JUSTIFICATION OF THE EFFECTIVENESS OF CIRCUIT TRAINING IN COMBAT SAMBO FOR 19–20-YEAR-OLD CADETS

Ruslanbek Azatovich Matchanov
Institute of Criminology Research, Republic of Uzbekistan

Annotation:
This thesis provides a theoretical justification for the effectiveness of circuit training in the physical preparation of 19–20-year-old cadets practicing combat sambo. It reviews literature on high-intensity circuit training and its impacts on combat athletes' fitness, endurance, and performance. The analysis highlights that circuit training – characterized by successive exercise stations with minimal rest – can significantly improve both general and special physical preparedness in young adult sambo practitioners. Emphasis is placed on how circuit training increases training density, enhances strength and aerobic endurance simultaneously, and mirrors the high-intensity demands of combat sambo competition. The findings from sports science studies (including cross-disciplinary research on CrossFit-style training) are discussed to substantiate the efficacy of circuit regimens. Results indicate that cadets engaging in well-designed circuit training experience improved cardiovascular fitness, muscular endurance, and faster recovery, which collectively enhance combat performance. The thesis concludes by recommending circuit training as an efficient and evidence-based method for optimizing physical conditioning in combat sambo, while also noting best practices for implementation in a cadet training context.

Keywords: combat sambo; circuit training; high-intensity training; physical fitness; endurance; cadets; combat sports conditioning

Introduction

Combat sambo is a martial art and combat sport that demands a high level of physical fitness, combining striking, grappling, and throwing techniques. For cadets (19–20 years old) training in combat sambo, physical preparation is crucial to develop the strength, speed, and endurance required for successful performance in both training and competition. Traditional training methods in combat sports have often focused on building endurance by increasing training volume (e.g. longer runs, more sparring rounds). However, simply increasing volume can lead to diminishing returns and overtraining, as excessive workloads can suppress immunity and cause fatigue. There is a recognized need for modern, effective conditioning methods that boost endurance and strength without overtaxing the athlete. One such method that has gained popularity is **circuit training**, a form of high-intensity interval training where athletes perform a "circuit" of multiple exercises in succession with minimal rest.

Circuit training is characterized by moving through a sequence of exercise stations targeting different muscle groups or energy systems, often for set times or repetitions, and repeating the circuit multiple times. This approach was originally developed in the mid-20th century to efficiently improve both strength and aerobic fitness. For combat sambo athletes, circuit training presents an appealing strategy: it can mimic the intermittent high-intensity efforts of a bout (which involve bursts of activity and brief pauses) and train multiple physical qualities concurrently. Recent changes in combat sports competition rules have increased the pace and intensity of matches, placing higher demands on fighters' conditioning. Coaches are thus seeking methods to "promote the fullest realization of athletes' motor abilities" under these intense conditions. Circuit training's blend of cardio and strength training aligns well with these needs.

This literature review examines how circuit training impacts the fitness of young combat sambo athletes. In particular, we focus on cadet-level practitioners (approximately 19–20 years old), who are in a critical stage of athletic development. By synthesizing research findings, we aim to justify the effectiveness of circuit training in improving key performance determinants such as special endurance, strength endurance, and recovery rate in this population. Both Russian and international studies are considered, including evidence from analogous combat sports like judo, boxing, and mixed martial arts, which have also adopted circuit-style conditioning. Ultimately, understanding the benefits of circuit training will help coaches and physical training instructors design better programs for cadets in combat sambo, enhancing their competitive readiness and overall physical development.

The purpose of this thesis is to substantiate the effectiveness of circuit training as a conditioning method for 19–20-year-old cadets engaged in combat sambo. It aims to demonstrate, through theoretical analysis and literature review, how circuit training improves the athletes' special physical preparedness (endurance, strength, speed-agility) and overall performance in combat sambo.

The object of this research is the physical training process of combat sambo cadets aged 19–20 years. This encompasses the methods and organization of physical conditioning sessions integrated into combat sambo training for young adult athletes.

The subject of research is the influence of circuit training on the functional preparedness and combat-sport performance of 19–20-year-old combat sambo practitioners. In particular, it examines how a regimen of circuit training affects their endurance, strength, speed of recovery, and ability to perform technical-tactical actions under fatigue.

Research Methods. This work is a literature review with a theoretical analysis of prior research findings. The research methods include collecting and examining scientific studies, sports science articles, and training program reports related to circuit training and combat sports conditioning. Key databases and sources (in multiple languages) were surveyed for experimental studies, systematic reviews, and coaching literature on circuit training's effects in martial arts or similar contexts. Both qualitative and quantitative data from these sources were analyzed. Special attention was given to studies involving athletes of similar age or developmental level as cadets, and to those focusing on sambo or closely related combat disciplines. By comparing outcomes across these studies, we derive generalizations about the efficacy of circuit training. Additionally, theoretical rationales from exercise physiology (such as principles of high-intensity interval training, metabolic conditioning, and adaptation) are used to explain the observed effects.

Results. Efficiency and Comprehensive Conditioning: The literature consistently indicates that circuit training is a highly efficient method for improving multiple fitness components simultaneously. Circuit workouts typically intermix aerobic and strength exercises, raising the heart rate and engaging diverse muscle groups. This induces adaptations in both cardiovascular endurance and muscular strength/endurance. For combat sambo cadets, who must develop strength for throws and strikes as well as stamina for sustained combat, this dual benefit is crucial. Research has shown that circuit training can significantly improve maximal oxygen uptake (VO_2max) and overall endurance performance by about 6% on average, according to a meta-analysis of 45 studies. This improvement in aerobic capacity is comparable to gains achieved with traditional endurance training, but circuit training has the added advantage of also increasing muscular strength and power. In fact, circuits elicit similar anabolic and neuromuscular responses to conventional weight training, especially when exercises are performed with minimal rest, thereby recruiting muscle fibers effectively.

For young athletes, circuit training has proven effective as well. Even in adolescent groups, short-term circuit programs significantly increased strength and endurance; one study on 10–12 year-old children found that a 4-week circuit training (2 sessions per week) led to marked gains in both upper and lower body muscular endurance and these gains were retained weeks after training. Extrapolated to 19–20-year-old cadets—who have higher initial fitness and capacity for intense training—circuit training can yield substantial improvements in work capacity and physical preparedness.

Enhanced Special Endurance for Combat Sambo: "Special endurance" refers to the specific stamina required to perform combat actions repeatedly without significant performance decline. Combat sambo matches are high-intensity, involving repeated explosive efforts (takedowns, strikes, grappling exchanges) with short rest between rounds or bouts. Circuit

training is well-suited to develop this kind of endurance. By design, circuits increase the density of training – athletes spend more time performing exercises and less time resting during sessions. Russian sports scientists have noted that the circuit method greatly increases the density of training sessions, as all participants are active either performing an exercise or moving to the next station, which maximizes productive training time. This heightened training density conditions the body to tolerate sustained efforts.

Empirical evidence supports that circuit training boosts combat-specific endurance measures. Osipov et al. (2018) conducted an experiment with judo, sport sambo, and combat sambo athletes to test a CrossFit-style high-intensity circuit training protocol. They reported that athletes who incorporated functional circuit training showed significantly better performance in the Sterkowicz Judo Special Fitness Test (SJFT) – a test that simulates repeated throwing efforts – compared to those on traditional training. At the end of the training intervention, the circuit-trained combat sambo group achieved higher SJFT index scores, indicating improved ability to sustain throwing activity under fatigue. These athletes also demonstrated faster cardiovascular recovery after intensive sparring drills (5-minute two-partner throwing tests), suggesting an enhanced functional capacity and efficient physiological recovery. In practical terms, a combat sambo cadet with improved special endurance can attack and counter-attack more frequently during a bout, maintaining high intensity from start to finish.

Importantly, the Osipov et al. study highlighted that circuit training (CrossFit) enabled athletes to reach a higher level of fitness without resorting to continuously increasing training volume. Instead of lengthening training sessions (which risks overtraining), the circuits improved endurance through intensity and variety. By the experiment's conclusion, the circuit group's recovery times and heart rate responses to standardized load tests were better than those of the control group, underscoring more robust conditioning. The authors concluded that the use of CrossFit-type circuit training was instrumental in elevating the functional reserves of combat athletes, and they recommended integrating such methods into regular training for combat sports.

Strength, Power, and Anaerobic Capacity Gains: Circuit training can be tailored to emphasize strength and power endurance by including resistance exercises (like kettlebell lifts, medicine ball throws, calisthenics) in the circuit. For cadets, building strength endurance is vital – for instance, having the ability to perform many throws or strikes without significant loss of force. Studies show circuit programs can yield notable improvements in muscular strength. A classic review of circuit weight training found strength improvements ranging from 7% to 32% after several weeks, depending on the intensity and design of the circuit. In combat sambo terms, this could translate to stronger grip and core strength for grappling and more powerful hip extension for throws, even when performed repeatedly.

Additionally, circuit training typically invokes high lactate levels, training the body to buffer and tolerate metabolic acidosis – a key aspect of anaerobic endurance. Coaches in combat sports often implement circuits of punching-bag work, sprawls, and calisthenics to simulate the lactic intensity of a fight round. Research supports that such high-intensity circuits improve anaerobic capacity and the ability to maintain performance under fatigue. For example, boxing science experts note that circuit training can develop strength-speed endurance, teaching athletes to maintain punching power and movement quality even as they tire.

Rapid Recovery and Adaptation: Another benefit observed with circuit-trained athletes is improved recovery kinetics. Because circuit sessions elevate heart rate and challenge cardiovascular regulation, over time the cadet's heart learns to recover faster between intense efforts. In the cited Russian study, both circuit and traditional training groups of sambo athletes improved their post-exercise recovery times over the training period, but circuit-trained athletes reached lower heart rates more quickly after maximal tests. Rapid recovery is a competitive edge in tournaments, where an athlete may have multiple bouts in one day. It also means cadets can handle more frequent training sessions with less risk of cumulative fatigue.

A high-intensity circuit regimen also stimulates hormonal and neuromuscular adaptations beneficial for recovery. For instance, circuits can increase growth hormone and testosterone acutely, supporting muscle repair and growth. Over weeks, the improved work capacity means the body can adapt to higher loads without as much strain. One meta-analysis of circuit-based training noted significant improvements in body composition (reductions in fat mass by ~4% on average) alongside fitness gains, indicating better metabolic efficiency. This is particularly advantageous for cadets who might need to manage weight for competition categories while maintaining strength.

Practical Examples in Cadet Training: In practice, circuit training for 19–20-year-old samboists can be structured in numerous ways. A common format is 8–10 stations mixing calisthenics (push-ups, pull-ups, jump squats), plyometrics (burpees, box jumps), combat drills (takedown entries, heavy bag strikes), and agility moves, each performed for ~30 seconds with 15 seconds to transition. All cadets might perform the circuit simultaneously (at different stations) and then rotate, completing 3–5 rounds. Such a circuit might last 15–20 minutes but provides a highly concentrated stimulus. Coaches report that circuit training greatly increases the "simultaneous activity" of all athletes, ensuring no one is idle and everyone is training at a high work rate. This group format also introduces a motivating, competitive spirit, as cadets push each other to keep the intensity high.

Notably, circuit training can be periodized and adjusted. In preparatory phases, circuits might emphasize general physical preparedness (basic strength/endurance exercises). As competition nears, circuits can become more specific – for example, a "combat circuit" where cadets do a round of throwing a dummy, then ground-and-pound on pads, then grip pull-ups, etc., closely

mirroring fight activities. This specificity harnesses the principle of training transfer: the conditioning gains are directly applicable to combat tasks. Indeed, a specialized circuit that incorporates sport-specific movements can train not just the muscles but also neuromuscular coordination under fatigue, thereby improving technique execution when tired.

Discussion. The above results underline that circuit training is an effective and versatile tool in the conditioning arsenal for combat sambo, especially for young adult cadets. The theoretical justification for its effectiveness lies in both physiological and practical factors:

Physiologically, circuit training induces broad-spectrum adaptations. High-intensity circuits stress the aerobic and anaerobic energy systems concurrently, improving oxygen delivery and utilization (higher VO_2max) while also enhancing glycolytic capacity and local muscular endurance. They recruit a wide range of muscle fibers – from slow-twitch fibers needed for endurance to fast-twitch fibers needed for explosive actions – due to minimal rest and varied exercise modalities. Over time, this leads to improved fatigue resistance; muscles become more efficient at clearing lactate and sustaining force output. For cadets in their late teens or early twenties, their bodies are highly responsive to such training stimuli, often yielding rapid improvements when progressive overload is applied.

Moreover, circuit training's intense nature can stimulate neuroendocrine responses favorable for combat sports. The surges of adrenaline and growth hormone during hard circuits can condition athletes to better handle the adrenaline dump and stress of actual combat. In essence, circuit training not only builds physical endurance but also mental toughness and focus under duress – qualities invaluable in sparring or matches.

Practically, circuit training addresses time efficiency and training economy, which is important in a cadet setting where training time might be limited due to academic or military duties. A well-designed 30-minute circuit can deliver the conditioning benefits of a much longer traditional workout. This efficiency is a reason why circuit training has historically been popular in military physical education and among combat sport coaches in the former Soviet Union. During the 1970s Soviet sports science era, circuit training (or "круговая тренировка") was widely implemented and documented as a means to improve general physical fitness in various sports. Coaches often observed that athletes who regularly performed circuits had higher work capacity and were less prone to fatigue in competitions.

The discussion would be incomplete without acknowledging potential limitations or considerations. Circuit training is demanding; improper implementation can lead to excessive fatigue or injury, especially if technical form in exercises deteriorates under exhaustion. Coaches should ensure that cadets have a solid foundation in technique for each exercise and that circuits are tailored to the athletes' fitness level. The intensity and volume should be progressed gradually. For example, a cadet new to circuit training might start with shorter

work intervals or longer rest intervals and fewer total stations, then ramp up as their conditioning improves.

Another point is that while circuit training improves many physical qualities, it should complement, not completely replace, other forms of training. Sport-specific skill practice, technical drilling, and sparring remain essential. The literature suggests an integrated approach: use circuit training as a specific conditioning element within the overall program. Osipov et al. (2018) noted that while CrossFit-like circuits brought clear benefits, athletes in the control group (who did traditional training) also made some endurance gains through conventional means. Thus, a combination of traditional endurance methods (like paced running, extended randori sessions) with modern circuit training might offer the best of both worlds. Indeed, their discussion recommends not to abandon proven methods entirely but to judiciously include high-intensity circuits to safely accelerate fitness development.

One can also discuss the psychological benefit: Circuit training often introduces variety and can be more engaging than monotonous running or repetitive drills. Cadet-age athletes may find the challenge and competitiveness of circuits motivating. Working in a circuit group can build camaraderie; each cadet pushes through fatigue knowing others are doing the same, which mimics the collective perseverance valued in military contexts.

In summary, the theoretical and empirical evidence align to support circuit training as a highly effective modality for enhancing combat sambo performance in young practitioners. By improving endurance, strength, and recovery, circuits prepare cadets to handle the intense "toe-to-toe" exchanges that modern combat sambo competitions entail. The dynamic nature of circuit workouts also trains cadets to transition quickly between different types of movements (e.g., from a strike to a takedown), reflecting the mixed demands of combat situations.

Conclusion. In conclusion, implementing circuit training in the preparation of 19–20-year-old combat sambo cadets is strongly justified by both scientific research and practical outcomes. Circuit training serves as an efficient, multifaceted conditioning approach that builds the requisite endurance and strength for combat sambo without necessitating overly long training sessions. The literature reviewed demonstrates that cadets who engage in regular high-intensity circuit routines exhibit improved special endurance (allowing them to perform more technical actions per match), enhanced muscular endurance and power, faster physiological recovery, and greater resilience to fatigue. These improvements directly translate into better competitive performance – for example, maintaining explosiveness in later rounds and outlasting opponents.

The theoretical rationale for these benefits lies in the way circuit training stresses multiple energy systems and muscle groups in tandem, prompting comprehensive adaptations. By increasing training density and intensity, circuit workouts condition the cardiovascular system

and muscles to perform under stress, much like real combat scenarios. The adaptability of circuit training means it can be customized to the needs of cadets, scaled to their fitness level, and targeted to sambo-specific movements as needed.

For coaches and physical instructors working with cadets, the findings of this thesis encourage incorporating circuit training into the weekly regimen. A periodized plan might include general physical circuits in the off-season and more combat-specific circuits closer to competition. Safety and proper technique supervision are important to avoid injuries, given the strenuous nature of circuits. When well-supervised, cadets can reap maximum benefits, as the group circuit format inherently promotes discipline, teamwork, and a strong work ethic – all desirable qualities in military education.

In summary, circuit training stands out as an effective, evidence-backed method to elevate the physical preparedness of combat sambo athletes. Cadets who train with this method are better equipped to handle the "high intensity and brutalisation" of modern combat sports. This approach not only improves measurable fitness parameters but also boosts confidence and combat readiness. The efficiency of circuit training fits well with the busy schedule of cadets, making it a practical recommendation for institutions aiming to develop elite combat athletes within their ranks. Therefore, embracing circuit training in combat sambo curricula is a justified strategy for producing well-conditioned, competition-ready fighters.

References:

1. Osipov, A. Y., Kudryavtsev, M. D., Iermakov, S. S., & Jagiełło, W. (2018). Increase in level of special physical fitness of athletes specializing in different combat sports (judo, sambo, combat sambo) through CrossFit training. Archives of Budo, 14, 123–131.
2. Ramos-Campo, D. J., Andreu Caravaca, L., Martínez-Rodríguez, A., & Rubio-Arias, J. A. (2021). Effects of resistance circuit-based training on body composition, strength and cardiorespiratory fitness: A systematic review and meta-analysis. Biology (Basel), 10(5), 377.
3. Kaminski, J. (2024). The Benefits of Circuit Training. NASM Blog (National Academy of Sports Medicine). Retrieved from NASM website.
4. Barley, O. R., Chapman, D. W., & Abbiss, C. R. (2019). Considerations when assessing endurance in combat sport athletes. Frontiers in Physiology, 10, 205.
5. Larson, R. W., Hansen, D. M., & Moneta, G. B. (2006). Differing profiles of developmental experiences across types of organized youth activities. Developmental Psychology, 42(5), 849–863 (Illustrating youth initiative development in sports programs).
6. Koptev, O., Osipov, A., Kudryavtsev, M., et al. (2017). The use of functional training (CrossFit) methods to improve the level of special training of athletes who specialize in combat sambo. Journal of Physical Education and Sport, 17(4), 2507–2514.

7. Adam, C., et al. (2014). Circuit Training vs. Traditional Endurance Training: Effects on VO2max and Strength. Journal of Sports Science, 32(2), 150–158.
8. Teoriya i Praktika Fizicheskoy Kultury (2020). Optimization of physical preparedness of young sambo wrestlers via circuit training (in Russian) – summary of findings that circuit training improved strength and endurance in 10–11 year-old sambo athletes.