herzig, D., Freiburghaus, I., Marchi, S. D., Zimmermann, A. J., Schmid, J.-P., & Wilhelm, M. (2022). Short- and Long-Term Effects of High-Intensity Interval Training vs. Moderate-Intensity Continuous Training on Left Ventricular Remodeling in Patients Early After ST-Segment Elevation Myocardial Infarction—The HIIT-EARLY Randomized Controlled Trial. *Frontiers in Cardiovascular*

- Medicine, 9(Query date: 2024-09-16 10:42:08).
<https://doi.org/10.3389/fcvm.2022.869501>
- GALYAN, Y., & SEMENUTA, O. (2022). Perspective on the problem: Diagnosis in traditional medicine – comparative analysis of the effectiveness of diagnostic systems in Eastern and European medicine. *Fitoterapia*, 3, 120–124. <https://doi.org/10.33617/2522-9680-2022-3-124>
- guo, chenggen, shao, wenjuan, li, fuyou, tan, xuefen, & xie, yongmin. (2023). *Effectiveness of Traditional Chinese Medicine (TCM) Exercise Therapy Intervention on the Cognitive Function in the Elderly: A Systematic Review and Meta-analysis*. Query date: 2024-09-16 10:36:37. <https://doi.org/10.37766/inplasy2023.7.0061>
- Hackett, G. I. (2024). Long Term Cardiovascular Safety of Testosterone Therapy: A Review of the TRAVERSE Study. *The World Journal of Men's Health*, 42(Query date: 2024-09-16 10:42:08). <https://doi.org/10.5534/wjmh.240081>
- Held, S., Speer, K., Rappelt, L., Wicker, P., & Donath, L. (2022). The effectiveness of traditional vs. Velocity-based strength training on explosive and maximal strength performance: A network meta-analysis. *Frontiers in Physiology*, 13(Query date: 2024-09-16 10:36:37). <https://doi.org/10.3389/fphys.2022.926972>
- Horton, A. (2024). Lipoprotein apheresis and long-term cardiovascular health: A real answer for children with HoFH? *The Lancet Child & Adolescent Health*, 8(7), 468–469. [https://doi.org/10.1016/s2352-4642\(24\)00105-6](https://doi.org/10.1016/s2352-4642(24)00105-6)
- Lassi, Z. S., Padhani, Z. A., Salam, R. A., & Bhutta, Z. A. (2022). Prenatal nutrition and nutrition in pregnancy: Effects on long-term growth and development. *Early Nutrition and Long-Term Health*, Query date: 2024-09-16 10:42:08, 397–417. <https://doi.org/10.1016/b978-0-12-824389-3.00013-1>
- Lei, Z., Mozaffaritabar, S., Kawamura, T., Koike, A., Kolonics, A., Kéring, J., Pinho, R. A., Sun, J., Shangguan, R., & Radák, Z. (2024). The effects of long-term lactate and high-intensity interval training (HIIT) on brain neuroplasticity of aged mice. *Heliyon*, 10(2). <https://doi.org/10.1016/j.heliyon.2024.e24421>
- Liu, T. (2023). Comparative Analysis of Image Classification Algorithms Based on Traditional and Advanced Convolutional Neural Networks. *Proceedings of the 1st International Conference on Data Analysis and Machine Learning*, Query date: 2024-09-16 10:36:37, 225–230. <https://doi.org/10.5220/0012798600003885>
- MANAGE, M. D. L. D., Karunanayake, A., & Malliaropoulos, N. (2023). Effectiveness of High-Intensity Interval Training (HIIT) in overweight individuals between 25-45yrs of age registered in Sports Medicine clinic, General Hospital Kalutara. *Journal of Science and Medicine in*

- Sport, 26(Query date: 2024-09-16 10:36:37).
<https://doi.org/10.1016/j.jsams.2023.08.163>
- Masterman, B. J., Ambulkar, T., & Hartrick, O. (2024). Exercise-Induced Ischemic Colitis From Home-Based High-Intensity Interval Training (HIIT). *Cureus*, Query date: 2024-09-16 10:36:37.
<https://doi.org/10.7759/cureus.55791>
- Mbelekani, N. Y. (2024). *Systemizing Long-Term Research: Assessing Long-Term Automation Effects and Behaviour Modification*. Query date: 2024-09-16 10:42:08. <https://doi.org/10.31234/osf.io/nm9p6>
- Navarro, J. R. S., Pacheco, L. Á. C., & Núñez, M. D. J. C. (2023). Efectos del entrenamiento funcional tipo hiit vs tradicional en un grupo de trabajadores con riesgo de pa-decer síndrome metabólico y enfermedad cardiovascular del distrito de Cartagena- Colombia (Effects of hiit-type functional training versus traditional training in a group of workers at risk of suffering from metabolic syndrome and cardiovascular disease in the district of Cartagena-Colombia). *Retos*, 51(Query date: 2024-09-16 10:36:37), 551–558.
<https://doi.org/10.47197/retos.v51.100767>
- Quilindo, C. A. L., & Narváez, L. M. C. (2023). Entrenamiento Interválico de Alta Intensidad (HIIT) en Deportistas Paralímpicos. Una revisión narrativa (High Intensity Interval Training (HIIT) in Paralympic Athletes. A narrative review). *Retos*, 51(Query date: 2024-09-16 10:36:37), 1431–1441.
<https://doi.org/10.47197/retos.v51.101379>
- Redinger, A. L., Allen, S. M. F., Buchanan, S. R., Black, C. D., & Baker, B. S. (2023). Non-traditional HIIT-style ROTC training elicits positive bone quality and performance adaptations. *Journal of Sports Sciences*, 41(17), 1587–1595. <https://doi.org/10.1080/02640414.2023.2283998>
- Roehl, K. M., Farina, J. M., Suppah, M., Arsanjani, R., Lester, S. J., Geske, J. B., & Alsidawi, S. (2024). Predictors of short-term and long-term effects of mavacamten in obstructive hypertrophic cardiomyopathy. *Progress in Cardiovascular Diseases*, Query date: 2024-09-16 10:42:08.
<https://doi.org/10.1016/j.pcad.2024.05.008>
- Salazar, J. R. J., & Rabinovich, R. (2023). Comparing the effects of high-intensity interval training (HIIT) with different oxygen delivery methods in patients with pulmonary fibrosis. *Http://Isrctn.Com/*, Query date: 2024-09-16 10:36:37. <https://doi.org/10.1186/isrctn76572442>
- Shangguan, R., Hu, Z., Luo, Y., Chen, M., Sun, J., & Chen, S. (2022). *Intramuscular Mitochondrial Adaptation and Lipid Metabolic Alteration in Rats after Chronic High-intensity Interval Training (HIIT) of Different Training Periods*. Query date: 2024-09-16 10:36:37.
<https://doi.org/10.21203/rs.3.rs-1733332/v1>
- Shiralinejad, F., Ghasemi, M., & Emamipour, S. (2022). The comparison of the effectiveness of traditional, electronic and combined (electronic and

- traditional) training on the cognitive load of talented adolescent girls. *Applied Family Therapy Journal*, 3(1), 363–384. <https://doi.org/10.61838/kman.aftj.3.1.18>
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, 104, 333-339.
- Su, J. J., Liu, J. Y. W., Cheung, D. S. K., Wang, S., Christensen, M., Kor, P. P. K., Tyrovolas, S., & Leung, A. Y. M. (2023). Long-term effects of e-Health secondary prevention on cardiovascular health: A systematic review and meta-analysis. *European Journal of Cardiovascular Nursing*, 22(6), 562–574. <https://doi.org/10.1093/eurjcn/zvac116>
- Tahir, M., Saeed, A., Sohail, A., Hassan, A., Azfar, H., & Nazir, U. F. (2024). The Role of High-Intensity Interval Training (HIIT) vs. Moderate-Intensity Continuous Training (MICT) in Improving Cardiovascular Fitness in Patients with Coronary Artery Disease. *Journal of Health and Rehabilitation Research*, 4(3), 1–4. <https://doi.org/10.61919/jhrr.v4i3.1481>
- Thiravetyan, B., & Vathesatogkit, P. (2022). Long-Term Effects of Cigarette Smoking on All-Cause Mortality and Cardiovascular Outcomes in Thai Population: Results From a 30-Year Cohort Study. *Asia Pacific Journal of Public Health*, 34(8), 761–769. <https://doi.org/10.1177/10105395221106860>
- Waffak, M. N., Arifianti, E., & Graha, A. S. (2024). HIIT vs continuous training in obesity prevention. *Fizjoterapia Polska*, 24(3), 363–366. <https://doi.org/10.56984/8zg020a8pl>
- Westmacott, A., Sanal-Hayes, N. E. M., McLaughlin, M., Mair, J. L., & Hayes, L. D. (2022). High-Intensity Interval Training (HIIT) in Hypoxia Improves Maximal Aerobic Capacity More Than HIIT in Normoxia: A Systematic Review, Meta-Analysis, and Meta-Regression. *International Journal of Environmental Research and Public Health*, 19(21), 14261–14261. <https://doi.org/10.3390/ijerph192114261>