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Adaptations in the physical capacities of U-18 futsal athletes during a competitive season

Adaptações nas capacidades físicas de atletas de futsal da categoria sub 18 no decorrer de uma temporada competitiva

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Abstract – The aim of this study was to verify and to analyze adaptations on physical and physiological variables of futsal athletes during the pre-competitive and competitive phases of a training macrocycle. The sample was composed of nine Under-18 futsal athletes who performed the following tests: vertical jump, 10 and 30-meter linear sprint, repeated sprint ability test, Yo-Yo intermittent recovery test level 1 and $VO_{2máx}$. Based on the qualitative analysis of the change magnitude, it was possible to verify adaptations from training for the vertical jump test (certainly positive), 10-meter linear sprint (likely decrease), 30-meter linear sprint (irrelevant), repeated sprint ability test for best sprint (irrelevant), mean of sprints (likely decrease), fatigue index (likely decrease), YYIRI (likely increase), $VO_{2máx}$ (likely decrease) and speed of $VO_{2máx}$ (likely increase). Thus, it was possible to verify that training-induced adaptations were positive since athletes improved their performance for the most control tests for each physical capacities of futsal (vertical jumps, 10-meter linear sprint, and repeated agility sprint test for the mean of sprints and fatigue index and aerobic resistance. Therefore, data have shown that athletes improved their physical performance considering the characteristics of futsal during training throughout a macrocycle.

Key words: Monitoring; Performance; Physical fitness; Team sports; Training.

Resumo – *O objetivo do presente estudo foi o de verificar e analisar as adaptações nas variáveis físicas e fisiológicas de atletas de futsal durante as etapas pré-competitiva e competitiva de um macrociclo de treinamento. Participaram do estudo nove atletas de futsal da categoria sub-18, que realizaram os seguintes testes: saltos verticais, velocidade de 10 e 30 metros, resistência de velocidade, Yo-Yo intermitentt recovery test Level 1 (YYIR1) e consumo máximo de oxigênio ($VO_{2máx}$). Baseado na análise qualitativa da magnitude da mudança, foi possível verificar as adaptações advindas do treinamento para os testes de saltos verticais (certamente positivo), velocidade de 10 metros (provável diminuição), velocidade de 30 metros (irrelevante), resistência de velocidade para o melhor sprint (irrelevante), média dos sprints (provável diminuição) e índice de fadiga (possível diminuição), YYIR1 (possível aumento), $VO_{2máx}$ (provável diminuição) e velocidade do $VO_{2máx}$ (provável aumento). Foi possível verificar que as adaptações causadas pelo treinamento realizado foram positivas, já que os atletas melhoraram o desempenho na maioria dos testes de controle das capacidades físicas solicitadas na modalidade (saltos verticais, velocidade de aceleração 10 m, resistência de velocidade nas variáveis média dos sprints e índice de fadiga e na resistência aeróbia específica). Desta forma, os dados demonstraram que os atletas melhoraram suas condições físicas, considerando as características do treinamento do futsal durante um macrociclo.*

Palavras-chave: *Aptidão física; Desempenho; Esportes coletivos; Monitoramento; Treinamento.*

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INTRODUCTION

Sciences applied to sports have sought to understand the structural and functional changes in the body of individuals submitted to training process. Although there are studies related to gene polymorphisms[1,2], biochemistry dimension of the body, anthropometric, psychological, cognitive, physical and physiological aspects are the most investigated in this area.

Despite the current offer of articles related to the topic, two points must be highlighted: the first is that further studies are still needed in order to understand the physical and physiological adaptations resulting from the training process in certain sports. Futsal is one of the sport modalities lacking deeper studies on this subject. The second is the importance of trying to understand that the training process should be considered as a set of manipulated variables in order to obtain a result (sports)[3,4].

The predominance of studies related to these issues is due to the methodological and technological development. Today, it is increasingly possible to accurately record the performance of athletes and to quantify the training load applied through the use of photocells to measure speed, or equipment to test vertical jump height and register heart rate during training sessions and competitions, measure oxygen uptake and other cardiorespiratory variables, in addition to the use of the latest technologies such as Global Positioning System (GPS) and other portable equipment. For this reason, much of the information available in Sport Science is about the physical aspects of training.

The training load is the result of the ratio between total volume prescribed and its quality, or between work and its intensity. Accordingly, external load refers to the amount of work while internal load is the effect that a certain external load exerts on the body[5].

Therefore, to verify the effectiveness of a particular training program, it is necessary to quantify its load and analyze the performance of athletes over time. Training adaptations are associated with changes in performance, for example, delayed fatigue or increased power. The adaptive responses of training are usually evaluated through physical testing in laboratory or in the field[6], and the information collected relate to a complex organism and therefore interrelated and interdependent of other dimensions that transcend physical and physiological dimensions[7].

Thus, this shows that performing periodical measurements and tests is important not only for the diagnosis of the health status and performance of athletes, but also in the training prescription and control of dynamics of functional changes arising from the training effects; body composition and physical abilities of athletes, and the others are consequences of other structures interacting with them, either behavioral or morphological[7].

Some studies have suggested specific tests for futsal[4;6,7]. However, there are few studies showing the behavior of such capacities throughout the season or only verifying the dynamics in some variables in a short training period consisting of one or two stages of preparation of futsal players[8,9].

However, it is necessary to monitor the development of players at different times (from pre-season to the competition period). In addition, in order to understand the information collected, analysis methods capable of detecting changes not only on a group level but individual changes should also be used, since the responses of the same training vary according to the adaptive capabilities of each individual. To this end, progressive statistical models have been suggested for a more accurate interpretation of adjustments resulting from training[10-12].

In this sense, the aim of this study was to determine and analyze adjustments in physical and physiological variables of futsal players during pre-competitive and competitive periods.

METHODS

The study was conducted during a 31-week macrocycle covering precompetitive and competitive phases. During the season, two weeks were scheduled (third and twenty-seventh week) to carry out the control tests in order to verify the physical and physiological adaptations arising from tactical, physical and technical training of a futsal team state champion of U-18 category. To monitor the adjustments that occurred during the study period, a maximum oxygen uptake test in laboratory used for athletes and five field tests used by the sport in question and specific to different biomotor capabilities were applied. Furthermore, the volume dedicated to each type of training was recorded by quantifying time. The internal training load was monitored during all sessions (n = 57) by means of the heart rate (Suunto Team Pod, Suunto Oy, Finland) and perceived exertion by using the scale proposed by Foster et al.[13] in all training sessions.

Subjects

Study participants were nine under-18 futsal players who compete at state level (age: 17.2 ± 0.4 years; height: 176.4 ± 6.6 cm; body mass: 68.1 ± 9.3 kg and body fat: 9.9 ± 6.8%). The initial sample was composed of 14 athletes, but five were excluded for at least one of the following reasons: a) Not performing all tests in the pre-competitive and / or competitive period; b) Frequency less than 80% in training sessions; c) Team off in the course of the season. This study was approved by the Ethics Committee of the State University of Londrina, Brazil (protocol No. 35902/2011) and was developed according to resolution of the National Health Council (196/96) for research with humans. All subjects were verbally and written instructed about the procedures performed in the study and voluntarily participated after completing the free and informed consent form.

Training characteristics

During the season, 57 training sessions were conducted, lasting about 90 minutes each session. The total training time was 5,103 minutes and the external load distribution was as follows: 3,929 minutes (77%) were dedicated to technical / tactical training (contact with the ball) and 1,174 minutes (23%) to the development of the physical abilities of athletes. The division of training of physical abilities was as follows: 204 minutes (17%) for speed resistance training; 306 minutes (26%) for muscular power training; 256 minutes (22%) for aerobic training; 102 minutes (9%) for co-ordinative training and 306 minutes (26%) for flexibility training (Table 1).

Control tests

Control tests were performed (laboratory and field) together with body composition assessment to verify adaptations caused by training during the study period. All tests were performed in the afternoon, the same period of the team's training sessions, with minimum interval of 48 hours prior to tests, athletes performed warm-up exercises for about 15 minutes, which were composed of five minutes of slow jogging; five minutes of dynamic and static stretching and five minutes of movements in progressive speed with acceleration, deceleration and direction changes. Participants were asked to come to sessions rested, fed and hydrated and not making efforts 24 hours preceding each evaluation.

Special aerobic resistance test

The Yo-Yo Intermittent Recovery Level 1 (YYIR1) incremental test was used. The test consists of performing 40-meter runs (20 + 20 m, with change of direction of 180º), increasing the speed by sound stimulus. Between each 40-meter run, subjects performed ten seconds of active recovery, jogging 10 meters (5 + 5 m). The test ended when subjects failed twice in an attempt to reach the finish line in time determined by the sound stimulus, at the same stage, or upon reaching exhaustion [14]. The test result was obtained by the total distance in meters.

Speed resistance test (repeated sprints)

The test consisted of six 40-meter sprints (20 + 20m, with change of direction of 180˚), interspersed with 20 seconds recovery between sprints [5]. A photocell (Hidrofit®, Belo Horizonte, Brazil) was used to determine the time of each sprint. The test results were expressed by the average and total time of all sprints, the best sprint time and the fatigue index were obtained by the following equation: ([Mean of sprints] / [Best sprint] x 100) - 100[16].

Speed test

To evaluate speed, the 10 and 30-meter linear sprint test was used [17]. Subjects performed two attempts within an interval longer than three minutes, being considered the best time for analysis. Photocell (Hidrofit®, Belo Horizonte, Brazil) was used to measure the time of each 10 and 30-meter linear sprint test.

Lower limb power test

To determine the power of the lower limbs, the three vertical jump techniques, squat jump (SQJ), countermovement jump (CMJ) and free jump (FJ) were performed, all on the Multisprint contact platform. Each subject performed three attempts in each jumping technique and the highest value reached by participants was considered for analysis[18].

Maximum oxygen uptake test ($VO2_{max}$)

To determine the maximum oxygen uptake, subjects were submitted to a continuous and progressive workout on a ATL 10200 treadmill (Inbramed®). Before the test, three was previous warm-up exercise at 7 km h^{-1}, soon after, test at speed of 8 km h^{-1} begun with increments in speed of 1 km h^{-1} each minute until exhaustion. At the end of the test, participants were allowed to active recovery for three minutes at speed of 7 km / h^{-1}. Treadmill inclination was set at 1%. Heart rate and respiratory gas exchange values were measured by breath for breath method using a portable ergospirometer system (Cosmed K4b2, Rome, Italy). Data were filtered at the average value every 10 seconds. $VO2_{max}$ was considered when the test reached two of the following criteria: a) $VO2_{max}$ plateau despite increasing speed, b) respiratory exchange ratio above 1.10, c) HR reached ± 10 bpm. min^{-1} of HR_{max} predicted for age using the formula (220-age). The protocol used to determine $VO2_{max}$ was adapted from Barbero et al.[19]

Statistical analysis

The results of this study were revealed by means of descriptive statistics on measures of central tendency (mean) and dispersion (standard deviation and confidence intervals) to detect changes induced by training in the evaluated variables and compare the results before and after testing,

To check the magnitude of change induced by training, the delta percentage (Δ%) was calculated by the following equation: (TC post - TC pre) / (TC pre) x 100. In addition, a qualitative analysis of data was carried out, which were presented from the relative change described in percentage change and 90% confidence interval, as suggested by Hopkins et al.[11].

Practical inference based on the change magnitude was applied [11]. The chance of finding a positive or a negative effect of training [e.g. higher or lower than the minimum detectable change (0.2 multiplied by the initial standard deviation based on effect size[20])] was calculated. Thus, the change was qualitatively assessed as described below: <1% almost certainly not; 1-5% very unlikely; 5-25% unlikely; 25 - 75% possible; 75-95% likely; 95-99% very likely; > 99% certainly; positive and negative values> ± 10% inconclusive. Spreadsheets available on http://www.sportsci.org/resources/stats/index.html were used on these analyses.

The size effect of changes in each physical parameter analyzed was also calculated. The limit values for the analysis of the Cohen's size effect were: <0.2 (trivial or irrelevant effect) 0.2 - 0.6 (small effect) 0.6 - 1.2 (moderate effect) 1.2 - 2.0 (large effect) and> 2.0 (very large effect)[20].

Table 1. Total time in minutes (%) devoted to each training component for each mesocycle.

TC/meso	Meso 1	Meso 2	Meso 3	Meso 4	Meso 5	Meso 6	Meso 7	Meso 8	Total
Total time	355	972	634	708	475	639	638	682	5.103
Weekly Time	118	243	127	236	119	160	159	227	170
Technical / Tactical (%)	111,5 (32)	631 (65)	507 (80)	511 (72)	413 (87)	569,5 (89)	528 (83)	635 (93)	3.929 (77)
RSA (%)	44 (12)	37 (4)	23 (4)	30 (4)	21 (4)	29,5 (5)	15 (2)	-	204 (4)
MP (%)	39 (11)	146 (15)	25 (4)	90 (13)	10 (2)	-	41 (7)	-	306 (6)
Aerobic (%)	96 (27)	76 (8)	26 (4)	34 (5)	-	-	-	-	256 (5)
Coordination (%)	35 (10)	22 (2)	10 (1,5)	12 (1,5)	9 (2)	-	8 (1)	-	102 (2)
Flexibility (%)	29,5 (8)	60 (6)	42 (6,5)	31 (4,5)	22 (5)	40 (6)	44 (7)	47 (7)	306 (6)

TC = training components; Meso = mesocycle; RSA = Capacity of Performing Repeated Sprints; MP = Muscle Power.

RESULTS

The average intensity recorded during training sessions was 69 ± 6% HR max and PSE 5.8 ± 1.5 (CR - 10).

Table 2 shows the pre and post-test results of all variables observed during the macrocycle. It also shows the delta percentage (CI 90%), the effect size and classification and the change magnitude percentage of all variables analyzed during the study.

Figure 1 presents the results considering the statistical method used[10], and in this case, it was possible to infer that the evaluated group had 100% chance of having an increase in performance on vertical jump tests at the end of the training period.

Table 2. Changes in physical abilities (mean ± standard deviation) of athletes throughout the season (n = 9).

Tests	Pre	Post	Δ% CI (90%)	Standard differences (Cohen) (CI 90%)	Effect classification	Change magnitude classification
SQJ (cm)	33.7 ± 3.37	39.9 ± 2.59	18.9 – (11.7 – 26.4)	1.48 (0.95 to 2.01)	Large	Certainly Positive
CMJ (cm)	37.3 ± 3.52	43.2 ± 4.03	16 (12.6 – 19.5)	1.31 (1.05 to 1.57)	Large	Certainly Positive
FJ (cm)	44 ± 5.32	47.7 ± 5.33	8.5 (5.8 – 11.3)	0.6 (0.42 to 0.78)	Moderate	Certainly Positive
Speed 10m (s)	1.79 ± 0.07	1.73 ± 0.1	-2.9 (-6.3 – 0.6)	-0.6 (-1.32 to 0.12)	Moderate	Likely decrease
Speed 30m (s)	4.18 ± 0.14	4.15 ± 0.18	-0.7 (-4.1- 2.8)	-0.18 (-1.1 to 0.73)	Irrelevant	Irrelevant
RSA_{best} (s)	7.13 ± 0.26	7.15 ± 0.24	0.2 (-2.1 – 2.5)	0.04 (-0.52 v 0.6)	Irrelevant	Irrelevant
RSA_{mean} (s)	7.49 ± 0.34	7.42 ± 0.27	-0.9 (-3 – 1.2)	-0.18 (-0.6 to 0.24)	Irrelevant	Likely decrease
$RSA_{fatigue\ index}$ (%)	4.86 ± 1.72	3.84 ± 1.93	-29.1 (-49 – -1.4)	-0.94 (-1.84 to -0.04)	Moderate	Likely decrease
YYIR1 (m)	1573 ± 513	1684 ± 390	11.3 (-6.7 – 32.9)	0.23 (-0.15 to 0.62)	Small	Likely increase
VO_{2max} (ml/kg/min^{-1})	50 ± 3.67	46.8 ± 6.01	-6.9 (-13.5 – 0.2)	-0.87 (-1.77 to 0.02)	Moderate	Likely decrease
VO_{2max} speed (km/h)	15.89 ± 1.76	16.89 ± 1.16	6.7 (-0.5 – 14.5)	0.48 (-0.04 to 1.01)	Small	Likely increase

SQJ = Salto Squat Jump; CMJ = Countermovement jump; FJ = Free jump; RSA = Capacity of Performing Repeated Sprints; RSA_{best} = best sprint; RSA_{mean} = Mean os sprints; YYIR1 = Yo-yo Intermittent Recovery Test Level 1; VO_{2max} = maximum oxygen uptake; VO_{2max} speed = speed of maximum oxygen uptake.

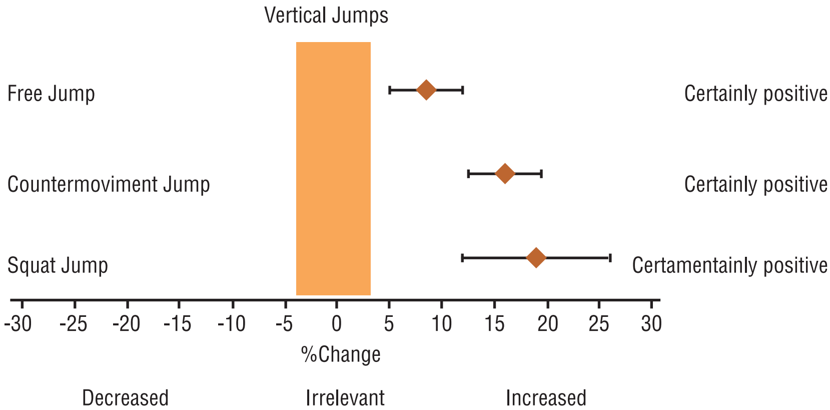

Figure 1. Change magnitude in vertical jumps.

DISCUSSION

The aim of this study was to determine and analyze the behavior of physical and physiological variables of futsal players during pre-competitive and competitive stages of a training macrocycle. The hypothesis of this study was confirmed because there were positive adjustments of specific skills required in the sport resulting from the training load.

The training load prescription of the present study aimed at the specificity of the sport during the annual training cycle, which consisted of approximately 77% of the total time for technical / tactical training and 23% for the development of physical abilities. According to Gomes[5], the goal of this training stage is to achieve sports scores and to seek a stable motivation for the pursuit of these results, in which tactical abilities must be improved, considering the functions exercised both individually and collectively, in addition to the gain of specific physical abilities of the sport.

The power of the lower limbs is of fundamental importance for futsal players, as is required in the decisive moments of the match, whether in situations of counterattack, recovery of ball possession or even in trying to prevent a goal. In this study, it was measured by applying the jumping tests, which were also applied in other studies, thus enabling the comparison with values reported by Gorostiaga et al.[21] and Silva et al.[22] for CMJ, which presented the following values: 38.1 ± 4.1 cm and 43.8 ± 6.8 cm during the preparatory period, respectively. In addition, Silva et al.[22] reported that U-20 athletes jumped on average 43.7 ± 4.1 cm, values, very close to those of the current study, indicating that the evaluated subjects had values similar those of above studies, demonstrating a performance level compatible for futsal players.

As for values found using the FJ technique, the values found in this study were lower than those reported by Freitas et al.[8] of 50.5 ± 3.8 cm in pretest and 56.6 ± 5.9 in post-test, performed 14 weeks after the first assessment. Unlike performance in CMJ, results in free jumping were lower than those of professional athletes, which is a variable to be further developed in training sessions of this category.

In addition to comparisons with other studies in literature, it was found that the change magnitude for power of the lower limbs by means of jumping tests was classified as "certainly positive". This means that athletes have positively adapted to muscle power training stimuli within 23% prescribed for the development of physical capacities, in addition to stimuli offered by technical / tactical training, which appears to induce adaptations in muscle power through specific actions of the sport. The power of the lower limbs enables athletes to perform quick and explosive movements in a short time, which is a quite requested feature in futsal. This capacity, when trained in a specific way, has a high degree of transfer to motor actions performed in court such as making jumps and sprints, enabling an improved performance of athletes during a match[21,22].

The motor actions used in futsal are carried out quickly and in all directions, being necessary to cover spaces as quickly as possible. So, when the acceleration speed test (10 m) was analyzed, the results found in this study in the first evaluation after two weeks of training (1.79 ± 0.08 s) were better than the findings by Freitas et al.[7] (2.04 ± 0.11 s) during the preparatory period and after a two-month vacation period, which was a justification for performance lower than expected by these authors.

Thus, this variable showed a positive adjustment resulting from training, being also consistent with standards of the sport, perhaps due to the training specificity. This capacity is extremely important in futsal, since most of the sprints performed on the court are around 6 to 16 meters, which occur in the decisive moments of the match[25-27].

Regarding linear speed (30 m), subjects of this research were faster (4.18 ± 0.14 s pretest and; 4.15 ± 0.18 s post-test) than the 27 semifinalist athletes of the professional State of Paraná Futsal Championship, which covered 30m in 4.40 ± 0.20 s during the final phase of the competition[24]. It could be inferred that the sample of this study is within the linear speed standard for futsal, although the change magnitude in the 30-m speed test have been regarded as "irrelevant". A possible explanation for this may be the fact that during training, 30-meter linear sprints were not conducted because there were no reports in literature that during a futsal match, athletes perform sprints of that distance.

Another specific capacity of the sport is the ability to perform repeated sprints. In this study, the effect of training was classified as "irrelevant" in the speed resistance test for variable best sprint. Variables, average of sprints and fatigue index were classified as "possible reduction" and "likely reduction" in the test execution time and reduction percentage, respectively, thus reflecting a positive adjustment to the training performed (4% of total training volume) and throughout the technical / tactical training, particularly in counterattack training, in which athletes performed sprints within short periods of time.

Oliveira et al.[14] assessed 11 professional futsal athletes in three different times, at the beginning and end of the preparatory period and during competition. The authors reported values similar to those of this investigation at the beginning of the preparatory period the average of sprints (7.43 ± 0.2 s), and higher values at the end of the preparatory period (7.24 ± 0.2 s) and during competition (7.13 ± 0.3 s).

With regard to the fatigue index, the values recorded in the second assessment (3.84 ± 1.93%) in this study are similar to those found by Impellizzeri et al.[15] in a study with high-level athletes (3.3 ± 1.5%) and higher than those achieved by mid-level athletes (5.1 ± 1.8%) of professional soccer players. The authors also reported that the difference between high-level and intermediate-level players was significant and can be considered able to differentiate performance levels[15]. The low reduction percentage shows that there is a small difference among times of the six sprints, which means that athletes who reported lower fatigue index had better speed resistance[15,16].

Given the findings above, it is noteworthy that the distance covered at high intensity, due to the presence of sprints, can be considered a specific characteristic of the sport, as sprints occur in the decisive moments of the match. So, to perform relatively more sprints and high-intensity activities during a match, athletes must show good ability to repeat high-intensity efforts and resist fatigue, which is vital for the physical performance of athletes on the court[15,25].

In addition to the above capabilities, futsal athletes must also have special preparation for the development of aerobic resistance. YYIR1 has been used to assess this ability in a special way in many sports due to its specificity and practicality. Krustrup et al.[14] reported that YYIR1 is sensitive to detect changes in performance throughout the season and to identify athletes with lower physical fitness.

During the macrocycle, the magnitude of performance changes in YYIR1 was classified as "possible increase". On the first moment, the subjects ran on average 1,573 ± 513 m, and on the second moment, they ran 1,684 ± 390 m. There are few studies on the use of YYIR1 to measure the special aerobic resistance of futsal players in literature. The distance covered by subjects in this study was lower than distances reported by Heineck et al.[28] of 1842 ± 432 m in a study of 12 professional futsal athletes. On the other hand, values are higher than those obtained by Oliveira et al.[4] in a study of professional athletes of this sport, with initial values of 1,244 ± 298 m, 1,491 ± 396 m at the end of the preparatory period and 1,465 ± 270 me during competition.

In this case and according to results obtained, it was possible to infer that athletes have positively adapted to stimuli due to training on the special aerobic resistance throughout the season. This adaptation seems to be important because athletes who showed better result in this test tend to cover a longer distance at high intensity and longer total distance during a match. Thus, subjects are more involved in the actions of the game, covering more space on the court with greater number of contacts with the ball, and stay longer on the court[14,29].

In the current futsal, the game's decisive actions are performed at high intensity and high oxygen uptake can produce a faster recovery among intense stimuli, thus enabling greater participation of athletes in specific game actions, ensuring high overall performance during matches[19,25,26].

Given the results obtained, aerobic power ($VO2_{max}$) was the only variable analyzed in which the change magnitude was classified as “likely decrease” in the performance of athletes. Rodrigues et al.[8] evaluated 14 professional futsal athletes who competed in the National League of Brazil and found at the beginning of the season (71.5 ± 5.9 ml / kg / min^{-1}) and at the end of the season (67.6 ± 3.5 ml / kg / min^{-1}). According to Senso and Drust[17], negative adjustments in this variable can occur due to its low sensitivity to stimulus caused by training, in which changes in aerobic fitness can be attributed to peripheral adaptations and not to central adaptations. The change magnitude in the final speed test was classified as a “likely increase”. A possible explanation for such change is that athletes increased metabolic and mechanical efficiency of the movement, thereby improving the running economy [17].

Some authors advise that professional futsal athletes should have $VO2_{max}$ of approximately 55-60 ml / kg / min^{-1} to support the high demands of the game[19,24,25].

Even with results similar to those of professional athletes in anaerobic performance variables, variables related to aerobic performance have shown results below those obtained by athletes under this category. This can be attributed to physiological ballast acquired by professionalized athletes with many years of training, supporting higher training loads and increased competitive demands, while U-19 athletes are in the sports training process, and have not yet reached maximum potential capacity.

One of the peculiarities of this study was that the first evaluation was carried out after two weeks of training after the vacation of young athletes, which may have contributed to the maintenance of initial fitness levels, which is similar to that of professional athletes in many variables. All these aspects, together with training volume and competitive demands, relatively low in relation to demands required of professional athletes, could lead to lower degree of adaptation of these individuals. However, it could be inferred that the intensity and specific training caused positive effects on the physical abilities required in futsal. These changes were detected by the use of non-conventional statistics (minimum detectable change), widely used in sports in situations where the sample size is relatively small. With regard to sports performance, any change (positive and / or negative), though relatively small, influence the performance of athletes and may lead to a better result in a particular test or in a particular game situation[11]. Therefore, we emphasize the importance of using this performance analysis model for longitudinal studies of young athletes.

The importance of this study for technical / scientific knowledge of the sport lies in the fact that the method has applicability to coaches and physical trainers in futsal. This design can be related to the application of physical control tests, which can be used to monitor the health and performance of athletes and verify adaptations resulting from training loads applied. In addition, the description of the external training load behavior that positively influenced physical abilities analyzed throughout the study showed that the content of training loads should be as specific as possible and quantified as detailed as possible so that these associations can be carried out with accuracy.

CONCLUSION

It was possible to verify that the adaptations caused by training were positive, as athletes improved performance in most control testing of physical capabilities requested in the sport (power of the lower limbs, 10-m acceleration speed, speed resistance in variables average sprints and fatigue index and specific aerobic resistance). It is important to emphasize the validity of studies that monitor in many different ways the athlete's performance during preparation macrocycles, because only through this method, coaches and physical trainers are able to understand in more detail the adjustments of athletes to training loads.

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