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# A MONITORING STUDY ON CHANGES IN PHYSICAL PARAMETERS TO YOUNG PLAYERS THROUGHOUT 5 MONTHS OF TRAINING IN FOOTBALL TEAMS IN SHKODRA, ALBANIA

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**Abstract:**
The best performance of soccer practitioners is certainly a consequence of regular football training, which also seems to bring acceleration to physical growth (Navarro F, 2000). The aim of this study was to give evidence on changes in physical parameters to young players throughout 5 months of training in football teams in Shkodra. Selection of the sample measurements were made in 2 teams of the city of Shkodra. In these measurements participated 78 boys players in the first and second phase of the measurements for a period of 5 months. The participant undertook anthropometrics parameters evaluation and performed three speed test (10m and 30m sprint test, speed and agility 10x5m). The necessary measurements for testing were: for the maximum capacity of the Vo2max oxygen (Andersen test) and strength tests. The difference between the first and second test (T2- T1) results of 10 m, presents the following values: mean of improvement 0.26 s (standard deviation 0.26 s and average error 0.04 s (p = 0.00)). Meanwhile, the difference between the results of the first and second tests of 30m velocity (improvement) is the following: average 0.18 s (standard deviation 0.37 s and average error 0.06 s (p = 0.00)). The difference between the results of the first and the second aerobic capacity tests is the following: average 26.6 m (standard deviation 126.28 m and average error of 51.55 m (p = 0.63)). The difference between the results of the first and second tests of the lower leg limbs presents the following values: mean -0.06 times (standard deviation 0.20 times and standard error of 0.03 times average (p = 0.05)). The results of the study showed the impact of training load at different stages of the training cycle for linear running speed, changes in speed, strength, and aerobic capacity to new

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football players in Shkodra. These results can serve as a basis for comparisons with colleagues in similar research studies. We have noticed that the speed performance and the ability to quickly change the direction of the players have improved throughout the observation period. For aerobic capacity, we did not notice a major improvement during the pre-season training period, while at the end of the season, sustainability increased slightly. We conclude that the training process in the youth plays an important role in the development of young players and positively influences the development of individual athletic performance components.

**Keywords:** physical parameters, young players, football teams, Albania

## 1. Introduction

It is a fact that early exercise brings development over the years (Reyes & Malina 2004). It is widely considered that biological maturity influences physical performance. Children may be advantageous / disadvantaged by being more or less mature than a "colleague" of the same chronological age (Jones et al., 1995; Beunen & Malina 2008; Janssens et al., 1999; Malina 2004; Navarro 2000). There is evidence of a growth momentum in childhood (the effect of exercise) in stature and possibly in many other dimensions but this, not all children (Malina & Bouchard, 1991). As reported in another study (Jones et al., 1995), the controversies that exist during the exercise seem not to affect the growth and development of these young athletes. Moreover, their continued success in sports seems to be related to inheritance features. Carrying out the right time training by a child can maximize his / her potential in sports when he is a adult sportsman. The intensity and timing of adolescent growth are individual and diverse, but the sense of momentum is useful for understanding early maturation and moderate maturity in girls and boys (Malina 2004; Malina & Bouchard, 1991; Sobral 1994), and these tend to be more prevalent in elite groups. The performance of a variety of strength, speed, and strength improves more or less proportionally to body mass gains, as well as improving balance and coordination between the ages of 5 and 8. In the adolescent transition phase (8 to 12 years old), performance in motor skills (many of them non-aerobic), strength and aerobic exercise are generally improved with age (Malina & Bouchard 1991). Regular football practice has a positive effect on the performance of motor skills, speed and skill of boys aged 10-11. The best performance of soccer practitioners is certainly a consequence of regular football training, which also seems to bring acceleration to physical growth (Navarro F, 2000). An important implication for youth football is that individual growth rates need to be considered.

However, some authors indicate that they respond to resistance training with increased strength, probably due to changes in the coordination of the nervous system (Malina 2003; Malina et al., 2005). In this line of thought, another study (Mass & Nicolai 2006) finds that youth sports programs should focus on controlling and regulating speeding mechanisms during childhood rather than on metabolic and muscular mechanisms, which should be highlighted After puberty, despite the predominance of muscular strengthening responsive to the game's posture (Toteva 1999). Some studies (Barata 2000; Marques & Oliveira J, 2004; Rowland & Boyajian A, 1995) point to the speed that reveals the highest levels of speed development based on coordination activities 6-9 years of age. Another study concluded that growth in body size during the growth and maturation phase is strongly linked to increased psychological performance (Weineck J, 2004). Sports exercise during growth depends on morphological characteristics and maturation stage (Figueiredo et al., 2009). It was later discussed that upper secondary childhood limits may be difficult to separate learning outcomes from those related to growth and maturation. A general attention should be focused on the exercise of overall sustainability with a particular focus on fundamentals and flexibility in general (Bompa TO, 2000). However, the aim of this study was to give evidence on changes in physical parameters to young players throughout 6 months of training in football teams in Shkodra.

## 2. Methods

The average body weight was 48 kg (+/- 9.4 kg), body height 157.6 cm (+/- 8.1cm) and BMI 19.1 kg/m2 (2.6 kg/m2). The participant undertook anthropometrics parameters evaluation and performed three speed test (10m and 30m sprint test, speed and agility 10x5m).

The necessary measurements for testing were: • for the maximum capacity of the Vo2max oxygen (Andersen test). Milestones have been used at both ends of the field • for the strength of the lower limbs (long-distance jump test) with use the meter extending to the ground and for speed (10x5m test) with use 2 milestones at each edge.

## 3. Protocols of the tests

### 3.1 Standing long jump

The purpose of this test was evaluation of functional force, neuromuscular control and dynamic strength of lower extremities. Equipment needed were standard measuring tape or testing tapes to measure the horizontal jump distance, flat non-slipping testing surface. The measurement of the lower limbs is done by the standing long jump test. This measurement is performed in open or closed environments. On the right or left side, a meter is placed in order to measure how much an athlete will jump while the is placed on the floor. The instructor explains the jumping mode and gives the signal that the athlete performs jumping. The aim is how much the athlete is jumping, which shows the strength of the lower limbs.

### 3.2 Speed and agility 10x5 m

The purpose of this test was testing speed and multi-directional skills and body control. The equipment needed were flat-slip surface, stopwatch, measuring tape. Speed measurement is done by test 10x5m. This test is carried out at a distance of 5m. At the ends of this distance, two points are set so that the athlete can be guided during the exercise (test). Athletes should perform this interval of 5m- 10 times. After the instructor gives the signal, the athlete starts running and based on the time he / she is to decide, the speed of test performed.

### 3.3 Sprint test 10m and 30m

The aim of these tests was to measure the athlete's linear speed capabilities (10m and 30m). The sprint tests were used to measure acceleration from a static position

### 3.4 Dynamic sustainability of abdominal muscle

The purpose of this test was evaluation of dynamic abdominal muscles in the lying position at the back at a certain repeat rate. The equipment needed were stopwatch, solid table for test surface, two adhesive tapes throughout the test surface, preliminary recordings (tape, etc.).

### 3.5 Strength of upper limbs (push up test)

The purpose of this test was evaluation of muscular strength of high extremities and their sustainability. The equipment needed were sustainable testing surface.

### 3.6 Cardiorespiratory fitness

To carry out the measurement of Vo2max, Andersen test was done. Test conducted on open or closed ground. Field dimensions have a length of 20 m. The athletes are placed in an area of the field where they run to the other area of the field and return for a period of 10 min. The instructor gives the signal for the start and end of the test, where the athlete run for 15 seconds and 15 seconds are rest for the entire 10 min. Here the total turnover of the athlete is measured and the result of the formula is returned in ml / kg/min where is the consumption L (vo2max).

### 3.7 Statistical analysis

A descriptive statistics (mean ± SD) was calculated for all of the variables (speed 10m, speed 30m, agility 10x5m, standing long jump, body weight and height) and putted before in an excel database taken for the field tests. An analysis of correlation was used to determine whether there was association for body weight and height with each variable assessed (motor abilities) in this study. All of the data were conducted using SPSS, version 20.0 (SPSS, Inc. Chicago, IL, USA). The significance level was set at $p < 0.05$.

## 4. Results

Table 1 shows the descriptive data (minimum, maximum, average, standard deviation) of the velocity, deformity, stability and force measured in the first phase of the tests. In the first 10m distance test, we estimate these data: minimum 1.65s, maximum 3.27s, mean 2.15s (dv 0.37s). In the first 30m distance tests, we estimate these data: minimum 4.05s, maximum 6.25s meanwhile 4.81s (dv 0.50s). The first tests of dexterity taken from the 10x5m test have these values: minimum 17.28s, maximum 25.02s mean 20.59s (dv 1.31s). In the first aerobic endurance tests, we have these measurement values: minimum 300m, the maximum 940m, while the 559.29m (dv 192.18m) mid-range. The first tests of the force measurement for the lower limbs through the crossroads of the country have these values: minimum 1.45m, maximum 2.42m meanwhile 1.92m (dv 0.29m). In the first tests of force measurement pe The upper limbs realized by lowering (pumps) with the force of the arms have the following data: minimum 6 lift-ups, maximum 40 take-offs, meanwhile 18.86 increase (7.22 increase). The first measurements of the abdominal force (abdominal muscles) through the folds of the trunk with fixed legs have the following test results: minimum 13 folds, maximum 80 folds, meanwhile 40.71 leaflets (16.50 folds).

**Table 1:** Descriptive data on speed, dexterity, cardiorespiratory fitness, stability and force measurements in the first measurement phase

| | Min | Max | Mean | Stand Dev |
|---|---|---|---|---|
| Speed 10m pre (sec) | 1.65 | 3.27 | 2.15 | 0.37 |
| Speed 30m pre (sec) | 4.05 | 6.25 | 4.81 | 0.50 |
| 10x5 m pre (sec) | 17.28 | 25.02 | 20.59 | 1.31 |
| cardiorespiratory fitness pre (m) | 300 | 940 | 559.29 | 192.18 |

| | | | | |
|---|---|---|---|---|
| Standing long jump pre (m) | 1.45 | 2.42 | 1.92 | 0.29 |
| Push up pre (time) | 6 | 40 | 18.86 | 7.22 |
| Abdominal pre (time) | 13 | 80 | 40.71 | 16.50 |

Table 2 shows the description of the difference between the results of the first and second tests of speed 10 m, 30 m speed and agility. Specifically, the difference between the first and second test results of 10 m, presents the following values: mean 0.26 s, standard deviation 0.26 s and average error 0.04 s (p = 0.00). Meanwhile, the difference between the results of the first and second tests of 30m velocity is the following: average 0.18 s, standard deviation 0.37 s and average error 0.06 s (p = 0.00). We also present the results of the difference between the results of the first and second tests of agility, which presents these values: mean 1.24 s, standard deviation 1.90 s and standard error of 0.32 s (p = 0.00).

**Table 2:** Distinguishing table of the difference between the results of the first and second tests of speed 10 m, 30 m speed and agility

| | **Mean** | **Dev Standard** | **Mean st Err** | **95% Diff IC** | | **t** | **Sig. (2-tailed)** |
|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | |
| Speed 10m pre- 10m post | 0.26 | 0.26 | 0.04 | 0.18 | 0.34 | **6.41** | **0.00** |
| Speed 30m pre- 10m post | 0.18 | 0.37 | 0.06 | 0.06 | 0.29 | **3.05** | **0.00** |
| Agility pre- post | 1.24 | 1.90 | 0.32 | 0.59 | 1.89 | **3.86** | **0.00** |

Table 3 shows descriptive data on the difference between the results of the first and the second tests of aerobic capacity. Specifically, the difference between the results of the first and the second aerobic capacity tests is the following: average 26.66667 m, standard deviation 126.28 m and average error of 51.55 m (p = 0.63).

**Table 3:** Descriptive chart of the difference between the results of the first and the second tests of aerobic capacity

| | **Mean** | **Dev Standard** | **Mean st Err** | **95% Diff IC** | | **t** | **Sig. (2-tailed)** |
|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | |
| Aerobic m pre- Aerobic m post | 26.66667 | 126.28 | 51.55 | -105.86 | 159.19 | 0.52 | 0.63 |

Table 4 shows descriptive data on the difference between the first and second test results of the lower leg limbs, upper limb forces, and abdominal muscle strength. Specifically, the difference between the results of the first and second tests of the lower leg limbs presents the following values: mean -0.06 times, standard deviation 0.20 times and standard error of 0.03 times average (p = 0.05). Meanwhile, the difference between the results of the first and second tests of upper limb forces is the following: the mean -0.32 times, the standard deviation 7.85 times and the standard error of 1.57 times (p = 0.84). Also, we have presented the results of the difference between the first and the second results of the abdominal muscle strength, which presents these values: mean -3.50 times, standard deviation 6.78 times and average standard error 1.33 times (p = 0.01).

**Table 4:** Descriptive chart of the difference between the results of the first and second tests of lower leg limbs, force of upper limbs and abdominal muscle strength

| | **Mean** | **Dev Standard** | **Mean st Err** | **95% Diff IC** | | **t** | **Sig. (2-tailed)** |
|---|---|---|---|---|---|---|---|
| | | | | **Lower** | **Upper** | | |
| Standing long jump pre (m)-Standing long jump post (m) | -0.06 | 0.20 | 0.03 | -0.12 | 0.01 | **-1.87** | **0.05** |
| Push up pre (time)-Push up post (time) | -0.32 | 7.85 | 1.57 | -3.56 | 2.92 | -0.20 | 0.84 |
| Abdominal pre (time) - Abdominal post (time) | -3.50 | 6.78 | 1.33 | -6.24 | -0.76 | **-2.63** | **0.01** |

## 5. Discussion

In this scientific research, we focused on young players under the age of 15 (U15) in two football teams in Shkodra where we noticed the changes during the period from the preparation to the end of the first competitive period (5 months). Monitoring the physical readiness parameters in the youth age group is an important part of the training process, as it is an important period of physical development. The purpose of this study was to investigate changes in the performance of motor skills such as the speed of linear running, skillfulness (agility), strength and cardiorespiratory fitness during the soccer season for young players from category U15. In this study the aim was to make comparisons with the results obtained, conclusions from several authors on the differences in the skill performance were taken into account.

For the strength skills measured in the study, the difference between the results of the first two tests of the force of the lower limbs on the average is 0.06 times, the upper limb force at 0.32 times the average of the abdominal muscle force in Average value 3.50 times. The most important variables for measuring performance in football are physical ability and technical and tactical performance (Rosch, D, et al., 2000). The physical condition of football players is usually measured in terms of sustainability, speed, strength and power (Hoff, J, 2005). It is relatively easy to prove the physical ability of young players, but it is a more challenging task to distinguish the effects of soccer training and growth-mediated development.

In other words, changes in body size, functional capacity and motor skills are very individual during puberty and the existing performance of a certain player is often closely related to their maturity status (Malina, RM, et al., 2005; Philippaerts, R, et al., 2006). In the same line are our monitoring results as well as the respective changes to the new football players in the city of Shkodra.

In football, there is demand for football players in terms of fitness readiness requirements to produce energy, explosiveness, speed, skill, balance (balance), body stability, flexibility, and an adequate level of sustainability (Bloomfield, Jet al. 2007; Helgerud, Jet et al., 2001; Krustrup, P et al., 2005).

Maintaining a high level of these components throughout the season is necessary for achieving consistent quality performance, while the basis for these individual player components is built during the teenage years. Aerobic capacity is an important factor, which in addition to the quality of the game itself, ultimately affects the final position of the teams in the championship (Hoff, J, 2005; Impellizzeri, F.M et al., 2005). Moreover, aerobic capacity has beneficial effects on parameters such as total time spent on high-intensity activities during the game, number of sprints, and number of contacts with the ball during the match. High aerobic capacity also increases the recovery from high intensity band loads (Bangsbo, J, 1993; Svensson, M & Drust, B, 2005). In the results of the difference between the second and the first measurements, there is no noticeable statistical improvement in the meters during the performance of the aerobic endurance test. The improvement is only 26.6 m ($p = 0.63$) but not statistically significant.

Caldwell and Peters (2009) found massive (slow) improvements to the players for the 15m sprint in the middle of the season ($2.44 \pm 0.10$s) than at the start of the competitive season ($2.49 \pm 0.10$s ), which is at odds with our results where players improve significantly compared to the start of the competitive period. These differences may indicate a different adaptation to the training load during the training period between adults and young players. An important change in the speed and agility component appeared during the monitoring period, which may be because of the greater number of adaptation initiatives (more matches) during the competitive period or the morphological changes in the body of the player (increase of Body height, highest percentage of body mass), which may positively affect a player's motor skills (extended walking pace, increased lower extremity muscle output, etc.). Ostojic (Ostojic, S.M, 2003) found significant improvement (12.6 ± 3.3%) at the linear running speed of 50 m for most players. Significant improvement (11.7 ± 2.68%) at 35 m linear velocity during the competitive period was observed in most of the adult players of the Greek league (Bekris, E et al., 2016).

Previous research has suggested that different physical performance characteristics become apparent in different age groups. Sprinting ability is likely to be more important in football during early puberty than later when the growth-related differences are equated. Gravina et al. (Gravina, L, 2008) found that sprint speed was the most important physiological factor associated with players between the ages of 10 and 14 being selected for the first teams. Vaeyens et al. (Vaeyens, R, et al., 2006) also found that speed was one of the factors that discriminated between elite and nun elite players at the age of 13 and 14, while aerobic endurance was more important in discrimination among 15 year olds 16 years old. The development of the strength of football players during puberty is less studied than speed or stamina, but observations suggest that football players have a higher average strength compared to the average population during puberty (Baxter-Jones, A & Helms, P, 1996; Capranica, L et al., 1992). It also seems that the biggest difference was found in the agility and speed performance when the results were considered in their entirety. These results can be explained by the nature of the game and the team training phase. It was logical that the power of football players would vary greatly because muscle size during growth was largely determined by the hormonal environment (Matos, N & Winsley, R, 2007) and without specific training of force; the development of strength is closely related to Chronological age (Blimkie, C, 1989). The observed difference in skill and strength performance was also expected, as these skills are constantly emphasized in football and players also gain continuous practice in these skills (Kaplan, T et al., 2009; Baxter-Jones, A & Helms, P, 1994; Bangsbo, J, 1996).

## 6. Conclusions

The results of the study showed the impact of training load at different stages of the training cycle for linear running speed, changes in speed, strength, and aerobic capacity to new football players in Shkodra. These results can serve as a basis for comparisons with colleagues in similar research studies. We have noticed that the speed performance and the ability to quickly change the direction of the players have improved throughout the observation period. For aerobic capacity, we did not notice a major improvement during the pre-season training period, while at the end of the season, sustainability increased slightly. We conclude that the training process in the youth plays an important role in the development of young players and positively influences the development of individual athletic performance components. The study can help sports practice for clinics, fitness trainers, soccer coaches and physiotherapy coaches by comparing these results with other groups.

## References

1. Bloomfield, J.; Polman, R.; O'Donoghue, P. Physical demands of different positions in FA Premier League soccer. J. Sports Sci. Med. 2007, 6, 63–70. [PubMed]
   Barata A, editor. O treino da resistência com jovens. Seminário Internacional de Treino de Jovens Pensar no futuro-apostar na qualidade; 2000; Centro de Estudo e Formação Desportiva, Portugal. [Article in Portuguese].
2. Baxter-Jones, A. and Helms, P. Effects of training at a young age: A Review of The Training of Young Athletes (TOYA) study. Ped Exerc Sci 8: 310–327, 1996.
3. Lindquist F, Bangsbo J. Do young soccer players need specific physical training? In: Reilly T, Clarys J, Stibbe A, editors. Science and Soccer: E and FN Spon; 1993. p. 275-80.
4. Baxter-Jones AD, Helms P, Maffulli N, Baines-Preece JC, Preece M. Growth and development of male gymnasts, swimmers, soccer and tennis players: a longitudinal study. Annals of human biology. 995;22(5):381- 94. Epub 1995/09/01.
5. Beunen G, Malina RM. Growth and Biologic Maturation: Relevance to Athletic Performance. In: Hebestreit H, Bar-Or O, editors. The Young Athlete: Blackwell Publishing Ltd; 2008. p. 3-17.
6. Bompa, T. (1983).Theory and methodology of training. Dubuque, IA: Kendall Hunt
7. Bekris, E.; Mylonis, L.; Gioldasis, A.; Gissis, I.; Kombodieta, N. Aerobic and anaerobic capacity of professional soccer players in annual macrocycle. J. Phys. Edu. Sport 2016, 16, 527.
8. Blimkie, C. Age- and sex-associated variation in strength during childhood: Anthropometric, morphologic, neurologic, biomechanical, endocrinologic, genetic and physical activity correlates. In: Perspectives in Exercise Science and Sports Medicine. Vol II: Youth Exercise and Sport. C. Gisolfi and D. Lamb, eds. Indianapolis, IN: Benchmark Press, 1989. pp. 99–163.

9. Capranica, L, Cama, G, Fanton, F, Tessitore, A, and Figura, F. Force and power of preferred and non-preferred leg in young soccer players. J Sports Med Phys Fitness 31: 358–363, 1992.
10. Figueiredo AJ, Coelho e Silva MJ, Dias J, Malina RM, editors. Age and Maturity-Related Variability in Body Size and Physique among Youth Male Portuguese Soccer Players. Science and Football V: The Proceedings of the Fifth World Congress on Sports Science and Football; 2003 (2005); Portugal: Taylor & Francis.
11. Gravina, L, Gil, S, Ruiz, F, Zubero, J, Gil, J, and Irazusta, J. Anthropometric and physiological differences between first team and reserve soccer players aged 10–14 years at the beginning and end of the season. J Strength Cond Res 22: 1308–1314, 2008.
12. Helgerud, J.; Engen, L.C.; Wisloff, U.; Hoff, J. Aerobic endurance training improves soccer performance. Med. Sci. Sports Exerc. 2001, 33, 1925–1931. [CrossRef] [PubMed]
13. Krustrup, P, Aagaard, P, Nybo, L, Petersen, J, Mohr, M, and Bangsbo, J. Recreational football as a health promoting activity: A topical review. Scand J Med Sci Sports 20: 1–13, 2010.
14. Krustrup, P.; Mohr, M.; Ellingsgaard, H.; Bangsbo, J. Physical demands during an elite female soccer game: Importance of training status. Med. Sci. Sports Exerc.2005, 37, 1242. [CrossRef] [PubMed]
15. Caldwell, B.P.; Peters, D.M. Seasonal variation in physiological fitness of a semiprofessional soccer team. J. Strength Cond. Res. 2009, 23, 1370–1377. [CrossRef] [PubMed]
16. Ostojic, S.M. Seasonal alterations in body composition and sprint performance of elite soccer players. J. Exerc. Physiol. 2003, 6, 11–14.
17. Impellizzeri, F.M.; Rampinini, E.; Marcora, S.M. Physiological assessment of aerobic training in soccer. J. Sports Sci. 2005, 23, 583–592. [CrossRef] [PubMed]
18. Janssens M, Van Renterghem B, Vrijens J, editors. Anthropometric characteristics of 11-12 year old Flemish soccer players. Science and Football IV (World Congress of Science and Football 4); 1999 (2002); Sydney: Routledge: Taylor & Francis (Psychology Press).
19. Matos, N and Winsley, R. Trainability of young athletes and overtraining. J Sports Sci Med 6: 353–367, 2007.
20. Malina RM. Growth and maturation: basic principles and effects of training. In: Coelho e Silva M, Malina RM, editors. Children and Youth in Organized Sports. Reitoria: Imprensa da Universidade de Coimbra; 2004. p. 137-62.

21. Malina RM. Growth and maturity status of young soccer players. In: Reilly T, Williams AM, editors. Science and Soccer: Routledge-Psychology Press; 2003. p. 287-306.
22. Malina RM. Growth and maturation: basic principles and effects of training. In: Coelho e Silva M, Malina RM, editors. Children and Youth in Organized Sports. Reitoria: Imprensa da Universidade de Coimbra; 2004. p. 137-62.
23. Malina RM, editor. Youth football players: Number of participants, growth and maturity status. Science and Football V: The Proceedings of the Fifth World Congress on Sports Science and Football; 2003 (2005); Portugal: Taylor & Francis.
24. Malina RM, Bouchard C. Growth, Maturation, and Physical Activity. 2nd ed: Human Kinetics Europe, Limited; 1991. 501 p.
25. Mass M, Nicolai AH. Características de crescimento e desenvolvimento. In: Rigolin da Silva LR, editor. Desempenho Esportivo: Treinamento com Crianças e Adolescentes: Phorte Editora; 2006. p. 153-91.
26. Marques A, Oliveira J. Promoting quality in youth sports. In: Coelho e Silva M, Malina RM, editors. Children and Youth in Organized Sports. 1st ed: Imprensa da Universidade de Coimbra; 2004. p. 31-4.
27. Navarro F, editor. Treinabilidade das capacidades físicas em função da idade e do grau de maturação. Seminário Internacional de Treino de Jovens Pensar no futuro-apostar na qualidade; 2000; Centro de Estudo e Formação Desportiva, Portugal. [Article in Portuguese].
28. Hoff J. Training and testing physical capacities for elite soccer players.Journal of Sports Sciences. 2005;23(6):573-82.
29. Pena Reyes ME, Malina RM. Growth and maturity profile of youth swimmers in Mexico. In: Coelho e Silva M, Malina RM, editors. Children and Youth in Organized Sports. 1st ed: Imprensa da Universidade de Coimbra; 2004. p. 222-31.
30. Philippaerts RM, Vaeyens R, Janssens M, Van Renterghem B, Matthys D, Craen R, et al. The relationship between peak height velocity and physical performance in youth soccer players. Journal of sports sciences. 2006;24(3):221-30. Epub 2005/12/22.
31. Rosch, D, Hodgson, R, Peterson, L, Graf-Baumann, T, Junge, A, Chomiak, J, and Dvorak, J. Assessment and evaluation of football performance. Am J Sports Med 28: 29–39, 2000.
32. Roozen, M. Illinois agility test. NSCA's Perform. Train. J. 2004, 3, 5–6. Rowland TW, Boyajian A. Aerobic response to endurance exercise training in children. Pediatrics. 1995;96(4 Pt 1):654-8. Epub 1995/10/01.

33. Sobral F. Desporto infanto-juvenil: prontidão e talento: LIVROS HORIZONTE; 1994. 88 p.
34. Sobral F. O adolescente atleta: Livros Horizonte; 1988. [Book in Portuguese].
35. Svensson, M.; Drust, B. Testing soccer players. J. Sports Sci. 2005, 23, 601–618. [CrossRef] [PubMed]
36. Toteva M, editor. Somatotype characteristics of young football players. Science and Football IV (World Congress of Science and Football 4); 1999 (2002); Sydney: Routledge: Taylor & Francis (Psychology Press).
37. Vaeyens, R, Malina, RM, Janssens, M, Van Renterghem, R, Bourgois, J, Vrijens, J, and Philippaerts, RM. A multidisciplinary selection model for youth soccer: The Ghent Youth Soccer Project. Br J Sports Med 40: 928–934, 2006.
38. Weineck J. Futebol Total. O treinamento físico no futebol: Phorte Editora; 2004. [Book in Portuguese].