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Benefits of concurrent endurance-strength training to increase the efficiency of fat loss: what do studies say?

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***Abstract*---**According to many studies, concurrent training has many benefits for the general fitness of the body, especially fat Loss. In fact, this article include a set of elements that explain the benefits of concurrent endurance-strength training in improving the efficiency of fat Loss, Starting with clarifying the effects of concurrent training on physical fitness, then understanding the balance between Intensity and volume in fat-reducing training, understanding the mechanism of fat metabolism in Concurrent training, as well as the benefits of endurance and strength training, and finally dealing with the benefits of improving Concurrent endurance-strength training by using the Periodization.

***Keywords*---**concurrent training, endurance training, strength training, fat Loss.

1. Introduction

Nowdays, both of athletes and non-athletes have made training for health purposes their top priority. Perhaps one of the most prominent training methods that achieve the goal of health is strength and endurance training.

Concurrent endurance and strength training has been shown to positively affect fat burning. Overweight and obese individuals with insulin resistance who participated in a 12-week. Indeed, according to a research by Azocar-Gallardo et al (Markov et al., 2022), exercise programme saw a notable increase in maximal fat oxidation compared to those who received metformin, Additionally, Strength

and endurance training decreased total body fat in distance runners with a modest level of training (Parastesh et al., 2022). These results indicate that integrating strength and endurance training can boost fat oxidation and increase body composition.

This article discusses the effects of concurrent endurance-strength training on physical fitness, also balancing Fat Loss Training: Intensity and Volume, The Fat Metabolism Mechanism in Concurrent Training, Endurance Training: Optimizing Lipid Use, and Strength Training: Changes The Number and Function of Mitochondria, Optimisation of Concurrent Endurance-Strength Training Using Periodization.

2. The Effect of Concurrent Endurance-Strength Training on Physical Fitness

Numerous facets of physical fitness have been demonstrated to benefit from concurrent strength and endurance training. Research has shown that concurrent strength and endurance training improves running economy (RE) and running biomechanics (Patoz et al., 2023). Additionally, Concurrent training enhances VO2max and lower-limb performance. Moreover, the strength-endurance (S-E) cycle results in higher improvements in lower extremity strength compared to the endurance-strength (E-S) sequence (Gao & Yu, 2023). In older adults, Concurrent training has demonstrated comparable impacts on muscular strength, power, and cardiorespiratory endurance (CRE) when compared to single-mode strength or endurance training (Markov et al., 2022). Moreover, Concurrent training benefits recreational endurance athletes by enhancing performance and specific anthropometric parameters. Running-specific strength training improves maximum and explosive strength as well as running economy (RE), while endurance training enhances VO2max, anaerobic threshold (AnT), and RE (Prieto-González & Sedlacek, 2022). Concurrent training may enhance endurance and strength abilities among team sports athletes. Interference effects may be reduced by ensuring adequate rest time, proper sequencing order, and selecting the right endurance exercise type (Seipp et al., 2022).

3. Balancing Fat Loss Training: Intensity and Volume

Fat loss requires the correct balance between workout intensity and volume. Multiple research have examined how various training methods impact the body composition and physical abilities of adults with obesity. A study discovered that combining a MICT with HIIT enhanced body composition and athletic abilities in obese persons (Reljic et al., 2021). Another study found that HIIT improved cardiopulmonary fitness and body fat in obese adults better than traditional exercise. (D'Alleva et al., 2023). In addition, Low-volume interval exercises were helpful in enhancing cardiometabolic wellness in obese persons even at moderate intensity (Türk et al., 2017; Reljic et al., 2020). Moreover, HIIT at or above 90% of peak oxygen consumption (VO2peak) was found that effectively reduce visceral fat. All-out sprint interval training was identified as the best time-efficient method for managing visceral obesity (Zhang et al., 2021).

4. The Fat Metabolism Mechanism in Concurrent Training

Concurrent training impacts fat metabolism through various mechanisms, including an increase in the highest fat oxidation through exercise. Research by Azocar-Gallardo et al. demonstrated that concurrent training led to a notable enhancement in the highest fat oxidation as compared to metformin pharmaceutical treatment (Azócar-Gallardo et al., 2022). Another approach is insulin sensitivity enhancement. High-intensity concurrent and moderate-intensity continuous exercise enhance insulin sensitivity in after menopause women (Rashti et al., 2019). Additionally, concurrent training can reduce subcutaneous and visceral abdomen fat (Turner & Comfort, 2022; Delgado-Floody et al., 2022). However, the connection between endurance and strength training in concurrent training is complicated and requires forethought. Optimization and minimization of interaction between the two variables need consideration of volume, intensity, rest, timing, and training stress (Klomklorm et al., 2020).

5. Endurance Training: Optimizing Lipid Use

Endurance exercise alters substrate metabolism, notably glycogen conservation. Lipid, lipid-like, and amino acid metabolic alterations are among these adaptations. Studies show that endurance-trained people regulate acylcarnitines and glycerophosphocholines differently than untrained people (Weiss et al., 2022). Additionally, Endurance exercise at low to medium intensities that focused on maximising lipid oxidation was shown to impact eating behaviour through epigenetic and regulatory mechanisms, promoting fullness and decreasing the desire to snack (Myzia et al., 2022). Moreover, Long-term LIPOXmax endurance exercise improves fuel metabolism, eating habits, and body composition, reducing weight and improving lipid metabolism (Brun et al., 2022). Glucose homeostasis and stress hormone reduction are also improved by endurance exercise (Guzzoni et al., 2022). Additionally, Researchers explored the molecular pathways that enhance lipid metabolism with regular exercise. In reaction to exercise, specific groups of molecules in the circulation shift, which are connected to lipid and lipoprotein levels (Barber et al., 2022).

6. Strength Training: Changes the Number and Function of Mitochondria

Research has demonstrated that strength training affects mitochondrial density and function. Mitochondria are essential for generating ATP and are crucial for muscle function and metabolism (Garibotti & Perry, 2023). Strength athletes had more mitochondrial surface and cristae density than non-athletes (MacLeod, 2023). The increased energy needs of strength exercise may explain this mitochondrial density increase (Botella et al., 2023). Additionally, Strength training increases mitochondrial respiration and function (Leo et al., 2023). However, The structural modifications of mitochondria in response to resistance exercise are not well known (Mesquita et al., 2023).

7. Optimisation of Concurrent Endurance-Strength Training Using Periodization

Concurrent endurance- strength training requires periodization to maximise results. These two types of training effect maximal strength, hypertrophy and power. Multiple factors should be considered to optimise concurrent training and reduce interference. Strength training should precede endurance training to enhance strength stimulus (Turner & Comfort, 2022). Additionally, Manage training stress to reduce progressive fatigue and strength adaptation adverse effects (Azócar-Gallardo et al., 2022). Maximise inter-session rest to minimise competing molecular signalling pathways and facilitate refuelling (Medeiros et al., 2020). Adjusting volume, intensity, and rest may affect concurrent training interference (de Hoyo Lora & Arrones, 2021). Furthermore, Daily and flexible nonlinear periodization can moderately improve maximum strength and aerobic capacity in postmenopausal women (Fyfe, 2016).

8. Conclusion

Concurrent endurance- strength training boosts fat reduction. Research has demonstrated that this training can effectively decrease body fat and enhance body composition. Concurrent exercise increases muscular build and strength, which boosts metabolism and fat loss. VO2max increases show it improves cardiorespiratory fitness. Additionally, concurrent training improves hormonal profiles. These data imply that concurrent endurance-resistance exercise may optimise fat loss and body composition.

References

Azócar-Gallardo, J., Ramirez-Campillo, R., Afonso, J., Sá, M., Granacher, U., González-Rojas, L., Ojeda-Aravena, A., & García-García, J. M. (2022). Overweight and Obese Adult Patients Show Larger Benefits from Concurrent Training Compared with Pharmacological Metformin Treatment on Insulin Resistance and Fat Oxidation. *International Journal of Environmental Research and Public Health*, 19(21), 14331. https://doi.org/10.3390/ijerph192114331

Barber, J. L., Cai, G., Robbins, J. M., Rao, P., Mi, M., Ghosh, S., Clish, C., Katz, D. H., Gerszten, R. E., Bouchard, C., & Sarzynski, M. A. (2022). Exercise Training-Induced Change in Lipid are Associated with Change in Circulating Protein and Metabolites. *Medicine & Science in Sports & Exercise*, 54(9S), 250–251. https://doi.org/10.1249/01.mss.0000878156.71301.7f

Botella, J., Schytz, C. T., Pehrson, T. F., Hokken, R., Laugesen, S., Aagaard, P., Suetta, C., Christensen, B., Ørtenblad, N., & Nielsen, J. (2023). Increased mitochondrial surface area and cristae density in the skeletal muscle of strength athletes. *The Journal of Physiology*, 601(14), 2899–2915. https://doi.org/10.1113/jp284394

Brun, J. F., Myzia, J., Varlet-Marie, E., Mercier, J., & Raynaud de Mauverger, E. (2022). The weight-lowering effect of low-intensity endurance training targeted at the level of maximal lipid oxidation (LIPOX max) lasts for more than 8 years, and is associated with improvements in body composition and blood pressure. *Science & Sports*, 37(7), 603–609. https://doi.org/10.1016/j.scispo.2022.03.002

D'Alleva, M., Giovanelli, N., Graniero, F., Billat, V. L., Fiori, F., Marinoni, M., Parpinel, M., & Lazzer, S. (2023). Effects of 24-week Polarized Training vs. Threshold Training in Obese Male Adults. *International Journal of Sports Medicine*. https://doi.org/10.1055/a-2123-0851

de Hoyo Lora, M., & Arrones, L. S. (2021). Programming and Periodisation for Team Sports. Resistance Training Methods, 237–258. https://doi.org/10.1007/978-3-030-81989-7_13

Delgado-Floody, P., Chirosa-Ríos, L., Caamaño-Navarrete, F., Valdés-Badilla, P., Herrera-Valenzuela, T., Monsalves-Álvarez, M., Núñez-Espinosa, C., Castro-Sepulveda, M., Guzmán-Muñoz, E., Andrade, D. C., & Álvarez, C. (2022). Concurrent training and interindividual response in women with a high number of metabolic syndrome risk factors. *Frontiers in Physiology*, 13. https://doi.org/10.3389/fphys.2022.934038

Leo, V. D., Lawless, C., Roussel, M. P., Gomes, T. B., Gorman, G. S., Russell, O. M., Tuppen, H. A. L., Duchesne, E., & Vincent, A. E. (2023). Strength training rescues mitochondrial dysfunction in skeletal muscle of patients with myotonic dystrophy type 1. . medRxiv. https://doi.org/10.1101/2023.01.20.23284552

Fyfe, Jackson. (2016). *Adaptation to Concurrent Training: Role of Endurance Training Intensity*. PhD thesis, Victoria University. https://vuir.vu.edu.au/id/eprint/32399

Gao, J., & Yu, L. (2023). Effects of concurrent training sequence on VO2max and lower limb strength performance: A systematic review and meta-analysis. *Frontiers in physiology*, 14, 1072679. https://doi.org/10.3389/fphys.2023.1072679

Garibotti, M. C., & Perry, C. G. (2023). Strength athletes and mitochondria: it's about 'time.' *The Journal of Physiology*, 601(14), 2753–2754. https://doi.org/10.1113/jp284856

Guzzoni, V., Sanches, A., Costa, R., de Souza, L. B., Firoozmand, L. T., de Abreu, I. C. M. E., Guerra, J. F. D. C., Pedrosa, M. L., Casarini, D. E., Marcondes, F. K., & Cunha, T. S. (2022). Stress-Induced Cardiometabolic Perturbations, Increased Oxidative Stress and ACE/ACE2 Imbalance are Improved by High-Volume Endurance Training in Rats. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4121004

Klomklorm, A., Ruangthai, R., Vaithanomsat, P., Sukatta, U., & Phoemsapthawee, J. (2020). Concurrent training and Eri silkworm pupae ingestion improve resting and exercise fat oxidation and energy expenditure in obese adults. *Journal of exercise rehabilitation*, 16(5), 467–479. https://doi.org/10.12965/jer.2040682.341

MacLeod, B. (2023). Exploring mitochondrial morphology in skeletal muscle: implications for highly trained individuals. *The Journal of Physiology*, 601(14), 2769–2770. https://doi.org/10.1113/jp284873

Markov, A., Hauser, L., & Chaabene, H. (2022). Effects of Concurrent Strength and Endurance Training on Measures of Physical Fitness in Healthy Middle-Aged and Older Adults: A Systematic Review with Meta-Analysis. *Sports Medicine*, 53(2), 437–455. https://doi.org/10.1007/s40279-022-01764-2

Medeiros, L. H., Sandbakk, S. B., Bertazone, T. M., & Bueno Júnior, C. R. (2020, February 21). Comparison of Periodization Models of Concurrent Training in Recreationally Active Postmenopausal Women. *Journal of Strength and Conditioning Research*, 36(4), 977–983. https://doi.org/10.1519/jsc.0000000000003559

Mesquita, P. H. C., Godwin, J. S., Ruple, B. A., Sexton, C. L., McIntosh, M. C., Mueller, B. J., Osburn, S. C., Mobley, C. B., Libardi, C. A., Young, K. C., Gladden, L. B., Roberts, M. D., & Kavazis, A. N. (2023). Resistance training diminishes mitochondrial adaptations to subsequent endurance training in healthy untrained men. *The Journal of physiology*, 601(17), 3825–3846. https://doi.org/10.1113/JP284822

Myzia, J., Brun, J. F., Varlet-Marie, E., Bui, G., Raynaud De Mauverger, E., & Mercier, J. (2022). Endurance training minimizing carbohydrate oxidation by targeting the optimal level of fat/carbohydrate oxidation ratio (OLORFOX)? *Science & Sports*, 37(7), 624–628. https://doi.org/10.1016/j.scispo.2022.03.003

Parastesh, M., Saremi, A., Hashemi, Y., Ramezani, S., & Shavandi, N. (2022). The effect of concurrent endurance-resistance training on serum testosterone levels, body composition, muscular strength and international index of erectile function in older men. *Advances in Rehabilitation*, 36(1), 1-10. https://doi.org/10.5114/areh.2022.113350

Patoz, A., Lussiana, T., Breine, B., Mourot, L., Gindre, C., & Hébert-Losier, K. (2023). Concurrent endurance training with either plyometric or dynamic body-weight training both improve running economy with minimal or no changes in running biomechanics. *Sports Biomechanics*, 1–18. https://doi.org/10.1080/14763141.2023.2200403

Prieto-González, P., & Sedlacek, J. (2022, August 29). Effects of Running-Specific Strength Training, Endurance Training, and Concurrent Training on Recreational Endurance Athletes' Performance and Selected Anthropometric Parameters. *International Journal of Environmental Research and Public Health*, 19(17), 10773. https://doi.org/10.3390/ijerph191710773

Rashti, B., Mehrabani, J., Damirchi, A., & Babaei, P. (2019). The influence of concurrent training intensity on serum irisin and abdominal fat in postmenopausal women. *Menopausal Review*, 18(3), 166–173. https://doi.org/10.5114/pm.2019.90810

Reljic, D., Frenk, F., Herrmann, H. J., Neurath, M. F., & Zopf, Y. (2021). Effects of very low volume high intensity versus moderate intensity interval training in obese metabolic syndrome patients: a randomized controlled study. *Scientific reports*, 11(1), 2836. https://doi.org/10.1038/s41598-021-82372-4

Reljic, D., Frenk, F., Herrmann, H. J., Neurath, M. F., & Zopf, Y. (2020). Low-volume high-intensity interval training improves cardiometabolic health, work ability and well-being in severely obese individuals: a randomized-controlled trial sub-study. *Journal of translational medicine*, 18(1), 419. https://doi.org/10.1186/s12967-020-02592-6

Seipp, D., Quittmann, O. J., Fasold, F., & Klatt, S. (2023). Concurrent training in team sports: A systematic review. *International Journal of Sports Science & Coaching*, 18(4), 1342-1364. https://doi.org/10.1177/17479541221099846

Türk, Y., Theel, W., Kasteleyn, M. J., Franssen, F. M. E., Hiemstra, P. S., Rudolphus, A., Taube, C., & Braunstahl, G. J. (2017). High intensity training in obesity: a Meta-analysis. *Obesity science & practice*, 3(3), 258–271. https://doi.org/10.1002/osp4.109

Turner, A., & Comfort, P. (2022). *Advanced strength and conditioning* (2nd ed.). Routledge.

Weiss, A., Alack, K., Klatt, S., Zukunft, S., Schermuly, R., Frech, T., Mooren, F. C., & Krüger, K. (2022). Sustained Endurance Training Leads to Metabolomic

Adaptation. *Metabolites*, 12(7), 658. https://doi.org/10.3390/metabo12070658

Zhang, H., Tong, T. K., Kong, Z., Shi, Q., Liu, Y., & Nie, J. (2021). Exercise training-induced visceral fat loss in obese women: The role of training intensity and modality. *Scandinavian journal of medicine & science in sports*, 31(1), 30–43. https://doi.org/10.1111/sms.13803