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Exercises Of Varying Resistances And Muscular Work Exchange Effects On Physical Adequacy And The Completion Of 200m - Meter Freestyle Swimming

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Abstract

This research aims to prepare exercises of varying resistances and muscular work exchange for 200m freestyle swimmers, in addition to these exercises' effects on physical adequacy and the time needed to complete this distance. The experimental method is the basis for the design of the experimental group and the control group of a 100% intentionally chosen sample from a community of elite-youth swimmers of 200m freestyle swimming for the sport season of 2020-2021 at the Police Sports Club. The sample consists of 15 swimmers that were divided, randomly, into two groups; 7 of them in the experimental group while 8 were in the control group. Physical adequacy was calculated with the use of swimmers' mechanical energy measurements while they were on the treadmill. This was done to measure the kinetic energy by fixing the potential energy and in order to measure the kinetic energy from the calories measurements by linking the Fitmate Pro device' system. The following equation was applied: physical adequacy = mechanical energy\kinetic energy. Exercises' preparation relies on resistance' quantity graduation and diversification in every instrument within these exercises. This was achieved by two methods of periodic, intensity elevated, and repetitive training with the addition of applying this procedure for 10 consecutive-training weeks at the rate of 3 units each off day within the same-training week. In each training unit, there were 4 quick movement exercises. After the previously mentioned was done, the data was processed by the use of the SPSS program in order for the conclusions and applications of this research to demonstrate the helpful quality of these exercises, of varying resistances and muscular work exchange, in the development of the level of physical adequacy and the improvement of the period needed to complete the 200m distance for the elite-youth swimmers. It is of the utmost importance to support the knowledge of coaches on how to utilize the laws of physics to help them affect the energy-producing chemical processes in swimmers. Furthermore, it is vital to account for the muscular contractions and their direction, in swimmers, whenever the employment of resistances is involved. This enables swimmers to overcome the circumstances of the race at maximum speed; avoiding negative side effects, when the quantity of these resistances rises, on the decrease of the speed of completion.

Key Words: Varying resistances, muscular work exchange, physical adequacy, 200m freestyle swimming.

The Problem and Significance of the Study: Most of the movements that swimmers make require an economical stance when it comes to biological energy, especially the greatest adequacy for muscular contraction. The biological explanation is the prolonging of the mechanical-efficiency period for repetitive movement within a high enough level which fits the demands of the race. The issue is not only linked with or determined by the way that an economical stance of biological energy is achieved, rather it encompasses to the acquisition of an economical stance of the movements which represent the mechanical efficiency of the muscles. The comprehension of the mutual relationship between the two

energies gives a clear directionality for swimmers about the way to reach the required physical adequacy to achieve the best result. For "adequacy is calculated by the percentage of the converted energy to muscular work which does not convert to heat. The percentage of energy quantity (food chemistry) which does not convert to muscular work is less than (20-25%) as the facts have stated. The rest of this chemical energy gets converted into heat, the reason for this is that approximately half of the available energy is wasted in the process of constructing the biological-energy component in the body. Afterwards, only (40-45%) gets converted from the (ATP) component." (Wonsky and Judy 2008: 131) As well as the "the lack of preparation of energy in the body, which is symbolized by (ATP), might be the main reason in sickness. The deficiency in the ability to produce this component is determined by the biochemical mechanics of metabolism's accumulated results and the biological control inside the system of the cell which cannot be isolated or be in isolation from this" (Swartz et.al 2017: 6) "However, it is possible to acquire the greatest-possible adequacy when the muscle minimizes itself at a moderate speed. In the case of slow minimization or without a motion outcome, then a large quantities of maintenance heat will be lost in the minimization process despite the lack of any effort. This results in the decrease of muscular-minimization adequacy. On the contrary, a large percentage of energy gets used up in the fast minimization for the purpose of handling the slimness of the muscle and the stopping force within it. This decreases the muscular-minimization adequacy as well. The greatest functionality occurs when the muscle-minimization speed is at (30%) as previously mentioned" (Giesinger et.al 2002: 1200). Additionally, "The energy release process, in the case of the increased blood acidity, suffers a temporary difficulty due to the decrease in enzymes'' activity which are responsible for the production of energy" (Ahmad and Hussein ,2017). Furthermore, "when the muscles get trained, they consume carbohydrates as a main source of energy, especially in high-intensity training. This produces lactic acid as a undesirable outcomes of this procedure. The lactic acid breaks down and gets converted directly into hydrogen ions and lactic. Lactic gets transported from muscles to blood vessels" (Mohammed , 2013) "When the glycogen deposits gets depleted then the main source of fuel is from the (Lipid) deposits at rest and low activity, for the glycogen lasts about two hours and it's the favorite fuel for the lasting of active exercise. The (Lipid), on the other hand, provides, essentially, the (ATP) of each unit of glycogen when oxygen and a heavier workout are available" (Wonsky and Judy). Despite the knowledge of the biological energy's source, which comes from the components of the consumed food for each of fat, protein and carbohydrate, the determining of the release of the biological energy depends on the functionality of the metabolic processes. Physics, also, governs the physical explanation of this release; every action requires energy. Since the burden of swimming exercises targets the muscles that are responsible for producing the muscular power and the physical abilities, then the effect of the resistances will be met by the production of muscle force which is known as "the ability to overcome or stand up to an outside resistance. It is also known as the maximum amount of force that the muscle can perform at" (Ahmad , 2019) It is "useful to divide the power training exercises according to the methods of attaining maximum muscle tension; this division is according to the type of exercise that is in use" (Adel and Ahab,2004). Moreover, The term 'resistances training' is sometimes employed as a substitute for 'muscle force training'. Resistances exercises are used to develop the muscle force and the increase of skeletal muscles' size. There are a number of forms for resistances' training, the most common of which are: earth-gravity force, rubber and hydraulic resistances. The gravity of the earth, ropes-weights-disks-dumbbells, or the hydraulic and rubber resistances function against muscular contraction. It is possible to train muscle force without hand movement hindering weights". (Jamal, 2012) It is to be noted that the methods and shapes of resistances vary outside of the aquatic environment, for some of it are loaded, carried, added and some only relies on the balancing of extremities which are employed in a variety of strength-boosting exercises or the restoration of its function or size. The muscular work varies it is use of such resistances, for some are moveable, stationary, central and non-central which encompasses medicinal balls, dumbbells, rubber ropes and stationary weights. Some of these resistances have a gradient level of impact, hence it must be

taken into consideration that the balance of the steady speed of swimming and what is being developed in power by the resistances exercises in actions similar to freestyle swimming. "The assisting-training tools for each type of resistances enable both athlete and coach to save a lot of expended effort within athletic training. However, it needs to be adequate for the game or the activity in question and be fit for the age range and sex of athletes." (Duane, 2017) In addition, "the principle based on valid-scientific grounds has positive effects symbolized in increasing the muscular pull which makes the function of muscles at the best possible productivity by inciting the greatest number of muscular fibers. The continuation of these loads makes the muscle grow in strength due to adaptability" (Haider , 2013). In addition "Physical training must be connected with skillful motions. The physical traits associated with the basic skills must be developed by the designing of special-training programs for each athletic behavior. This means that the training program focuses on the participating muscles within the activity") Petersen& et. al, 2002(Duty requires the availability of knowledge about how the muscular work occurs and its direction in order to assist in directing the contractions' movement in varying resistances and the diversification of muscular work within the most common classifications in athletic-exercises physiology. This is done by the isometric muscular contraction, elongated muscular contraction (isotonic\non-central), compressed muscular contraction (isotonic\central), reversed stretched muscular contraction (Biometric) and the muscular contraction (isokinetic). (Fatima et. Al, 2013) "The elements that affect the production of muscular force are defined by the number of incited muscular fibers, the muscular cross section, the muscles that function in performance, the development of muscular fibers, the angle of muscular-force production, length and relaxation of muscle\s before contraction, the time period that the muscular contraction takes, the compatibility of muscles involved in the performance, the emotional state of the player during and before the production of muscular force, age, sex and warm up." (2010Ma'ad Salman et. al)The muscular work exchange refers to a principle of athletic training, for it signifies the function of muscles in order to meet the requirements of exercises' variation which forces a change in the contractions of each functioning, causal and assisting muscle. Thus, the physical development of each of the positively affected abilities by resistances exercises is considered a development of the quantity of mechanical energy in the body of the swimmer. This requires a bio energy that is adequate with the quantity of the kinetic energy which is combined with the dormant energy in order for their combination to result in mechanical energy. The "Physical adequacy indicator = mechanical energy\biological energy". (Bracey, 1997) "There are multiple tests that measure the physical adequacy at a pulse rate of 170 (PWCI 70) or (PWCI 30). In this case, the physical adequacy is measured by kilogram\meter\minute meaning that the body' ability to function through. Depending on the work of a coach, specialized in youth swimmers of 200m freestyle swimming, and an academic researcher in the physiology of athletic training, a decrease in physical effort and mechanic efficiency for swimmers have been noticed. This calls for further experimentation in the field of exercises that up the effort level for it has a role in the elevation of completion level. This research aims to prepare exercises of varying resistances and muscular work exchange for 200m freestyle swimmers, in addition to these exercises' effects on physical adequacy and the time needed to complete this distance. The researcher hypotheses that there are analytical differences between the results of physical adequacy tests and the completion time of 200 meter freestyle swimming for initial and final tests done by both the experimental and control groups. There are differences that possess analytical references between the test results of physical adequacy and completion time for the aforementioned groups.

Research Methodology:

The experimental method was relied upon and is defined as "an inevitable change of certain circumstances according to determined factors by an independent variable, test or measure within these circumstances." (Suzan , 2018) As well as the experimental design, which is controlled in both initial and final tests, of the experimental group and the control group.

Research Community and its Sample: The limitations of the study's community is symbolized by elite-youth swimmers of 200m

freestyle swimming who follow their exercises continuously for the sport season of (2020-2021) at the Police Sport Club and who are officially registered in the Iraqi Association of Swimming and Aquatic Activities. They are 15 swimmers all of which are chosen intentionally and then divided randomly into two groups; experimental (7) and control (8).

Measurement and Research methods: The physical adequacy was calculated by measuring the mechanical energy of the swimmer while the swimmer was running on a treadmill. The tread mill is a lifestyle fitness 95T brand, American origin, electrically powered and electronically programmed in order to measure the kinetic energy by fixating the dormant energy. In addition, the calculation of physical adequacy encompassed the measuring of the bio energy from calories' measurement by the kinking of the system of, COSMED brand, Fitmate pro which is of Italian origin. Furthermore, a link was established between the breathing mask and the chest belt with a Bluetooth device for pulse measurement of every swimmer. Moreover, the application of the physical adequacy = mechanical energy\ bio energy equation was involved. This was done by a measurement unit of Joule\calorie. In order to calculate the time required to complete a 200m freestyle swimming course, an electronic stopwatch was used within the terms and regulations of this distance. The varying resistances exercises (Appendix 1) was prepared for the purpose of inciting change in the slimness of the muscles and the increasing of its economic force by the way of motions that their contractions result in muscular power. It is important to mention that "athletes differ amongst themselves in their need for energy according to the type of activity, the period of the activity, the level of physical adequacy, body weight, age, sex and the type of sport's game. There is an important principle that states 'the less the weight is, the less energy required to do the same activity'" (Salma , 2000).Exercises' preparation relies on resistance' quantity graduation and diversification in every instrument within these exercises. This was achieved by two methods of periodic, intensity elevated, and repetitive training with the addition of applying this procedure for 10 consecutive-training weeks at the rate of 3 units each off day within the same-training week. In each training unit, there were 4 quick movement exercises. After this was done, data was processed by the data analysis program SPSS; this was done for each of percentages, Arithmetic mean, standard deviation, uncorrelated sample test (T) and correlated sample test (T).

Results and discussion:

Table (1) demonstrates the results of the initial test

Refere nce	(Sig)	(T)	(Sig)	Liven) (	Control Group (8)		Experimental group (7)		Tests and measurement units	
					Y ±	X	Y ±	X		
Does not refer	0.692	0.405	0.332	1.014	0.256	2.538	0.195	2.586	C\Joule alorie	Physical adequacy
Does not refer	0.496	0.7	0.596	0.295	0.061	70.134	0.0513	70.154	second	200m freestyle completion

Degree of freedom N-2 = (13), does not refer if (sig) > (0.05) at the reference level (0.05).

Table (2) demonstrates the results of the initial and final tests

R e	(Sig)	(T)	YZ	Z	Final test	Initial test	G r	

					Y±	X	Y±	X		Tests and measurement units
refers	0.000	13.439	0.309	1.571	0.134	4.157	0.195	2.586	ex (7)	Physical adequacy
refers	0.000	6.216	0.489	1.075	0.264	3.613	0.256	2.538	c (8)	
refers	0.000	400.537	0.061	9.25	0.023	60.904	0.0513	70.154	ex (7)	200m freestyle completion
refers	0.000	361.182	0.072	9.169	0.026	60.965	0.061	70.134	c (8)	

Degree of freedom N-1 for each group the reference level (0.05). The difference reference (0.05) ≥ (sig).

Table (3) demonstrates the results of the final tests for both groups

Reference	(Sig)	(T)	Control Group (8)		Experimental group (7)		Tests and measurement units	
			Y ±	X	Y ±	X		
refers	0.000	4.875	0.264	3.613	0.134	4.157	Cal\Joule orie	Physical adequacy
refers	0.000	4.737	0.026	60.965	0.023	60.904	second	200m freestyle completion

Degree of freedom N-2 = (13), does not refer if (sig) >(0.05) at the reference level (0.05).

It is to be noted from the results of table (2) that the differences between the initial and final test did support the final tests of each group's swimmers which their physical-adequacy level developed. Their completion time of 200m freestyle swimming has improved. Table (3) shows that the differences between the final tests of both groups supported the experimental group's swimmers which received varying resistances and muscular work exchange exercises. The researcher attributes these results to the role of the different training tool for resistances between each and every exercise. This helped the muscular work exchange for the functioning muscles in freestyle swimming. In addition, it had two directional effects; physical in which the mechanical efficiency increased and chemical in which the swimmers were enabled to achieve a calorie spending economic result. This benefits the level of physical adequacy and the prolonging of the appearance of signs of fatigue which surfaces as a result of tiring the carboxyl transporters. In varying-resistances exercises, the mechanical energy increases (Mechanical energy = kinetic energy + dormant energy) after the adjustment made by the development of muscle's strength and the improvement of its speed by lessening the internal resistance for the brake force between the muscles and slimness which impede this speed. This was contributed by the contrast between the type of resistance and the nature of the heavy-muscular work that is required to train by. Moreover the produced-muscle force, in a high frequency, helped in increasing the mechanical work based on the fact that work = energy. This increase, in turn, is met by the expenditure of a biological energy that fit with the practiced effort of resistances exercised that are of a highly mechanical nature due to the speed of muscular tissue's contraction by the increase of mass. After the required development has taken place, the mechanical energy (kinetic and dormant) has increased in accordance with the increase of both movement speed and the fixation of altitude of the dormant energy. After the completion of resistances' exercises outside of the aquatic environment and the preservation of the quantity of unhindered mechanical energy, the biochemical energy was at a lesser level in order to meet the mass of the unhindered swimmers whilst maintain the same work. According to what the referential frame dictations that the weight (mass) of the swimmer

and his\her resistance of it has decreased while maintaining the same work, in addition to the role of the development of the physical abilities, which are a result of the known resistances' exercises, in improving the physiological processes that improved the completion time of 200m freestyle swimming, for the "the effects of physical exercises in the adequacy of the motion system strengthens the neural signal within the muscle, alerts the motion centers in the brain scalp and inhibits the emotional centers. In addition to that, it affects the circulation within the muscles, reduces the slimness of the muscle." (Sadiq, Mohammad Tolan et.al, 2012) Moreover, "to increase of chemical changes of the muscle fibers, exercises should be at a high intensity and within the speed type of training it will be very active." (Samir,2003)Within the principles of privacy and cellular chemical changes, work by the unaired system and its intensity increases the deposits of unaired energy within the cells. (Gayton, 2014) "The gradual increase in work load is the basis of any training planning for a player. It should be adopted by every player that cares about his\her completion level." (Jamal ،2018) "For resistances' training leads to the occurrence of physiological changes which include bodily devices. The athletic-performance level advances further the more these changes were positive; it achieves physiological adaptability for the bodily devices then the body load." (Baha'a ،2018) Additionally, "the muscular changes include the increase in the adequacy of energy production, ATP phosphate, muscle deposit of energy sources (ATP-Pc)within the keratin system, activity of helpful enzymes and the muscle's ability to use glycogen to produce energy in the absence of oxygen." (Mohammad and Abo al-Ola ,2000) "for every physical activity of a player lead to multiple physical changes. Yet when these activities happen to the body within regulated scientific rules, then it leads to further improve achievement." (Mansour ،2010) "When the athlete becomes more efficient in training, then the need for energy, within training, decreases or lessens compared to low efficiency athlete." (Bha'a al-Deen ،2000،)

Conclusions and Applications:

1. Varying resistances and muscular work exchange help in developing the level of physical adequacy and the improvement of the completion time of 200m freestyle swimming for elite-youth swimmers.

2. It is of utmost importance that the knowledge of coaches be reinforced by ways of utilizing the laws of physics to assist them to impact the chemical processes that produce bio energy in swimmers.

3. It is necessary to accommodate the speed of muscular contractions and their direction for swimmers when employing resistances in order to enable swimmers to meet the race's circumstances at maximum speed; avoiding the negative effects of the decrease of completion time when these resistances' quantity rises.

References:

1. **Bracey leveau (1997).** Biomechanical Of human motion: Is haiku publishers. Inc. Tokyo, P: 89.
2. **Duane Knudson (2007).** Fundamentals of Biomechanics: 2end, Edition, USA Springer Science Business Medial, p:109.
3. **Gayton A.C,(2011).** The Glycogen – lactic Acid system. In Book medical physiology, w.b saunders, U.S.A, p: 315. VICL.
4. **Giesinger, E. Carafoli, and V. Helms, Chem,(2002).** Biochem, 3, 1200–1208.
5. **Ira Wolinsky & Judy A. Driskell (2008).** Sports nutrition: energy metabolism and exercise: New York, Library of Congress Cataloging, p:131.
6. **Petersen, S.,and Miller ,G.and Wenger,H.A (2002).** The acquisition of muscular strength: the influence of training, USA, P:212.
7. **Swartz, A. M., Strath, S. J, Bassett, D. R, Jr, O'Brien, W. L, King, G. A, and Ainsworth, B. E, (2017).** Estimation of energy expenditure using CSA accelerometers at hip and wrist sites, Medicine Sports Exercises, 32, S450–6.

Arabic References:

8. **Abo al-Ola, Ahmad abd al-Fattah and Ahmad Nasr al-Deen Said (2003).**

Physiology of Physical Fitness. 2nd edition, Cairo: Dar al-Fikr al-Arabi, pp. 28
9. **Ahamd Farhan Ali and Hussien Manati Sajet (2017).** Physiology of body load. Babel. Dar al-Sadiq. pp. 154-155.
10. **Ahamd Nasr al-Deen Said (2019).** The Principles of Sport Physiology. 3rd edition. Cairo, Modern Book Publishing Center. pp. 263-264
11. **Baha' Ebraheem Salameh (2018).** The Application of Biochemistry and the Representation of Energy within the Field of Sports. Cairo, Dar al-Hikmah. pp. 179
12. **Baha' al-Deen Ebraheem Salmeh (2000).** Physiology of Sport and the physical performance of Blood Lactates. Cairo, Dar al-Fikr al-Arabi. pp. 179
13. **Jamal Sabri Faraj (2012).** Power and Ability and Modern Sports' training, Jordan, Dar Dijlah, pp. 34
14. **Jamal Sabri Faraj al-Abdallah (2018).** Elongation Enclepedia and training load. Vol.2, Amman, Dar al-Safaa', pp. 66
15. **Haider Jabbar abd al-Ziarah (2013).** "The Effect of Two Electrical Frequencies on Motivating some Muscles that Function at a Max Force and the Kinetic Changes of Weight and Completion in Weight Lifting for Advanced Quarterbacks, PhD Thesis, Qadisiah University, College of Physical Education and sport sciences, pp. 69
16. **Salma Tucan (2000).** Food and Nourishment: The University Medical book of Athletes' Nourishment. Beirut, UNDP, pp. 502
17. **Samir Abdallah Rizq (2003).** Swimming Training, Amman, Dar Wa'el, pp. 150-151
18. **Suzan Ali Khafajeh (2018).** Scientific Research in the Twenty First Century, Cairo, Dar al-Fikr al-Arabi, pp. 201
19. **Sadiq Mohammed Tulan et.al (2012).** Scientific Grounds for exercises and Sports' shows, Alexandria, Dar al-Wafaa', pp.165
20. **Adel abd al-Bassir and Ahab Adel (2004).** Muscular Force Training: Integration between Theory and practice. Cairo, The Egyptian Library, pp. 162
21. **Emad al-Deen Abo Zaid (2007).** Planning and Scientific Grounds for Building and Preparing a Team in Group Sports: Theories and Applications, 2nd edition, Alexandria, Al-Maa'ref Institute, pp. 183
22. **Fatima abd-Maleh et.al (2011).** Sport's Training for Second Stage Students of Faculties of Sports, Amman, Arabic Society Library, pp.55
23. **Mohamad Alawie and Abo al-Ola abd al-Fattah (2000).** The Physiology of Sport's Training, 2nd edition Cairo, Dar al-Fikr al-Arabi, pp, 25
24. **Mohammed Ali al-Cot (2013).** The Peak Pacification of Athletes, Cairo, Bookers Center, pp.65
25. **Ma'd Salman et.al (2010)**. Introduction to Sports' Training Theories, Al-Riadh Office, Baghdad, pp. 66-69
26. **Mansour Jameel al-Anbaki (2010).** Sports' Training and Future Horizons, Baghdad, Sports Library, pp.45

Appendix (1) a demonstration of a model of training tools employed in varying resistances' exercises.