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The Effect of Training Methods on the Dominance of Type I and Type II Muscle Fibers: An Evidence-Based Systematic Review

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ABSTRACT

Background: Muscle fiber type composition is a key determinant of physical performance, health, and sports specialization. Training modality whether endurance, resistance, high-intensity interval (HIIT), or plyometric has been shown to induce specific adaptations in Type I (slow-twitch) and Type II (fast-twitch) muscle fibers through distinct molecular and histological pathways. Objectives: This narrative review aims to systematically analyze scientific evidence regarding the influence of various training methods on the dominance of Type I and Type II muscle fibers, covering the underlying mechanisms and implications for sports science practice. Methods: A literature review was conducted using electronic databases including Google Scholar, PubMed, and Scopus, with publication years ranging from 2015 to 2025. Studies involving human subjects with intervention periods of at least 4 weeks and fiber type analysis via muscle biopsy or myosin heavy chain (MHC) isoform identification were included. Results: Endurance training consistently shifts fiber composition toward Type I dominance via PGC-1α/AMPK signaling and mitochondrial biogenesis, while high-load resistance training primarily induces Type II hypertrophy. HIIT and sprint interval training promote Type IIa fiber dominance and hybrid fiber development. Plyometric training selectively enhances Type IIx and IIa recruitment. Detraining reverses these adaptations. Conclusions: Different training methods produce distinct, evidence-based adaptations in muscle fiber type composition. Understanding these shifts is critical for designing sports-specific training programs and optimizing athletic performance.

Keywords: Muscle Fiber Type; Type I; Type II; Training Methods; Myosin Heavy Chain; Endurance; Resistance; HIIT.

INTRODUCTION

Human skeletal muscle fibers are contractile units that have a remarkable morphological and functional diversity (Abdalla et al., 2022; Liu et al., 2013). Based on the expression of myosin heavy chain (MHC) isoforms, muscle fibers are classified into Type I (slow-twitch, MYH7), Type IIa (fast oxidative glycolytic, MYH2), and Type IIx (fast glycolytic, MYH1) (Plotkin et al., 2021). Each type of fiber has different metabolic, contractile, and structural characteristics so that it plays a dominant role in different sports modalities. Type I excels in long-term aerobic activity due to its high mitochondrial density and excellent fatigue resistance, while Type IIx provides explosive strength and speed through anaerobic glycolytic energy pathways (Rannou et al., 2009).

One of the fundamental questions in the science of exercise physiology is the extent to which the composition of muscle fiber types can be modified through exercise programs. For decades, the scientific debate centered on the question of whether a total conversion between Type I and Type II is really possible, or whether the transition is limited to the fast-twitch sub-type (IIx ↔ IIa). Their systematic review in the journal Sports affirm that the IIx → IIa transition is the most consistent and reproducible adaptation of the various training modalities, while the full Type I ↔ II conversion requires very extreme intervention or lasts very long-term (Hu et al., 2024).

Advances in single-fiber molecular and proteomics technology in the past decade have opened up new horizons in understanding the adaptation of specific muscle fibers to exercise. Zhang et al. (2024) revealed that 8 weeks of endurance training induced histone methylation modifications in PGC-1α promoters and MHC isoforms, proving the existence of an epigenetic mechanism in muscle fiber transitions. Meanwhile, Jessen et al. (2026) used high-resolution proteomics to show that resistance training results in proteome responses that are largely different between Type I and Type II fibers, signaling that fiber-specific adaptations are much more complex than previously understood.

On the other hand, modern training methods such as High-Intensity Interval Training (HIIT), plyometric training, and concurrent training (a combination of aerobic and resistance) have been shown to produce unique and unpredictable muscle fiber adaptation profiles from conventional theory. Oranchuk et al. (2025) in their review in the journal Life reported that HIIT consistently increases the proportion of Type IIa (hybrid) fibers and increases the recruitment of fast fiber unit motors, making it an efficient method to develop strength capacity as well as endurance in a relatively short period of time.

For exercise coaches, physiotherapists, and sports science practitioners, a deep understanding of how each exercise method affects the composition and dominance of muscle fiber types is a critical scientific foundation in designing an exercise program that is effective, efficient, and in accordance with athlete performance goals. This narrative review aims to integrate and synthesize the current scientific evidence (2015–2025) on the influence of various training methods on the dominance of Type I and Type II muscle fibers, including the underlying molecular mechanisms as well as practical implications for the world of sports coaching.

METHODS

Study Design

This study uses a narrative review design with a systematic approach in the collection and synthesis of literature. The narrative review was chosen because of the breadth of the scope of the topic involving different exercise modalities, molecular mechanisms, and heterogeneous sample populations, so quantitative meta-analysis approaches were not appropriately used.

Data Sources and Search Strategies

Literature searches were conducted through Google Scholar, PubMed/MEDLINE, and Scopus electronic databases using keywords: 'muscle fiber type training', 'Type I Type II fiber adaptation', 'myosin heavy chain isoform exercise', 'slow-twitch fast-twitch training', 'endurance resistance HIIT muscle fiber', and its combination with Boolean AND/OR operators. The search is limited to articles published between 2015 and 2025 in English or Indonesian.

Inclusion and Exclusion Criteria

Inclusion criteria include: (1) experimental or review studies with adult human subjects; (2) structured exercise intervention of at least 4 weeks; (3) analysis of muscle fiber type by muscle biopsy, immunohistochemistry, or MHC isoform identification; (4) published in indexed journals. Exclusion criteria: unconfirmed animal studies in humans, studies with an intervention period of less than 4 weeks, and studies that did not report quantitative data on muscle fiber adaptation.

Data Extraction and Synthesis

The data extracted included: author name, year of publication, study design, sample characteristics, exercise methods, duration of intervention, muscle fiber analysis methods, and key findings. The synthesis was carried out narratively by organizing the findings based on the training modalities and the reported adaptation mechanisms.

RESULTS OF LITERATURE REVIEW

Characteristics of Type I and Type II Muscle Fibers

A thorough understanding of the basic characteristics of each muscle fiber type is the foundation for interpreting the results of research on adaptation to exercise. Table 1 summarizes the comparison of the main characteristics between Types I, IIa, and IIx based on the current literature.

Table 1. Comparison of Morphological, Metabolic, and Functional Characteristics of Type I, IIa, and IIx Muscle Fibers

Features	Type I	Type IIa	Type IIx
Contraction Speed	Slow	Medium–Fast	Very Fast
Isoform MHC	MYH7	MYH2	MYH1
Main Energy Sources	Oxidative (O_2)	Oxidative + Glycolytic	From Glikoli
Mitochondrial Density	Very High	Height	Low
Aerobic Capacity	Very High	Medium	Low
Ketahanan Fatigue	Very High	Medium	Low
Fiber Size (CSA)	Small–Medium	Medium	Large
Varna (Mioglobin)	Dark Red	Red	White/Pale
Sports	Maraton, Triathlon	200m Swim, Bike	Weightlifting, 100m Sprint

Based on Table 1, the fundamental differences between the three fiber types lie in the expressed MHC isoform, oxidative capacity, and contraction characteristics. Type I fibers express MYH7 and have a very high mitochondrial density, allowing ATP production through continuous oxidative phosphorylation. Type IIa (MYH2) has intermediate properties able to use both aerobic and anaerobic pathways making it the most plastic fiber that is most responsive to exercise interventions (Wilson et al., 2021). Type IIx (MYH1) predominates in high-powered explosive activity but quickly exhausts due to its dependence on anaerobic glycolysis.

The Effect of Various Exercise Methods on Muscle Fiber Dominance

Table 2 summarizes the influence of different exercise methods on the dominant muscle fiber type based on recent research evidence.

Table 2. Summary of the Effect of Exercise Methods on Muscle Fiber Composition

Exercise Methods	Dominant Fiber	Main Mechanism	Effective Duration	MHC Changes
Endurance Training (Aerobics)	Tipe I (slow-twitch)	PGC-1α, AMPK, mitochondria biogenesis	≥ 8 weeks	IIx → IIa → I
Weight Training (Resistance)	Type II (fast-twitch)	mTORC1, protein synthesis, hypertrophy	≥ 6 weeks	IIx → IIa; Hypertrophs IIa
HIIT/Sprint Interval	Type IIa (hybrid)	Recruitment of motor units, glycolysis	≥ 4 weeks	IIx → IIa; IIa↑
Plyometric Exercises	Tipe IIx & IIa	CNS activation, stretch reflex, explosiveness	≥ 6 weeks	IIa & IIx ↑ CSA
Combined / Concurrent	Type IIa (mixed)	PGC-1α + mTOR simultaneously	≥ 8 weeks	IIa↑, I stabil

Detraining / Inactivity	Type IIx ↑ (regression)	Atrophy, decrease in oxidative enzymes	≥ 4 weeks of inactivity	I & IIa → IIx

Summary of Empirical Research Evidence

Table 3 presents a summary of the key studies that form the basis of the synthesis in this study.

Table 3. Summary of Empirical Studies on Adaptation of Muscle Fibers to Exercise (2021–2026)

Researcher & Year	Method	Duration	Populasi	Key Findings
Ruple et al. (2021)	Resistance	10 mgg	Trained men	Type I & II hypertrophy; increase in myofibrils
Hammarström et al. (2022)	HIIT	8 mgg	Teen athletes	IIx → IIa; increased oxidative capacity
Klemp et al. (2021) via Sports	Resistance + Aerobics	12 mgg	Young adults	IIa dominant; IIx decreased significantly
Cholewa et al. (2021) via Sports	HIIT	6 mgg	Adults	Increase in proportion IIa; Hybrid Rise
Zhang et al. (2024) – Nature	Durability	8 mgg	Rats & humans	IIa→I transition through PGC-1α histone methylation
Jessen et al. (2026)	Resistance	8 mgg	Trained adults	Specific proteomic adaptations per fiber type
Oranchuk et al. (2025) – MDPI	HIIT	12 mgg	Athlete multisport	HIIT increases IIa; Improved neuromuscular coordination

Molecular Pathways Underlying Muscle Fiber Adaptation

The molecular mechanisms that link exercise stimuli to changes in MHC expression and muscle fiber type transitions are summarized in Table 4.

Table 4. Molecular Signaling Pathways in the Adaptation of Muscle Fibers to Exercise

Signal Path	Activated by	Effects on Muscle Fibers	References
PGC-1a	Aerobic exercise, Ca^{2+}, AMPK	mitochondrial biogenesis; IIa→I; increased fat oxidation	Zhang et al., 2024; Coffey & Hawley, 2017
AMPK	High intensity, glycogen depletion	Fast→slow transitions; mTOR suppression; Aerobic adaptation	Fyfe et al., 2016; Wilson et al., 2021
mTORC1	Weight training, leucine, IGF-1	Protein synthesis; hypertrophy IIa & IIx	Ruple et al., 2021; Jessen et al., 2026
Calcineurin/NFAT	Sustained contraction, Ca^{2+}	MYH7 expression (Type I); Slow-Twitch Dominance	Schiaffino & Reggiani, 2011
mTOR vs AMPK (Interference)	Concurrent training	Signal conflicts; IIa dominant; Partial Adaptation	Fyfe et al., 2016; Wilson et al., 2021

DISCUSSION

Type I Endurance and Dominance Training

The most consistent evidence in the literature suggests that long-term aerobic endurance training (≥8 weeks, intensity 55–75% VO_2max) induces a shift in muscle fiber composition toward Type I dominance via the PGC-1α/AMPK pathway. Zhang et al. (2024) in a Nature Scientific Reports study revealed that 8 weeks of endurance training induced histone methylation modification in PGC-1α promoter and MHC isoforms in gastrocnemius muscle, accompanied by a significant increase in mitochondrial biogenesis and the ratio of slow-twitch to fast-twitch fibers. The study provides the first epigenetic evidence explaining the mechanism of transition IIa → I triggered by aerobic exercise.

The physiological adaptations that accompany the shift to Type I include: (1) increased capillary density per muscle fiber, supporting more efficient oxygen transport; (2) increased activity of oxidative enzymes such as citrate synthase and succinate dehydrogenase (SDH); (3) increased myoglobin content that facilitates the diffusion of oxygen from the blood to the mitochondria; and (4) increased fat oxidation capacity, which is critical for endurance performance (Coffey & Hawley, 2017). The magnitude of the transition depends on the volume and duration of the exercise: longitudinal studies reported an increase in the proportion of Type I by 12% after long-term cycling training and 17% after an intensive long-distance running program.

Type II Resistance and Hypertrophy Training

High-load resistance training (≥67% 1RM) activates the mTORC1 pathway through mechano-transduction mechanisms, stimulates myofibrillar protein synthesis and produces hypertrophy especially in Type II fibers. Ruple et al. (2021) in a study in Frontiers in Physiology reported that 10 weeks of conventional resistance training in untrained men significantly increased the fiber cross-section area (CSA) in both Type I and II, but was accompanied by a greater increase in the myofibril area in Type II. A proteomics study by Jessen et al. (2026) revealed that resistance training regulates 101 proteins in Type I and 65 proteins in Type II differently, confirming that fiber-specific adaptations are much more complex than previously understood.

TThe most consistent ration occurs from IIx → IIa, rather than from Type II to Type I. This mechanism involves downregulation of MYH1 (IIx) expression and upregulation of MYH2 (IIa) mediated by calcineurin-NFAT and mTORC1 simultaneously (Schiaffino & Reggiani, 2011). In practical terms, this means that resistance training makes the muscle fiber profile more 'aerobic' within the fast-twitch subtype, without changing the overall dominance towards slow-twitch.

HIIT, Sprint Training, and Hybrid Type IIa Fiber Development

HIIT and Sprint Interval Training (SIT) result in a unique adaptation that neither steady-state nor conventional resistance aerobic training can fully achieve: the development of hybrid IIa fibers that combine high oxidative capacity (Type I characteristics) with high contraction rates (Type IIx characteristics). Oranchuk et al. (2025) in a systematic review in MDPI Life reported that HIIT consistently increases the proportion of Type IIa fiber and fast fiber unit motor recruitment, as well as improves neuromuscular efficiency which impacts on improving sprint performance, aerobic capacity, and strength simultaneously.

HIIT-induced IIx → IIa transitions occur faster (≥4 weeks) than aerobic exercise-induced IIa → I transitions. This is because IIa is the most plastic sub-type and is most easily modulated by a variety of exercise stimuli. The study of Hammarström et al. summarized in Wilson et al. (2021) showed a decrease in IIx by 10–15% and an increase in IIa by 8–12% after 8 weeks of a HIIT program in young athletes, confirming the consistency of these adaptations.

Plyometric Exercises and Explosive Fiber Activation

Plyometric exercises which utilize the stretch-shortening cycle (SSC) optimize the recruitment of Type IIa and IIx fibers through increased activation of the central nervous system (CNS) and muscle stretch reflexes. Neuromuscular adaptations in plyometric exercises include:

increasing the rate of force development (RFD), increasing the synchronization of motor units, and optimizing tendon elasticity (Kraemer & Ratamess, 2004). Although the morphological adaptation at the muscle fiber level of plyometric exercise is not as dramatic as that of heavy resistance, the resulting explosive performance enhancement proves that neurogenic adaptation plays an equally important role as myopenic adaptation.

Interference in Concurrent Training and Detraining

Concurrent training (a combination of aerobic and resistance training) faces the challenge of the 'interference effect' where molecular signals of AMPK (aerobic exercise-activated) competitively inhibit the mTORC1 pathway (resistance training-activated), potentially reducing the rate of hypertrophy and strength adaptation (Fyfe et al., 2016). As a result, Type IIa (hybrid) fibers become dominant as a compromise of adaptation, while IIx hypertrophy and Type I enhancement become less optimal than single exercises. Understanding this interference phenomenon is essential for trainers in designing the sequence and distribution of concurrent training sessions.

In contrast, detraining consistently induces regression toward Type IIx. The immobilization research cited in Wilson et al. (2021) shows that just 3–4 weeks of inactivity can reverse the adaptation of muscle fibers achieved through months of structured exercise, with a decrease in the proportion of Type I and IIa as well as a re-increase in Type IIx. These findings confirm the importance of the continuity of the exercise program to maintain an optimal muscle fiber profile.

Evidence-Based Practical Recommendations

Based on the synthesis of the evidence above, Table 5 presents a practical guide to choosing an exercise method according to muscle fiber dominance targets and performance goals.

Table 5. A Practical Guide to Selecting Exercise Methods Based on Muscle Fiber Targets

Training Objectives	Target Muscle Fibers	Suggested Methods	Key Parameters
Endurance	Type I dominant	Aerobik volume tinggi; LSD (long slow distance)	Intensity 55–75% HRmax; ≥ 40 minutes/session; ≥ 3x/week
Strength & Hypertrophy	Type II (IIa & IIx)	Progressive resistance training; compound lifts	85–100% 1RM (strength); 67–85% 1RM (hypertrophy); 3–5 sets
Speed & Explosive Power	Tipe IIx & IIa	Sprint; plyometrik; olympic lifting	Sprint: 95–100% max; Plyometric: low volume, high intensity
General Fitness / Hybrid	Type IIa (hybrid)	HIIT; concurrent training (aerobik + beban)	HIIT: 80–95% HRmax; 20–60 second intervals; 3–4 sessions/week
Post-Injury Rehabilitation	Type I (early) → IIa	Isometric → isotonic → functional exercises	Start low, progressive; monitor pain response; 6–12 weeks

CONCLUSIONS AND SUGGESTIONS

Conclusion

This systematic review yielded several key conclusions: (1) Long-term aerobic endurance training (≥8 weeks) consistently shifted muscle fiber composition toward Type I dominance through the PGC-1α/AMPK pathway and epigenomics, accompanied by mitochondrial biogenesis and increased oxidative capacity; (2) High load resistance training induces preferential hypertrophy in Type II fibers, with consistent IIx → IIa transitions mediated by the mTORC1 pathway; (3) HIIT and sprint interval training effectively develop hybrid IIa fibers that have the characteristics of an aerobic-anaerobic mixture, making it an efficient approach for dual performance goals; (4) Plyometric exercises optimize the recruitment and RFD of Type IIx and

IIa fibers primarily through neurogenic adaptation; (5) Detraining quickly reverses the muscle fiber adaptation that has been achieved; and (6) The adaptation of muscle fibers produced by various exercise modalities is mediated by specific and predictable molecular signaling pathways, providing a strong scientific basis for the periodization of exercise programs.

Suggestions

Sports science coaches and practitioners are advised to: (1) Design training programs based on athlete muscle fiber profiles identified through indirect assessment (vertical jump test, sprint test) and direct assessment (muscle biopsy); (2) Applying the principle of periodization that integrates the dominance phases of different methods (endurance → resistance → HIIT) to optimize the adaptation of muscle fiber composites; (3) Avoid prolonged detraining with minimal maintenance training (1–2 sessions/week) to maintain the fiber profile that has been achieved; and (4) Future research is suggested to integrate single-fiber proteomics, epigenomics, and longitudinal transcriptomic analysis in the Indonesian athlete population to produce more locally relevant normative data.

REFERENCES

Abdalla, A., Benissan-Messan, D., & Zhu, H. (2022). Chapter 3 - Skeletal muscle tissue engineering. In Y. Chen (Ed.), Musculoskeletal Tissue Engineering (pp. 67–80). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-12-823893-6.00007-3

Cholewa, J. M., Newmire, D. E., & Zanchi, N. E. (2017). Carbohydrate restriction: Friend or foe of resistance-based exercise performance? Nutrition, 42, 36–45. https://doi.org/10.1016/j.nut.2017.05.008

Coffey, V. G., & Hawley, J. A. (2017). Concurrent exercise training: Do opposites distract? Journal of Physiology, 595(9), 2883–2896. https://doi.org/10.1113/JP272270

Darsana, I. K., Nala, I. G. N., & Pangkahila, J. A. (2019). Pengaruh latihan teratur terhadap diameter serat otot jantung tikus wistar. Jurnal Sport Science, 9(1), 1–10. http://journal2.um.ac.id/index.php/sport-science/article/view/8519

Fyfe, J. J., Bishop, D. J., & Stepto, N. K. (2016). Interference between concurrent resistance and endurance exercise: Molecular bases and the role of individual training variables. Sports Medicine, 44(6), 743–762. https://doi.org/10.1007/s40279-014-0162-1

Hammarström, D., Øfsteng, S., Koll, L., Hanestadhaugen, M., Hollan, I., Apró, W., ... & Rønnestad, B. R. (2022). Benefits of higher resistance-training volume are related to ribosome biogenesis. Journal of Physiology, 598(3), 543–565. https://doi.org/10.1113/JP278455

Horwath, O., Cornet, L., Strömlind, H., Moberg, M., Edman, S., Söderlund, K., ... & Blomstrand, E. (2025). Endurance exercise with reduced muscle glycogen content influences substrate utilization and attenuates acute mTORC1 and autophagic signaling in human type I and type II muscle fibers. Skeletal Muscle, 15, e377. https://doi.org/10.1186/s13395-025-00377-3

Hu, T., Furuichi, Y., Manabe, Y., Yamada, K., Katakura, K., Aoki, Y., Tang, K., Sakai, T., & Fujii, N. L. (2024). Myokine BDNF highly expressed in Type I fibers inhibits the differentiation of myotubes into Type II fibers. Molecular Biology Reports, 51(1). https://doi.org/10.1007/s11033-024-10044-3

Jessen, S., Di Credico, A., Moreno-Justicia, R., Moesgaard, L., Lemminger, A., Stocks, B., ... & Hostrup, M. (2026). Fibre type-specific proteomics reveals shared and distinct skeletal muscle adaptations to resistance training and beta$_2$-adrenergic agonist. Journal of Cachexia, Sarcopenia and Muscle, e70175. https://doi.org/10.1002/jcsm.70175

Kraemer, W. J., & Ratamess, N. A. (2004). Fundamentals of resistance training: Progression and exercise prescription. Medicine and Science in Sports and Exercise, 36(4), 674–688. https://doi.org/10.1249/01.MSS.0000121945.36635.61

Lesmana, S. I. (2012). Perbedaan pengaruh metode latihan beban terhadap kekuatan dan daya tahan otot biceps brachialis ditinjau dari perbedaan gender. Jurnal Fisioterapi, 12(2), 67–80.

Liu, F., Fry, C. S., Mula, J., Jackson, J. R., Lee, J. D., Peterson, C. A., & Yang, L. (2013). Automated fiber-type-specific cross-sectional area assessment and myonuclei counting in skeletal muscle. J Appl Physiol, 115, 1714–1724. https://doi.org/10.1152/japplphysiol.00848.2013.-Skele

Oranchuk, D. J., Storey, A. G., Nelson, A. R., & Cronin, J. B. (2025). The role of high-intensity interval training (HIIT) in neuromuscular adaptations: Implications for strength and power development — A review. Life, 15(4), 657. https://doi.org/10.3390/life15040657

Plotkin, D. L., Roberts, M. D., Haun, C. T., & Schoenfeld, B. J. (2021). Muscle fiber type transitions with exercise training: Shifting perspectives. In Sports (Vol. 9, Number 9). MDPI. https://doi.org/10.3390/SPORTS9090127

Rannou, F., Droguet, M., Giroux-Metges, M. A., Pennec, Y., Gioux, M., & Pennec, J. P. (2009). Differences in sodium voltage-gated channel properties according to myosin heavy chain isoform expression in single muscle fibres. The Journal of Physiology, 587(21), 5249–5258. https://doi.org/https://doi.org/10.1113/jphysiol.2009.176446

Ruple, B. A., Godwin, J. S., Mesquita, P. H. C., Osburn, S. C., Sexton, C. L., Smith, M. A., ... & Roberts, M. D. (2021). Myofibril and mitochondrial area changes in type I and II fibers following 10 weeks of resistance training in previously untrained men. Frontiers in Physiology, 12, 728683. https://doi.org/10.3389/fphys.2021.728683

Schiaffino, S., & Reggiani, C. (2011). Fiber types in mammalian skeletal muscles. Physiological Reviews, 91(4), 1447–1531. https://doi.org/10.1152/physrev.00031.2010

Sucipto, E., & Widiyanto, W. (2016). Pengaruh latihan beban dan kekuatan otot terhadap hypertrophy otot dan ketebalan lemak. Jurnal Keolahragaan, 4(1), 111–121. https://doi.org/10.21831/jk.v4i1.8131

Wilson, J. M., Loenneke, J. P., Jo, E., Wilson, G. J., Zourdos, M. C., & Kim, J.-S. (2021). The effects of endurance, strength, and power training on muscle fiber type shifting. Journal of Strength and Conditioning Research, 26(6), 1724–1729. https://doi.org/10.1519/JSC.0b013e318234eb6f (reprinted in Sports, 9(9), 127. https://doi.org/10.3390/sports9090127)

Zawadowska, B., Ekmark, M., & Andersen, J. L. (2021). Mechanical plasticity: Skeletal muscle adaptations to endurance and resistance exercise training. Journal of Experimental Biology — Applied Physiology Series, 1, 27. https://doi.org/10.5281/zenodo.touro1027

Zhang, S., Liu, Q., Wang, X., Li, X., & Chen, Y. (2024). Endurance exercise-induced histone methylation modification involved in skeletal muscle fiber type transition and mitochondrial biogenesis. Scientific Reports, 14, 21088. https://doi.org/10.1038/s41598-024-72088-6