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Effect of Three Months Specific Training on Physical Capacities of Iraq Futsal Players

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Abstract

Background: Futsal is a high-intensity team sport taxing both the aerobic and the anaerobic pathways. Thus, this sport requires the development of some specific physical capacities such as: Sprinting, jumping, agility and endurance.
Objectives: Examine the effect of three months specific training on physical capacities (speed, explosive strength, agility and endurance) of Iraq futsal players.
Methods: Twenty males' professional futsal players (age: 19.73 ± 1.1 years, height: 172 ± 4.2 cm; body mass: 55.3 ± 8.9 kg) were divided into an experimental group (EG; n = 10) and a control group (CG; n = 10). Participants were selected from a first division team in Iraq. Before and after three months of specific training (at the pre-season phase), 5m and 15m sprint, counter movement jump (CMJ), change of direction [505 agility test (CODA)] and futsal intermittent endurance (FIET) tests were realized. During the three months, the CG continue their usual training and the EG used plyometric as well as technical and physical exercises.
Results: For the sprint performance, although no-significant difference was reported between pre- and post-training for the 5 m sprint, the 15 m sprint performance was better at post- compared to pre-training ($P < 0.05$) for the EG. For jumping performance, CMJ was higher at post- compared to pre-training ($P < 0.05$) for the EG. Likewise, for agility and endurance, CODA performance and peak velocity during the FIET test were better at post- compared to pre-training ($P < 0.05$) for the EG. However, except a better performance for 15m sprint and peak velocity during the FIET test for the EG compared to CG at post-training ($P < 0.05$), no-significant differences were reported between pre- and post-training for the CG and between the two groups at pre- and post-training.
Conclusions: In the light of these data, results have shown that improvement in physical capacities take into consideration the characteristics of futsal during training.

Keywords: Team Sport, Athletic Performance, Iraq, Season

1. Background

In the first quarter of the 20th century, futsal has been developed rapidly and started to be played (1). This sport is directed by the FIFA organization and played in the five continents in professional and amateur leagues for both women and men (2). This indoor sport is widespread in several countries and is very popular (3). Futsal (five-a-side indoor soccer), is played on a reduced pitch dimension with a smaller players' number. This lack of space obliges players to move quickly in order to create free space and playing opportunities (4).

This game can be described as a physical, tactical and technical sport by the large number of high intensity actions. The rapid changes in direction, acceleration, start moving, abrupt stop, jumping and kicking during the match require the players to have good aerobic, anaerobic and neuromuscular systems (3, 5, 6). Barbero-Alvarez et al. (3) demonstrated that futsal is a multiple-sprints sport as they reported the following data: mean distance covered per minute of play was 117.3 m of which 28.5% was covered at medium-intensity running, 13.7% at high-intensity running and 8.9% while sprinting. Also, Castagna et al. (5)

showed that during a futsal game played by professional players, aerobic power was heavily taxed accounting for 76% of maximal individual values. The substantial physical demands of futsal was evidenced by the range of 45 - 50 $mL.kg^{-1}.min^{-1}$ of oxygen uptake requirements and the repeated high-intensity efforts (i.e., a sprint bout every 79 s of play) (5). In this context, after four weeks of futsal training at the pre-season period, Nogueira et al. (6) reported an improvement in performance during the Yo-Yo Intermittent Recovery and the Squat Jump tests.

In comparison with football, futsal is characterized by more sprint and agility with less vertical jump. That the total distance logged at high intensity during the game in futsal is higher than other team sports (e.g., football, basketball and handball) (3).

The necessity of physical capacity in futsal requires their development at high level because physical capacity limits are very difficult. Moreover, the demand for performance in each match among futsal players requires better physical preparation before the start of the season (7). In fact, we can cite some factors that contribute to the fall of physical parameters in futsal players: challenging league, the high pace of the matches and the strong and talented players of other teams (7). Thus, it is necessary to monitor the condition of players before the season. Because of the variation in adaptation of the same training between individuals, it is necessary to use data analysis methods capable of detecting individual changes. At this point, the importance of evaluating the physical parameters of athletes before training program becomes apparent (8).

To our knowledge, no research has been undertaken to evaluate the physical capacities of Iraqian futsal players after 3 month of two training programs. Understanding physiological and neuromuscular capacities of futsal could facilitate the transfer of many information to the player.

2. Objectives

To compare and analyze the physical capacities of Iraq futsal players before and after 3 month of a specific training program.

3. Methods

3.1. Participants

Twenty males' professional futsal players (age: 19.73 ± 1.1 years, height: 172 ± 4.2 cm and body mass: 55.3 ± 8.9 kg), from a first division team in Iraq, participated in this study. The participants were divided into an experimental group (EG; n: 10) and a control group (CG; n: 10). The inclusion criteria were to have attended more than 85% of the training sessions during the two months prior to the tests and to haven't suffered from injuries for more than two weeks in the two months prior to the study. The players have participated in many official competitions organized by the futsal federation in Iraq and have an experience as futsal players of at least 4 years. The players trained three times per week (1.5 h per training session). This study was conducted according to the Helsinki Declaration, and a written informed consent was obtained from all the participants.

3.2. Experimental Protocol

The training program included three months during the pre-season period that precedes the competition period. The experimental group used combined training program (plyometric, technical and physical); while the control group used the usual futsal training program. All training sessions were monitored by the researcher with the help of the coach and his assistant. Before and after the training period, four physical capacities were evaluated: speed, explosive strength, agility and endurance. Except the goalkeepers, all players were evaluated.

3.3. Measurements

The physical tests were organized on three consecutive days. Each evaluation session was preceded by a 15-min standardized warm-up consisting of low-intensity running, dynamic stretching and accelerations at a distance less than 20 m. The measurements lasted for three days. On the first day, they performed the counter movement jump (CMJ) and the futsal intermittent endurance test (FIET). On the second day, they realized the change of direction capacity test (CODA) and on the third day, the 5 m and the 15 m speed tests were performed. All the measurements were carried out between 10 - 12 a.m.

Change of direction capacity test, CODA (505 agility test): The athlete must accelerate 15 m (i.e., the time starts when the athlete runs through the first set of timing gates, at the 10 m mark, also labelled the finish line), to the turn line (one foot must be on or over the line), change direction and accelerate 5 m through the markers (9). The time is recorded when the athletes first run through the 5-meter marker, and stopped when they return through these markers. Electronic timing gates (Photocell Microgate® Polifemo Radio Light, Bolzano, Italy) was used to record the time. The best time of the two tests in each direction should be recorded.

Five m and 15 m. sprint test: From a standing static position, players are required to run as fast as possible on a distance of 5 m and 15 m (9). The time of each distance and repetition was recorded using a photoelectric cell

(Microgate® Polifemo Radio Light, Bolzano, Italy). Three trials were accorded to each player and the best one was registered for statistical analysis.

Futsal intermittent endurance test (FIET). It is an intermittent fitness test designed to assess the endurance of futsal players. The test consists of multiple shuttles running over 45 m (3 × 15 m) distance performed at progressive speeds (controlled using beep emitted by prerecorded audio cues). The starting speed is set at 9 km/h. The speed increments during the first 9 × 45 m bouts are 0.33 km/h, then the speed increments were 0.20 km/h following each 45 m. Every 45 m, the participants were allowed to walk for 10 s. After each 8 × 45-m bout, the players rested for 30 s. The test continues until the player did not reach the front line in time with the beep during two successive repetitions. The highest speed recorded was considered as performance value (PVFIET).

- Counter movement jump (CMJ): From a standing position, with hands fixed on the hips (no arm-swing) and with a countermovement drop during the loading phase, the player performs a maximal vertical jump (10) that was s monitored using an Optojump system (Microgate, Bolzano, Italy).

3.4. Statistical Analysis

The STATISTICA 12.0 (Stat-Soft, Maisons-Alfort, Paris, France) and the Microsoft Excel 2010 (Microsoft Corp., Redmont, WA, USA) software were used for the data presentation and analysis. The data are presented as mean ± standard deviation (SD) in the table. The Shapiro-Wilk test was used to assess the normality of the data. After the confirmation of the normality of the distribution, a two way [2 × (groups) and 2 × (training)] analysis of variance (ANOVA) was used. When significant main effect or interaction was recorded, a pair-wise comparison was performed using the Bonferroni post-hoc test. Significant main effect, interaction or pair-wise comparisons were considered when the alpha level was ≤ 0.05.

4. Results

The pre- and post-training values of the 5 m and 15 m sprint, the counter movement jump (CMJ), the change of direction ability (CODA) and the peak velocity of the futsal intermittent endurance test (PVFIET) of the experimental group and the control group are presented in Table 1.

For the sprint performance, although no-significant difference was reported between pre- and post-training for the 5 m sprint, the 15 m sprint performance was better at post- compared to pre-training ($P < 0.05$) for the EG. For jumping performance, CMJ was higher at post- compared to pre-training ($P < 0.05$) for the EG. Likewise, for agility and endurance, CODA performance and peak velocity during the FIET test were better at post- compared to pre-training ($P < 0.05$) for the EG. However, except a better performance for 15 m sprint and peak velocity during the FIET test for the EG compared to CG at post-training ($P < 0.05$), no-significant differences were reported between pre- and post-training for the CG and between the two groups at pre- and post-training.

Table 1. Pre- and Post-training Values of the 5 m and 15 m Sprint, the Counter Movement Jump (CMJ), the Change of Direction Ability (CODA) and the Peak Velocity of the Futsal Intermittent Endurance Test (PVFIET) of the Experimental Group and the Control Group

Group	Pre-test	Post-test
5 m sprint (sec)		
EG	1.04 ± 0.06	1.01 ± 0.05
CG	1.06 ± 0.08	1.04 ± 0.09
15 m sprint (sec)		
EG	2.41 ± 0.11	2.36 ± 0.10 [a]
CG	2.43 ± 0.13	2.41 ± 0.15
CMJ (cm)		
EG	38.73 ± 5.32	43.33 ± 6.30 [a]
CG	40.38 ± 6.20	42.20 ± 6.55
PVFIET ($km.h^{-1}$)		
EG	16.10 ± 1.10	16.62 ± 1.15 [a, b]
CG	15.85 ± 0.80	16.05 ± 1.00
CODA (s)		
EG	2.28 ± 0.09	2.17 ± 0.05 [a]
CG	2.30 ± 0.10	2.26 ± 0.08

[a] Significant differences compared to pre-training ($P < 0.05$).
[b] Significant difference between the EG and the CG ($P < 0.05$).

5. Discussion

The objective of this research was to evaluate the performance of physical fitness tests for Iraq futsal players before and after 3 month of a specific training program. The results of our study showed a significant improvement between the pre-test and post-test for the 15 m sprint, the CMJ, the FIET and the CODA 505 test in the EG. Also, a better performance was recorded for 15 m sprint and peak velocity during the FIET test for the EG compared to CG. However, no significant difference was reported between the two groups during the two periods.

The complexity of futsal, in comparison with other team sports, needs better physical condition (11). Most of the actions during the futsal match (counter-attack, recovery of the ball, defending) requires a better power of the lower limbs. The majority of futsal match actions

(counterattack, recovery of ball possession or even in trying to prevent a goal) requires significant power of the lower limbs. Corroborating with the results of this study, previous studies has demonstrated that at the beginning of the competitive season an increased performance in vertical jump was observed (12, 13).

In this study, vertical jump was measured by the CMJ, like other studies, which enable a comparison with data recorded by Gorostiaga et al. (14) and Silva et al. (15) who reported during the preparatory period values of 38.1 ± 4.1 cm and 43.8 ± 6.8 cm, respectively. In addition, Silva et al. (15) recorded a value of 43.7 ± 4.1 cm in U-20 athletes jump. Matzenbacher et al. (8) found an increase in performance on CMJ tests with U-18 futsal players after a training period (from 37.3 ± 3.52 cm to 43.2 ± 4.03 cm). The performance level compatible for futsal players are demonstrated by the very close values of the current study (8). The reduction of training volume usually observed during the preparation period can justify the increase in lower limb power observed (13, 16). Collective sports are characterized by the short preparation period, for this reason, training sessions aimed to develop many motor skills which may lead to enhanced performance during competitions (13, 16). In addition, another important factor for improving lower limb power, was the load used in training during this physical capacity (13, 17). In fact, it seems that there's a relation between improvement in lower limb power and improvement in the 15 m speed test. Apparently, there's a relation between speed in short-speed runs (< 50 m, acceleration phase) and the capacity to produce force in the soil (18). A previous study observed that performance in sprint tests at different speeds (10 m, 20 m, 40 m, 60 m, 100 m and 150 m) was in very large correlation with data recorded in tests performed in the optimum power zone (e.g., hip-thrust and jump after back squat). In addition, by adding vertical and horizontal plyometric training in the training routine of U-20 soccer players, a speed improvement in 0 - 20 m tests were observed (16). In the present study, for the EG, vertically and horizontally jumping exercises were added to the training routine. Thus, the improved speed of players observed in this study are related to these exercises, according to other studies. Moreover, important actions in futsal match such as defensive return and counter-attack request an increase in speed over short distances. Thus, to increase the speed of futsal players, this study supports the addition of power development in training (19).

FIET is a high-intensity field test that involve aerobic and anaerobic metabolism (20). Freitas et al. (19) have found an increase in the PVFIET after 4 weeks of futsal training (exercises developing and strengthening power of lower and upper limb muscles) corresponding to the beginning of the competitive period characterized by a reduced total training volume (compared to the training period). It is supposed that the great effect on FIET is due to the anaerobic system, as well as neuromuscular components (i.e., large number of changes of direction and short distance traveled during the match) (20). In young soccer players, Matos et al. (21) have observed increases in performance in the Yo-Yo intermittent endurance run test after a twelve-week field training combining strength and power. Moreover, Matzenbacher et al. (8) have analyzed the effects of 31 weeks of futsal training covering precompetitive and competitive phases on the aerobic capacity of futsal players using the YYR1 and the program includes muscle power exercises. Authors have found an increase in the distance covered in the YYR1 (1573 m vs. 1684 m). Moreover, the performance improvement in FIET can be due to the addition of lower limbs power in training. The improvement in decelerations and accelerations involved in the constant changes of direction during FIET may have by adding in training lower limbs power.

Change of direction (505 agility test) is a fundamental aspect for performance in futsal (3, 5, 22, 23). In our study, EG (including plyometric training) displayed important increases in CODA compared to the CG (2.28 s vs. 2.17 s in EG vs. 2.30 s vs. 2.26 s in CG). The results obtained by Ayarra et al. (24) with futsal players coincide with our results. They have found that plyometric training groups displayed practically important improvements in CODA compared to other groups. In addition, in soccer players (25, 26), suggestion was made for the plyometric training and his effectiveness to improve sprinting speed. It's believed that CODA is highly required during games due to the smaller futsal courts. Therefore, to improve players' specific physical components and the rapidity of change direction, we suggest the use of plyometric training during the pre-season futsal period. To improve CODA, it is possible that some exercises are more effective (i.e., side-to-side ankle hops and lateral steps 2 sound 1 in and out), but this issue requires more studies. Moreover, Ramirez-Campillo et al. (27) have suggested the combination of other eccentric overloading strategies with plyometric training.

The specificity of this study was that the first evaluation was carried out for 3 months during the pre-season period which fitness levels can be maintained. All these aspects, together with training volume could lead to higher degree of adaptation of these individuals. Moreover, method used can facilitate elaborating physical programs among futsal players, because the importance of this study for physical/scientific knowledge of this sport. To verify adaptations resulting from training loads applied and to monitor the health and performance of athletes, application of physical control tests is required. However, the main limitation of the current study was

the absence of the verification of the training load. Using external and internal training load (GPS, heart-rate monitor) could help that the content of training loads should be as specific as possible and quantified as detailed as possible so that training program can be carried out with accuracy. For this reason, verification of training load can help coaches and physical trainers to monitor the health and performance of athletes and verify adaptations resulting from training.

5.1. Conclusions

It was possible to verify that the adaptations caused by training were positive, as athletes (experimental group) improved performance in most testing of physical capabilities requested in the sport (power of the lower limbs, 15 m sprint, intermittent endurance test and change of direction ability). In addition, information and data from studies concerning player's performance during preparation period are very important, because it can help coaches and physical trainers to understand in more details the evolution of performance at the first period of a season.

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Footnotes

Authors' Contribution: Dheyab Mashaan Hailan Al-Azzawi and Jamel Halouani, data collection and analysis; Dheyab Mashaan Hailan Al-Azzawi and Ahmed Oraibi Sabea Al-Gertani, writing the first version of the manuscript; Dheyab Mashaan Hailan Al-Azzawi, Jamel Halouani and Hamdi Chtourou, drafting and revising the manuscript. All authors have participated in preparation of the final version of the manuscript, whose contents they approve.

Conflict of Interests: No conflict of interest exists.

Data Reproducibility: The data presented in this study are openly available in one of the repositories or will be available on request from the corresponding author by this journal representative at any time during submission or after publication. Otherwise, all consequences of possible withdrawal or future retraction will be with the corresponding author.

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