2024, Retos, 54, 243-247

The effect of high-intensity circuit training on physical fitness in healthy young males
El efecto del entrenamiento en circuito de alta intensidad sobre la aptitud física en hombres jóvenes sanos

*Mahmud Yunus, *Slamet Raharjo, **Witri Suwanto, ***Ramdan Pelana, ****Nguyen Tra Giang
*Universitas Negeri Malang (Indonesia), **Universitas Tanjungpura (Indonesia), ***Universitas Negeri Jakarta (Indonesia), ****University of Management and Technology Hochiminh City (Vietnam)

Abstract. Sedentism, along with a lack of physical activity, contributes to a decline in quality of life and is the fourth greatest cause of mortality. Changing sedentary lifestyle choices, such as increased physical exercise, is a method of health problem prevention. As a result, the purpose of this study is to investigate the effect of high-intensity circuit training on developing physical fitness in young healthy guys. A proper experimental procedure was employed in this investigation, including a pre-test - post-test control group design. Twenty Malang City students aged 19 to 22 were selected and separated into CNTL (control group) and HICT (high-intensity circuit training group). The high-intensity circuit training (HICT) intervention was performed three times per week for eight weeks. Physical fitness (VO_2max, strength, speed, and agility) was assessed pre- and post-intervention. An independent sample t-test with a significance threshold of 5% is used in the data analysis procedure. The findings revealed a delta (Δ) difference in the average gain in physical fitness (VO_2max, strength, speed, and agility) between CNTL and HICT ($p \leq 0.01$). This study shows that high-intensity circuit training done three times per week for eight weeks improves physical fitness in healthy young males.
Keywords: Healthy male; high-intensity circuit training; physical fitness; sedentary lifestyle

Resumen. El sedentarismo, junto con la falta de actividad física, contribuye a una disminución de la calidad de vida y es la cuarta causa de mortalidad. Cambiar las opciones de estilo de vida sedentario, como aumentar el ejercicio físico, es un método de prevención de problemas de salud. Como resultado, el propósito de este estudio es investigar el efecto del entrenamiento en circuito de alta intensidad en el desarrollo de la aptitud física en chicos jóvenes sanos. En esta investigación se empleó un procedimiento experimental adecuado, incluido un diseño de grupo de control pre-prueba y post-prueba. Se seleccionaron veinte estudiantes de la ciudad de Malang de entre 19 y 22 años y se separaron en CNTL (grupo de control) y HICT (grupo de entrenamiento en circuito de alta intensidad). La intervención de entrenamiento en circuito de alta intensidad (HICT) se realizó tres veces por semana durante ocho semanas. La aptitud física (VO2máx, fuerza, velocidad y agilidad) se evaluó antes y después de la intervención. En el procedimiento de análisis de datos se utiliza una prueba t de muestra independiente con un umbral de significancia del 5%. Los hallazgos revelaron una diferencia delta (Δ) en la ganancia promedio en aptitud física (VO2máx, fuerza, velocidad y agilidad) entre CNTL y HICT ($p \leq 0.01$). Este estudio muestra que el entrenamiento en circuito de alta intensidad realizado tres veces por semana durante ocho semanas mejora la condición física en hombres jóvenes sanos.
Palabras clave: Varón sano; entrenamiento en circuito de alta intensidad; aptitud física; estilo de vida sedentario

Fecha recepción: 17-11-23. Fecha de aceptación: 09-02-24
Mahmud Yunus
mahmud.yunus.fik@um.ac.id

Introduction

Sedentism, along with a lack of physical activity, contributes to a decline in quality of life and is the fourth greatest cause of mortality (Wypych-Ślusarska et al., 2023), representing a significant economic burden for modern society (Sarto et al., 2023; Santos et al., 2023; Ding et al., 2016). According to recent worldwide estimates, 1.4 billion individuals (27.5% of the global adult population) do not achieve recommended levels of physical exercise for improving and protecting individual health problems (Guthold et al., 2018). Physical inactivity is the most significant secondary factor influencing muscle aging (Distefano & Goodpaster, 2018). Physical inactivity has been linked to accelerated physiological aging and is a significant risk factor for all causes of mortality, cardiometabolic illness, and numerous forms of cancer (Kennedy et al., 2023; Katzmarzyk et al., 2022; Piercy et al., 2018). Physical inactivity has been found as a crucial role in mitochondrial dysfunction in a variety of disorders (San-Millán et al., 2023). Mitochondria include enzymes that are vital in the regeneration of reducing equivalents and the synthesis of energy in the form of Adenosine triphosphate (ATP) (Shang et al., 2023). The importance of mitochondria in cellular processes such as metabolism and apoptosis is well established (Schäfer et al., 2023). Changes in sedentary lifestyle habits, such as increased physical activity, are used as first-line therapy for 26 chronic illnesses, including metabolic syndrome (Peiris et al., 2023). Adults should engage in at least 150 minutes per week of moderate-intensity physical activity, 75 minutes per week of vigorous-intensity physical activity, or a combination of the two (Bohlen et al., 2023). Various high-intensity training methods have arisen as a trend in enhancing fitness during the last 50 years (McDougle et al., 2023). According to Gutiérrez-Arroyo et al. (2023), circuit training routines with high intensity can be an effective and safe technique to increase physical fitness. Exercise promotes mitochondrial biogenesis and fusion/division to add new mitochondria or repair dysfunctional mitochondria while maintaining mitochondrial calcium homeostasis, antioxidant defense system, and autophagy to promote normal mitochondrial function (Zhu et al., 2023). Mitochondrial networks in skeletal muscle exhibit complex behaviors and undergo dynamic remodeling in response to various conditions and pathologies characterized by changes in muscle cell structure and metabolism, such as exercise, muscle damage, and myopathy (Chatzinikita et al., 2023). However, little is known about the role of the correct amount of exercise in enhancing physical fitness. Physical fitness is an important indicator of generating positive self-perception in healthy young (Galán-Arroyo et al., 2024). As a result, the purpose of this study is to investigate the effect of high-intensity circuit training performed three times per week for eight years on enhancing physical fitness in healthy young males.

Material and Methods

This study used a true experimental method with a pre-test - post-test control group design. A total of 20 male adolescents were selected to be subjects in this study with the criteria of age 19-22 years, normal body mass index, normal blood pressure, normal heart rate, and no history of disease. Subjects were randomly divided into two groups, namely CNTL (control group), HICT (high-intensity circuit training group), and each group consists of 10 participants, so there are a total of 20 participants for 2 groups. Calculation of subject size used the Higgins & Kleinbaum (1985) formula using previous research reference values so that a minimum subject size was obtained (n=10) and 20 participants were taken for two groups (Gutiérrez-Arroyo et al., 2023). Subjects voluntarily agreed to participate in the study as evidenced by filling out and signing informed consent which was done consciously. All procedures in this study complied with the Helsinki Declaration on ethical behavior in research involving human subjects.

The high-intensity circuit training (HICT) intervention was carried out with a frequency of 3x/week for 8 weeks with a training duration of 25-30 minutes/session or 75-90 minutes/week, with active rest (walk slowly) between stations of 20-30 seconds. HICT consists of 6 stations including jumping jacks' total body, running in place total body, zig-zag run, squat thrust, down-the-line drill, and dot-wave drill training. The total active rest time required for each exercise was 10 minutes. Polar H10 heart rate sensor was used to control intensity during training.

Data collection was carried out by carrying out physical fitness tests between pre-intervention and 24 hours post-intervention. A series of physical fitness tests are carried out at the same time both pre and post. The maximal oxygen volume (VO_2max) test was performed with a multi-stage 20-m shuttle run fitness test (20mMSFT) (Paradisis et al., 2014). The strength test was carried out with the Back & Leg Dynamometer, while the speed test was with the 30 Meter Sprint Test (Putera et al., 2023). The Illinois Agility Test (IAT) was carried out with the Shuttle Run Test (Soares Fernandes Jacomo da Silva et al., 2024).

The normality test was applied with the Shapiro-Wilk test. The difference test was applied by paired sample t-test to find out differences in physical fitness in each group, while to find out differences between groups was done by independent sample t-test. All statistical analyzes were performed using SPSS software version 20. Data presented with mean ± SD. The data was stated to have a significant difference if $p \leq 0.05$.

Results

Table 1 results of the analysis show that there were no significant differences in the characteristics of the study subjects between the two groups: CNTL (control group), and HICT (high-intensity circuit training group) ($p \geq 0.05$), so the two groups were at the same starting point. Meanwhile, the results of the analysis of differences in physical fitness in each group are presented in Figure 1 and Figure 2. Table 2 presents the results of the analysis of differences in physical fitness between groups.

Table 1.
Characteristics of research study

Parameters	n	CNTL	HICT	p-Values
		mean ± SD	mean ± SD	
Resting heart rate (bpm)	10	65.50±4.14	65.00±4.27	0.793
Systolic blood pressure (mmHg)	10	116.40±3.17	115.30±3.34	0.459
Diastolic blood pressure (mmHg)	10	74.60±3.03	74.40±3.34	0.890
Age (yrs)	10	20.50±0.85	20.90±1.10	0.376
Height (m)	10	1.76±0.05	1.77±0.04	0.400
Weight (kg)	10	64.80±5.29	66.60±3.75	0.393
Body mass index (kg/m^2)	10	21.01±0.84	21.17±1.08	0.721

Description: p-Values were determined by independent sample t-test.

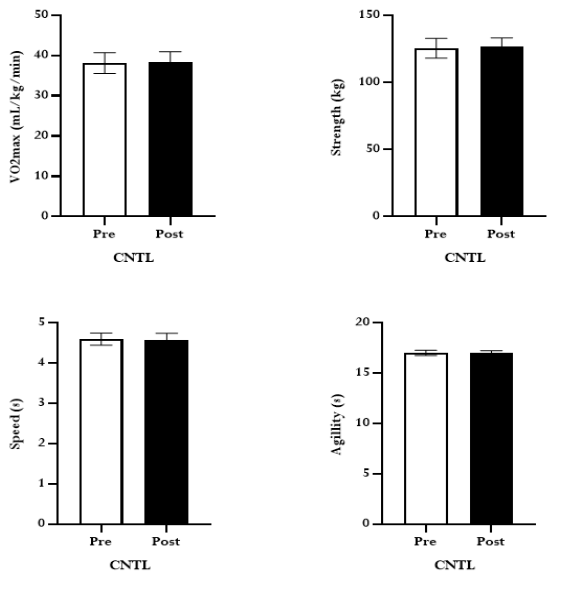

Figure 1. Differences in mean physical fitness between pre and post-in CNTL

2024, Retos, 54, 243-247

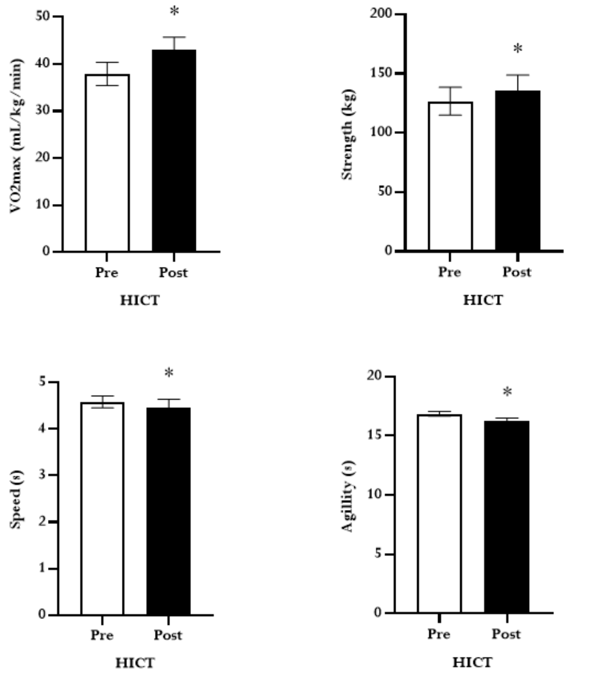

Figure 2. Differences in mean physical fitness between pre and post in HICT.
Description: (*) Significant at pre ($p \leq 0.01$).

Table 2.
Differences in mean physical fitness between CNTL and HICT

Parameters	n	CNTL	HICT	p-Values
		mean ± SD	mean ± SD	
Pre VO_2max (mL/kg/min)	10	38.12±2.58	37.95±2.46	0.882
Post VO_2max (mL/kg/min)	10	38.37±2.58	43.13±2.61*	0.001
Delta VO_2max (mL/kg/min)	10	0.25±0.41	5.18±1.11*	0.000
Pre Strength (kg)	10	125.30±7.37	126.70±11.76	0.754
Post Strength (kg)	10	126.60±6.43	136.10±12.68*	0.049
Delta Strength (kg)	10	1.30±2.59	9.40±4.41*	0.000
Pre-Speed (s)	10	4.59±0.15	4.58±0.13	0.899
Post Speed (s)	10	4.57±0.16	4.46±0.18	0.152
Delta Speed (s)	10	-0.02±0.05	-0.13±0.08*	0.003
Pre Agility (s)	10	17.00±0.26	16.86±0.20	0.184
Post Agility (s)	10	16.96±0.28	16.29±0.22*	0.000
Delta Agility (s)	10	-0.05±0.12	-0.57±0.14*	0.000

Description: p-Values were determined by independent sample t-test. (*) Significant at CNTL ($p \leq 0.01$).

Discussion

This research aims to determine how high-intensity circuit training affects physical fitness in healthy young males. Our findings suggest that high-intensity circuit training three times per week for eight weeks improves physical fitness (VO_2max, strength, speed, and agility) in healthy young males. According to Putera et al. (2023), high-intensity training helped boost strength and speed in male adolescents. Similarly, Puspodari et al. (2022) found that high-intensity exercise performed for 30 minutes per session, three times per week for eight weeks, increased maximum oxygen volume and agility. According to Gutierrez-Arroyo et al. (2023), A high-intensity circuit training program can be an efficient and risk-free technique to boost physical fitness. Research by Schmidt et al. (2016) reported that short duration circuit training with high intensity can increase muscle endurance in healthy populations. This shows that HICT is effective and safe in improving physical fitness, marked by increases in VO_2max, speed, agility, and muscle strength in healthy young males.

Exercise is one of the most effective approaches for providing beneficial effects on health and prolonging life (Permana et al., 2022; Chen et al., 2023). The application of high-intensity circuit training carried out 3x/week for 8 weeks has a positive effect on increasing physical fitness (VO_2max, strength, speed, and agility) in healthy young males. Therefore, the intervention we conducted fulfilled the minimal physical activity requirement of 75 minutes of high-intensity physical exercise per week (Bohlen et al., 2023). Exercise triggers mitochondrial biogenesis, upregulating the expression of ocular atrophy 1 (OPA1), dynamin-associated protein 1 (DRP1), and mitofusin protein 2 (MFN2). Swimming also stimulates mitochondrial biogenesis via the sirtuin 1 (SIRT1)/AMP-activated protein kinase (AMPK)/PPARγ coactivator 1 alpha (PGC1α) pathway and enhances mRNA expression of mitochondrial fatty acid oxidation and oxidative phosphorylation genes (Zou et al., 2023). Exercise intensity and duration both contribute to increased physical fitness (Kang et al., 2023). Exercise intensity and duration are also known to have a rather big impact on metabolic pathways (Hargreaves & Spriet, 2020).

Decreased muscle mass and function is one of the most problematic changes associated with aging, and has a significant impact on autonomy and quality of life (Agostini et al., 2023). On the other hand, increased energy expenditure takes place during the post-exercise period causing an increase in oxidative stress (Iwayama et al., 2023). It is known that muscle damage can occur due to inflammatory conditions triggered by oxidative stress (Caballero-García et al., 2023). However, our results show the opposite, namely an increase in speed, agility, muscle strength, and cellular respiration which is characterized by an increase in VO_2max. This is a key finding in this study since we were unable to reduce oxidative stress after the training. Perhaps, because this exercise is chronic, it triggers muscle adaptation by increasing anti-oxidants to balance oxidative stress levels, namely increasing mitochondrial function (Supruniuk et al., 2023).

The main limitations of this research are the number of subjects used is still small, so future research can use more subjects and compare them across age and gender groups. This study only examined physical fitness (VO2 max, strength, speed, and agility), and did not examine molecular parameters. However, the current findings show the potential benefits of the HICT program on the physical fitness level of healthy male adolescents so that it can prevent the risk of developing health problems in the future.

Conclusion

This study proves that high-intensity circuit training conducted 3x/week for 8 weeks with a training duration of 25-30 minutes/session or 75-90 minutes/week was effective in increasing physical fitness (VO_2max, strength, speed, and agility) in healthy young males.

Conflicts of Interest

The authors declare no conflict of interest.

References

Agostini, D., Gervasi, M., Ferrini, F., Bartolacci, A., Stranieri, A., Piccoli, G., … Donati Zeppa, S. (2023). An Integrated Approach to Skeletal Muscle Health in Aging. *Nutrients, 15*(8), 1802. https://doi.org/10.3390/nu15081802.

Bohlen, L. C., LaRowe, L. R., Dunsiger, S. I., Dionne, L., Griffin, E., Kim, A. E., … Williams, D. M. (2023). Comparing a recommendation for self-paced versus moderate intensity physical activity for midlife adults: Rationale and design. *Contemporary clinical trials, 128*, 107169. https://doi.org/10.1016/j.cct.2023.107169.

Caballero-García, A., Noriega-González, D. C., Roche, E., Drobnic, F., & Córdova, A. (2023). Effects of L-Carnitine Intake on Exercise-Induced Muscle Damage and Oxidative Stress: A Narrative Scoping Review. *Nutrients, 15*(11), 2587. https://doi.org/10.3390/nu15112587.

Chatzinikita, E., Maridaki, M., Palikaras, K., Koutsilieris, M., & Philippou, A. (2023). The Role of Mitophagy in Skeletal Muscle Damage and Regeneration. *Cells, 12*(5), 716. https://doi.org/10.3390/cells12050716.

Chen, Y. L., Ma, Y. C., Tang, J., Zhang, D., Zhao, Q., Liu, J. J., … Zou, C. G. (2023). Physical exercise attenuates age-related muscle atrophy and exhibits anti-ageing effects via the adiponectin receptor 1 signalling. *Journal of cachexia, sarcopenia and muscle*, 10.1002/jcsm.13257. Advance online publication. https://doi.org/10.1002/jcsm.13257.

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., van Mechelen, W., … Lancet Physical Activity Series 2 Executive Committee (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *Lancet (London, England), 388*(10051), 1311–1324. https://doi.org/10.1016/S0140-6736(16)30383-X.

Distefano, G., & Goodpaster, B. H. (2018). Effects of Exercise and Aging on Skeletal Muscle. *Cold Spring Harbor perspectives in medicine, 8*(3), a029785. https://doi.org/10.1101/cshperspect.a029785.

Galán-Arroyo, C., Mendoza-Muñoz , D. M. ., Mañana-Iglesia, C., & Rojo-Ramos , J. (2024). Physical fitness, indicator of healthy preadolescent development. *Retos, 52*, 447–456. https://doi.org/10.47197/retos.v52.99772.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. The Lancet. *Global health, 6*(10), e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7.

Gutiérrez-Arroyo, J., García-Heras, F., Carballo-Leyenda, B., Villa-Vicente, J. G., Rodríguez-Medina, J., & Rodríguez-Marroyo, J. A. (2023). Effect of a High-Intensity Circuit Training Program on the Physical Fitness of Wildland Firefighters. *International journal of environmental research and public health, 20*(3), 2073. https://doi.org/10.3390/ijerph20032073.

Hargreaves, M., & Spriet, L. L. (2020). Skeletal muscle energy metabolism during exercise. *Nature metabolism, 2*(9), 817–828. https://doi.org/10.1038/s42255-020-0251-4.

Higgins, J.K., & Kleimbaun, A.P. (1985). *Design Methodology for Randomized Clinical Trials*; Family Health International: Arlington, VA, USA. pp. 24–25.

Iwayama, K., Seol, J., & Tokuyama, K. (2023). Exercise Timing Matters for Glycogen Metabolism and Accumulated Fat Oxidation over 24 h. *Nutrients, 15*(5), 1109. https://doi.org/10.3390/nu15051109.

Kang, J. S., Kim, M. J., Kwon, E. S., Lee, K. P., Kim, C., Kwon, K. S., & Yang, Y. R. (2023). Identification of novel genes associated with exercise and calorie restriction effects in skeletal muscle. *Aging, 15*(11), 4667–4684. https://doi.org/10.18632/aging.204793.

Kennedy, M., Roche, S., McGowan, M., Singleton, E., Elsheikh, E., O'Donovan, M., … iPATH study group (2023). Physical activity, physical fitness and cardiometabolic risk amongst adults with moderate and severe haemophilia. *Haemophilia : the official journal of the World Federation of Hemophilia, 29*(1), 72–83. https://doi.org/10.1111/hae.14653.

Katzmarzyk, P. T., Friedenreich, C., Shiroma, E. J., & Lee, I. M. (2022). Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. *British journal of sports medicine, 56*(2), 101–106. https://doi.org/10.1136/bjsports-2020-103640.

McDougle, J. M., Mangine, G. T., Townsend, J. R., Jajtner, A. R., & Feito, Y. (2023). Acute physiological outcomes of high-intensity functional training: a scoping review. *PeerJ, 11*, e14493. https://doi.org/10.7717/peerj.14493.

Paradisis, G. P., Zacharogiannis, E., Mandila, D., Smirtiotou, A., Argeitaki, P., & Cooke, C. B. (2014). Multi-Stage 20-m Shuttle Run Fitness Test, Maximal Oxygen Uptake and Velocity at Maximal Oxygen Uptake. *Journal of human kinetics, 41*, 81–87. https://doi.org/10.2478/hukin-2014-0035.

Peiris, C. L., Gallagher, A., Taylor, N. F., & McLean, S. (2023). Behavior Change Techniques Improve Adherence to Physical Activity Recommendations for Adults with Metabolic Syndrome: A Systematic Review. *Patient preference and adherence, 17*, 689–697. https://doi.org/10.2147/PPA.S393174.

Permana, D. A., Kusnanik, N. W., Nurhasan, N., & Raharjo, S. (2022). A Six-Week Plyometric Training Program Improves Explosive Power and Agility in Professional Athletes of East Java. *Physical Education Theory and Methodology, 22*(4), 510–515. https://doi.org/10.17309/tmfv.2022.4.08.

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., … Olson, R. D. (2018). *The Physical Activity Guidelines for Americans. JAMA, 320*(19), 2020–2028. https://doi.org/10.1001/jama.2018.14854.

Puspodari, P., Wiriawan, O., Setijono, H., Arfanda, P. E., Himawanto, W., Koestanto, S. H., … Pranoto, A. (2022). Effectiveness of Zumba Exercise on Maximum Oxygen Volume, Agility, and Muscle Power in Female Students. *Physical Education Theory and Methodology, 22*(4), 478–484. https://doi.org/10.17309/tmfv.2022.4.04.

Putera, S. H. P., Setijono, H., Wiriawan, O., Nurhasan, Muhammad, H. N., Hariyanto, A., … Pranoto, A. (2023). Positive Effects of Plyometric Training on Increasing Speed, Strength and Limb Muscles Power in Adolescent Males. *Physical Education Theory and Methodology, 23*(1), 42–48. https://doi.org/10.17309/tmfv.2023.1.06.

San-Millán I. (2023). The Key Role of Mitochondrial Function in Health and Disease. *Antioxidants (Basel, Switzerland), 12*(4), 782. https://doi.org/10.3390/antiox12040782.

Santos, A. C., Willumsen, J., Meheus, F., Ilbawi, A., & Bull, F. C. (2023). The cost of inaction on physical inactivity to public health-care systems: a population-attributable fraction analysis. *The Lancet. Global health, 11*(1), e32–e39. https://doi.org/10.1016/S2214-109X(22)00464-8.

Soares Fernandes Jacomo da Silva, W. ., De Oliveira, F., Gonçalves Corrêa Neto, V., Rodrigues Marques Neto, S., Colonna de Miranda, M. J., Dias da Silva, L., … Rios Monteiro, E. (2024). Physical fitness analysis of strength training and functional fitness practitioners. *Retos, 52*, 185–190. https://doi.org/10.47197/retos.v52.101062.

Sarto, F., Bottinelli, R., Franchi, M. V., Porcelli, S., Simunič, B., Pišot, R., & Narici, M. V. (2023). Pathophysiological mechanisms of reduced physical activity: Insights from the human step reduction model and animal analogues. *Acta physiologica (Oxford, England), 238*(3), e13986. https://doi.org/10.1111/apha.13986.

Schäfer, J. A., Sutandy, F. X. R., & Münch, C. (2023). Omics-based approaches for the systematic profiling of mitochondrial biology. *Molecular cell, 83*(6), 911–926. https://doi.org/10.1016/j.molcel.2023.02.015.

Schmidt, D., Anderson, K., Graff, M., & Strutz, V. (2016). The effect of high-intensity circuit training on physical fitness. *The Journal of sports medicine and physical fitness, 56*(5), 534–540.

Shang, E., Nguyen, T. T. T., Westhoff, M. A., Karpel-Massler, G., & Siegelin, M. D. (2023). Targeting cellular respiration as a therapeutic strategy in glioblastoma. *Oncotarget, 14*, 419–425. https://doi.org/10.18632/oncotarget.28424.

Supruniuk, E., Górski, J., & Chabowski, A. (2023). Endogenous and Exogenous Antioxidants in Skeletal Muscle Fatigue Development during Exercise. *Antioxidants (Basel, Switzerland), 12*(2), 501. https://doi.org/10.3390/antiox12020501.

Wypych-Ślusarska, A., Majer, N., Krupa-Kotara, K., & Niewiadomska, E. (2023). Active and Happy? Physical Activity and Life Satisfaction among Young Educated Women. *International journal of environmental research and public health, 20*(4), 3145. https://doi.org/10.3390/ijerph20043145.

Zhu, Y., Zhou, X., Zhu, A., Xiong, S., Xie, J., & Bai, Z. (2023). Advances in exercise to alleviate sarcopenia in older adults by improving mitochondrial dysfunction. *Frontiers in Physiology, 14*, 1196426. https://doi.org/10.3389/fphys.2023.1196426.

Zou, Y. Y., Tang, X. B., Chen, Z. L., Liu, B., Zheng, L., Song, M. Y., … Tang, C. F. (2023). Exercise intervention improves mitochondrial quality in non-alcoholic fatty liver disease zebrafish. *Frontiers in endocrinology, 14*, 1162485. https://doi.org/10.3389/fendo.2023.1162485.

Datos de los autores y traductor:

Mahmud Yunus	mahmud.yunus.fik@um.ac.id	Autor/a
Slamet Raharjo	slamet.raharjo.fik@um.ac.id	Autor/a
Witri Suwanto	witri.suwanto@fkip.untan.ac.id	Autor/a
Ramdan Pelana	ramdanpelana@unj.ac.id	Autor/a
Nguyen Tra Giang	giang.nguyen@umt.edu.vn	Autor/a
Rahmatya Ikhwanurrosida, S.S	lingolinkpro@gmail.com	Traductor/a