Methodology for Developing the General Physical Fitness of 13-14-Year-Old Handball Players Using the Circuit Training Method.

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Annotation: *The effectiveness of circuit training for enhancing the general physical condition of 13–14 year old handball players is investigated in this work. Combining qualitative observations and interviews with quantitative fitness tests, the study uses a mixed-methods approach. Forty teenage handball players signed up for a 12-week circuit training program meant to enhance many facets of physical fitness. Measured both before and after the intervention were strength, endurance, agility, and speed gains. The results reveal very significant increases in all evaluated fitness indices, most especially in muscular endurance and agility. Qualitative data show people enjoy their activities and are more driven. According to the study, circuit training is a good and interesting approach for increasing general physical fitness in young handball players and advises including it into regular training schedules for this age group.*

Keywords: *adolescent athletes, physical fitness, strength and conditioning, circuit training, handball, sport performance*

Методология развития общей физической подготовки гандболистов 13-14 лет с использованием метода круговой тренировки.

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Аннотация: *В данной работе исследуется эффективность круговой тренировки для улучшения общей физической подготовки гандболистов 13-14 лет. Исследование использует смешанный подход, сочетая качественные наблюдения и интервью с количественными тестами физической подготовки. Сорок юных гандболистов приняли участие в 12-недельной программе круговой тренировки, направленной на улучшение различных аспектов физической подготовки. Прирост силы, выносливости, ловкости и скорости измерялся до и после вмешательства. Результаты показывают значительные улучшения по всем оцениваемым показателям физической подготовки, особенно в мышечной выносливости и ловкости. Качественные данные свидетельствуют о повышении удовольствия от занятий и мотивации участников. Исследование заключает, что круговая тренировка является эффективным и увлекательным методом повышения общей физической подготовки юных гандболистов, и рекомендует включать ее в регулярные тренировочные программы для этой возрастной группы.*

Ключевые слова*: юные спортсмены, физическая подготовка, силовая и кондиционная тренировка, круговая тренировка, гандбол, спортивные результаты*

13-14 yoshli gandbol o‘yinchilarining umumiy jismoniy tayyorgarligini aylanma mashg‘ulot usuli yordamida rivojlantirish metodologiyasi

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Annotatsiya: *Ushbu ishda 13-14 yoshli gandbol o‘yinchilarining umumiy jismoniy holatini yaxshilash uchun aylanma mashg‘ulotlarning samaradorligi o‘rganiladi. Tadqiqot sifatli kuzatuvlar va intervyularni miqdoriy jismoniy tayyorgarlik testlari bilan birlashtirgan holda aralash usuldan foydalanadi. Qirqta o‘smir gandbol o‘yinchisi jismoniy tayyorgarlikning turli jihatlarini yaxshilashga qaratilgan 12 haftalik aylanma mashg‘ulot dasturiga yozilgan. Kuch, chidamlilik, chaqqonlik va tezlik ko‘rsatkichlari aralashuv oldi va keyin o‘lchangan. Natijalar barcha baholangan jismoniy tayyorgarlik ko‘rsatkichlarida, ayniqsa mushak chidamliligi va chaqqonlikda sezilarli yaxshilanishni ko‘rsatadi. Sifat ma’lumotlari ishtirokchilarning mashg‘ulotlardan zavqlanishi va motivatsiyasi oshganligini ko‘rsatadi. Tadqiqot shuni ko‘rsatadiki, aylanma mashg‘ulot yosh gandbol o‘yinchilarining umumiy jismoniy tayyorgarligini oshirish uchun samarali va qiziqarli usul hisoblanadi va uni ushbu yosh guruhi uchun muntazam mashg‘ulot jadvallariga kiritishni tavsiya qiladi.*

Kalit so‘zlar*: o‘smir sportchilar, jismoniy tayyorgarlik, kuch va konditsion mashg‘ulotlar, aylanma mashg‘ulot, gandbol, sport natijalari*

Introduction.

Players of handball must have a broad spectrum of physical traits including strength, endurance, agility, and speed since this is a dynamic and physically demanding activity. For 13 to 14 year olds who are budding athletes, this is a critical period for their physical growth and skill acquisition. Therefore, their long-term athletic development and success in the sport depend on using effective training techniques that might concurrently enhance several components of physical fitness.

With the capacity to address many fitness components in one training session, circuit training has become a flexible and time-efficient approach of physical conditioning. To stress the musculoskeletal and cardiovascular systems, this approach consists of performing a defined series of exercises in a predetermined sequence with few breaks between stations. Although circuit training has been much studied in adult populations and many sports environments, its particular usage and effectiveness in improving the general physical fitness of young handball players is yet unknown.

The aim of this study is to ascertain whether a well-designed circuit training program would help 13-14 year old handball players to reach better overall physical condition. By concentrating on this crucial growth period, we intend to provide coaches, trainers, and sports scientists with essential understanding of how to enhance junior handball players’ training programs. The study attempts to answer the following questions: (1) How much does a 12-week circuit training program improve several facets of physical fitness in young handball players? (2) In this age range, how does circuit training affect the enjoyment and drive behind exercise? (3) What are the pragmatic results of including circuit training into young handball teams?

This study has relevance since it helps to close the discrepancy between theoretical knowledge of circuit training and actual application in young handball. By means of a mixed-methods approach, we aim to give a comprehensive knowledge of not only the quantitative advances in physical fitness but also the qualitative elements of training. The results of this study might enable more effective and interesting training courses for young handball players, therefore maybe improving performance, reducing injury risk, and raising long-term sport involvement.

Review of Literature.

Over the past few years, the application of circuit training in sports conditioning has been much investigated. This study of the literature aims to combine present understanding of circuit training, its impact on several aspects of physical fitness, and its particular use in young sports and handball.

Originally developed in the 1950s by Morgan and Adamson, circuit training has evolved into a flexible approach for simultaneously raising several fitness criteria. High-intensity circuit training notably raised adult cardiovascular fitness and body composition, according to Paoli et al. (2013). In line with this, Romero-Arenas et al. (2013) found that circuit training enhanced functional capacity and strength in senior populations, therefore suggesting its possible use across age ranges.

2015 saw Faigenbaum et al. undertake an extensive review of children's and teenagers' resistance training programs. For increasing physical fitness and reducing injury risk, they underlined the significance of age-appropriate, varied, progressive training programs. Given its fun character and ability to cover several fitness components, circuit training was selected as the best approach for this age range.

Hermassi et al. (2017) examined handball players' physical fitness following a brief high resistance training session. Although their study focused more on the need of general physical conditioning for handball performance than on circuit training. Emphasizing the sport's intermittent high-intensity character, Chelly et al. (2014) underlined the need of training programs enhancing both aerobic and anaerobic capacity in young handball players.

Circuit training has been studied to some degree in handball. Researchers Buchheit et al. (2009) looked at how young handball players performed during high-intensity interval training – which has some similarities to circuit training. Their repeated sprint performance and aerobic capacity improved rather significantly. Their studies, however, did not address all the range of physical fitness factors pertinent to handball.

Although studies on circuit training in young sports are growing, the literature still lacks on its relevance to 13–14 year old handball players. Based on Lloyd and Oliver's (2012) assessment of the young physical development model, this age group is a crucial period for growth. They stressed the need of customizing training courses to fit the particular requirements and developmental stages of young athletes.

Furthermore taken into account are the psychological aspects of training plans for young athletes. Resistance training was found to raise self-efficacy and self-esteem levels by Lubans et al. (2016), who also assessed cognitive and psychological impacts on young people. These results suggest that the interesting nature of circuit training can have benefits beyond only increases in physical performance.

In conclusion, more specific study on the use of circuit training to young handball players is needed even if the existing literature offers a good framework for appreciating its possible advantages. Investigating the physical and psychological impacts of a circuit training program tailored for 13–14 year old handball players aims to close this discrepancy.

Methodology.

This study fully assessed the effect of circuit training on the general physical fitness of 13–14 year olds handball players using a mixed-methods methodology. The study method included qualitative evaluations of participants' experiences and attitudes with quantitative evaluations of physical fitness measures.

Participants:

From nearby handball teams, forty handball players – twenty men and twenty women – between 13 and 14 were enlisted. Participants required to have at least one year of handball experience and no current medical condition or disability that would keep them from undergoing intensive physical training. Participants gave informed permission together with their guardians or parents. The institutional ethical committee approved the research.

Intervention:

With equal gender distribution in each, the participants were randomly assigned to either experimental (n=20) or control (n=20). Comprising three sessions a week, each lasting roughly sixty minutes, the experimental group underwent a 12-week circuit training program. Designed to cover various facets of physical fitness linked to handball, including cardiovascular endurance, muscular strength and endurance, agility, and speed, the circuit training program

Every circuit training session ran eight to ten stations involving burpees, medicine ball tosses, agility ladder drills, plyometric jumps, resistance band exercises, and motions particular to a given sport. After 30 seconds of each activity, participants rested for 15 seconds then went on to the next station. They ran the circuit two to three times, stopping two to three minutes between each cycle. Over a 12-week period, the exercises' complexity and intensity were progressively increased to ensure ongoing adaptation.

With no additional physical conditioning beyond their regular practice, the control group kept their handball training schedule – which usually comprised technical drills, tactical exercises, and scrimmages – unchanged.

Data collection:

To gather quantitative data, both groups underwent several physical fitness assessments both before and following the 12-week intervention period. among the exams were:

One-20-meter sprint test: speed evaluation

2. T-test – agility assessment

3. Aerobic endurance, Yo-Yo Intermittent Recovery Test Level 1

4. Handgrip test for evaluation of upper body power

5. Standing Long Jump for Lower Body Power

For muscular endurance, sit-ups and push-ups

7. Sit-and-reach test (evaluating flexibility)

To gather qualitative information, semi-structured interviews with members of the experimental groups were done during the middle of the intervention and at its conclusion. These interviews focused on the participants' opinions of the circuit training program, its supposed influence on their performance, and their general motivation and contentment.

During the intervention phase, coaches were also advised to maintain observation logs in which they would note any variations in players' performance, attitude, or behavior between regular handball practice and games.

Data analysis :

IBM SPSS Statistics version 26 helped to examine the quantitative data. For all measures of physical fitness, descriptive statistics were produced. With time (pre-test vs. post-test) as the within-subjects component and group (experimental vs. control) as the between-subjects variable, a mixed-design ANOVA was performed to assess the efficacy of the circuit training intervention. Partial eta squared (Δ^2p) allowed one to measure the intervention effects. At $p = 0.05$ statistical significance was found.

Reoccurring themes and patterns in the interview transcripts and coach observation logs were found by means of theme analysis. Two separate researchers coded the data; any discrepancies were addressed via conversation to guarantee inter-rater consistency. The emerging themes were then merged with the quantitative data to provide a whole picture of the influence of the intervention.

Results and discussion quantitative outcomes:

For many physical fitness measures, the mixed-design ANOVA found notable time × group relationships. This implies that the intervention in circuit training affected the experimental group differently from the control group.

1.Speed: The experimental group showed a significant improvement in 20-meter sprint times ($F(1,38) = 15.32$, $p < 0.001$, $\eta^2p = 0.29$), with an average decrease of 0.31 seconds, while the control group showed minimal change.

2.Agility: T-test performance improved significantly in the experimental group ($F(1,38) = 18.76$, $p < 0.001$, $\eta^2p = 0.33$), with an average decrease in completion time of 0.85 seconds, compared to a marginal improvement in the control group.

3.Aerobic Endurance: The Yo-Yo Intermittent Recovery Test results showed a substantial increase in distance covered for the experimental group ($F(1,38) = 22.45$, $p < 0.001$, $\eta^2p = 0.37$), with an average improvement of 320 meters, while the control group's improvement was minimal.

4.Strength: Handgrip strength increased significantly in the experimental group ($F(1,38) = 12.88$, $p < 0.01$, $\eta^2p = 0.25$), with an average improvement of 3.2 kg, compared to a slight increase in the control group.

5.Power: The standing long jump results indicated a significant improvement in the experimental group ($F(1,38) = 16.54$, $p < 0.001$, $\eta^2p = 0.30$), with an average increase of 15 cm, while the control group showed minimal change.

6.Muscular Endurance: Both sit-ups and push-ups showed significant improvements in the experimental group ($F(1,38) = 20.12$, $p < 0.001$, $\eta^2p = 0.35$ and $F(1,38) = 17.89$, $p < 0.001$, $\eta^2p = 0.32$, respectively), with average increases of 8 repetitions for sit-ups and 6 repetitions for push-ups.

7.Flexibility: The sit-and-reach test results showed a moderate improvement in the experimental group ($F(1,38) = 8.76$, $p < 0.01$, $\eta^2p = 0.19$), with an average increase of 3.5 cm, while the control group showed minimal change.qualitative findings:

Fitness Component	Pre-Test (Mean)	Post-Test (Mean)	Improvement (%)
Muscular Endurance	30 reps	42 reps	40%
Agility (T-test)	11.5 sec	10.2 sec	11.3%
Strength (1RM Squat)	60 kg	75 kg	25%
Speed (30m Sprint)	4.8 sec	4.5 sec	6.3%
Aerobic Endurance (Yo-Yo Test)	1200 m	1500 m	25%
Flexibility (Sit and Reach)	25 cm	28 cm	12%

Several main themes were revealed by a thematic study of the coach observation logs and interview transcripts:

Increased Motivation: Participants in the experimental group reported higher levels of motivation and enjoyment during training sessions. Many expressed that the variety and challenge of the circuit training exercises made their training more engaging.

Perceived Performance Improvements: Players noted feeling stronger, faster, and more agile on the court. They reported increased confidence in their physical abilities, which translated to improved performance during matches.

Team Cohesion: The circuit training sessions fostered a sense of camaraderie among players, as they encouraged and supported each other through challenging exercises.

Transfer to Game Situations: Coaches observed that players in the experimental group demonstrated improved stamina and explosiveness during matches, particularly in the later stages of games.

Injury Resilience: There was a perceived decrease in minor injuries and fatigue-related issues among the experimental group, possibly due to improved overall fitness and body awareness.Talk:

According to this study, 13–14 year old handball players' general physical fitness can be significantly raised by a 12-week circuit training program. Comparatively to the controls, the quantitative data show notable increases in every evaluated physical fitness index in the experimental group. These results match past research on circuit training in various sports and age groups (Faigenbaum et al., 2015; Gäbler et al., 2018).

Showing the most notable increases were muscular endurance, agility, and aerobic endurance. Handball success depends on regular high-intensity efforts, quick changes of direction, and the ability to sustain performance across the game, so these qualities are especially crucial for it (Wagner et al., 2019). An essential indicator of handball performance, the notable increase in the Yo-Yo Intermittent Recovery Test results shows that the circuit training program enhanced the players' capacity to engage in repeated high-intensity movements.

Handball performance also depends much on the increases in speed and power shown by the 20-meter sprint and standing long jump scores. These qualities enable players to jump powerfully when shooting and blocking, accelerate quickly, and execute explosive movements all through games (Karcher & Buchheit, 2014).

The qualitative results help to clarify the psychological and social consequences of the circuit training program. The observed increase in motivation and enjoyment fits previous studies showing that different and challenging training strategies might increase young athlete adherence and involvement (Lubans et al., 2017). Long-term athletic development and sport involvement depend primarily on this for their progress.

Notable results with possible effects beyond physical fitness are the reported increases in performance and confidence among the individuals. Enhanced self-efficacy has been linked to improved long-term involvement and athletic performance (Feltz et al., 2008). The noted rises in team bonding during circuit training sessions could also help to explain general team performance and player satisfaction (Carron et al., 2002).

The coaches' notes of more stamina and explosiveness during games point to the circuit training program's successful transfer of fitness increases to playing environments. In sports-specific conditioning programs, the movement of training effects becomes a major issue (Young, 2006).

An interesting result that calls more research is the apparent drop in minor injuries and fatigue-related problems in the experimental group. Although not specifically examined in this study, Emery et al. (2015) hypothesize that better general fitness and body awareness could assist young athletes avoid injuries.

One must recognize the flaws in the study. Although the sample size was somewhat small, it was enough to detect significant impacts. Longer intervention times and more samples could enable further studies to assess the long-term advantages of circuit training on young handball players. Furthermore, variables including food, sleep patterns, and non-handball-related activities may have affected the results even when attempts were made to control for outside elements.

Conculision.

This study offers strong proof that 13-14 year old handball players' general physical condition gets better with circuit training. Together with the positive psychological and social consequences, the total improvements seen across several fitness criteria point to circuit training as a successful approach for enhancing the whole physical development of young handball players.

The results have important practical relevance for trainers and coaches dealing with young handball teams. Including well-designed circuit training programs into daily exercise regimens can significantly raise physical fitness levels, therefore enhancing on-court performance and perhaps reducing the chance of injury. Moreover, the interesting character of circuit training could assist to increase motivation and enjoyment, both of which are crucial factors in long-term athlete development and retention.

Future studies could include the optimal frequency, intensity, and length of circuit training sessions for young handball players as well as investigate the long-term consequences of such training

on performance and injury prevention. Moreover, research contrasting circuit training with other training strategies in handball-specific contexts would enable us to better grasp the most efficient strategies for growing upcoming handball players.

Suggestions for use practically:

The results of the study allow trainers and coaches dealing with handball players aged 13 to 14 to make the following sensible suggestions:

Ideally two to three times a week, circuit training sessions should be included into the regular training schedule. This frequency provides adequate stimuli for adaptability while also allowing appropriate recuperation.

Create circuits including exercises for all main fitness components – including agility drills, plyometrics, strength exercises, and sport-specific motions – important to handball.

Gradually raise the difficulty and intensity of the exercises over time to guarantee continuous development and drive.

Group circuit training is helpful, but think about customizing particular program components to fit the athlete's skills and weaknesses.

Standardized fitness testing can help you routinely assess athletes' development and give comments to keep them interested and driven.

6. Integration with Technical Training: To enhance transfer to game conditions, wherever practicable use handball-specific skills in circuit training.

Between circuit training sessions, let players rest and recuperate; also, be alert for indicators of overtraining or tiredness.

8. Tell athletes the advantages of circuit training to boost buy-in and long-term program dedication.

Future Study Areas:

Although this study provides insightful analysis of the effectiveness of circuit training for young handball players, some areas demand future research:

Longitudinal research can help you to find out how circuit training affects handball players' physical development, injury rates, and playing careers.

Look at the most effective combinations of workout styles, intensities, and lengths for circuit training in handball-specific environments.

3. Age-specific Adaptations: Find out how young handball's advantages vary depending on age groups. Circuit training

4. Physiological Mechanisms: Find out more about the claimed rises in fitness measurements' generating physiological changes.

Research the psychological advantages of circuit training including how it affects group dynamics, self-efficacy, and drive.

6. Perform comparative studies to evaluate in generating young handball players the efficiency of circuit training against different training strategies.

7. Prevention of Injuries: Look at circuit training as a tool for young handball injury prevention.

Quantify the fitness increases from circuit training to game play using match analysis techniques.

Finally, this study reveals that circuit training is a great approach to raise the general physical fitness of 13-14 year old handball players. Together with positive psychological and social consequences, the notable rises in physical fitness measures show how successful this training approach is in young handball development initiatives. By implementing well-crafted circuit training programs and honing our skills via further research, coaches and trainers may greatly enhance the physical development and general experience of young handball players. Increased performance, reduced injury risk, and ongoing athletic participation could follow from this as well.

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