

Diagnosis of Percentages of Progress in Weight Training and its Relationship to the Dynamic Development of Muscle Strength of Football Players

Received 3rd April 2019
Accepted 19th June 2019

www.ijpefs.com

Koutchouk Sidi Mohamed –keroum Mohamed ^a, Mokrani djamel ^{a,*}, Sebbane Mohammed ^b

^a Laboratory of Programs Optimization in APS, Institute of Physical Education and Sports, University of Mostaganem, Algeria.

^b Laboratory of Applied Sciences to Movement Human Institute of Physical Education and Sports, University of Mostaganem, Algeria.

*Corresponding Author: Email: djamel.mokrani@univ-mosta.dz

Abstract: Muscle strength is one of the most important elements of fitness that must be available to football players. For a long period of time the weight training has been the subject of controversy among the specialists in the preparation and training of football players, the scientific researches has settled this controversy, where most of the results indicated that weight training has become necessary for the development of different types of muscular strength (maximum force – the special force of speed – endurance power). In fact the Algerian football sport lacks weight training programs and how to plan and evaluate the level of development of muscular strength during the training program with scientific bases and methods to avoid muscle inflation and increase muscle mass that can affect skill performance. The researchers' study note that there is a great detour of football players around the muscle strengthening rooms without a formal training program, which may lead to an increase in muscle inflation. So that the researchers decided to design a weight training program ,and diagnosing the percentage of progression and its relation to the dynamics of muscle strength development of different muscle groups and increasing muscle inflation as much as required for football players under 21 years of research experimental sample.

Key Words: Muscle exercises - Muscle strength - Diagnosis of progression ratios - Dynamism - maximum muscle strength test)- weight training.

1. Introduction

Muscle strength is considered as an important physical characteristic, and it is considered as the most important physical and physiological ability, and a dynamic element among other physical attributes [1–3]. Therefore, trainers see it as a key to progress in various sports activities that require overcoming certain resistors and contribute significantly to the increase of sports production in general, where performance depends on the player's muscle strength. elements of fitness that must be available to football players who require to be strong in most large muscle groups in the body to overcome a number of factors imposed by the

nature of the game on which the movement depends on physical performance in the practice of football[4–6], The results of some studies have agreed that muscle strength is a key factor in the ability to develop the motor performance of football players because of their association and impact to other physical abilities related to performance such as speed, endurance, agility and flexibility For [7].Weight training has long been the subject of controversy among specialists in the preparation and training of football players[8]. Some of them opposed heavy weight training on the grounds that it reduces motor speed[9], reduces motor range, reduces muscle stiffness, and reduces weight training as an

objective means of developing the different types of muscle strength that any player needs and which helps in developing physical abilities and improving performance. Most of the results indicated that heavy weight training has become an effective and necessary tool for developing different types of muscle strength (maximum strength, speed-bearing force, speed endurance) and has direct and essential impact on the degree of developing and improving all elements of overall fitness which is considered as the fundamental pillar of motor capacity and speed [10,11]

The good scientific planning of weight training programs for football players leads to the development of muscle strength [12,13] (the strength with speed) by increasing the load on the muscles with the appropriate weight to allow the development of strength to the desired limits[14], with programs rated in lifting or pushing the weight of light weights are training with quick exercises [10,15,16]

The fact is that the Algerian football sport lacks well-planned weight training programs as supplementary or integrated exercises in the physical preparation stages[17,18]. We can confirm that 90% of most sports teams have not undergone weight training programs throughout the training seasons[19–21]. And that the problem is not in weight training, but in the exercises selected and appropriate specialized in the direction of muscle work appropriate for the football player[22,23], and how to plan and evaluate the level of development of muscle strength during the training program bases and scientific methods to avoid muscle inflation and increase muscle mass, which can affect the performance skill negatively, and that there is a lack of use of weight training within the content of the preparatory program[24], the survey conducted by the researchers noticed a large detour of football players around the halls of muscle strength without a legal training program, which may lead to an increase in muscle inflation in addition to the interviews with some of the trainers, which determined the extent of knowledge of these trainers[25,26] about the nature of the drills and the limits of their knowledge[25] about this type of training as their ideas were conflicting between supporters and exhibits on the

possibility of training heavy weights for football players, arguing that it leads to muscle inflation and reduces the range as well as those who support the use of weights in their training, however, refrain from using them and that their problem is in the exercise selected ,appropriate and specialized in the direction of appropriate muscle work for the player and to the type of force which must be developed, the amount of weights it raises, the type of muscle contractions that should be focused on without increasing muscle inflation, and how to plan and evaluate the level of muscle strength development during the training program. Therefore, the researchers ought to the design a weight training program and diagnose the percentages of progress and its relationship to the dynamics of the developing muscle strength of different muscle groups of football players without the increase in muscle mass and inflation (the researchers emphasize that this issue was not tackled previously) and ask the following questions:

- What is the effectiveness of supplementary exercises or integrated with weights during the preparation periods in developing some of muscle strength characteristics of football players under the age of 21?
- What are the effect of such exercises and their rates of development on the increase in muscle inflation of the experimental sample?
- What are the differences obtained in increasing muscle strength between the control sample and the experimental sample on which the research is conducted?

2. Methods

The human field: The sample of the research is presented in football youth players under the age of 21, where the number of 36 players divided into two teams each team containing 18 players, one was in the experimental sample and applied the training program using tools and equipped weights for the development of muscle strength as a proposed training units, and control sample which left exercising physical preparation for regular football with traditional exercises in the development of muscle strength.

Spatial field: The research was carried out in the sports compound "RAED FARRAJ IN MOSTAGANEM" because it contains the muscular reinforcement hall equipped with modern weights devices.

Time domain: The preliminary study was conducted during the end of the sports season 2015/2016 while the basic study was completed during the preparatory phase (physical preparation) for the 2016/2017 sports season.

2.1 Research tools

- The maximum weight test can be lifted once: (1-RM) .Maximum repetition tests.
- Basic muscle groups (upper, lower and torso limbs), which must determine the maximum weight that can be overcome one time as follows: [3].
 - a. Upper limb muscles: pressure from sleeping on the sleeping seat (Developer coucher) To lay down bedtime.
 - b. Abdominal muscles: body weight (Abdominals).
 - c. Lower limb muscles (two legs): bending the knees, the weight behind the neck - half squatting (1/2-squat).

2.2 General planning of the program

The researchers took into consideration that the duration of the weight training program coincided with the preparation period for the training season as a component of the general training program for the team for approximately 4 months, 3 training courses with weights of 5 training units per week during the general and special preparation period, and (2) sessions per week in the competition phase.

The researchers took into account the principles of training in the design of the program, especially the principle of privacy and overload, adaptation and gradation, etc., and by sequential measurements after each training period it was possible to determine the new weight[27], which should be trained in the next period through the tests of the maximum number of times the performance is appropriate for each training period, where the intensity of the training increases and the number of repetitions decreases as the program progresses,

with the development of all types of muscle strength beginning with the development of tolerance of strength and strength characteristic of speed and explosive power. Training module (30-40 minutes).

Determination of the intensity of the training load using the maximum weight that can be overcome once:

In the table showing the arithmetic average of the results of sequential measurements of the maximum weight tests, the percentage of progress in muscle strength of upper limb muscles (chest, shoulders, arms) reached 25% in the first training period (first month) i.e an average increase of 7 kg. Progress at the end of the second training period was 14.28%, with an average increase of 5 kg. At the end of the third period (the third month), the rate of progress was 15%, ie an average increase of 60 kg. The table also shows the percentage of progress of the muscle groups of the upper limbs during the program (tribal and remote measurement) was 64.28%, ie an average increase of 18 kg.

**The amount of gravity required
by the player to perform a
certain KG = maximum weight
to be overcome once (kg)
Selected load intensity is 100%**

3. Results and Discussion

The results of the table showing the arithmetic average of sequential measurements of the maximal test of the strength of the trunk muscles and their rates of progression indicate that they reached 26.92% in the first training period (first month) ie an average of 7 recurrences. (18.3%), ie, an increase of 6 recurrences. At the end of the third training period (the third month), the abdominal muscle strength was 12.82%, which is an average of 5 recurrences. The table also shows the progress of the muscular strength of the torso muscles during the program Tribal and post-secondary) reached 69.23%, I.e an

average of 18 kg.

Muscle capacity of the experimental sample in weight exercises.

Table (01) shows the strength training variables during the general training program.

Program Variables	Training period	Period of incorporation	Period of preparation	Pre-competition period
Number of training units per week		3	3	3
Training System (Muscle Groups)		Multiple groups Low and high intensity	Multiple groups Low and high intensity	Multiple groups Low and high intensity hierarchical groups
Groups		3-5	3-5	1-3
Intensity (maximum weight)		30-50%	50 - 75%	80-90%
Size (repetitions)		Frequency of exercise 15-20 recurrence	Frequency of exercise 10-15 repetitions	Repeating the exercise from 3-10 times.
Speed performance		Slow	Fast	Fast
Breaks		30 seconds between terminals 3 minutes between cycle and the other	2 - 4 minutes between groups	30 seconds between
Power type		Endurance	The power of speed (Muscle development)	Endurance
Target		Increase of muscle size	Development of core power	Development of power and capacity

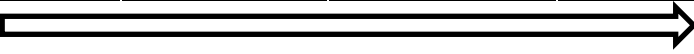
1-Presenting and discussing the percentages of progress concerning muscles strength of the upper limbs (chest, shoulders, arms)

Table (02) shows the results of the progress rates of the maximum tests weight (RM-1) to the strength of upper limb muscles (kg).

Progress rates (%)	Tests (RM-1)	First Test	End of First Month	End of Second Month	End of Third Month	Progress rate
Arithmetic mean (kg)		28	35	40	46	18
- Progress rate during the first month						
- Progress rate during the second month						
				14.28%		
- Progress rate during the third month						
					15%	
- Progress rate during the program.						64.28%

2 - Presenting and discussing the ratio of progress concerning muscles strength of the trunk (abdomen): (Abdominal).


Table (03) shows the progress rates of the maximum tests (repeat) of the strength of the muscles (abdomen).

Progress rates (%)	Tests (RM-1)	First Test	End of First Month	End of Second Month	End of Third Month	Progress rate
Arithmetic average (kg)		26	33	39	44	18
- Progress rate during the first month			26.92%			
- Progress rate during the second month test				18.18%		
- Progress rate during the third month					12.82%	
- Progress rate during the program.						69.23%

Through the table which shows the arithmetic average of the sequential measurements' results of the maximum weight tests, we observe that the percentage of progress in the muscular strength of the two legs muscles reached 31.25% in the first training period (first Month) i.e with an average increase of 10 kg. The rate of progress at the end of the second training period was 19.04% with an average increase of 08 kg and at the end of the third period (the third month) ,the proportion of the strength of the muscles of the two legs reached 20%,with an average increase of 10kg.

3-Presentation and discussion of the strength of the muscles of the lower limbs (the two legs): Quadriceps.

Table (04) shows the progress rates of the maximum weight tests (RM-1) for the strength of the muscles of the two legs (kg).

Progress rates (%)	Tests (RM-1)	First Test	End of First Month	End of Second Month	End of Third Month	Progress rate
Arithmetic average (kg)		32	42	50	60	28
Progress rate during the first month			31.25%			
Progress rate during the second month				19.04%		
Progress rate during the third month					20 %	
Progress rate during the program.						87.50%

4-Comparing the results of muscular strength tests for research samples (experimental and control) in the post test:

Table (05) "shows the comparison of the results of muscular tests capacity of the two research samples in the post-test.

TESTS	STATISTICAL STUDY	Sample number	Degree of liberty	statistical significance level	calculated value	Tabular value	statistical significance
Muscular capacity tests	1. Throw the medical ball 3 kg in front of the chest (m).	36	34	0.05	1.69	1.73	significant
	2.vertical jump (SERGENT)					2.50	significant
	3 .Tensile test on the brain.10 s					2.47	significant
	4.Abdominal muscle strength Test.					1.95	significant

The table also shows that the strength of the lower muscle groups (both legs) during the program (Pre and post measurement) reached 87.50%, with an average increase of 28 kg.

4. Discussion

The above-mentioned results of the rate of force progression showed that there was a positive development in muscle strength. This development occurred in each muscle group that was measured by the follow-up measurements of the RM-1 tests. During the results of the post-measurement after the application of the weight training program, a clear development in muscle strength of the upper limbs (chest, shoulders, arms), which reached 64.28% with an average increase of 18 kg, and the development of abdominal muscle strength at the end of the program by 69.23% (18 repetitions). The strength of the muscle groups of the lower limbs (legs) was 87.50%, with an average increase of 28 kg. This means that the different training units were in the appropriate intensity to increase muscle strength, and that the overall training time was sufficiently effective to show significant changes in each muscle strength variable, which may mean that the proposed weight training program had a positive effect on the development of muscle strength without the increase in the inflation of muscle and muscle mass. In this

regard, [28,29] points out that football is a sport that requires a kind of muscular strength during the annual training plan, so that the strength component must be developed at the beginning of the first preparatory period as a basis for developing the muscle strength of the competition. Then the power of strength and the maximum power will be developed in a focused manner[30]. As the percentage of the average rate of improvement in muscle strength among all consecutive measures in each muscle strength variable ranged from 15 to 30% as an improvement between each training period for each measured muscle group. Also, we observe that the greatest progress was for lower limb muscles with 87.50%, which is the most important muscle to be developed, especially when these muscles are not trained before, where the weakness of these muscles in the majority of players before the start of the program in addition to weak scoring skills during the matches [31].

The researchers conclude that these results in general terms are consistent with the results of the previous studies, emphasizes the growth rate of football player between 1-3% on average per week in weight training[32], and that untrained muscles improve more quickly and can reach 4-5.[33,34]states that when evaluating the improvement in muscle strength, the trainer must remember that there is a significant (concrete) improvement in muscle strength by 20% or more

during the 3-4 weeks of the training program. The improvement in muscle strength was more than 43% during weeks 8-12[35].

These results also stimulate the researcher to know the possibility of increasing muscle strength without the increase in muscle inflation, and the obtained differences between the experimental and control sample which used muscle strength development exercises and traditional individual exercises (body weight) without the use of weightlifting equipment [6,10,12,14,36].

The researchers found that this result is consistent with the results of the previous studies and personal observations that the program of training the force with well-designed weights lead to the development of strength and ability without increasing muscle inflation and muscle mass compared to traditional exercises, especially studies that dealt with the impact of strength training with weights, where [5], note that weight training studies have indicated that weight training has become an effective means of developing different types of muscle strength, especially for advanced athletes of the Countries of the world[36,37].

5. Conclusions

The present study was designed to determine the one-time maximum weight tests (RM), a weight training program applied to the experimental group led to the development of the muscle strength of the major measured muscle groups. We also note that the highest rates of progress between the different measurements of the training stages were for the first training period of the program and for all the measured muscle groups and this is according to the researchers to focus in this period on muscle inflation and increase muscle mass and as a basis at the beginning of the program to reach the capacity and this by increasing the size of the load and the number of repetitions and low intensity, points out that sports requiring muscle strength during the annual training plan must develop a force-bearing component at the beginning of the first preparatory period as a basis for developing muscle strength of the competition, especially with those who have

never muscular strength training. After the application of the proposed training program, the results showed a clear positive development in each measured muscle group between 60% -80% during the end of the program (muscles of the upper limbs chest, shoulders, arms 64.28% - abdominal muscles 69.23% - muscles of the lower limbs 87.50%). Therefore, we can say that the hypothesis of research has been achieved.

References

- [1] M. Górski, M. Starczewski, A. Pastuszek, J. Mazur-Różycka, J. Gajewski, K. Buśko, Changes of Strength and Maximum Power of Lower Extremities in Adolescent Handball Players During a Two-year Training Cycle, *Journal of Human Kinetics*, 63 (2018) 95–103.
- [2] S. Akila, Effect of basketball skill training and yoga training on playing ability of School basketball players, *International Journal of Adapted Physical Education ad Yoga*, 1 (2016) 1-8.
- [3] P.T. Nikolaidis, J. Ingebrigtsen, Physical and Physiological Characteristics of Elite Male Handball Players from Teams with a Different Ranking, *Journal of Human Kinetics*, 38 (2013) 115–124.
- [4] R. Pruna, Miñarro L. Tribaldos, K. Bahdur, Player talent identification and development in football, *Apunts Medicina de l'Esport* (English Edition), 53 (2018) 43–46.
- [5] T.J. Suchomel, S. Nimphius, M.H. Stone, The Importance of Muscular Strength in Athletic Performance, *Sports medicine* (Auckland, N.Z.), 46 (2016) 1419–1449.
- [6] S. Singh, R. Chengappa, A. Banerjee, Evaluation of Muscle Strength Among Different Sports Disciplines: Relevance for Improving Sports Performance, *Medical Journal Armed Forces India*, 58 (2002) 310–314.
- [7] S. Sturgess, R.U. Newton, Design and implementation of a specific strength program for badminton, *Strength & Conditioning Journal*, 30 (2008) 33–41.

- [8] A.D. Faigenbaum, Strength training for children and adolescents, *Clinics in Sports Medicine*, 19 (2000) 593–619.
- [9] W.J. Kraemer, N.A. Ratamess, Fundamentals of resistance training: progression and exercise prescription, *Medicine & Science in Sports & Exercise*, 36 (2004) 674–688.
- [10] N.C. Wetzel, Physical fitness in terms of physique, development and basal metabolism: with a guide to individual progress from infancy to maturity: A new method for evaluation, *Journal of the American Medical Association*, 116 (1941) 1187–1195.
- [11] M. Haga, Physical fitness in children with high motor competence is different from that in children with low motor competence, *Physical Therapy*, 89 (2009) 1089–1097.
- [12] K. Peek, D. Gatherer, K.J. Bennett, J. Fransen, M. Watsford, Muscle strength characteristics of the hamstrings and quadriceps in players from a high-level youth football (soccer) Academy, *Research in Sports Medicine*, 26 (2018) 276–88.
- [13] J.K. Rysgaard, J. Strøm, D.N. Sørensen, Changes in Power Output following 6 weeks of Jump Shrug Training with a Hexagonal Barbell or an Olympic Barbell in Adolescent American Football Players, 2018, Master thesis, Aalborg University.
- [14] T.J. Suchomel, S. Nimphius, C.R. Bellon, M.H. Stone, The importance of muscular strength: Training considerations, *Sports Medicine*, 48 (2018) 765–785.
- [15] R. Meir, R. Newton, E. Curtis, M. Fardell, B. Butler, Physical fitness qualities of professional rugby league football players: determination of positional differences, *Journal of Strength & Conditioning Research*, 215 (2001) 450–458.
- [16] A.D. Lyttle, G.J. Wilson, K.J. Ostrowski, Enhancing performance: Maximal power versus combined weights and plyometrics training, *Journal of Strength & Conditioning Research*, 10 (1996) 173–179.
- [17] A.C. Lacy, S.M. Williams, Measurement and evaluation in physical education and exercise science. Routledge; 2018, 8th Edition, CRC Press.
- [18] I. Mujika, S. Halson, L.M. Burke, G. Balagué, D. Farrow, An integrated, multifactorial approach to periodization for optimal performance in individual and team sports, *International Journal of Sports Physiology and Performance*, 13 (2018) 538–61.
- [19] H. Petré, P. Löfving, N. Psilander, The Effect of Two Different Concurrent Training Programs on Strength and Power Gains in Highly-Trained Individuals, *Journal of Sports Science and Medicine*, 17 (2018) 167.
- [20] D.L. Siedentop, P. Hastie, H. Van der Mars, Complete guide to sport education, *Human Kinetics*; 2019.
- [21] C-P. Jansen, C. Nerz, F. Kramer, S. Labudek, J. Klenk, J. Dams, H.H. König, L. Clemson, C. Becker, M. Schwenk, Comparison of a group-delivered and individually delivered lifestyle-integrated functional exercise (LiFE) program in older persons: a randomized noninferiority trial, *BMC Geriatrics*, 18 (2018) 267.
- [22] D. Lorenz, S. Morrison, Current concepts in periodization of strength and conditioning for the sports physical therapist, *International Journal of Sports Physical Therapy*, 10 (2015) 734–747.
- [23] M. Stone, S. Plisk, D. Collins, Strength and conditioning, *Sports Biomechanics*, 1 (2002) 79–103.
- [24] A.D. Faigenbaum, G.D. Myer, Resistance training among young athletes: safety, efficacy and injury prevention effects, *British Journal of Sports Medicine*, 44 (2010) 56–63.
- [25] Belkadi Adel, Benbernou Othman, Sebbane Mohamed, Laroua Abdelhafid, Benkazdali H. M, Jaques Gleyse, Contribution to the Identification of the Professional Skills Profile of Coaches in the Algerian Sport Judo System, *International Journal of Sports Science*, 5 (2015) 145–50.
- [26] G. Abdelkader, R. Madani, B. Adel, S. Bouabdellah, *International Journal of Physical Education, Fitness and Sports*, 7 (2018) 66–71.
- [27] L. Chrara, R.A. Raoui, A. Belkadi, A. Hocine, O. Benbernou, The impact of caloric restriction on anthropometrical and specific performance in

- highly-trained judo athletes, *Arab Journal of Nutrition and Exercise*, 3 (2018) 105–118.
- [28] J. Bangsbo, M. Mohr, P. Krstrup, Physical and metabolic demands of training and match-play in the elite football player, *Journal of Sports Sciences*, 24 (2006) 665–74.
- [29] A.J. Strudwick, T. Reilly, D. Doran, Anthropometric and fitness profiles of elite players in two football codes, *The Journal of Sports Medicine and Physical Fitness*, 42 (2002) 239–242.
- [30] D.G.B. Baker, S.P. Nance, M.K. Moore, The load that maximizes the average mechanical power output during jump squats in power-trained athletes, *The Journal of Strength and Conditioning Research*, 15 (2001) 92–97.
- [31] M. Berria, K. Bachir, S.N. Eddine, B. Adel, Study of LDH adaptations associated with the development of Speed endurance in basketball players U19, *International Journal of Applied Exercise Physiology*, 7 (2018) 35–43.
- [32] A. Rolls, K. George, The relationship between hamstring muscle injuries and hamstring muscle length in young elite footballers, *Physical Therapy in Sport*, 5 (2004) 179–187.
- [33] R.K. Idris, B. Bloufa, D. Mokrani, The effect of the contrastive training using weights and plyometrics on the development of muscular ability and Extension for Handball Players, *Journal of Education, Health and Sport*, 8 (2018) 163–168.
- [34] Djamel Mokrani, Houcine Benzidane, Tahar Tahar Sebbane Mohammed, The Reciprocal Relationship between Training with Weights and the Biometrical Training and Their Effect on the Muscles Capacities Growth for Basketball Players, *European Journal of Physical Education and Sport*, 2 (2015) 90-96.
- [35] J. Sundell, Resistance Training Is an Effective Tool against Metabolic and Frailty Syndromes, *Advances in Preventive Medicine*, (2011) 1-7.
- [36] R. Morgans, P. Orme, L. Anderson, B. Drust, Principles and practices of training for soccer, *Journal of Sport and Health Science*, 3 (2014) 251–257.
- [37] B.H. DeWeese, G. Hornsby, M. Stone, M.H. Stone, The training process: Planning for strength–power training in track and field. Part 1: Theoretical aspects, *Journal of Sport and Health Science*, 4 (2015) 308–17.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

Competing Interests: The author declares to have no competing interests

About The License

The text of this article is licensed under a Creative Commons Attribution 4.0 International License

