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A LITERATURE REVIEW ON THE EFFECT OF HIGH-INTENSIVE INTERVAL EXERCISE TRAINING ON CARDIORESPIRATORY FITNESS

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Abstract

Overeating, inadequate exercise, a sedentary lifestyle, and decreased fat oxidation all contribute to obesity, a disease that increases the risk of illness and death early in life. The goal of this literature review was to determine how cardiorespiratory fitness was impacted by high-intensity interval training from various articles. Online search engines such as a PubMed and Google Scholar were searched and 21 articles from 2009 and 2022 were chosen. The data were tallied in accordance with the literature review mixed research study, the number of participants, the conditions, the mode of treatment, and the conclusion. High-intensity interval training improves six out of ten general physical skills in athletes, including stamina, power, and cardiovascular/respiratory endurance, according to this evaluation of the literature. The remaining four physical abilities are speed, coordination, agility, and precision are the remaining four physical aptitudes that have not yet been identified.

Keywords: (HIIT) High-Intensity Interval Training, (MICT) Medium intensity circuit training Aerobic capacity, VO₂ max.

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INTRODUCTION:

Every healthy adult should engage in at least 150 minutes of moderate exercise or physical activity or at least 75 minutes of high-intensity exercise or physical activity each week, according to the World Health Organisation. However, 1.4 billion individuals, or more than 25% of the population, do not meet these suggested levels of physical exercise.

There have been more obese people throughout the world during the past 40 years, and current trends point to an increase in this number until 2030. Obesity is a condition that causes early morbidity and mortality and is explained by an altered energy balance brought on by overeating, insufficient exercise, a sedentary lifestyle, and impaired fat oxidation. In addition to helping with weight control, endurance exercise also enhances respiratory and cardiovascular health.

HIIT (HIGH-INTENSITY INTERVAL TRAINING):

A well-known type of exercise for enhancing cardiovascular endurance, respiratory fitness, aerobic capacity and health, and fat reduction is high-intensity interval training. The core of HIIT is repeating workouts or training sessions at maximal exertion while alternately taking rest intervals. High-intensity interval training's key benefits are its brief duration and plenty of workout variants, which keep sessions from growing monotonous.

When compared to moderate-intensity continuous training for weight loss, HIIT treatment might be a more enjoyable and appealing kind of exercise. Through this training regimen, power and anaerobic capacity are increased, simulating the effects of low-intensity endurance exercise.

In both healthy and ill populations, HIIT can be used as an alternate training method to traditional endurance training to bring

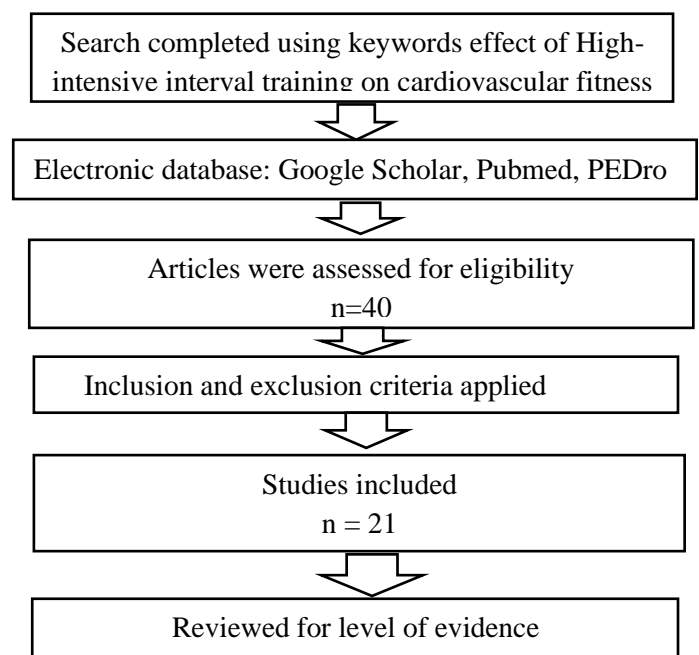
about positive physiological and biochemical changes. According to recent research, HIIT may be a time-effective approach to promote health in the inactive overweight/obese population.

Increased skeletal muscle, mitochondrial biogenesis, and mitochondrial function—which manifests itself as higher oxidative phosphorylation capacity—could all be contributing factors to this improvement.

Exercise that involves brief bursts of high-intensity activity, such as intermittent exercise that increases heart rate and oxygen consumption to 90% of maximum levels and is followed by recovery periods are referred to as HIIT.

MATERIALS AND METHODS:

Literature Search Methodology Online search engines that are used to collect journals are Google Scholar and PEDro. The authors identified articles based on the keywords. The articles were collected in full text. A total of 40 articles were identified, out of which 21 articles were



NO	AUTHORS	TITLE	YEAR	STUDY DESIGN	CONCLUSION
1.	Travis W Beck, et al	The effects of four weeks of creatine supplementation and high-intensity interval training on cardiorespiratory fitness: a randomized controlled trial	2022	Randomized Control Trial	HIIT is an effective and time-efficient way to improve maximal endurance performance. The addition of Cr improved VT, but did not increase TWD.
2.	Jaroslav Domaradzki, et al	The Relative Importance of Age at Peak Height Velocity and Fat Mass Index in High-Intensity Interval Training Effect on Cardiorespiratory Fitness in Adolescents: A Randomized Controlled Trial	2022	Randomized Control Trial	The effects of HIIT and APHV were analyzed according to the sexes, the significant influence of the APHV on Δ FI was observed (very close to significant, in fact) in girls.
3.	Kangle Wang, et al	Effects and dose-response relationship of high-intensity interval training on cardiorespiratory fitness in overweight and obese adults: a systematic review and meta-analysis	2021	Systematic Review	Dose-response relationship analysis provided some preliminary data regarding the training period, training intensity, and session duration. However, it is still not possible to provide accurate recommendations currently. Further studies are still needed to identify the most appropriate training variables to prescribe effective HIIT programs for improving CRF in overweight and obese adults.
4.	Hadi Nobari, et al	Effects of 8 Weeks of High-Intensity Interval Training and Spirulina Supplementation on Immunoglobulin Levels, Cardio-Respiratory Fitness, and Body Composition of Overweight and Obese Women	2021	Experimental Study	The data in the present study demonstrated the effectiveness of spirulina supplementation and HIIT concurrently in making significant changes in IgA concentrations and FFM. Taking spirulina with HIIT for overweight and obese women may be helpful not only for losing FFM but also for boosting IgA, which plays an important role in the immune system.

Inclusion criteria:

1. Articles discussing the effect of aerobic exercise were included.
2. Articles published only in the English language were included.

3. Articles from 2009-2022 have been taken.

NO	AUTHORS	TITLE	YEAR	STUDY DESIGN	CONCLUSION
5.	Ying Wang Hao, et al	Impact of high-intensity interval training on cardiorespiratory fitness, body composition, physical fitness, and metabolic parameters in older adults: A meta-analysis of randomized controlled trials	2021	Randomized Control Trial	This systematic review and meta-analysis showed that HIIT induces favorable adaptations in cardiorespiratory fitness, physical fitness, muscle power, cardiac contractile function, mitochondrial citrate synthase activity, and reduced blood triglyceride and glucose levels in older individuals, which may help to maintain aerobic fitness and slow
6.	Marie Carmen Valenza, et al	High-intensity interval training effects in cardiorespiratory fitness of lung cancer survivors: a systematic review and meta-analysis	2021	Systematic Review	The findings indicated a beneficial effect of HIIT for improving cardiorespiratory fitness in lung cancer patients in early stages around oncological treatment moment. Nevertheless, this review has several limitations, the total number of studies was low, and the stage and subtype of lung cancer patients were heterogeneous that means that the conclusions of this review should be taken with caution.
7.	N. Sultana, et al	The effect of low-volume high-intensity interval training on cardiovascular health outcomes in type 2 diabetes: A randomised controlled trial	2020	Randomized Control Trial	Twelve minutes of low-volume HIIT per week leads to improvements in central arterial stiffness and cardiovascular health in inactive individuals with obesity and T2D
8.	Rhona Martin Smith, et al	High Intensity Interval Training (HIIT) Improves Cardiorespiratory Fitness (CRF) in Healthy, Overweight and Obese Adolescents: A Systematic Review and Meta-Analysis of Controlled Studies	2020	Systematic Review	HIIT is an effective method to improve CRF in adolescents, irrespective of body composition. Notably, meta regression analysis identified that prolonged high volume HIIT programs are similarly effective to short term low volume HIIT programs. .

NO	AUTHORS	TITLE	YEAR	STUDY DESIGN	CONCLUSION
9.	John Ab, et al	Effect of high-intensity interval training on cardiorespiratory fitness, physical activity and body composition in people with schizophrenia: a randomized controlled trial	2020	Randomized Control Trial	Effect of high-intensity interval training on cardiorespiratory fitness, physical activity and body composition in people with schizophrenia: a randomized controlled trial
10.	Jesús Alarcón-Gómez, et al	Effects of a HIIT Protocol on Cardiovascular Risk Factors in a Type 1 Diabetes Mellitus Population	2020	Experimental Study	6-week HIIT protocol, was sufficient to improve VO ₂ max, HRV, body composition and fasting glucose in a previously sedentary T1DM population. HIIT seems an interesting approach for reducing cardiovascular risk in T1DM individuals.
11.	David C. Andrade, et al	Acute effects of high-intensity interval training session and endurance exercise on pulmonary function and cardiorespiratory coupling	2020	Experimental Study	The present study shows that EE elicited an increase of CRC in healthy individuals, independent to parasympathetic modulation of the heart; however, an acute bout of HIIT or EE did not modify pulmonary function, as determined by clinical spirometry.
12.	Matthew P. Wallen, et al	High-intensity interval training improves cardiorespiratory fitness in cancer patients and survivors: A meta-analysis	2020	Meta Analysis	Quantitative assessment of HIIT studies indicates good compliance, with a significant effect on peak $\dot{V}O_2$ and peak oxygen pulse compared with UC in cancer patients and survivors. HIIT demonstrates a comparable effect with MICT to improve peak $\dot{V}O_2$.
13.	Nathan A. Johnson, et al	The Effect of Low-Volume High-Intensity Interval Training on Body Composition and Cardiorespiratory Fitness: A Systematic Review and Meta-Analysis	2019	Systematic Review	These data suggest that low-volume HIIT is inefficient for the modulation of total body fat mass or total body fat percentage in comparison with a non-exercise control and MICT.

NO	AUTHORS	TITLE	YEAR	STUDY DESIGN	CONCLUSION
14.	<u>Christopher Hurst, et al</u>	The effect of 12 weeks of combined upper- and lower-body high-intensity interval training on muscular and cardiorespiratory fitness in older adults	2019	Experimental Study	Combined upper- and lower-body HIT has small clinically relevant beneficial effects on muscular and cardiorespiratory fitness in older adults.
15.	Jennifer Crozier, et al	High-Intensity Interval Training After Stroke: An Opportunity to Promote Functional Recovery, Cardiovascular Health, and Neuroplasticity	2018	Experimental Study	Larger randomized controlled trials are necessary to establish (a) effectiveness, safety, and optimal training parameters within more heterogeneous poststroke populations; (b) potential mechanisms of HIIT-associated improvements; and (c) adherence and psychosocial outcomes.
16.	<u>Jing-xin Liu, et al</u>	Effectiveness of high-intensity interval training on glycemic control and cardiorespiratory fitness in patients with type 2 diabetes: a systematic review and meta-analysis	2018	Systematic Review	HIIT may induce more positive effects in cardiopulmonary fitness than MICT in T2D patients.
17.	<u>Rebecca Mary, et al</u>	The effect of home-based low-volume, high-intensity interval training on cardiorespiratory fitness, body composition and cardiometabolic health in women of normal body mass and those with overweight or obesity: protocol for a randomized controlled trial	2018	Randomized Control Trial	Supervised laboratory-based HIIT interventions are effective in improving cardiometabolic health. More pragmatic exercise protocols may however show to be successful for mitigating barriers to the engagement in physical activity and exercise resulting in positive benefits to health. Investigation into home-based HIIT regimens are important in women, where globally the rising trend of overweight and obesity overshadows that of men. The results from this study may therefore inform future research on effective exercise prescription for women's health.

NO	AUTHORS	TITLE	YEAR	STUDY DESIGN	CONCLUSION
18.	Ruth Stoklund Thomsen, et al	Effect of high-intensity interval training on cardiovascular disease risk factors and body composition in psoriatic arthritis: a randomised controlled trial	2018	Randomized Control Trial	Conclusion in patients with PsA, 3 months with HIIT was associated with a substantial increase in VO _{2max} and a reduction in truncal fat percentage compared with controls. The beneficial effect on VO _{2max} was also sustained through 9 months.
19.	TomásRodolfo Reyes Amigo, et al	Effectiveness of High-Intensity Interval Training on cardiorespiratory fitness and body composition in preadolescents: A systematic review	2018	Systematic Review	HIIT in adolescents can significantly improve cardiorespiratory fitness, BMI, and decrease body fat percentage, in comparison to moderate intensity training and non-training control group conditions
20.	Schaun, Gustavo, et al	Whole-Body High-Intensity Interval Training Induce Similar Cardiorespiratory Adaptations Compared With Traditional High-Intensity Interval Training and Moderate-Intensity Continuous Training in Healthy Men	2018	Experimental Study	Our results demonstrate that HIIT-WB can be as effective as traditional HIIT while also being time-efficient compared with MICT to improve health-related outcomes after 16 weeks of training. However, HIIT-T and MICT seem preferable to enhance performance-related outcomes compared with HIIT-MICT.
21.	Zhaowei Kong, et al	High intensity interval training in normobaric hypoxia improves cardiorespiratory fitness in overweight Chinese young women	2017	Experimental Study	5-wk of HIIT improved cardiorespiratory fitness and blood lipids in overweight Chinese young females, while the additive effect of the HIIT under normobaric hypoxia solely enhanced cardiorespiratory fitness, but not body composition or serum lipid profile.

DISCUSSION:

Short bursts of high-intensity exercise, such as intermittent activity that achieves 90% of maximum heart rate (HR) and maximal oxygen uptake (VO_{2max}), are separated by times of recovery or rest. This kind of exercise training is known as HIIT.

The results of all the studies showed that high-intensity interval training is an effective way to help inactive young women lose body fat and improve their anthropometric indices. Additionally, it may be observed that the degree of activity played a significant role in the rise in adiponectin levels.



Compared to other forms of exercise, HIIT is good in increasing VO₂max, aerobic capacity, and cardiovascular fitness.

CONCLUSION

The results of this study show that high-intensity interval training enhances six out of ten general physical abilities in athletes, including stamina, power, and cardiovascular/respiratory endurance. Speed, coordination, agility, and accuracy are the other four physical aptitudes that have not yet been tested.

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