

Effect of Using Resistance Exercises on Muscular Ability and Some Physiological Variables Level for Soccer Youngsters

Dr. Ahmed Dobai

Assistant Professor in Biological Sciences and Sports Health Department, Faculty of Physical Education for Boys and Girls, Port Said University, Egypt. ah_dobai@hotmail.com

Abstract: Aim of the study was to determine the effect of using resistance exercises on muscular ability and some physiological variables level for soccer youngsters, the researcher used the experimental method (pre-post) measurement, (20) soccer youngster were chosen from Port Fouad club under (15) years to participate in the study, (10) players as control group and (10) players as experimental group, the resistance training program and the traditional program was applied to the experimental group and the control group for (6) weeks with (6) days training per week, (36) training units and (90) minutes training unit time, muscular ability level tests used... for arms - overhead medicine ball throw, for legs - steady wide jump, lactate and pulse rate measurement, (5) ml venous blood withdrawn before and after the resistance program and the regular program for evaluation of physiological variables level... T.WBCS, malondialdehyde, superoxide dismutase, interleukin₂, IGF₁, the resistance training program was positive in influencing the performance and health variables compared to the regular program.

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Key words: Resistance exercises – Muscular ability – Soccer youngsters

1. Introduction and Research Problem

Training program aimed to reach higher standard of the athletes, scientific theories in the field of training tried to explain some truth and help to find the best solutions to attain the highest level of the athletes through elevation of the physical capacity and skills in response to biological variables, as a relationship between training programs and assessment of the biological products.

Kraemer and Ratames (2004) stated that resistance training is a modality of exercise that has grown in popularity due to its role in improving performance, power, speed, hypertrophy, endurance, balance and coordination. (20: 674).

Anderson and Kearney (1982), Borst et al. (2001), Campbell et al. (2002), Mark (2011) reported that resistance training was performed by athletes aiming to gain increase in muscle mass such as body builders, However, researchers have a better understanding of the health related benefits of resistance training as this form of exercise is recommended by national health organizations such American college of sports medicine and the American Heart association. (5:1), (8: 648), (11: 631), (24: 67).

Guyton and Hall (2006) stated that resistance training at more than 50% (maximal force of contraction will develop strength rapidly even if the contractions are performed only a few times each day experiments on muscle building have shown that (6) maximal muscle contractions performed in (3) sets (3) days a week give approximately optimal increase in

muscle strength without producing muscle fatigue chronically along with the increased muscle strength equal percentage increase in muscle mass called hypertrophy. (16: 1060).

They also added that body fitness reduce cardiovascular disease by maintaining lower blood pressure and reduce cholesterol, in addition the ability to increase cardiac output in times of need, these changes all work together to reduce the number of heart attack and brain strokes, meaning that resistance training might improve performance and health. (16: 1062).

Mackinnon (2000) reported that the clinical relevance of changes in health and immunological variables in blood samples after acute bouts of exercise has been debated because these changes may reflect a brief upset in homeostasis on the other hand it may be argued that WBCS numbers and functions in blood samples taken at rest are clinically relevant as an indicator of an individual immune potential. (23: 369).

By taking blood samples from soccer players during standardized conditions at rest, the long term effect of physical training on the immune system can be evaluated, results from such an investigation are important for optimizing training programs of soccer players over longer period of time.

Lehman (2002) stated that soccer players need a high physical level due to the physical demand of this sport through (90) minutes, as it needs different training methods to face the high physical load during competitions, the soccer players must perform a great effort so as their muscles activity can be prepared to

continue an extreme muscle situation throughout the duration of the training or competition as they need the speed in performance and work with the highest effort in the least duration accompanied by an increased acceleration of pulse rate during energy production an aerobically. (21: 124).

Hatfield (2013) reported that there are four technologies of training equipment...

1. Constant resistance devices which means that a weight (resistance) does not increase or decrease during the course of exercise.

2. Variable resistance devices in this case the amount of weight increase or decrease during an exercise movement.

3. Accommodating resistance devices in this case it is allowed to exert maximum resistance throughout the full range of movement in each exercise.

4. Static resistance devices in this case the contraction of muscle become without movement and is called isometric exercise. (18:201)

The researcher observed from his experience in soccer field that there are some players with low physical and health conditions, so as to improve

physical and health cases, the researcher used resistance exercises in an attempt to upgrade both performance and health.

So, the aim of this study was to evaluate the effect of using resistance exercises on muscular ability and some physiological variables level for soccer youngsters.

It is hypothesized that the resistance exercises will improve muscular ability and some of physiological variables level for soccer youngsters who are participating in the study.

2. Research Procedures

Research method: The researcher used the experimental method (pre –post) measurement of a control and experimental groups due to the suitability of the nature of the study.

Research sample: (24) young soccer players were chosen from Port Fouad club under (15) years to participate in the study, (20) players for the main study and (4) players for the pilot study.

Homogeneity & equivalence of sample:

Table (2) reported that skewness were between (± 3) indicating homogeneity of the sample.

Table (1) Research sample

The club	Main study	Pilot study		
Port Fouad under (15) years	20 players	10	Control group	4 players
		10	Experimental group	

Table (2) Arithmetic mean, median, standard deviation, skewness in variables of age, height, weight and training experience. N=20

Variables	U of M	A. Mean	Median	S.D.	Skewness
Age	years	15.5	15.4	0.25	1.2
Height	cm	171.8	172	3.35	- 0.18
Weight	kg	65.5	65	2.91	0.52
Training experience	years	5.5	5	0.72	2.08

Table (3) Significance of differences between the control group & the experimental group in variables of the study N₁=N₂=10

Variables	U of M	S. Ranks		Ranks V.		(U) value		Sig	
		C	E	C	E	Table	Calcu.		
Age	years	106.5	103.5	48.5	51.5	23	48.5	No	
Height	cm	106	104	49	51	23	49	No	
Weight	kg	102	108	53	47	23	47	No	
Training experience	years	108	102	47	53	23	47	No	
Muscular ability	Arms	m	92	118	37	63	23	37	No
	Legs	cm	110	100	45	55	23	45	No

Table (3) reported there are no statistically significant differences between the control group & the experimental group in variables of the study indicating equivalence between groups.

Data collection tools:

- **Height:** by using... Restameter.

- **Weight:** by using... Medical scale.

-**Muscular ability:** the researcher determined the tests of muscular ability which is appropriate to the nature and purpose of the study through the survey and analysis of scientific references specialized in soccer

field which were obtained. (4), (12), (17), (26), (33).. muscular ability tests:

1- Overhead medicine ball (3) kg throw (throw in position) - muscular ability for arms.

2- Steady wide jump – muscular ability for legs.

Validity & Reliability for muscular ability tests:

Validity: The researcher used the discrimination validity by applying the tests on two groups under (15) years of each (10) players from outside of the main sample, one of them from Al-Masry club and the other non-practitioners and applied tests on the groups on 03/09/2014.

Table (4) Discrimination validity for used physical tests between practitioners group & non-practitioners group. $N_1=N_2=10$

Tests	U of M	S. Ranks		Ranks V.		(U) value		Sig
		P	Non	P	Non	Table	Calcu.	
Overhead medicine ball throw	m	155	55	0	100	23	0	S
Steady wide jump	cm	155	55	0	100	23	0	S

Table (4) reported there are statistically significant differences between practitioners group & non-practitioners group for practitioners group, that the (U)calculated value less than the (U)tabular value Indicating validity of tests.

Reliability: The researcher used the test-retest method by applying the tests on group of players under (15) years from Al-Masry club which used before for validity and after one week on 11/09/2014.

Table (5) Reliability of the physical tests by using Spearman correlation coefficient. N=10

Tests	U of M	A.mean		S. (d ²)	(r _s) value		Sig
		Test	Retest		Table	Calcu.	
Overhead medicine ball throw	m	9.18	9.62	9	0.648	0.95	S
Steady wide jump	cm	1.95	2.04	10	0.648	0.94	S

Table (5) reported there is statistically significant correlation between test-retest in used physical tests indicating high level of reliability.

- **Lactic acid:** by using... Accusport.

- **Pulse rate:** by using... Pulse meter.

- **Physiological variables:** (5) ml venous blood were withdrawn before and after the resistance program and the regular program for evaluation of physiological variable level... white blood cells T.WBCS... by using... Coulter counter, malondialdehyde MDA, superoxide dismutase enzyme SOD, interleukin₂hormone, insulin-like growth factor IGF₁hormone... by using... Elisa.

- All blood samples were withdrawn by a specialist, laboratory measurements were conducted at... Allawah laboratory in Port Said.

Pilot study:

(4) young soccer players were the participants of the pilot study, they were from the same group chosen for the study, for a period of (3) days before the study on 13/09/2014, the reason is to...

- Investigate the soundness of the equipment and tools.

- To know the problems this might face the study.

- Determine the best ways to perform measurements and record data.

Main study:

- Pre-measurements on 17/09/2014.

- The resistance training program by using elastic bands and the traditional program was applied to the experimental group and control group for (6) weeks beginning on 18/09/2014 to 29/10/2014 with (6) days training per week, (36) training units and (90) minutes training unit time were divided to... warming up (10) minutes- main part (75) minutes- cooling down (5) minutes.

- The resistance training is a composite include... muscle actions, resistance used, volume, exercise selected, repetition velocity and training frequency together with rest interval.

- The ability to jump, change pace and change direction is essential in soccer players, special consideration must include the quadriceps muscles and is antagonist the hamstring muscle by exercising... leg press, leg extension, seated leg curl and basic squat, also attention for the selected calf exercises together with the different part of the body.

- Post-measurements on 30/10/2014.

Statistical data analysis:

Using (SPSS) including...

-Arithmetic mean.

- Median.

-Standard deviation.

- Skewness.

- Spearman correlation coefficient.

- Mann-Whitney U test.

-Wilcoxon signed rank test.

-Rates of change formula.

variables of the study for the control group and for post measurement, that the (T) calculated value less than the (T) tabular value.

3. Results:

Table (6) reported statistical significant changes between pre & post measurements in

Table (6): Significance of differences between pre & post measurements in variables of the study for the control group. N=10

Variables		U of M	N. Ranks		S. Ranks		(T) value		Sig
			-	+	-	+	Table	Calcu.	
Muscular ability	Arms	m	0	9	0	45	5	0	S
	Legs	cm	0	9	0	45	5	0	S
Lactate		mmol/l	9	1	54	1	8	0	S
Pulse rate		count/m	8	2	40	15	8	0	S
T.WBCS		thousand	0	9	0	45	5	0	S
MDA		mmol/ml	10	0	55	0	8	0	S
SOD		mmol/ml	10	0	55	0	8	0	S
Interleukin ₂		ng/ml	0	9	0	45	5	0	S
IGF ₁		pg/ml	0	10	0	55	8	0	S

Table (7): Significance of differences between pre & post measurements in variables of the study for the experimental group. N=10

Variables		U of M	N. Ranks		S. Ranks		(T) value		Sig
			-	+	-	+	Table	Calcu.	
Muscular ability	Arms	m	0	10	0	55	8	0	S
	Legs	cm	0	10	0	55	8	0	S
Lactate		mmol/l	10	0	55	0	8	0	S
Pulse rate		count/m	10	0	55	0	8	0	S
T.WBCS		thousand	0	10	0	55	8	0	S
MDA		mmol/ml	10	0	55	0	8	0	S
SOD		mmol/ml	10	0	55	0	8	0	S
Interleukin ₂		ng/ml	0	10	0	55	8	0	S
IGF ₁		pg/ml	0	10	0	55	8	0	S

Table (7) reported statistical significant changes between pre & post measurements in variables of the study for the experimental group and for post measurement, that the (T) calculated value less than the (T) tabular value.

Table (8) reported statistical significant changes between the control group & the experimental group in variables of the study and for the experimental group, that the (U) calculated value less than the (U) tabular value.

Table (8): Significance of differences between the control group & the experimental group in variables of the study. N₁=N₂=10

Variables		U of M	S. Ranks		RanksV.		(U) value		Sig
			C	E	C	E	Table	Calcu.	
Muscular ability	Arms	m	59.5	150.5	95.5	4.5	23	4.5	S
	Legs	cm	55.5	154.5	99.5	0.5	23	0.5	S
Lactate		mmol/l	152.5	57.5	2.5	97.5	23	2.5	S
Pulse rate		count/m	134.5	75.5	20.5	79.5	23	20.5	S
T.WBCS		thousand	56	154	99	1	23	1	S
MDA		mmol/ml	155	55	0	100	23	0	S
SOD		mmol/ml	155	55	0	100	23	0	S
Interleukin ₂		ng/ml	75.5	134.5	79.5	20.5	23	20.5	S
IGF ₁		pg/ml	61	149	94	6	23	6	S

Table (9): Rates of change between control group & experimental group in variables of the study. $N_1=N_2=10$

Variables	U of M	Control group		differences between means	Change rate%	Experim.group		differences between means	Change rate %	Change direction	
		Pre.	Post.			Pre.	Post.				
		M	M			M	M				
Muscular ability	Arms	m	9.18	9.83	0.2	2.18	9.33	10.83	1.5	16.08	E
	Legs	cm	166.9	174.5	7.6	4.55	195.7	220	24.3	12.42	E
Lactate		mmol/l	1.71	1.43	0.28	16.37	1.58	1.06	0.52	32.91	E
Pulse rate		count/m	72.6	70.4	2.2	3.03	72.4	68.2	4.2	5.8	E
T.WBCS		thousand	6.8	7.7	0.9	13.24	6.7	8.6	1.9	28.35	E
MDA		mmol/ml	4.3	2.7	1.6	37.2	4.2	1.21	2.99	71.19	E
SOD		mmol/ml	6.6	5.3	1.3	19.69	6.5	4.31	2.19	33.69	E
Interleukin ₂		ng/ml	57	66	9	15.78	52.9	71	18.1	34.22	E
IGF ₁		pg/ml	69.6	81	11.4	16.38	71	88.3	17.3	24.44	E

Table (9) reported that the experimental group outperformed the control group in the rates of change in all variables of the study.

4. Discussion

Nagi et al. (1996) stated that muscles are a dynamic reservoir of bound and unbound proteins that are constantly broken down and regenerated to meet all the metabolic demands of the body. (29: 1743).

Feigenbaum and Pollock (1999) reported that although regular aerobic exercise provides a great way to burn calories and increase fitness, but such activity does not provide adequate stimuli to maintain muscle mass. (13: 38).

Kreamer et al. (2002) stated that more than any other activity resistance training exercise stimulates muscle protein synthesis rates to promote increase in strength and muscle mass that ultimately lead to an improved body composition. (19: 364).

Tables (6,7,8,9) revealed an increased insulin growth factors IGF₁ and elevated muscular ability levels for arms and legs with lower lactate and pulse rate after the regular and resistance program of the young soccer players and an extra improvement for the resistance program.

The changes which happened after the program of the resistance training program compared to regular program indicated that the resistance training program may induce a positive action on muscle due to increased IGF₁ hormone leading to increase fitness and stimulate muscle protein synthesis to improve strength and muscle mass together with the positive results of the performance tests and the lower lactate concentration of pulse rate, all these results indicated a higher fitness of the young soccer players with improvement of the performance ability of the players.

These data are in accordance with the contribution of lactate concentration and pulse rate were obvious in the study data, as the decrease level of both variables are a valuable indicators of the higher fitness level of the young soccer players after the resistance training program compared to regular program a decreased lactate means a retardation of fatigue due to increase mitochondria numbers and sizes, the same theory occur due to decreased pulse rate after the resistance training program which

indicated an increased cardiac output and a higher oxygenation of the skeletal muscle fibers which led to increased performance of the players due to the retardation of muscle fatigue, both lactate and pulse rate might be used as a markers of improvement of fitness and performance.

As for the effect of resistance training program, it is important to have a good working knowledge of many types of conditional programs, but also to be able to apply them to situations other than athletic performance, strength training research has grown and will continue to grow rapidly, for the health at the same time to achieving fitness and performance, especially for the popular soccer play.

Tables (8,9) indicated a better condition of health for the young soccer players, the data revealed a lower malondialdehyde concentration and an elevated superoxide dismutase levels with a higher T.WBCS values and interleukin₂ concentration after the resistance training program of the young soccer players compared to regular program, the determined parameters demonstrated that the resistance training program may improve immunity.

As Bouchard (1990) reported the importance of exercise for fitness and health and stated that Antioxidants... superoxide dismutase and glutathione are compounds that prevent and repair damage to cells caused by oxidants... free radicals and malondialdehyde, these elements cause oxidation in the athletic body, forming hazards to the organs, because these compounds are highly reactive and have the potential to damage DNA, causing mutations that can result in the malignant transformations of cells, free radicals can easily cause harm to the immune system, they may also be responsible for some of the changes of aging. (9:216).

Hatfield (2013) added that properly supervised strength training for youth should be included in physical education classes, as well as in community fitness programs and private fitness organizations, teaching of resistance training principles and their benefit to overall fitness will be important in maintaining youth health. (18: 199).

Alexander and Granger (2000), Blander and Medzhitov (2004), Moser et al. (2004), Ley and Kansas (2004) reported an increased T.WBCS in case

of strenuous exercises and in response to stress situations and added that while blood cells are formed in the bone marrow and stored within the marrow until they are needed in the circulatory system, Then when the need arises, various factors cause them to be released such as bacterial toxins, degenerated products in inflamed tissues of caused by clotting in inflamed area. (1: 1190), (7: 1014), (28: 75), (22: 325).

Scott et al. (2003), Mcgreedy (2004) stated that many interleukins_{2,3,4,5,6} are secreted by the helper tells in response to stress, as the results of the study indicated that interleukin₂ were elevated in response to the resistance training program and the increase interleukin₂ has an especially strong stimulatory effect in causing growth and proliferation of both cytotoxic and suppressor Tcells. (32: 137), (25: 1107).

Grossman et al. (2004) added that interleukin₂ have direct positive feedback effect in stimulating activation of the helper T cells, this acts a sampler by further enhancing the helper cells response as well as the entire immune response to invading antigen. (15: 387).

The discussion of the different variables indicated that the resistance program will improve both muscular ability and some physiological variables level of the young soccer players participating in the study which verify the hypothesis of the study.

Conclusion

The resistance training program improved performance and health in soccer youngsters.

Evaluation of the results is important for optimizing training programs of soccer youngsters.

Recommendation

It is recommended to practice such resistance training programs in soccer youngsters due to its importance in developing performance and health.

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