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The effect of high-intensity interval training on triglyceride levels in obese adolescents

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Abstract

This study aims to analyze the effect of HIIT training on triglyceride levels in obese adolescents. This study used an experimental method with a pretest–posttest control group design. A total of 32 adolescents with type I obesity (BMI >31–38 kg/m²) were divided into an experimental group and a control group. The experimental group underwent HIIT training with a ratio of 10 seconds of work and 20 seconds of rest for six weeks with a frequency of three times per week, while the control group did not receive structured training. Blood triglyceride levels were measured using the SD BIOSENSOR LipidoCare Analyzer before and after the intervention. Data analysis was performed using paired sample t-tests and independent sample t-tests with a significance level of 0.05. The results showed that HIIT significantly reduced triglyceride levels from 351.1±6.9 mg/dL to 140.1±2.2 mg/dL ($p<0.001$). In addition, body mass index also decreased significantly from 34.3±0.4 kg/m² to 30.5±0.15 kg/m² ($p=0.012$). The greater decrease in triglycerides compared to BMI indicates that metabolic improvement can occur more quickly than anthropometric changes. It is concluded that HIIT exercise is effective in lowering triglyceride levels and improving metabolic health in obese adolescents. HIIT can be recommended as an efficient and applicable exercise strategy in efforts to prevent cardiometabolic risks from adolescence.

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INTRODUCTION

This should be brief and indicates the aim of the study and the essential Obesity rates among children and adolescents are rising rapidly and have become a global public health issue: since 1990, the prevalence of overweight individuals aged 5–19 years has risen from around 8% to ~20% in 2022, with hundreds of millions of children and adolescents affected (El Meouchy et al., 2022). In Indonesia, the trend is also increasing national survey data reports an increase in the prevalence of obesity in the adult population, and the rate of overweight/obesity in children and adolescents remains a national concern, with higher prevalence in cities (Monica & Hendrianingtyas, 2022). This spiked is associated with a diet high in processed foods, decreased physical activity, and environmental and socioeconomic factors (Bacchetti et al., 2024). Due to its long-term consequences (type 2 diabetes, dyslipidemia, cardiovascular disease), adolescent obesity requires rapid and effective prevention and treatment interventions (Gaweł et al., 2024). Therefore, research evaluating time-efficient physical interventions such as HIIT is relevant for the context of obese adolescents in Indonesia.

Adolescent obesity was chosen because adolescence is a critical window: lifestyle habits formed during this period tend to continue into adulthood and determine the risk of metabolic diseases in the future (Powell-Wiley et al., 2021). Obese adolescents show a greater risk of dyslipidemia (including high triglyceride levels), insulin resistance, and increased blood pressure factors that accelerate early atherosclerosis (Sean Davidson et al., 2017). Effective interventions in this group have the potential to reduce the burden of chronic disease in the population and reduce long-term healthcare costs (Messineo et al., 2024). Additionally, many conventional exercise interventions require a significant time commitment, making short but effective protocols such as HIIT a more practical solution for school or clinical programs. Testing the effects of HIIT on specific metabolic parameters (triglycerides) in obese adolescents provides direct evidence for exercise policy recommendations for children/adolescents.

Obesity causes the accumulation of adipose tissue fat, particularly visceral fat, which is metabolically active and releases pro-inflammatory adipokines (e.g., TNF-α, IL-6) and decreases adiponectin (Ouerghi et al., 2022; Rusip & Suhartini, 2020). This mild chronic inflammation disrupts insulin signaling, causing insulin resistance in peripheral tissues (skeletal muscle, liver, adipose tissue) (Nedunchezhiyan et al., 2022). Insulin resistance causes the liver to increase de novo lipogenesis and decrease fatty acid oxidation, resulting in increased production of triglyceride-rich very-low-density lipoprotein (VLDL) (Feng et al., 2024). In addition, uncontrolled lipolysis of adipocytes releases free fatty acids into the circulation, which are taken up by the liver and esterified into triglycerides, contributing directly to hypertriglyceridemia (Powell-Wiley et al., 2021). Changes in enzyme composition (e.g., increased DGAT activity, decreased

LPL in peripheral tissues) also worsen the lipid profile (Louzada Júnior et al., 2020). The combination of insulin resistance, inflammation, and adipose dysfunction explains why obesity is closely associated with an atherogenic lipid profile, including high triglyceride levels (Koskinas et al., 2024).

Elevated triglyceride levels in adolescents are associated with components of metabolic syndrome and predict cardiometabolic risk in adulthood. Reductions in triglycerides through non-pharmacological interventions (e.g., exercise) are often accompanied by improvements in other lipoprotein profiles (HDL, small-dense LDL) and vascular function (Louzada Júnior et al., 2020). Therefore, triglycerides are a relevant outcome for assessing the effectiveness of lifestyle interventions in obese adolescents—especially when the research objective is to capture metabolic changes that occur before significant changes in body weight (Setyawati & Lasroha, 2021). Measuring triglycerides provides actionable mechanistic and clinical information for public health recommendations.

HIIT (High-Intensity Interval Training) is an exercise method that combines short periods of high intensity (e.g., >85–90% HRmax) with periods of active or passive recovery (Gaweł et al., 2024). From a metabolic perspective, HIIT increases skeletal muscle oxidative capacity (mitochondriogenesis), increases oxidative enzyme activity, and improves glucose utilization and lipid oxidation during and after sessions (Lelou et al., 2022). These adaptations reduce intracellular lipid accumulation, improve insulin sensitivity, and decrease hepatic VLDL production—pathways that can all lower systemic triglyceride levels. Additionally, HIIT increases post-exercise oxygen consumption (EPOC), which prolongs the increase in energy expenditure after exercise and can contribute to an energy deficit despite shorter exercise duration compared to continuous moderate exercise (ÖZHAN & YÜKSEL, 2022).

Within the context of adolescent obesity, HIIT is particularly appealing due to its time efficiency and ability to improve program adherence (easily implemented in schools or group programs). Meta-analytic evidence and RCT studies in adolescents and adults show that HIIT can improve body composition, cardiovascular capacity, and several lipid parameters (including a reduction in triglycerides in some studies) (Murillo et al., 2022). However, heterogeneous results effects on triglycerides depend on intervention duration, frequency, dietary control, and sample characteristics highlight the need for controlled studies in local obese adolescent populations to determine optimal protocol parameters.

METHODS

We used an experimental method with a quantitative descriptive approach to examine the effect of High-Intensity Interval Training (HIIT) on triglyceride levels. The research design used was a pretest–posttest control group design, which allowed researchers to compare changes in triglyceride levels before and after treatment in the experimental group and compare them with the control group.

This approach was chosen to identify the causal effects of HIIT on metabolic parameters. Research was conducted during a six-week intervention period. Each subject underwent initial and final measurements to ensure changes occurred due to treatment. With this design, the internal validity of the study was optimally maintained.

Participants

The participants in this study were adolescents with type I obesity who met the body mass index (BMI) criteria of >31 kg/m² to 38 kg/m². A total of 32 participants were involved, selected based on predetermined inclusion and exclusion criteria. All participants were in good general health and had no history of severe metabolic diseases or cardiovascular disorders. The sample was then divided evenly into two groups, namely the experimental group and the control group, each consisting of 16 people. The experimental group received HIIT training, while the control group did not receive structured training. All participants received an explanation of the research procedure prior to implementation. Participation was voluntary with written informed consent.

Sampling Procedures

Sampling techniques in this study used purposive sampling, which is the selection of samples based on specific criteria relevant to the research objectives. These criteria included type I obesity status, a predetermined BMI range, and willingness to participate in the entire research process. This technique was chosen to ensure the homogeneity of the research subjects' characteristics. Once selected, the samples were divided into control and experimental groups proportionally. This approach aimed to minimize bias and increase the validity of the research results.

Materials and Apparatus

This study used exercise equipment and physiological parameter measurement tools as its main materials. The HIIT exercise program was designed using a work-rest ratio of 10 seconds of high-intensity activity (on) and 20 seconds of recovery (off). The exercises were carried out for six weeks at a frequency of three sessions per week. Each training session was supervised by researchers to ensure that the intensity and duration of the training were in accordance with the protocol. In addition, a stopwatch and exercise control sheet were used to monitor participant compliance. All training procedures were carried out under relatively uniform environmental conditions.

Blood triglyceride levels were measured using the SD BIOSENSOR LipidoCare Analyzer, which is a portable point-of-care testing device. This device was used with special triglyceride reagent strips according to the manufacturer's standards. Blood samples were collected from capillaries using disposable sterile lancets. This device was chosen because it is accurate, practical, and suitable for field research. In addition, alcohol swabs, sterile cotton, and medical gloves were used to maintain the sterility and safety of the blood collection procedure.

Procedures

Research procedures began with initial measurements (pretest) of triglyceride levels in all participants before the intervention was given. Blood samples were taken in the morning with participants fasting for at least 8 hours. After the initial measurements, the experimental group underwent a six-week HIIT exercise program three times a week, using a pattern of 10 seconds on and 20 seconds off. Meanwhile, the control group did not follow a structured exercise program and carried out their daily activities as usual. When the intervention period was over, all participants underwent another triglyceride level measurement (posttest) using the same procedure as the initial measurement. The pretest and posttest data were then recorded and analyzed to see the changes in triglyceride levels resulting from the HIIT exercise treatment.

Design or Data Analysis

Statistical analysis in this study was performed using an inferential statistical approach with a significance level set at 0.05. Triglyceride levels were first tested for normality using the Shapiro–Wilk test to ensure compliance with the assumption of normal distribution. If the data were normally distributed, the analysis was continued with a paired sample t-test to determine the difference in triglyceride levels before and after treatment in each group. Next, an independent sample t-test was used to compare the difference in triglyceride levels between the experimental group and the control group.

RESULT (Times New Roman 12)

The results of the study show a significant reduction in triglyceride levels and body mass index (BMI) after HIIT training. The average triglyceride level decreased from 351.1±6.9 mg/dL in the pretest to 140.1±2.2 mg/dL in the posttest. This reduction indicates a clinically and statistically significant change.

Table 1. Pre-Post Test

	Pre	Post
Triglyserida	351.1±6.9	140.1±2.2
BMI	34.3±0.4	30.5±0.15

* *Significantly different; Triglycerides (p=0.000), Body Mass Index (p=0.012).*

Additionally, BMI values also decreased from 34.3±0.4 kg/m² to 30.5±0.15 kg/m² after the intervention period. The asterisk (*) in the data indicates that the difference is statistically significant. These results indicate that six weeks of HIIT exercise has a positive impact on improving the metabolic parameters and anthropometric status of the study subjects.

DISCUSSION

An interesting finding of this study is that triglyceride levels decreased significantly more than BMI. This finding indicates that lipid metabolism can improve independently of significant weight loss. Physiologically, this suggests that HIIT training first affects metabolic pathways such as fatty acid oxidation, insulin sensitivity, and lipolytic enzyme activity before being reflected in anthropometric changes (Chinasho et al., 2023). It is important because it challenges the paradigm that weight loss is the only indicator of the success of an exercise intervention (McCrary &

Altenmüller, 2021). For obese adolescents, these results offer hope that health benefits can be achieved even if weight loss is not optimal. Thus, the focus of interventions can be directed toward improving metabolic health. This is an important conceptual contribution to adolescent exercise physiology.

Relatively smaller decreases in body mass index (BMI) compared to triglyceride levels in this study can be explained by differences in the body's metabolic and physiological responses to HIIT training. Physiologically, HIIT provides a high-intensity stimulus that rapidly triggers metabolic adaptations at the cellular and tissue levels, particularly in skeletal muscle and liver (Bartoloni et al., 2024). High-intensity exercise increases the activation of AMP-activated protein kinase (AMPK) and peroxisome proliferator-activated receptor gamma coactivator-1α (PGC-1α), which play an important role in increasing fatty acid oxidation and mitochondrial biogenesis (Brooks, 2020). These adaptations directly accelerate the utilization of triglycerides and free fatty acids as energy sources, resulting in a significant decrease in triglyceride levels in the bloodstream, even before significant changes in body mass occur (Stadler et al., 2021).

Metabolically, triglyceride reduction occurs relatively quickly because HIIT increases the activity of lipoprotein lipase (LPL) in skeletal muscle tissue, which hydrolyzes triglycerides in lipoproteins into free fatty acids for use as energy (Alarcón-Gómez et al., 2021). Additionally, HIIT reduces the production of very-low-density lipoprotein (VLDL) in the liver through improved insulin sensitivity and a decrease in the flow of free fatty acids from adipose tissue to the liver (Ahmad et al., 2023). This pathway is functional-metabolic and responsive to short-term exercise stimuli, so changes in triglyceride levels can occur within weeks (Lopez-Jimenez et al., 2022). In contrast, a decrease in BMI reflects changes in fat mass and/or total body mass that require a cumulative energy deficit over a longer period of time.

Physiologically, changes in BMI are also influenced by neuromuscular and hormonal adaptations resulting from HIIT training (Sean Davidson et al., 2017). High-intensity exercise can increase skeletal muscle mass or at least maintain it, through activation of the mTOR pathway and increased recruitment of type II muscle fibers (Bartoloni et al., 2024; Jaakonmäki et al., 2022). This condition causes total body weight not to decrease drastically even though there is a decrease in body fat, so the decrease in BMI appears smaller (Shireesha & Obulesu, 2022). Additionally, hormonal responses such as increased growth hormone and catecholamines during HIIT accelerate lipolysis without immediately causing significant weight loss (Zhu et al., 2024). Thus, BMI as a global anthropometric indicator is less sensitive to detecting short-term changes in body composition.

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CONCLUSION

High-Intensity Interval Training (HIIT) exercises with a ratio of 10 seconds of work and 20 seconds of rest conducted over six weeks significantly reduced triglyceride levels and body mass index in obese adolescents. The greater reduction in triglyceride levels compared to BMI reduction indicates that HIIT provides faster metabolic adaptation than anthropometric changes. These findings confirm that HIIT is an effective, time-efficient, and applicable exercise intervention for improving metabolic health and reducing cardiometabolic risk in obese adolescents.

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REFERENCES (Times New Roman 12)

Ahmad, A. M., Mahmoud, A. M., Serry, Z. H., Mohamed, M. M., & Abd Elghaffar, H. A. (2023). Effects of low-versus high-volume high-intensity interval training on glycemic control and quality of life in obese women with type 2 diabetes. A randomized controlled trial. *Journal of Exercise Science and Fitness*, *21*(4), 395–404. https://doi.org/10.1016/j.jesf.2023.08.003

Alarcón-Gómez, J., Calatayud, J., Chulvi-Medrano, I., & Martín-Rivera, F. (2021). Effects of a HIIT protocol on cardiovascular risk factors in a type 1 diabetes mellitus population. *International Journal of Environmental Research and Public Health*, *18*(3), 1–12. https://doi.org/10.3390/ijerph18031262

Bacchetti, T., Morresi, C., Simonetti, O., & Ferretti, G. (2024). Effect of Diet on HDL in Obesity. *Molecules*, *29*(24), 1–17. https://doi.org/10.3390/molecules29245955

Bartoloni, B., Mannelli, M., Gamberi, T., & Fiaschi, T. (2024). *The Multiple Roles of Lactate in the Skeletal Muscle*.

Brooks, G. A. (2020). Redox Biology Lactate as a fulcrum of metabolism. *Redox Biology*, *35*(January), 101454. https://doi.org/10.1016/j.redox.2020.101454

Chinasho, A., Bedadi, B., Lemma, T., Tana, T., Hordofa, T., & Elias, B. (2023). Quality assessment and evaluation of irrigation water and soil used for maize (Zea mays L.) production in Boloso Sore district, southern Ethiopia. *Heliyon*, *9*(6), e17299. https://doi.org/10.1016/j.heliyon.2023.e17299

El Meouchy, P., Wahoud, M., Allam, S., Chedid, R., Karam, W., & Karam, S. (2022). Hypertension Related to Obesity: Pathogenesis, Characteristics and Factors for Control. *International Journal of Molecular Sciences*, *23*(20). https://doi.org/10.3390/ijms232012305

Feng, J., Zhang, Q., Chen, B., Chen, J., Wang, W., Hu, Y., Yu, J., & Huang, H. (2024). Effects of high-intensity intermittent exercise on glucose and lipid metabolism in type 2 diabetes patients: a systematic review and meta-analysis. *Frontiers in Endocrinology*, *15*(June).

https://doi.org/10.3389/fendo.2024.1360998

Gaweł, E., Hall, B., Siatkowski, S., Grabowska, A., & Zwierzchowska, A. (2024). The Combined Effects of High-Intensity Interval Exercise Training and Dietary Supplementation on Reduction of Body Fat in Adults with Overweight and Obesity: A Systematic Review. *Nutrients*, *16*(3). https://doi.org/10.3390/nu16030355

Jaakonmäki, N., Zedde, M., Sarkanen, T., Martinez-Majander, N., Tuohinen, S., Sinisalo, J., Ryödi, E., Autere, J., Hedman, M., Junttola, U., Huhtakangas, J. K., Grimaldi, T., Pascarella, R., Nordanstig, A., Bech-Hanssen, O., Holbe, C., Busch, R., Fromm, A., Ylikotila, P., … Putaala, J. (2022). Obesity and the Risk of Cryptogenic Ischemic Stroke in Young Adults. *Journal of Stroke and Cerebrovascular Diseases*, *31*(5), 1–9. https://doi.org/10.1016/j.jstrokecerebrovasdis.2022.106380

Koskinas, K. C., Van Craenenbroeck, E. M., Antoniades, C., Blüher, M., Gorter, T. M., Hanssen, H., Marx, N., McDonagh, T. A., Mingrone, G., Rosengren, A., Prescott, E. B., Aboyans, V., Blomstrom-Lundqvist, C., Nielsen, J. C., Donal, E., Döhner, W., Ferrini, M., Halvorsen, S., Hassager, C., … Zeppenfeld, K. (2024). Obesity and cardiovascular disease: an ESC clinical consensus statement. *European Heart Journal*, *45*(38), 4063–4098. https://doi.org/10.1093/eurheartj/ehae508

Lelou, E., Corlu, A., Nesseler, N., Rauch, C., Mallédant, Y., Seguin, P., & Aninat, C. (2022). The Role of Catecholamines in Pathophysiological Liver Processes. *Cells*, *11*(6). https://doi.org/10.3390/cells11061021

Lopez-Jimenez, F., Almahmeed, W., Bays, H., Cuevas, A., Di Angelantonio, E., le Roux, C. W., Sattar, N., Sun, M. C., Wittert, G., Pinto, F. J., & Wilding, J. P. H. (2022). Obesity and cardiovascular disease: mechanistic insights and management strategies. A joint position paper by the World Heart Federation and World Obesity Federation. *European Journal of Preventive Cardiology*, *29*(17), 2218–2237. https://doi.org/10.1093/eurjpc/zwac187

Louzada Júnior, A., Mota da Silva, J., Furtado da Silva, V., Clodoaldo Melo Castro, A., Eufrásio de Freitas, R., Braga Cavalcante, J., Maia dos Santos, K., Paula Azevedo Albuquerque, A., Paraguassú Brandão, P., de Nazaré Dias Bello, M., Carmen Guimarães, A., Cesar Gurgel de Alencar Carvalho, M., Soares Pernambuco, C., Benício Ramos Lima, E., Ramos Coelho, R., Augusto de Souza Santos, C., Cleria Pereira Bezerra, J., Henrique Martin Dantas, E., Paulo Martins Silva, R., … Rafael Valentim-Silva, J. (2020). Multimodal HIIT is More Efficient Than Moderate Continuous Training for Management of Body Composition, Lipid Profile and Glucose Metabolism in the Diabetic Elderly El Entrenamiento Multimodal es más Eficiente que el Entrenamiento Continuo Moderado para e. *Int. J. Morphol*, *38*(2), 392–399.

McCrary, J. M., & Altenmüller, E. (2021). Mechanisms of Music Impact: Autonomic Tone and the Physical Activity Roadmap to Advancing Understanding and Evidence-Based Policy. *Frontiers in Psychology*, *12*(August), 1–9. https://doi.org/10.3389/fpsyg.2021.727231

Messineo, L., Bakker, J. P., Cronin, J., Yee, J., & White, D. P. (2024). Obstructive sleep apnea and obesity: A review of epidemiology, pathophysiology and the effect of weight-loss treatments. *Sleep Medicine Reviews*, *78*(August), 101996. https://doi.org/10.1016/j.smrv.2024.101996

Monica, & Hendrianingtyas, M. (2022). Correlation of Triglyceride/HDL-Cholesterol Ratio and Visceral Adiposity Index with 25(OH)D in Obese Female. *Indonesian Journal of Clinical Pathology and Medical Laboratory*, *29*(1), 59–63. https://doi.org/10.24293/ijcpml.v29i1.1923

Murillo, S., Brugnara, L., Servitja, J. M., & Novials, A. (2022). High Intensity Interval Training reduces hypoglycemic events compared with continuous aerobic training in individuals with type 1 diabetes: HIIT and hypoglycemia in type 1 diabetes. *Diabetes and Metabolism*, *48*(6). https://doi.org/10.1016/j.diabet.2022.101361

Nedunchezhiyan, U., Varughese, I., Sun, A. R. J., Wu, X., Crawford, R., & Prasadam, I. (2022). Obesity, Inflammation, and Immune System in Osteoarthritis. *Frontiers in Immunology*, *13*(July), 1–19. https://doi.org/10.3389/fimmu.2022.907750

Ouerghi, N., Fradj, M. K. Ben, Duclos, M., Bouassida, A., Feki, M., Weiss, K., & Knechtle, B. (2022). Effects of High-Intensity Interval Training on Selected Adipokines and Cardiometabolic Risk Markers in Normal-Weight and Overweight/Obese Young Males. A Pre-Post Test Trial. *Biology*, *11*(6). https://doi.org/10.3390/biology11060853

ÖZHAN, M. B., & YÜKSEL, G. (2022). The Effect of School Burnout on Academic Achievement and Well-Being in High School Students: A Holistic Model Proposal. *International Journal of Contemporary Educational Research*, *8*(1), 145–162. https://doi.org/10.33200/ijcer.824488

Powell-Wiley, T. M., Poirier, P., Burke, L. E., Després, J. P., Gordon-Larsen, P., Lavie, C. J., Lear, S. A., Ndumele, C. E., Neeland, I. J., Sanders, P., & St-Onge, M. P. (2021). Obesity and Cardiovascular Disease A Scientific Statement From the American Heart Association. *Circulation*, *143*(21), E984–E1010. https://doi.org/10.1161/CIR.0000000000000973

Rusip, G., & Suhartini, S. M. (2020). *Effects of Moderate Intensity Exercise on Glutathione Peroxidase Activity and VO 2 max in Elderly Women*. *8*, 230–233.

Sean Davidson, W., Heink, A., Sexmith, H., Dolan, L. M., Gordon, S. M., Otvos, J. D., Melchior, J. T., Elder, D. A., Khoury, J., Geh, E., & Shah, A. S. (2017). Obesity is associated with an altered HDL subspecies profle among adolescents with metabolic disease. *Journal of Lipid Research*, *58*(9), 1916–1923. https://doi.org/10.1194/jlr.M078667

Setyawati, R., & Lasroha, M. (2021). Overview of HDL, LDL, Triglycerides, and Total Cholesterol in Obese Patients. *Advances in Health Sciences Research*, *39*(SeSICNiMPH), 12–14.

Shireesha, R., & Obulesu, O. (2022). Assessment of Effect of Exercise on

Body Composition in Obese and Overweight. *Annals of International Medical and Dental Research*, *8*(1), 1–6. https://doi.org/10.53339/aimdr.2022.8.1.1

Stadler, J. T., Lackner, S., Mörkl, S., Trakaki, A., Scharnagl, H., Borenich, A., Wonisch, W., Mangge, H., Zelzer, S., Meier-allard, N., Holasek, S. J., & Marsche, G. (2021). *Subclass Distribution*. *9*(242), 1–17.

Zhu, X., Jiao, J., Liu, Y., Li, H., & Zhang, H. (2024). *The Release of Lipolytic Hormones during Various High-Intensity Interval and Moderate-Intensity Continuous Training Regimens and Their Effects on Fat Loss*. *April*, 559–570.