



## Literature Review: Hiit Training on Physical Fitness, Vo2max and Social Status in Adults with Sedentary Lifestyle

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### Abstract

In 2020, the World Health Organization (WHO) recommended engaging in 150-300 minutes of moderate-intensity physical activity per week, at 40-60% of the Maximal Pulse Rate (HRM), or 75-150 minutes of high-intensity physical activity at 60-85% HRM to maintain and enhance adult fitness. However, commonly cited obstacles to physical activity include time constraints, low motivation, and difficulties in adhering to guidelines. High-Intensity Interval Training (HIIT), requiring less time for exercise, has been shown to deliver equivalent or greater health benefits compared to WHO recommendations. This study aims to assess the impact of HIIT on physical fitness, VO<sub>2</sub>Max, and social status. Utilizing a literature review method, articles were sourced from Electronic Databases such as PubMed, ScienceDirect, and ProQuest. The results indicate that High-Intensity Interval Training (HIIT) can efficiently enhance physical fitness, significantly impact social status, and do so within a shorter time frame. This makes HIIT an appealing alternative for individuals facing challenges like time constraints, low motivation, or difficulties in adhering to traditional activity guidelines. With improvements observed in physical fitness and VO<sub>2</sub>Max, HIIT emerges as a compelling option for those seeking a time-efficient yet effective exercise method. Consequently, this research highlights that HIIT not only serves as an efficient strategy for achieving physical fitness and cardiorespiratory health but also contributes to enhancing social aspects. These findings offer valuable insights for designing more acceptable and sustainable physical activity programs within the community.

**Keywords:** High Intensity Interval Training, Physical Fitness, VO<sub>2</sub>Max, Social Status, Sedentary Lifestyle

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## **A. Introduction**

In this modern era, sedentary lifestyles have become a serious problem in many countries. Sedentary lifestyle, also known as "sedentary lifestyle," refers to low or no levels of physical activity, such as spending long periods of time in front of a computer screen, watching television, or using mobile devices (Ma et al., 2019; Mamikutty et al., 2014). This sedentary lifestyle can lead to various health problems, such as obesity, heart disease, type 2 diabetes, and decreased physical fitness (Khoury et al., 2013). To address these issues, it is important to find effective ways to improve physical fitness and overall health in adults with sedentary lifestyles.

A focal point in current research is High-Intensity Interval Training (HIIT), a method proven to be effective in enhancing physical fitness and health across diverse populations, including adults with sedentary lifestyles (Vigriawan et al., 2022). Thompson (2019) notes that HIIT has gained substantial popularity globally, ranking as the third most prevalent physical exercise trend. HIIT involves high-intensity training sessions interspersed with brief recovery periods (Stöggl & Björklund, 2017). During HIIT, individuals engage in intense movements for short durations, followed by relatively

brief recovery intervals before the exercise cycle repeats. This approach allows individuals to achieve elevated levels of physical fitness within a shorter timeframe compared to low or moderate-intensity continuous exercise (Ahmadizad et al., 2015).

Previous studies have demonstrated the efficacy of High-Intensity Interval Training (HIIT) in enhancing cardiorespiratory fitness, as measured by VO<sub>2</sub>max (maximal oxygen consumption), a crucial indicator of overall physical fitness (Palaparthi, 2017). Furthermore, research by Ramos et al. (2015) has illustrated that HIIT training can positively impact various components of physical fitness, including muscle strength, endurance, and muscle mass. Subsequent investigations by Ahmadizad et al. (2015) and Weston et al. (2014) have highlighted the significant reduction in Percentage Body Fat (PBF) and Waist Circumference (WC) through HIIT, consequently contributing to improved social status, particularly in terms of enhanced self-confidence. Beyond the physical health benefits, HIIT training holds the potential to elevate social status and enhance the quality of life for individuals with a less active lifestyle. Engaging in group HIIT exercise programs within a social context has been shown to foster social

relationships and increase social support among participants (Syamsudin, 2021). Additionally, the improvement in physical fitness and enhanced physical appearance can influence individuals' self-perception, ultimately leading to increased self-confidence and greater life satisfaction (Nuzzo, 2019).

However, despite previous research demonstrating the advantages of High-Intensity Interval Training (HIIT) in more active demographics, there remains a gap in our understanding regarding the efficacy of HIIT training in adults leading less active lifestyles. Consequently, this study seeks to conduct an extensive literature review concerning the impact of HIIT training on physical fitness, VO<sub>2</sub>max, and social status in sedentary adults. The outcomes of this review are anticipated to offer valuable insights for devising more impactful interventions aimed at enhancing health and the overall quality of life in this specific target demographic. As such, this research is poised to advance our comprehension of the merits of HIIT exercise in enhancing physical fitness, VO<sub>2</sub>max, and social status among adults with sedentary lifestyles, serving as a foundational guide for the formulation of pertinent exercise programs tailored to this population.

## **B. Methods**

This article review is written based on secondary data sources. The secondary data referred to here are the results of research that has been published related to HIIT, physical fitness and social status. In writing this article review, the author uses articles published in the last 5 years from 2016 to 2020. The author collects articles obtained from databased PubMed, ScienceDirect, ProQuest, google scholar, eric journal, NCBI journal and Wiley Online Library.

The type of research needed in completing this article review is correlational research. To meet these needs, the research variables are adjusted to the theme of writing this literature review. For this reason, the author prioritizes articles that will be analyzed with the variables HIIT, Physical Fitness, Vo<sub>2</sub>Max. To find articles with the required variables, the author used an article search by writing the relationship between HIIT in passive lifestyle adults, the relationship between physical fitness and social status, the relationship between quality and to find international articles, the author used the sentence in English.

The results of the study are expected to be able to answer the initial objectives of the research in accordance with the research design. For this reason, in selecting articles that use research instruments in accordance

with the variables to be measured. Mainly articles that use IMT/BMI measurement instruments, Physical Activity, Questionnaires, Interviews, and food recall.

In the national article filtration process, the authors found 338 articles from Google Scholar and Mendeley. After identifying duplicates and removing articles outside the year range, 27 relevant articles remained. At this stage, the authors read the abstracts and research methods and verified credible journals, resulting in 8 articles worth reviewing.

For international articles, the authors found a total of 2620 articles from the Eric Journal database, Wiley Online Library, and NCBI Journal. After removing duplicates and articles outside the year range, 802 articles remained. After exclusion based on variables and abstracts, 34 relevant articles remained. The author read the abstracts and research methods and verified the journals were credible, and finally obtained 3 articles worthy of review.

### C. Result and Discussion

#### Result

**Table 1. Article Review and Analysis Table**

No	Penulis	Protokol & Duration Latihan	Vol & intervensi	Pre VO2Max (ml/kg min-1)	Post VO2Max (ml/kg min-1)	Gender & Usia	BMI
1	(Vigriawan Gosy et al., 2022)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> <li>• 2 minggu, 4x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 20 menit</li> <li>• 10:50 Detik, 10 detik aktif, Kecepatan 100 rpm dan</li> <li>• 50 detik pasif kecepatan 50 rpm</li> </ul>	26.4±2.47	35.2±2.12	Wanita	24.9 ± 3.0 (Nomal & Overweight )
2.	(Reljic, Frenk, Herrmann, Neurath, & Zopf, 2020)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> <li>• 12 minggu, 2x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 15 menit pemanasan</li> <li>• 2 menit 80-95% HRM,</li> <li>• 1 menit pasif, 5x repetisi</li> <li>• 3 menit pendinginan</li> </ul>	22.5 ± 6.5	26.0 ± 6.6	Wanita & Pria/ 48.5 ± 10.	40.4 ± 7.2 (Obese 2 & Obese 3)
3	(Reljic, Wittmann, & Fischer, 2018)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> </ul>	<ul style="list-style-type: none"> <li>• 15 menit pasif, 4 menit 85-95% HRM,</li> <li>• 2 menit</li> </ul>	30.3 ± 9.1	35.3 ± 6.6	Wanita & Pria/ 30.2 ± 7.7	Wanita & Pria/ 30.2 ± 7.7

No	Penulis	Protokol & Duration Latihan	Vol & intervensi	Pre VO2Max (ml/kg min-1)	Post VO2Max (ml/kg min-1)	Gender & Usia	BMI
		<ul style="list-style-type: none"> <li>• 8 minggu, 2x per minggu</li> </ul>	2x repetisi, di akhiri 3 menit pasif. <ul style="list-style-type: none"> <li>• 15 menit</li> <li>• 1 menit 85-95% HRM, 2 menit pasif, 5x repetisi</li> </ul>	29.4 ± 7.3	36.5 ± 7.3	Wanita & Pria/ 30.2 ± 7.7	24.9 ± 3.0 (Normal & Overweight)
4	(Vella, Taylor, & Drummer, 2017)	<ul style="list-style-type: none"> <li>• Ergocycle dan Treadmill</li> <li>• Heart rate monitor</li> <li>• 8 minggu, 4x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 20 menit</li> <li>• 1 menit aktif 75-80% HRM, 1 menit pasif 35-40% HRM, di ulangi selama 10x</li> </ul>	34.8 ± 2.9	37.4 ± 0.8	Wanita & Pria/ 23.1 ± 6.6	29.9 ± 3.3 (Overweight & Obese 1)
5	(Allen et al., 2017)	<ul style="list-style-type: none"> <li>• Ergocycle</li> <li>• Heart rate monitor</li> <li>• 9 minggu, 3x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 20-40 menit 20-30 detik sprint, 3-4 menit pasif, 5-8x repetisi, progresif</li> </ul>	26.34 ± 4.34	30.00 ± 4.97	Wanita & Pria/ 49.2 ± 6.1	27.3 ± 4.0 (Pre Obese)
6	(Metcalfe, Tardif, Thompson, & Vollaard, 2016)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> <li>6 minggu, 3x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 10 menit 10-20 detik sprint, 3-4.50 menit pasif, 10x repetisi, progresif</li> </ul>	31.7 ± 4.6	34.7 ± 5.2	Wanita/ 36 ± 9	24.1 ± 3.5 (Normal & Overweight)
7	(Kong et al., 2016)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> <li>5 minggu, 4x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 20 menit 8 detik aktif, 12 detik pasif</li> </ul>	32.0 ± 6.6	34.3 ± 7.5	Wanita/ 21.5 ± 4.0	25.8 ± 2.6 (Pre Obese)
8	(Astorino et al., 2013)	<ul style="list-style-type: none"> <li>• Cycle ergometer</li> <li>• Heart rate monitor</li> <li>• 12 minggu, 3x per minggu</li> </ul>	<ul style="list-style-type: none"> <li>• 40 menit pemanasan</li> <li>• 4 menit</li> <li>• 60 detik 85-100% HRM, 75 detik pasif, 6-10x repetisi, progresif</li> <li>• 2-4 menit</li> </ul>	29.4 ± 5.9	35.8 ± 5.7	Wanita 23.1 ± 5.6	25.3 ± 4.3 (Normal & Pre Obese)

No	Penulis	Protokol & Duration Latihan	Vol & intervensi	Pre VO2Max (ml/kg min-1)	Post VO2Max (ml/kg min-1)	Gender & Usia	BMI
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## Discussion

All studies were conducted using a Heart Rate Monitor (HRM), a modern device that monitors the subject's heart rate. This is important because the HRM provides the necessary information to assess the subject's performance in achieving the desired target heart rate (Nuzzo, 2019).

In addition, this study also used other tools that assist subjects in performing exercises, namely the ergocycle. Ergocycle was chosen as a tool because it has certain advantages. First, subjects do not need to hold their own body weight, so the ergocycle is suitable for use by individuals who are overweight or obese, because it can reduce the burden on the joints. Second, the ergocycle allows setting the pedaling load that can be adjusted to the strength of the subject's legs when sprinting. Third, supervision of the subject becomes easier because the subject does not need to move places or use other tools during exercise (Hoeger et al., 2019).

During the data analysis phase, the outcomes of six studies (Vigriawan et al., 2022; Allen et al., 2017; Kong et al., 2016;

Metcalf et al., 2016; Reljic et al., 2018; Vella et al., 2017) indicated that the subjects exhibited VO2max values falling within the moderate category, both in the pre-test and post-test phases. Furthermore, two studies (Astorino et al., 2013; Reljic et al., 2020) demonstrated an elevation in the VO2max category from a low level to a moderate level following the investigated exercise programs. Consequently, it can be inferred that all these studies collectively highlight a significant impact in elevating VO2max values.

The research conducted by Airlangga & Malang (2022) reveals differences in the effect on average resting heart rate (HR rest) values between the Continuous (CONT) and High-Intensity Interval Training (HIIT) groups. The HIIT group exhibited a higher reduction in HR rest compared to the CONT group. This finding aligns with a meta-analysis by Huang et al. (2005), which confirmed that chronic aerobic exercise in subjects aged  $\geq 60$  years can lead to a reduction in resting heart rate up to 8.4%, based on evidence from 13 studies. Similarly, research by Heydari et

al. (2012) reported a significant decrease in heart rate and a 17% increase in fitness levels in overweight men subjected to 12 weeks of High-Intensity Intermittent Exercise (HIIE). The reduction in resting heart rate post-routine HIIT may be attributed to the induction of an increase in stroke volume (Heydari et al., 2012). An augmented stroke volume contributes to increased plasma volume, subsequently enhancing myocardial contractility, resulting in a decrease in resting heart rate (Helgerud et al., 2007). This normal decrease in resting heart rate offers several health benefits, including a reduced risk of cardiovascular disease, lower levels of cholesterol and triglycerides, and a decrease in hypertension (Sharashova et al., 2015).

Considering the entirety of the conducted research, it becomes evident that High-Intensity Interval Training (HIIT) possesses the capability to elevate VO<sub>2</sub>max. Despite variations in training models, such as sprint volume and passive approaches, both demonstrate efficacy in increasing VO<sub>2</sub>max. Research indicates that as early as 5 weeks of HIIT training, a noticeable increase in VO<sub>2</sub>max can be achieved (Kong et al., 2016). However, optimal results necessitate a 12-week duration of HIIT training. (Astorino et al., 2013).

Interestingly, HIIT remains effective even when performed over a short period of time. For example, HIIT training performed for only 10 minutes in each session, totaling 30 minutes in a week, has shown significant differences in VO<sub>2</sub>max improvement (Metcalf et al., 2016). Similarly, if the training volume is increased to 15 minutes, more significant results will be obtained (Reljic et al., 2018). Thus, it can be concluded that HIIT is an effective training method in increasing VO<sub>2</sub>max, even in a relatively short duration.

Social status is an important aspect of an individual's life that includes their role and position in society. Sedentary lifestyles are often associated with social isolation, low engagement in social activities, and lack of social support. Therefore, it is important to understand how HIIT training can affect the social status of individuals with sedentary lifestyles.

HIIT training in groups can increase social engagement and reduce social isolation by providing opportunities for individuals to engage in social activities with people who share similar interests. In addition, a structured HIIT training environment can provide social support that improves self-confidence and overall quality of life (Medicine, 2013).

Regular and effective HIIT exercise can also improve physical fitness, weight

loss, and overall health, which in turn can improve the quality of life of individuals with sedentary lifestyles (Cardozo et al., 2015). In addition, participation in a HIIT exercise program can help individuals integrate into groups with similar interests, creating opportunities for new social relationships.

Group-based High-Intensity Interval Training (HIIT) offers sedentary individuals opportunities to engage in social activities, fostering interactions with like-minded individuals dedicated to enhancing fitness and health. Participating in group exercise sessions can effectively mitigate social isolation and facilitate the establishment of positive social connections. In the study conducted by Airlangga & Malang (2022), a reduction in back circumference was observed, consistent with the findings indicating that HIIT, specifically treadmill sessions conducted three times a week for six weeks, effectively reduces Percentage Body Fat (PBF) (Airlangga & Malang, 2022). Furthermore, research by Allen et al. (2017) demonstrated that HIIT, comprising 30-second sprints with 4-5 minutes of passive intervals over nine weeks, significantly reduces waist circumference in sedentary adults. The mechanism behind this effectiveness lies in the increased workload on skeletal muscles, leading to elevated ATP consumption, subsequently causing a

decrease in ATP levels within skeletal muscles. The resulting decrease in ATP triggers the activation of the enzyme AMPK (Adenosine Monophosphate-Activated protein Kinase), initiating fat mobilization from adipose tissue, particularly reducing fat stores around the waist (Marcinko et al., 2015).

Notably, fat loss in overweight women exhibits a positive correlation with improved physical fitness. Moreover, a reduction in waist circumference correlates positively with increased flexibility, a key component of physical fitness. Enhanced physical fitness facilitates the ease of performing various daily activities and reduces the likelihood of injuries (Nuzzo, 2019). The heightened self-confidence experienced by sedentary adults also correlates positively with an improved social status during community interactions (Nuzzo, 2019). These positive transformations can influence individuals' self-perception and elevate life satisfaction. Feeling healthier and more energized, sedentary individuals may experience increased confidence and an overall improved quality of life.

Considering the limitations of this study, it is important to recognize that the results may be influenced by specific protocol and exercise model variations among the reviewed studies. In addition,



the generalizability of these findings may be limited by variations in participant characteristics, exercise intensity, and exercise duration across studies. Future research may benefit from more standardized methodologies and larger sample sizes to improve the robustness and applicability of the results.

For recommendations, it is suggested that future research explore the long-term effects of High Intensity Interval Training (HIIT) on physical fitness, VO<sub>2</sub>max, and social status. Additionally, considering the potential benefits of group-based HIIT, further investigation into the impact of social interactions on adherence to exercise programs and overall health is warranted. Furthermore, incorporating diverse populations and exercise settings in future research may provide a more comprehensive understanding of the wider applicability and effectiveness of HIIT interventions.

In conclusion, although this study offers valuable insight into the positive effects of HIIT on physical fitness, VO<sub>2</sub>max, and social status, researchers should address the identified limitations and explore further to increase generalizability and depth of understanding in this area.

#### **D. Conclusion**

Based on the formulation of the

problems that have been described, it can be concluded that HIIT training has significant potential in improving physical fitness, VO<sub>2</sub>max, and social status in adults with sedentary lifestyles. HIIT training can improve social engagement, social support, quality of life, and social integration of individuals. This can help overcome social isolation, increase self-confidence, and improve individuals' social relationships with their surrounding environment. The implication of this study is the importance of introducing and encouraging participation in HIIT exercise programs for adults with sedentary lifestyles. In improving physical fitness and social status, a structured, group HIIT exercise program can provide a supportive, motivating environment and facilitate positive social interactions. These implications emphasize the importance of addressing social isolation and lack of social support that is common in this population.

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#### **F. Conflict of Interest**

No conflict of interest

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