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The effect of third zone intensity training on the speed-strength of the arms certain biochemical indicators and the completion time of a 50-meter freestyle swim

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Abstract

The research aimed to prepare and apply third zone intensity training for 50-meter freestyle swimmers, examining its impact on the speed strength of the arms, some biochemical indicators, and the completion time for 50 meters freestyle. The researcher hypothesized that there would be statistically significant differences between pre- and post-test results for the experimental and control groups in arm speed strength, biochemical indicators, and completion time. The experimental method involved a design with both experimental and control groups, consisting of 11 swimmers from the Army Club participating in the 2024/2025 sports season, selected intentionally with a 100% comprehensive approach. After determining the tests and preparing the training, the experimental group underwent two training sessions per week for 10 weeks. Results were analyzed using SPSS. Conclusions and recommendations indicated that applying third zone intensity training during the specific preparation period helps develop arm speed strength for 50-meter freestyle swimmers, outperforming peers who train without it. It also aids in regulating blood salts (calcium, potassium, sodium) among these swimmers, again outperforming their peers. Additionally, it improves completion time for 50 meters freestyle for those who train with it, surpassing those who do not. It is crucial to avoid excessive resistance increases when training arm speed strength with third zone intensity training for 50-meter freestyle swimmers. Furthermore, monitoring biochemical indicators of blood salts is essential for assessing swimmer health and cellular regulation during third zone intensity training.

Keywords: Third intensity zone training, speed-strength characteristics of the arms, biochemical indicators, swimming (50) meters freestyle.

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Introduction

Young swimmers, and especially short-distance ones, do in fact get stuck into a plateau when they train – hard core training going for sheer numerical attainment. This plateau thwarts their density even though they keep training to get these fitness goals._Myers They apply the brakes on their masses no matter how hard they train for it. Coaches must understand the importance of biological arrangement of mineral elements, which would appear in large quantities during the fast-training swimmer (directly in Sarcoplasm of muscle cells). As it is recognised, the VL mental component is genetically determined; therefore, training to direct development towards improving these mechanical factors of NM execution with strength and biochemical training directed to cellular ordering. This is of particular interest since speed training is related to enhancement of motor unit function, as well as strength training with low resistance and rapid muscle action.

It is suggested that "a diminishing form of intensity in training maintains adaptations accrued, without growing them, and so underlines the need for a new and adequate overload. This gradual increase in training volume is known as the principle of progressive overload. (Al-Qat, 2020, p. 31)

Plus, "the body needs to replace lost electrolytes, and refilling potassium levels helps speed recovery and decrease post-exercise fatigue and cramping. (Maughan & Sheriffs, 2010, p. 411)

Also, that "the mineral elements within the cell control its internal environment at rest and during work and hence determine whether excess or deficit will be sensed for storage or release of cellular water according to the amount available as needed". (Lerner & Brenda, 2007, p.53)

In addition, "mineral salt intake improves sports performance, but it also helps restore the athlete's losses that have occurred in the body during their metabolism process. They can hurt performance if these salts are depleted." (Ibrahim & Kamash, 2012:53)

The author argues that an effective swimming training program must take into account the athletic balance of electrolytes --that is needed for quick contractions. Special attention should be paid to control the intensity or the relative level of work, when designing training for reduced time to 50m free among swimmers at an early age.

In higher power, high speed sports,"muscle requires high force, and the increased velocity demands higher calcium levels so that actomyosin can react rapidly to vigorous exercise." Higher Ca2+ is needed to increase the speed and strength of muscle activation, and the muscle must also clear Ca2+ quickly out of the cytoplasm back into the sarcoplasmic reticulum in order for it to

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relax again after each contraction so that another effective forceful contraction can occur. In order to keep up the supply of calcium in intense work, muscles use a complex system of storage and re-absorption in calcium channels and pumps of the sarcoplasmic reticulum." (Allen & Westerblad, 2001, pg. 659)

Muscle function relies on the ability of calcium to regulate interaction between the two major muscle proteins, actin and myosin. In muscle cells, the action potential causes the release of calcium from the sarcoplasmic reticulum (SR). Calcium then attaches to the troponin C protein on actin filament which causes a conformational change in another protein called tropomyosin that exposes the binding sites between actin and myosin, thus allowing myosin to interact with actin and contraction of muscle occurs. (Rassier, 2012, p. 253)

Potassium is an important mineral for the heart muscles and has a direct role in blood pressure reduction. Potassium works closely with magnesium in the body, helping to keep muscles relaxed which allows for cellular processes. It is also important to note the importance of keeping blood sodium concentration at its' physiological levels since levels of this ion inversely associated with blood base stability and it's other role as the regulator of permeability. (Howler, 2017, p. 17)

Daily sodium chloride intake of human is (8-15) gm and potassium chloride intake is 3–4g, the requirement being higher during training. Why is potassium and sodium important becouse they are what absorb sugars in the intestines, muscle function, help for water retention inside of body cell`s regulate blood pH and body fluids and so on. (Al-Nasiri & Al-Rakabi, 2020, 141) It can be deduced from the above findings that team teaching has manifested as a remaining burden throughout decades.

Potassium also serves to potentiate chemical reactions used in production of energy inside the cell and help convert carbohydrates into glycogen (stored energy in muscle), both important for improved specific endurance performance at high intensity. The AI for potassium in adults is approximately (4700) mg, however athletes may require more as losses through sweat start at about this level. (Bakri, 2019, p. 105)

The researcher states that muscle contraction, considering its physiologic proprieties in sport training requires insertion of diverse (or a combination) of other types of training focused on this muscle contraction at the speed that swimmers use to cover 50m distance while equal amount is also discussed.

"The application of muscle force is the ultimate element underlying all efforts aimed at increasing driving speed in athletes." (Steven, 2001, p. 4)

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How to Create a Method of Isolating the Technical Muscles while performing such Special Preparation – Of this involves one and the same problem: How on earth may trainers contrive ways for isolating different muscle groups engaged in technical performance of these skills, Why is Trainers have decided they cannot – and instead must settle for variety and interchange that cover most muscles effected by resistance, so that each resistance corresponds to size type, direction of action characteristic muscles. (McBride & Other, 2022, 582)

Exercising forward and reverse muscles will increase strength to wider range of muscles in overall build quality. *Balanced arm strength to prevent unbalanced muscle loading or joint damage from arm tensed. Moreover, developing control of strong-arm movements during contraction and stabilization is essential because it supplements in helping improve the accuracy and control of exercises and technical tasks associated specifically with technical performance and success. (Seitz & Others, 2022, p. 1120) The importance is accepted that "the effective use of muscular strength is the basic factor in developing speed among athletes." (Steven, 2001, p. 4)

It is difficult for coaches to develop techniques that target the muscle involved in technical performance, which makes them (coaches) resort to a great amount of diversity and interchange in order to include most muscles under the involvement of resistance so that each resistance will be appropriate with regard to size, type, and direction as it represents each muscular function. (McBride & et al., 2022, p. 582)

Training both muscles increases overall strength and capability, and balanced arm strength leads to less risk of injury from uneven muscle loading or over-tension on arm joints. In addition, while contraction and stabilization occur it is important to increase the control over musculature in power arm movements because an increased ability to control these muscles will help promote better accuracy and balance when performing exercises/activities directly related to skill performance or accomplishment. (Seitz & Others, 2022, p. 1120)

With the large differences between the nature of performance and increases in training loads, both from intensity and volume, coaches should have knowledge to oversee negative effects that may come with exposure to chemical injuries in muscles tendons (fatigue). (Shahata, 2006, p. 17)

Muscle strength is “the ability of a muscle to develop maximal contractile force against resistance,” including maximum strength, speed-strength and strength endurance. (Sayed, 2025, p. 161)

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Exercise examples that include work in the third intensity zone are exercises which combine strength and speed as well as being performed is a repetitive fashion. (Bompa & Haff, 2018, p. 1)

Phase 3- Zone 3: Jumping and Acceleration Training Middle distance athletes must not only be fast, but they need to also have better acceleration abilities in order to beat other competitors. (Chaabene et al., 2021, p. 300)

Training in the third zone, helps also to develop different types of physical abilities like explosive-power and swimmers through from other sports they can use this kind of helping exercises. (Ramirez-Campillo & Other, 2020, p. 168)

Scientific and systematic training is reflected in changes of most structural and metabolic factors of muscle that influence body mass: speed ratio. (Despina, 2008, p. 78)

The importance of this work is demonstrated in two aspects: theoretical and empirical. The first represented an attempt to get the attention of academics doing sports-training physiology work for swimmers on how important it is for maintaining the biochemical cellular muscle-salts organisation that specific third-intensity zone swim training be performed while maybe showing these academics a way of shaving off some time on completion 50-metre freestyle train-for speed-strength only) stroke events. This is an attempt to make a contribution to the work and literature of sports training biology, at the academic level, in third intensity zone training programs on organized biochemical cellularity of salt-muscle (Ca^{2+} I K^{+} I Na^{+}) in blood during speed-strength changes for arm speed intended with 50 meters freestyle swimming time improvement; hence, making room for aid from research academics on classical importance. The pragmatic direction constitutes a scholarly approach to propose a training program that does not include randomness like trial and error, neither is filled by improvisation, which includes the systematic type of training of 3rd zone intensity in favor of specificity for 50 meters freestyle swimmers and at the same time not deprive them muscle cell integrity. It will also help stakeholders in swimming clubs to give the required demands that serve the applications related to third training intensity zone, which are based on the result of the present study by using digital language to control training loads for these practices.

It is concluded that within the framework of the literature available in sports training physiology for distant 50- meters free swimmers, this researcher had to use scientific observation to elaborate and identify the research problem by noting his sports weakness or stagnation encounter with competition times, on a closed circular distance, such as those found under Army Club swimmers assigned task set conditions display for changes in type of training unit receives and development speed-Strenght arms. This is under the assumption that training for this physical

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ability most closely pertains to rapid repetitive actions which aid swimmers in swimming faster this short distance and achieving more time. Particular cellular developments of some necessary mineral salts should be in good state during them formation to sustain the repetitions of those muscle contractions.

This research therefore seeks to prepare and apply third intensity zone training from the 50-meter freestyle swimmers as well as, determine the effect of third intensity zone training on speed-strength in arms, some biochemical indicators and completion time for 50 m freestyle. The difference in the pre and post test results for speed-strength of the hands, certain biochemical rates and 50 meter freestyle event time for experimental groups of swimmers and control are statistically significant as hypothesized by the researcher. Further, the differences in post-test between experimental and control groups were statistically significant in speed-strength of arms, some biochemical parameters and completion time of 50-meter freestyle.

Methodology

The current research problem necessitated the adoption of an experimental approach utilizing a design comprising two equivalent groups: the experimental group and the control group, with rigorous control through pre-test and post-test assessments. The research population was defined as the swimmers of the Army Sports Club participating in the 50-meter freestyle event during the sports season of 2024/2025, totaling 11 swimmers. All participants were deliberately selected using a comprehensive sampling method, constituting 100% of the main research sample. To meet the requirements of the experimental design, the swimmers were divided into two groups of unequal sizes through matched pairs, with the first group consisting of 5 swimmers and the second group comprising 6 swimmers. One group was randomly selected to serve as the experimental group, while the other acted as the control group. Additionally, 4 swimmers were chosen from the two groups for exploratory trial procedures without affecting the internal validity of the experimental design.

To assess dependent variables in this study, the researcher utilized a 20 kg barbell push exercise for 10 seconds duration performed in supine position due to its arm muscle episode isolation. Moreover, the research also used an immobile cycle, namely Life Fitness model (capacity 9700 American), which is arm and leg ergometric with digital electronic display that measures speed by calculating the subject's mass in kilograms times 0.075 to determine initial required resistance for each swimmer tested. A maximal physiological effort was done on the cycle ergometer during 30 sec to analyze some biochemical parameters such as: calcium (Ca+2), potassium (K+) and sodium (Na+). A timed freestyle swim test was also conducted at 50 meters,

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in accordance with the Terms and Conditions of World Aquatics, the international governing body for aquatic sports within the Olympic movement.

The researcher also undertook the preparation of exercises for the third intensity zone by following the subsequent steps:

- Reviewing the training protocols for 50-meter freestyle swimmers utilized at the Army Sports Club.

- Establishing the physical training factor (speed-strength of the arms).

- Defining the criteria for selecting the content of the exercises in accordance with the parameters of the third intensity zone training, which includes some exercises aimed at developing the speed-strength of the arms as follows: (Bompa & Haff, 2018, P: 3)

- Plyometric push-up exercises.

- Light to moderate weightlifting exercises performed rapidly and repetitively.

- Exercises that combine strength and speed.

The parameters for the hypoxic training system have been established, wherein the intensity and durations necessary for performing repetitions, the duration of rest periods between repetitions, and the number of sets have been determined based on the capabilities of each athlete as assessed through pre-tests measuring the speed-strength of the arms. This was achieved by employing the equation (maximum repetitions in a duration of 10 seconds × the percentage of the required intensity), while considering the principle of progressive overload in the training load of these exercises and the principle of undulation in their planning across training units and weeks throughout the specific preparation period for the swimmers.

The intensity of these training exercises commenced at 80% and concluded at an intensity of 90% of the speed-strength capacity of the arms, in accordance with the Hara training principle, where the researcher took into account the individual differences of each swimmer based on their maximum intensity.

The number of repetitions ranged from 5 to 10, with sets comprising 3 to 5 for each exercise. The inter-set rest duration between exercises varied from 4 to 8 seconds depending on the type and intensity of the exercise. The transitional rest duration between exercises was set at 2 to 5 minutes, in accordance with the anaerobic energy system.

A high-intensity interval training method was adopted to regulate the training load for the third intensity zone of speed-strength training. These exercises are implemented at the beginning

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of the main section of the training unit, with a frequency of 2 units per training week. The total number of training units amounts to 20, over a period of 10 consecutive training weeks.

Training sessions are conducted on Sundays and Tuesdays, with each training unit lasting 90 minutes. The total time allocated for these exercises is between 18 to 20 seconds, encompassing both work and rest for each exercise, considering that it is essential not to exceed 20 minutes of training time for athletes in each training unit focused on muscular strength, even those aimed at improving speed through the development of muscular strength. (Al-Nasiri & Al-Rakabi, 2020, p. 66)

An exploratory trial was conducted with 4 swimmers on Tuesday, February 4, 2025, at the Olympic People's Pool, and the researcher did not encounter any significant obstacles worth mentioning.

The pre-tests were conducted over two consecutive days, specifically on Wednesday and Thursday, corresponding to the dates (5-6/2/2025), at the Olympic People's Pool. The first day included tests for explosive strength characterized by speed for the arms, followed by a specified effort test lasting (30) seconds, and the collection of blood samples from the swimmers in the research groups amounting to (5 cc). The blood was then transported in a small refrigerator to the laboratory for the measurement of various biochemical indicators (calcium, potassium, sodium) in this venous blood. The second day involved a freestyle swimming test over a distance of (50) meters, conducted in accordance with the conditions and regulations set forth by World Aquatics, the international Olympic federation for aquatic sports.

The third zone intensity training was implemented for the swimmers in the experimental group over a period of (10) consecutive weeks, at a frequency of (2) sessions per week. In contrast, the control group trained for the same duration and number of sessions, adhering to their established training regimen without any intervention from the researcher, aside from monitoring. This training commenced on Sunday, (10/2/2025), and continued until Tuesday, (8/5/2025).

Post-tests were administered over two consecutive days, specifically on Wednesday and Thursday, corresponding to the dates (9-10/5/2025), at the Olympic People's Pool, under the same conditions and sequence as the pre-tests.

The research data were processed automatically using the SPSS system to extract the percentage, mean, standard deviation, and the independent samples t-test, as well as the paired samples t-test.

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Results

Table 1. *Pre-test Results Between the Two Groups*

Variables & Unit of Measurement	Group	Mean (M)	SD	Levene's Test (Sig.)	t-value	(Sig.)	Difference
Speed–Strength of the Arms (repetitions)	Experimental (n = 5)	11.00	1.225	0.238	0.638	0.905	Not significant
	Control (n = 6)	10.33	1.211				
Ca+2 (mmol/L)	Experimental (n = 5)	9.28	0.303	0.011	0.919	0.392	Not significant
	Control (n = 6)	9.35	0.288				
K+ (mmol/L)	Experimental (n = 5)	4.34	0.207	0.293	0.602	0.797	Not significant
	Control (n = 6)	4.45	0.243				
Na+ (mmol/L)	Experimental (n = 5)	143.4	3.435	0.279	0.610	0.290	Not significant
	Control (n = 6)	142.83	3.061				
50 m Freestyle Swimming Performance (sec)	Experimental (n = 5)	28.8	0.837	0.004	0.949	0.334	Not significant
	Control (n = 6)	29.0	1.095				

Notes: Degrees of freedom (df) = n − 2 = 9, The difference is not significant when Sig. > 0.05 at a significance level of 0.05

Table 2. *Pre- and Post-test Results for Both Groups*

Variables	Group	Comparison	(M)	SD	(ΔM)	(ΔSD)	T value	Sig.	Difference
Speed–Strength of the Arms (repetitions)	Experimental (n = 5)	Pre-test	11.00	1.225	2.80	1.483	4.221	0.013	Significant
		Post-test	13.80	0.447					
	Control (n = 6)	Pre-test	10.33	1.211	0.833	0.753	2.712	0.042	Significant
		Post-test	11.17	1.169					
Ca+2 (mmol/L)	Experimental (n = 5)	Pre-test	9.28	0.303	1.20	0.283	9.487	0.001	Significant
		Post-test	10.48	0.045					

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	Control (n = 6)	Pre-test	9.35	0.288	0.15	0.123	3.000	0.030	Significant
		Post-test	9.50	0.210					
K+ (mmol/L)	Experimental (n = 5)	Pre-test	4.34	0.207	1.20	0.187	14.343	0.000	Significant
		Post-test	5.54	0.055					
	Control (n = 6)	Pre-test	4.45	0.243	1.133	0.137	2.390	0.062	Not significant
		Post-test	4.583	0.160					
Na+ (mmol/L)	Experimental (n = 5)	Pre-test	143.40	3.435	5.40	3.362	3.592	0.023	Significant
		Post-test	148.80	0.447					
	Control (n = 6)	Pre-test	142.83	3.061	0.833	0.408	5.000	0.004	Significant
		Post-test	143.67	2.805					
50 m Freestyle Swimming Performance (sec)	Experimental (n = 5)	Pre-test	28.80	0.837	1.60	0.548	6.532	0.003	Significant
		Post-test	27.20	0.447					
	Control (n = 6)	Pre-test	29.00	1.095	0.167	0.408	1.000	0.363	Not significant
		Post-test	28.83	1.169					

Notes: Significant if (Sig.) < 0.05 at a significance level of 0.05, Degrees of freedom (df) per group = (n − 1).

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Table 3. *Post-test Results Between the Two Groups*

Dependent Variables & Units	Group	(M)	SD	t-value	Sig.	Difference
Speed–Strength of the Arms (repetitions)	Experimental (n = 5)	13.80	0.447	4.722	0.001	Significant
	Control (n = 6)	11.17	1.169			
Ca^{+2} (mmol/L)	Experimental (n = 5)	10.48	0.045	10.168	0.000	Significant
	Control (n = 6)	9.50	0.210			
K^{+} (mmol/L)	Experimental (n = 5)	5.54	0.055	12.652	0.000	Significant
	Control (n = 6)	4.583	0.160			
Na^{+} (mmol/L)	Experimental (n = 5)	148.80	0.447	4.015	0.003	Significant
	Control (n = 6)	143.67	2.805			
50 m Freestyle Swimming Performance (sec)	Experimental (n = 5)	27.20	0.447	2.929	0.017	Significant
	Control (n = 6)	28.83	1.169			

Notes: Degrees of freedom (df) = n – 2 = 9, A difference is considered significant when Sig. < 0.05 at the significance level (0.05).

Discussion

From the review of the results presented in Table (2), it is evident that the swimmers in my research group exhibited significant development and improvement in the values of all five dependent variables in the post-tests compared to their results in the pre-tests. Furthermore, an examination of the results in Table (3) reveals that the swimmers in the experimental group outperformed their peers in the control group across all post-test values for these five variables. The researcher attributes the emergence of these results regarding the capacity for speed-strength to the consideration of training within the third intensity zone, which involved a variety of resistances tailored to target the components of strength and speed, while also taking into account the rhythm and balance in the repetitive arm movements characteristic of freestyle swimming. Additionally, it was crucial to avoid excessive training loads, considering the inverse relationship between the swimmer's mass and their speed in the aquatic environment, in order to optimize the neuromuscular response to this type of training. The results demonstrated that this approach did not detract from the critical blood electrolytes involved in these repetitive contractions, as the effectiveness of calcium, potassium, and sodium increased in cellular regulation of biochemical reactions during exertion when applying repetitions of these exercises within the range of 80-90% outside the swimming pool environment. This was essential for achieving the components of speed

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and strength in muscular contractions. The training regimen proved effective in avoiding excessive loads, thereby improving the completion time for a distance of 50 meters in freestyle swimming, due to the enhancement of the physical factors influencing this achievement under healthy physiological conditions related to the cellular regulation mechanisms of the swimmers. Moreover, the standard deviations noted in the pre- and post-tests, as well as in the post-test tables, indicated that the intensity zone training took into account the individual differences among the swimmers in the experimental group, thereby fulfilling a fundamental principle in sports training physiology. Additionally, the principle of progression and variation was adhered to, starting from the first training unit and continuing through to the completion of these exercises across different units and training weeks, in order to mitigate losses in biochemical indicators and increase the opportunity for their compensation, thus sustaining the repetitive movements in speed-strength and achieving the 50-meter freestyle distance. Consequently, this overall impact of the results played a significant role in their superiority over the swimmers in the control group in the post-tests.

It is stated that "muscle strength is the fundamental element for achieving success in most physical and sports activities." (Majid, 2017, p. 43) Furthermore, "third zone training aids in strengthening muscles and developing the ability to perform rapid and powerful movements." (Haff & Triplett, 2016, p. 124) The "development of arm strength has numerous benefits, the most significant of which is the balanced development of muscles. When exercises are varied between muscle contractions and isometric holds, a diverse range of muscles in the arms, including the biceps and triceps, are stimulated, which helps to balance muscle development and avoid neglecting the strengthening of certain muscles at the expense of others." (Baker & Others, 2023, p. 63) "The level of development of physical and motor abilities must correspond to the requirements of the motor skill to execute it as intended." (Al-Rabdi, 2020, p. 66) Additionally, "third zone training is considered one of the modern applications in sports training that assists athletes in developing muscle strength without overexertion or harming the contraction processes, allowing for muscular interchange to avoid rapid fatigue." (Lerner & Brenda, 2007, p. 505) "Studies have shown that regular strength and resistance training leads to increased muscle and connective tissue strength, enhanced bone mass, flexibility, and metabolism, in addition to aesthetic appearance." (Faraj, 2011, p. 340) "The variation between muscle contractions and isometric holds in arm strength development training is of great importance in strength sports and athletics. This variation includes the ability to strengthen muscles during contraction (when bending the arm) and during isometric holds (when extending the arm), as the overall strength of the arms lies in the capacity for endurance and control of powerful movements in both directions." (Thomas & Newton, 2017, p. 153) Thus, "exercises that focus on dynamic contractions and muscular interchange contribute to the development of fast-twitch muscle fibers and improve coordination between the nervous system and muscles." (Ryan, 2018, p. 2) Moreover, "one of the

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exercises that enhances the development of various physical abilities reliant on muscle strength training is third zone exercises, which consider performance improvement in multi-directional training units to achieve more than one training objective within the same unit." (Arthur, 2012, p. 221) It is noted that "the negative effects of calcium deficiency on an athlete's health are significant, as a lack of salts during the sweating process disrupts the nerve signals directed to the muscles, leading to muscle cramps. Therefore, an athlete's diet should be rich in sodium due to its loss during sweating associated with sports activities, and athletes require it more than other individuals. Furthermore, an athlete's diet must include calcium and magnesium salts, which are consumed during various metabolic processes that intensify during exercise." (Al-Sisi, 2018, p. 231)

Calcium deficiency can lead to weakened muscle contractions and incomplete spasms, thereby limiting the capacity for intense physical performance. Furthermore, the availability of calcium is also associated with proper nutrition, as the intake of calcium through diet is essential for maintaining adequate levels of this element in the body, particularly among athletes who may require larger amounts due to intense muscular consumption. (Bers, 2002, p. 199)

Potassium is important in the transmission of nerve impulses which initiate muscle contractions. The potassium and sodium balance in the news helps regulate muscle contraction and relaxation, which can prevent cramping and fatigue. Potassium and Exercise During exercise, athletes lose large amounts of potassium in their sweat which alters this balance. Potassium Deficiency can cause muscle cramping, and reduce performance. (Clark, 2008, p. 11)

Your kidneys will also get rid of potassium, and, so if you are having more substances (renin angiotensin and aldosterone) secreted then it is likely your kidneys are flushing out a lot of potassium which results in hypokalemia, which means, muscle spasm pain and weakened muscular abilities. (Tawfiq, 2004, p. 68)

Additionally, it's advisable to have third zone training to protect athletes from the harmful effects of high loads for the development of explosive power, speed strength and maximum speed. (Abu Saleh et al., 2016, pg.4)

Zone three training helps to develop athletes of many types (who depend on speed and explosiveness). (Lloyd & Others,2016, p. 1241)

Third-zone training addresses the physical and skill focused stability barriers, Compare that to forcing you to break stability from a strength training standpoint where there is not much you can do outside of keeping people off-balance or using chains indoors and out but at some point

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"the chain is only as strong as its weakest link" so your gains in the gym will more than likely be lost unless you work on stabilizing those strength gains. (Abd al-Basir, 2023, p. 127)

The development of motor control aids in improving the performance of exercises and sports movements that are directly related to technical performance and achievement. (Seitz & Others, 2022, p. 1120)

A gradual increase in training load is fundamental to any training plan for athletes and should be adhered to by all athletes concerned with their performance levels. (Al-Abdullah, 2018, p. 66)

Conclusions and Recommendation

1. The third intensity zone training is suitable for 50-meter freestyle swimmers.
2. The implementation of third intensity zone training during the specific preparation period aids in the development of speed-strength in the arms of 50-meter freestyle swimmers, surpassing the progress of their peers who train without it.
3. The application of third intensity zone training during the specific preparation period assists in regulating the increase of blood salts (calcium, potassium, and sodium) in 50-meter freestyle swimmers, exceeding the regulation of these increases in their peers who train without it.
4. The implementation of third intensity zone training during the specific preparation period contributes to improving the completion time for 50-meter freestyle swimming among swimmers who engage in this training, outperforming the improvement in completion time of their peers who do not.
5. It is essential to avoid exaggerations in increasing resistance when training the speed-strength of the arms through the application of third intensity zone training for 50-meter freestyle swimmers.
6. It is crucial to pay attention to measuring biochemical indicators of blood salts, which provide insights into the well-being of swimmers and the development of their cellular regulation when training with third intensity zone exercises.

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