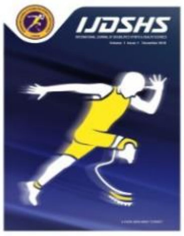

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RESEARCH ARTICLE

Effects of Tapering of Three Different Percentages on Physiological Variables Among Futsal Players

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Abstract

The purpose: this study aimed to determine the effect of a two-week tapering period on physiological variables by reducing three different percentages of volume (30%, 50%, 70%) while maintaining high training intensity on young futsal players. Method: An experimental design was used. The research sample was chosen from players of the talent school in Nineveh Governorate for the year 2023-2024, totaling 18 players (6 players per group). A paired student's t-test was used to process the interaction effect between pre- and post-training, and an ANCOVA test was used to determine the differences between the three groups. Results: Tapering with a 50% reduction rate led to the development of all physiological variables of performance in the Bruce test ($p<0.005$), aerobic ($p<0.025$) and anaerobic work ($p<0.018$), VO2max ($p<0.028$), and blood Lactate ($p<0.031$). while tapering with a 30% reduction rate led to the development of aerobic work ($p<0.33$) and VO2max ($p<0.044$). Tapering with a 70% reduction rate led to the development of achievement in the Bruce test($p<0.01$), anaerobic work ($p<0.046$), and LA ($p<0.030$). While there were no significant differences among the three groups in physiological variables of performance in the Bruce test ($p<0.151$), aerobic ($p<0.085$) and anaerobic work ($p<0.343$), VO2max ($p<0.181$), and LA ($p<0.166$). Conclusions: the tapering by 50%, showed a more balanced development in aerobic and anaerobic work, VO2max, and LA compared to to the tapering by 30% reduction, which developed only aerobic work and VO2max, and to the tapering 70% reduction, which developed anaerobic work and LA.

Keywords
Tapering, Futsal, Functional Variables, Bruce, Aerobic, Anaerobic

INTRODUCTION

Futsal has become a fertile field for researchers and coaches to conduct research, studies, and training programs that can contribute to the development of the training process to participate in many tournaments and sports competitions in a single season. Futsal is a high-intensity intermittent non-aerobic game. Naser (2017) indicates that the work-to-rest ratio in futsal is 1:1, and players exert low effort every 14 seconds, moderate effort every 37 seconds, high-intensity effort every 43 seconds, and maximal effort every 56 seconds, with changes in motor activities every 3.3 seconds. From these results, it can be concluded that futsal is a high-intensity non-aerobic activity (Naser et al, 2017).

The intensity and duration of training throughout the preparatory and competitive seasons can lead to severe fatigue among futsal players. Maintaining this high training workload throughout the season may lead to excessive fatigue and performance decline. Therefore, (Coutts et al. 2008) recommend using a tapering strategy between training cycles and implementing short-term reductions at the end of each Mesocycle. Training volume is an important component that can be manipulated during the tapering period to alleviate physical, psychological, and physiological stress on the body's systems.

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This helps in reducing fatigue and muscle soreness, aiding in glycogen replenishment, and tissue repair, and reducing the risk of injury to reach peak performance. Many researchers have described different strategies to improve tapering, but the common approach is to reduce training load by decreasing volume and repetitions while maintaining high training intensity, ensuring high-intensity intermittent training in team sports (Bosquet et al., 2007; Mujika, et al, 2004).

Researchers have tried to answer many questions regarding the tapering period in training loads through the results of experiments, research, and studies conducted in individual and team sports. In individual sports, several studies have been conducted, such as a study by Van Handel PJ et al. on elite swimmers, using a high training workload for 60 days followed by a gradual tapering period for 20 days, reducing the training workload from 10,000-20,000 meters of swimming to 2000-3000 meters while maintaining training intensity (Van Handel et al., 1988).

In another study, Smyth B & Lawlor A aimed to analyze tapering strategies for recreational runners to determine the most suitable strategy for the race day performance. The study analyzed 158,000 marathon runners to determine the appropriate tapering period based on different reductions in training volume and a mix of tapering durations ranging from 1-4 weeks (Smyth & Lawlor, 2021).

Another study by (Karimi) aimed to understand the effects of two types of tapering on plasma levels and the performance of elite male wrestlers. Thirty elite wrestlers participated in four weeks of high-intensity wrestling training during the competition period. The sample was then divided into three equal groups for one week of training: the first group reduced the training workload by 50%, the second group by 75%, and the control group trained with the same workload without reduction (Karimi, 2017).

In a study by Souhail HermassiI et al. on handball players in the premier league, a sample of 20 left-handed players in the wing and pivot positions was used. The first group performed weight training followed by tapering for two weeks, while the second group (control) followed the coach's training program (HermassiI et al., 2019).

In a study by Ameen Khazal Abe comparing three tapering methods (vertical, horizontal, and progressive) on futsal players, 18 players were divided into three groups (6 players per group) (Abe, 2015). Leonardo et al. aimed to analyze the effect of tapering on maximal oxygen consumption (VO2max) in young futsal players, showing that tapering in the final weeks of training increases maximum oxygen consumption efficiency (Leonardo et al., 2015).

In a study by Hugo Augusto on male youth basketball players, the effect of tapering type on anaerobic endurance was examined. The sample of 47 players was divided into three groups: the first group used linear tapering, the second group used step tapering, and the third group served as the control (Hugo Augusto, 2017).

In a study by Mohammed et al. to compare the impact of reducing training workload during tapering weeks on physical match activities among 19 professional futsal players over a 17-week high-load season and 7 weeks of load reduction, match activities were measured using a computerized match analysis system and compared between standard training and tapering weeks (Fessi et al., 2016).

These studies and research differ in the approach to tapering regarding how to control intensity and volume components to achieve the desired goal mentioned above. Some studies compared intensity and volume, while others compared methods of reducing workload (linear, progressive, and step). Some studies compared different percentages of training volume reduction. However, there has been no study to determine the appropriate training percentages for training volume reduction during the tapering period in futsal. It is important to note that there is variability in the percentage of tapering in training volume to prepare futsal players physically, skillfully, psychologically, and functionally for sports competitions at their best level, following a proposed training program consisting of general, specific, and competitive preparation stages.

The importance of this research lies in supporting sources and research that have addressed tapering in team sports and how to regulate training load through training workload components (intensity, volume, and rest). It also provides theoretical and practical solutions to detect fatigue and stress that may affect players before the most important competitions and how to deal with it. This study aims to provide a specific training program for the tapering period and determine the optimal training workload reduction percentages that are compatible with the specificity of futsal.

MATERIALS AND METHODS

Research Methodology

The experimental method was used since it suited the nature of the study, The original research sample consisted of 22 players , 4 players was excluded due to injuries or non-compliance with the training dose, The remaining 18 players were divided into three equal sections based on their anthropometric measurements (age, training age, height, and mass) and their results on the Bruce test, The division into three equal sections was based on Levene's test, which is a statistical test used to assess the equality of variances in different samples.

Ethical Approval

This study followed ethical standards and received approval from the College of Physical Education and Sports Sciences at the University of Mosul/Iraq with reference number [22/11/2022-3035]. Informed consent was obtained from the participants, with a volunteer form covering the details of the study, the risks and potential benefits to the participants, and the confidentiality and rights of each participant. Throughout the study process, the ethical principles of the Declaration of Helsinki were strictly adhered to, prioritizing the rights of participants in design, procedures, and confidentiality measures.

Research Sample

The research sample consisted of {18} players from the youth futsal team at the Talent School affiliated with the Ministry of Youth and Sports in Nineveh Governorate. The sample was then divided into three experimental groups as follows:

The first group: consisted of 6 players who used a 30% reduction in workload volume.

The second group: consisted of 6 players who used a 50% reduction in workload volume.

The third group: consisted of 6 players who used a 70% reduction in workload volume.

Devices And Tools Used

An Electronic device for measuring mass and length, type (Detecto™). A Treadmill device, type (tmx425 trackmaster 2004™). K5™ device for measuring functional variables. Electronic timing watches for measuring time in tests, type (Kenko™).

A 30-meter measuring tape, 15 plastic cones,12 legal futsal balls, 2 ladders for conducting agility exercises, Special obstacles used in exercises, 2 passing zones were used in the skill test.

Data Collection Methods

Functional Variable Measurement

After analyzing the content of literature, the protocol of graded exercise test on treadmill by Bruce was adopted to measure the following physiological variables (Adams, 2002):

The Key Points Regarding The Measurement Of Physiological Variables Are

The Bruce Protocol Treadmill Test was used to measure the following functional variables: (Test time, Aerobic work time, Anaerobic work time, Maximum oxygen consumption (VO2 max), Lactate accumulation)

The functional variables (VO2 max, METs, HR) were measured directly using the K5 device during the graded physical effort of the Bruce test.

Following Precautions were taken:

No training for at least 12 hours before the tes

No consumption of liquids or food for 4 hours before the test

Removal of jewelry or metal items

Aerobic and anaerobic work were determined based on the metabolic factor RQ (respiratory quotient)

RQ of 0.7 indicates reliance on fats, increasing to 1.0 indicates reliance on glycogen

Aerobic work time was determined from the start until RQ reached 1.0

Anaerobic work time was determined from RQ reaching 1.0 until the end of the test (Brown et al, 2006)

The highest VO2 max value was recorded during the graded Bruce test.

Blood lactate was measured 5 minutes after completing the Bruce test using the Lacta-Pro device

Training Program

The training curriculum was designed with:

7 weeks of preparation

4 weeks of competitions

4 training units per week during both the preparation and competition periods,

This was followed directly by a 2-week Tapering curriculum, also with 4 training units per week

During The Tapering Curriculum

Group 1 reduced their training volume by 30%
Group 2 reduced their training volume by 50%
Group 3 reduced their training volume by 70%

All 3 groups underwent training with similar intensity. At the end of tapering period, all 3 groups underwent posttests.

There were no changes made to the warm-up and cool-down periods

An additional "fast exponential decay" type of tapering was also used   Our study procedures were agreed with (Hovanlo et al, 2012; Fortes et al, 2016; Karimi, 2007).

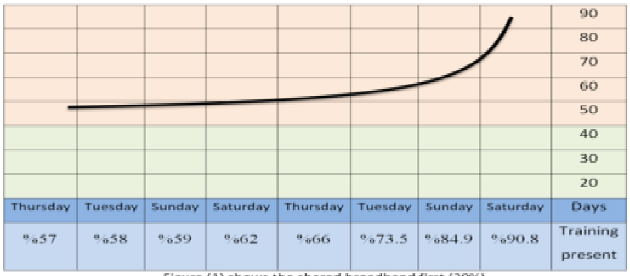

Figure (1) shows the shared broadband first (30%)

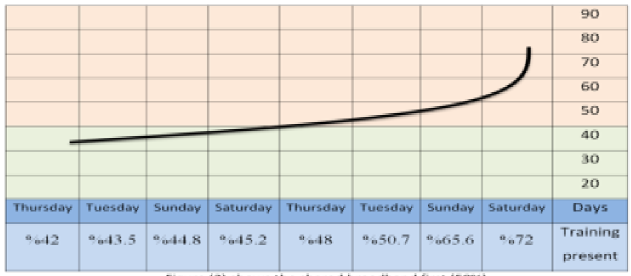

Figure (2) shows the shared broadband first (50%)

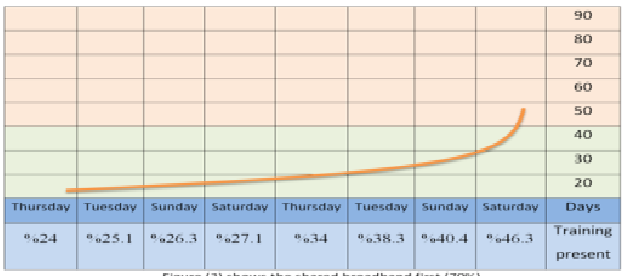

Figure (3) shows the shared broadband first (70%)

Figure 1,2,3. details the reduction in training workload for the three training groups.

Primary Research Procedures

Pre-Measurements

Pre-measurements of physiological variables were conducted. To achieve the study objectives, Bruce treadmill test conducted on all study sample members from January 31, 2024, to February 1, 2024.The measurement steps were taken as follows:

The Experiment was Conducted As Follows

The participants prepared for the test by wearing pants and sports shoes. The Warm-up was performed by giving the examiner (7-10) minutes at a speed of (5-7) km/h and an incline of (4-6) degrees on the treadmill. The rest period between warm-up and the start of the test was (5-7 minutes) to restore physiological variables to their normal state. A mask of the K5™ device was placed, and then the participant sat on a chair to take the pre-measurements of the physiological variables, and the device was worn on the participant's empty loop. The examiner started the Bruce test. The test continued with increasing speed and incline until the participant reached exhaustion. The test was stopped by pressing the stop button. The data were stored automatically.

Application of the Gradual Decrease Training Program

The gradual decrease training program was applied for two weeks, with 4 training sessions per week on Saturdays, Sundays, Tuesdays, and Thursdays for the three experimental groups.

Post-Measurements

Post-measurements were conducted, after completing the application of the training program for the three experimental groups, similar to the pre-test procedures, with the assistance of the same team under the same conditions as the pre-tests

Statistical Means

The data analysis was done in SPSS V. 26 package program. In this research, descriptive statistics (mean and standard deviation) was used to describe the data, To compare the changes in (Levene's test, t-test, Ancova test). The significance level of $p<0.05$ was determined in all of the statistical procedures.

RESULTS

Table 2. It shows the arithmetic mean, standard deviations, calculated T-values, and the degree of significance between the pre- and post-tests for the first experimental group, which reduced the training volume by (30 %).

The first group (30% reduction)						
Variables	**Pre-test**		**Post test**			
	Mean	SD	Mean	SD	T	Sig
Achievements in testing Bruce (min)	17.7533	1.36286	18.1900	0.97824	1.421	0.214
Aerobic work in Bruce test (min)	13.5633	.46753	13.9367	.71068	2.926	0.033
Anaerobic work in Bruce test(min)	3.9233	1.08354	4.0533	.75179	0.461	0.664
(VO2max).(ml/min)	4451.27	477.26	4715.97	412.89	2.669	0.044
(LA max) (mlg)	13.8167	2.74694	14.5167	1.79044	1.206	0.282

Table 3. It shows the arithmetic mean, standard deviations, calculated T-values, and the degree of significance between the pre- and post-tests for the second experimental group, which reduced the training volume by (50%).

The first group (50% reduction)						
Variables	**Pre-test**		**Post test**			
	Mean	SD	Mean	SD	T	Sig
Achievements in testing Bruce (min)	17.6450	1.32319	18.7500	1.26529	4.748	0.005
Aerobic work in Bruce test (min)	13.6833	2.12809	14.2400	1.90486	3.154	0.025
Anaerobic work in Bruce test(min)	3.7617	1.32034	4.3083	1.14922	3.475	0.018
(VO2max).(ml/min)	4411.76	654.39	4701.36	750.31	3.064	0.028
(LA max) (mlg)	14.1833	2.24893	16.6717	3.52800	2.969	0.031

Table 4. It shows the arithmetic mean, standard deviations, calculated T-values, and the degree of significance between the pre- and post-tests for the third experimental group, which reduced the training volume by 70%.

The first group (70% reduction)						
Variables	**Pre-test**		**Post test**			
	Mean	SD	Mean	SD	T	Sig
Achievements in testing Bruce (min)	18.0050	1.03940	18.7533	1.20199	6.929	0.001
Aerobic work in Bruce test (min)	14.2967	1.07897	14.2917	1.06099	.0600	0.954
Anaerobic work in Bruce test(min)	3.5750	1.37551	4.1283	1.17196	2.648	0.046
(VO2max).(ml/min)	4544.51	196.37	4569.87	125.22	0.407	0.701
(LA max) (mlg)	14.5167	2.03707	15.2667	1.93976	3.000	0.030

Through Table (2,3,4), it is evident that there are significant differences in aerobic work ($p<0.033$), (VO2max) ($p<0.044$), between the first and second post-tests for the second experimental group that implemented the gradual decrease (Tapering) program by 70% of the volume. While there were significant differences in Bruce test performance ($p<0.005$), aerobic work($p<0.025$), anaerobic work($p<0.018$), VO2max($p<0.028$), and blood LA max($p<0.031$), there were also significant differences in Bruce test performance($p<0.001$), anaerobic work($p<0.046$), and LA max ($p<0.030$).

Table 5. It shows the arithmetic mean, standard deviations, calculated (f) values, and the degree of significance after post tests for the tests of the three experimental groups for the functional variables.

Variables	The first group (30%)		The first group (50%)		The first group (70%)			
	Mean	**Chang %**	Mean	**Chang %**	Mean	**Chang %**	F	Sig
Achievements in testing Bruce (min)	18.229[a]	2.46	18.879[a]	6.26	18.585[a]	4.24	2.173	0.151
Aerobic work in Bruce test (min)	14.195[a]	2.75	14.38p[a]	4.07	13.917[a]	0.081	2.947	0.085
Anaerobic work in Bruce test(min)	3.930[a]	3.31	4.302[a]	14.53	4.224[a]	15.48	1.155	0.343
(VO2max).(ml/min)	4732.835[a]	5.95	4755.417a	6.56	4498.953a	0.56	2.499	0.118
(LA max) (mlg)	15.231[a]	5.07	16.662[a]	17.54	14.862[a]	5.166	2.050	0.166

In table 5, the significance value was greater than 0.05, indicating no significant differences in physiological variables among the three groups.

DISCUSSION

Pre and Post-Test Results for physiological Variables

Tables (2,3,4) comparing pre and post-tests in the three gradual decrease groups (30%, 50%, and 70%) respectively show improvements in physiological variables but at different levels. The 30% gradual decrease group showed a significant improvement in aerobic work time from the graded exercise test, maximal oxygen consumption, and maximal metabolic equivalents. On the other hand, the 70% gradual decrease group showed a significant improvement in performance and in the anaerobic phase, as well as in the maximum heart rate and maximum blood lactate accumulation in the blood. As for the remaining variables, they improved but did not reach a significant level in both the 30% and 70% gradual decrease groups. The 50% gradual decrease group showed a significant improvement in all physiological variables.

The developments in the above variables, for all three research groups, were attributed to external training workload factors, including the gradual decrease, and internal training load factors (physiological).

Regarding the gradual decrease in training workload, the three experimental groups followed a training plan for two weeks that included reducing the training volume using a rapid exponential tapering method while maintaining high training intensity. This facilitated the process of super-compensation and reaching peak performance or performance. Such an approach allowed for gradual adaptations of physiological systems, including improvements in VO2max, blood lactate accumulation, and maximum heart rate.

Researchers such as Mujika et al., (2009), Bosquet et al., (2007), Bomba, (2015), Shepley, (1992) and Houmard et al., (1992) suggest that a two-week period of gradual decrease, achieved by progressively reducing the training volume while maintaining high training intensity, allows for the necessary recovery for players and provides positive results in physical, physiological, and performance aspects in team and individual sports.

As for internal training workload factors (physiological), the overall development in the three groups and specifically in the 50% gradual decrease group in the post-test can be discussed as follows: In the graded exercise test, the gradual decrease by 50% and 70% allowed for recovery from accumulated fatigue while maintaining the acquired fitness levels from previous training. Studies like the one conducted by Neary on cyclists for a distance of 20 km showed a 5.4% improvement in performance for the experimental group that used a gradual decrease for 7 days with a 50% reduction in training volume while maintaining 85% training intensity, compared to no improvement in the groups that reduced training volume by 30% and 80% while maintaining high training intensity. Similarly, a study by Karimi on football players showed that a gradual decrease for a week with a 50% and 75% reduction in training volume would reflect the fatigue and exhaustion that primarily affected players, while improving their performance compared to the group that continued training with the same volume, and there were no differences between the reduction strategies (50%, 70%) (Mohammad, 2017).

Regarding the improvements in aerobic work and anaerobic threshold in the graded exercise test, they were attributed to the gradual decrease of 50% and 70% for two weeks, allowing for some physiological adaptations such as effort economy, increased mitochondrial density, and improved aerobic enzyme activity, leading to improved aerobic endurance and anaerobic threshold. Studies like that by Houmard et al., which evaluated energy expenditures in 18 middle-distance runners after a gradual decrease for 7 days, reported a 7% decrease (0.9 kcal/min) in energy expenditures at 80% of VO2peak on a treadmill. The researchers suggested that the reason for the oxygen consumption economy is the increase in muscle mitochondria capacity, in addition to neural, structural, and mechanical factors (Houmard et al., 1994).

Bomba mentions that the possibility of improving maximum oxygen consumption is attributed to the increased formation of red blood cells during the gradual decrease period (Bomba,2015). Iaia et al., (2009) also noted a 6-8% decrease in VO2 at sub-maximal running speeds, while maintaining muscle oxidative capacity, capillary density, and running performance for a 10-kilometer distance. Regarding improvements in anaerobic work and anaerobic threshold in the graded exercise test, the researcher attributes them to the gradual decrease of 50% and 30% for two weeks, allowing for some physiological adaptations such as increased lactate tolerance in the blood and improved anaerobic enzyme activity. Studies like Hugo et al. on basketball players assessed the effect of two types of gradual decrease (linear, and stepwise) on the anaerobic capacity of basketball players, with a 50% reduction in volume in the stepwise gradual decrease and reductions of 80%, 60%, 40% in the linear gradual decrease while maintaining high training intensity, found that both strategies were effective in improving anaerobic endurance, although the linear reduction strategy was more effective than the stepwise reduction (Hugo et al , 2017) , In a study by McArdle et al., it is mentioned that for the cell to be able to produce energy, oxidative enzymes must be present in sufficient concentrations to make reactions start and function properly and that these enzymes (CK) and (ATPase) tend to decrease with high training loads but increase with gradual decrease (McArdle et al., 2006).

In a study conducted by Mujika et al., (2002) on middle-distance runners, the improvement in competitive performance in the 800-meter race after the gradual decrease phase is positively correlated with the change in peak blood lactate concentration after the race, where an increase in peak blood lactate concentration by 7.6% was observed, and this increase is closely related to running performance.

Regarding the maximum oxygen consumption VO2max, this variable is a key factor in endurance capacity. The gradual decrease of 50% and 30% allowed for reducing fatigue while maintaining or even enhancing aerobic fitness levels, as was observed in the current study. The aim of the gradual decrease in the current study was to enhance the efficiency of oxygen utilization within muscle tissues, thereby improving aerobic capacity and endurance. This efficiency can be achieved through various physiological adaptations, including increased blood vessel density, enhanced mitochondrial density, and improved oxygen extraction by muscle fibers. This aligns with a study by Fortes et al., which found that the tapering strategy leads to an increase in VO2max while maintaining high training loads did not alter the maximum oxygen consumption VO2max. The researchers mentioned that the reason for this is the increase in mitochondrial density in muscles, which enhances fat and glucose oxidation, leading to improved aerobic energy production. Additionally, arterial-venous oxygen differences can also improve VO2max. Therefore, muscle tissues increase their ability to extract oxygen (Fortes et al., 2016).

This study also agrees with a study by Neary et al., which showed a 2.4% increase in VO2max for seven male endurance cyclists who maintained training intensity (85-90% maximum heart rate) while reducing training duration over 7 days (Neary et al., 2003**)** , In the same study, it was also found that a 17% increase in muscle glycogen stores after 4 days of gradual decrease and a 25% increase after 8 days of gradual decrease. This study also agrees with Leonardo's study on futsal players, where the tapering strategy increased VO2max while maintaining training loads did not change VO2max. This is attributed to the increase in mitochondrial density, which helps in fat and glycogen oxidation in muscles, leading to improved aerobic energy production and improving the muscles' ability to extract oxygen **(**Leonardo, 2016**)**. As for maximum blood lactate accumulation, gradual decrease will reduce its accumulation during exercise below maximum effort by allowing for muscle glycogen replenishment, which enhances lactate removal rates. However, the results of the current study showed an increase between the pre-test and post-test by 2.5 mg/dL in the 50% and 70% decrease groups, which are attributed to the nature of the graded exercise, characterized by maximum physical effort. This study agrees with Ameen's study, which used three different methods of reducing training load (linear, step, and stepwise) on futsal players, where the amount of accumulated lactate increased in the post-test for all three groups (Ameen, 2015; Abe, 2015).

Mujika also notes that an increase in blood lactate concentrations after a gradual decrease is associated with enhancing maximal performance capacities in swimming, running, cycling, and rowing. Conversely, no change or a decrease in blood lactate concentrations during sub-maximal exercise intensity is expected after an effective gradual decrease (Mujika, 2009) .

If we delve further into the underlying mechanisms behind the effect of gradual decrease on physiological variables under this study, we will find that gradual decrease allows for the replenishment of muscle glycogen stores, which are essential for high-intensity exercise performance. In a study by Neary et al., a 17% increase in muscle glycogen stores after 4 days of gradual decrease and a 25% increase after 8 days of gradual decrease were reported (Neary et al ,1992). Spurway and MacLaren also mentioned a 15% increase in muscle glycogen stores in a group of highly trained middle-distance runners after 7 days of high-intensity gradual decrease (Spurway & MacLaren, 2006). In Table 2, the significance value was greater than 0.05, indicating no significant differences in physiological variables among the three groups. However, by observing the development ratio, we notice the superiority of the second experimental group that reduced the volume by 50% in most functional variables, as it was more comprehensive in developing all physiological variables and with a higher development ratio than the others.

There were no significant differences between the post-tests of the three research groups in the variables (Bruce test performance, aerobic work, anaerobic work, VO2max, max blood Lactate). However, when we observe the development ratio, we find that the 50% reduction group showed the highest development ratio in all variables. This group is considered the most balanced compared to the first group (30%) and the third group (70%) in developing functional variables.

Between Three Groups

Tables (5) comparing post-tests in the three groups decrease (30%, 50%, and 70%) , if There were no significant differences between the post-tests of the three research groups in the variables (Bruce test performance, aerobic work, anaerobic work, VO2max, max blood Lactate). However, when we observe the development ratio, we find that the 50% reduction group showed the highest development ratio in all variables. This group is considered the most balanced compared to the first group (30%) and the third group (70%) in developing functional variables.

Conclusion

The tapering program has a positive effect on all physiological variables according to the three percentages used in the research (30%, 50%, 70%). They also found that a 50% reduction in tapering showed a significant improvement in functional variables of (Bruce test performance, aerobic work, anaerobic work, VO2 MAX, LA), while a 30% reduction showed improvement in aerobic work and VO2max. A 70% reduction showed improvement in Bruce test performance, anaerobic work, and LA. Based on these results, the researchers concluded that a 30% reduction in tapering tends to improve aerobic work, while a 50% reduction is the best as it balances the improvement in aerobic and anaerobic work. A 70% reduction tends to improve anaerobic work.

It is recommended to use a 50% reduction when using tapering with futsal players due to its balanced training program.

Conflict Of Interest

This research no conflict of interest. No financial support was received.

Ethics Statement

This study followed ethical standards and received approval from the College of Physical Education and Sports Sciences at the University of Mosul/Iraq with reference number [22/11/2022-3035]

Author Contributions

Planned by the authors: Study Design, MYS, AMA; Data Collection, MYS, AAT; Statistical Analysis, AAT; Data Interpretation, MYS, AMA; Manuscript Preparation, MYS, AAT; Literature Research, AMA The published version of th manuscript has been read and approved by all authors.

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