

## INVESTIGATION OF THE EFFECTS ON PHYSIOLOGICAL PARAMETERS OF FOOTBALL PLAYERS IN PRE-SEASON PERIOD

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### Abstract

*Purpose.* The pre-season period in football is of great importance in order to optimise the performance of athletes and minimise the risk of injury. The aim of this study was to follow the physiological parameters of the athletes in the first pre-season preparation phase and to determine their readiness levels. *Material and Methods.* Twenty-four professional licensed athletes aged between 18-35 (24.3±5.42) years participated in the study. The body weight and height of the athletes at the beginning of the season were 72.4±7.44 and 180.0±6.33, respectively. At the beginning and at the end of the first preparation phase, fat measurement, squat jump, overhead squat assessment and yo-yo endurance test were performed. *Results.* The fat percentage obtained as a result of the tests was 7.43±0.73 in the pre-test and 6.99±0.65 in the post-test, 40.25±4.9 in the squat jump pre-test and 41.45±4.8 in the post-test, 17.33±3.5 in the overhead squat assessment pre-test and 19.50±2.1 in the post-test and 1723.3±307.6 in the squat jump pre-test and 1852.08±335.8 in the post-test. According to t-test data, statistically significant differences were found in fat percentage, squat jump, overhead squat evaluation and yoyo data (<.001). *Conclusions.* According to the results of the study, it can be said that the fat percentage, strength assessment, anaerobic power and endurance skills of the athletes improved in the first pre-season preparation phase.

**Keywords:** Football, pre-season, squat jump, overhead squat, endurance.

### INTRODUCTION

The pre-season preparation period in football is of great importance in order to optimise athletes' performance and minimise the risk of injury (Bangsbo 1994). In this process, the focus is on the development of basic physiological parameters such as endurance, strength, speed and flexibility. Increasing aerobic capacity enables footballers to play at high tempo throughout the match, while improving anaerobic performance is decisive in sudden accelerations, sprints and changes of direction (Bangsbo et al., 2006). While an increase in VO<sub>2</sub>max values is observed with the training, the improvement of muscular endurance and explosive strength increases the

effectiveness of the match in both offensive and defensive aspects (Impellizeier et al., 2006). At the same time, the preparation period reduces the risk of injury by supporting musculoskeletal adaptations. The endurance of muscle-tendon structures increases through flexibility, mobility and strength training.

Interval training, which is frequently used in this period, delays the fatigue period by increasing the lactate threshold while improving oxygen utilisation capacity (Kelly and Dust 2009). Changes in body composition such as decreased fat and increased muscle mass are other positive outcomes of pre-season training. Furthermore, thanks to adaptations in the cardiovascular system, the heart rate decreases and athletes can perform high performance with a lower pulse rate (Rampinini et al., 2007). As a result, the pre-season preparation period enables football players to reach their peak performance by improving both physiological endurance and motor skills. The balanced development of these parameters through a systematic training programme allows athletes to make a strong start to the season and achieve sustainable success (Stolen et al., 2005).

The aim of this study was to investigate the physical and physiological performance data of a professional football club in the general preparation phase before the season.

## **METHOD**

### *Research Model*

Male football players between the ages of 18-35 ( $24.3 \pm 5.42$ ) playing in a professional football club constituted the population of the study; 24 male football players with a training age of at least 5 years, participating in national and international competitions, without any disease or injury, regularly training and competing in the professional league category constituted the sample of this study. The study design and possible risks were explained to the participants and a written consent form was filled out. In order to eliminate the learning effect on the test results, a 'familiarisation session' was first performed so that the athletes could get used to the test equipment, test protocols and the investigators. For example, a brief demonstration of how to perform the overhead squat test was given and participants were asked to perform at least 2

attempts (Engquist et al., 2015). Among the procedures for data collection, all ethical research care was taken, following the ethical principles of Helsinki 2008.

*Inclusion criteria:* Athletes with a regular training history of at least 5 years, training at least 5 days a week for at least 60 minutes, participating in national or international competitions, not having a serious injury in the last 6 months, not using regularly alcohol and medication were selected.

*Exclusion criteria:* Participants who had less than 5 weekly training sessions, consumed alcohol and regular medication were excluded.

#### *Height, mass, body composition measurements*

The height of the athletes was measured in cm with Mesilife (MC-210, Turkey) brand device. Body mass (kg), body mass index (BMI, kg/m<sup>2</sup>) and fat percentage (%) of the athletes were measured with Tanita (BC418, Japan) device by taking an upright position on the platform with bare feet and wearing only shorts and t-shirt.

#### *Y Balance Test*

The overhead squat assessment is a dynamic posture assessment that combines shoulder flexion with squatting (sitting to standing). It aims to assess whole body neuromuscular efficiency as well as dynamic flexibility, core strength and balance. Shoulder, lumbo/hip/pelvic, knee and ankle mobilisations were individually observed and angles were noted. The participants repeated the movement 2 times and the scores obtained from each region were noted as overall scores.

#### *Squat jump*

For squat jumps, participants were instructed to assume a squatting stance on a force platform (Witty, Italy) and to clasp their hands slightly behind their head to control arm support. Participants were instructed to jump continuously, as explosively as possible, as high as possible for the desired repetitions. Participants repeated the test 2 times and their best times were recorded.

#### *Yoyo endurance test*

The Yoyo test is a physical fitness test that measures endurance and fitness. Especially popular among athletes, it is used to assess running endurance and speed. The test involves the participant running forwards and backwards along a line and takes place at certain intervals at increasing speeds. The participant starts at one end of a line

and runs towards a target at the other end. Then, as soon as he/she reaches the target, he/she turns back and this process is repeated at a certain speed. The speed is indicated by audible signals and the speed increases each time. If the participant fails to reach the target or does not align with the signal sound, the test ends and the last level run is recorded (Thomas et al., 2006).

### *Statistical analysis*

Basic central and dispersion parameters (Mean, SD, Mean Difference, CI difference 95%) were calculated for each variable. The Kolmogorov-Smirnov test was applied to confirm normality ( $p > 0.05$ ). The data were analyzed using an independent student's T- test and statistical significance was set at level  $p < 0.01$ . SPSS 25 package programme (SPSS Inc., Chicago, IL, USA) was used for statistical analysis of the data.

## RESULTS

**Table 1.** Descriptive statistics of participants

Variables	N	Mean±Sd	Minimum	Maximum
Height (cm)	24	180.8±6.33	165	189
Body weight (kg)	24	72.4±7.44	60.2	91.0
Age (year)	24	24.3±5.42	5	31

Values are expressed as means ± standard deviations. According to Table 1, the age of the participants was 24.3±5.42 years and the height measurement was 180.8±6.33. Body weight index were 72.4±7.44, respectively.

**Table 2.** Changes in the variables of the participants before and after the tests.

Variables	N	Mean±Sd	Median	SE
Body Fat (pre)	24	7.4±0.7	7.5	0.15
Body Fat (post)	24	6.9±0.6	6.95	0.13
Squat jump (pre)	24	40.3±4.9	39.5	0.99
Squat (post)	24	41.5±4.8	41.2	0.97
Overhead Squat (pre)	24	17.3±3.5	16.5	0.71
Overhead Squat (post)	24	19.5±2.1	20	0.43
Yo-yo (pre)	24	1723.3±307.6	1760	62.78
Yo-yo (post)	24	1852.1±335.8	1845	68.55

Values are expressed as means ± standard deviations. When Table 2 is analysed, fat percentage pre-test 7.43±0.73, post-test 6.99±0.65, squat jump pre-test 40.25±4.9,

post-test 41.45±4.8, overhead squat assessment pre-test 17.33±3.5, post-test 19.50±2.1 and yoyo pre-test 1723.3±307.6, post-test 1852.08±335.8 were found.

**Table 3.** T-Test results

Variables	T	p-Value
Body Fat	7.46	0.000*
Squat jump	-4.65	0.000*
Overhead Squat	-5.72	0.104
Yo-yo	-4.51	0.000*

Note.  $H_a \mu_{\text{Measure 1}} - \mu_{\text{Measure 2}} \neq 0$ ; mean  $\pm$  standard error of the mean, N: number of participants. According to t-test data, statistically significant differences were found in fat percentage (7.46), squat jump (-4.65), overhead squat evaluation (-5.72), and yoyo (-451) (<.001).

## DISCUSSION

According to the results obtained as a result of the study, fat percentage pre-test 7.43±0.73, post-test 6.99±0.65, squat jump pre-test 40.25±4.9, post-test 41.45±4.8, overhead squat evaluation pre-test 17.33±3.5, post-test 19.50±2.1 and yoyo pre-test 1723.3±307.6, post-test 1852.08±335.8 were found. According to t-test data, statistically significant differences were found in fat percentage, squat jump, overhead squat evaluation and yoyo data (<.001). The pre-season preparation period is a critical period to improve the physical capacity of athletes and to eliminate deficiencies. Various performance and movement assessment tests used in this period provide data to optimise both individual and team performance. Squat jump, overhead squat and Yo-Yo tests are three basic tests that are frequently used in football training and focus on measuring different physiological parameters. Although each test has different purposes and advantages, when used together they allow for a more comprehensive analysis of the athletes' fitness level.

When the literature is analysed, it is known that athletes have different levels of pre-season readiness. For this reason, it is aimed to bring the physiological levels of the athletes to the same ratio in the 1st preparation period of the training plans. It is known that athletes have high body fat ratios in the tests performed before the season and these ratios start to change with the preparation period. This change in body fat ratios can be

attributed to high fat oxidation due to aerobic exercises and oxidative capacity. In our study, results supporting this conclusion were obtained (7.46)( $<.001$ ).

Endurance tests are commonly used to assess the aerobic and anaerobic endurance of footballers. In this test, athletes run certain distances at gradually increasing speeds and take short rest periods after each set. The test is valuable for measuring the repetitive sprinting ability required by football matches. Footballers who obtain high scores in the Yo-Yo test can play at a high tempo throughout the match and show signs of fatigue later. Kartal and Günay (1994) found 53.05 ml/kg/min in the pre-test and 55.62 ml/kg/min in the post-test and found a statistically significant difference. İşleyen stated in his study that there was a significant difference in pre-season preparation studies. Helgerud et al. reported a significant increase in  $Vo_{2max}$  levels. There are studies supporting these in the literature. The studies conducted by Raven et al, Filaire et al, Zizis (2013), Chin et al emphasise the development of endurance. It is in parallel with and supports the results obtained in our study.

The overhead squat analyses disturbances in movement patterns, joint mobility and postural stability. Since this test requires coordination of the shoulder, hip, knee and ankle joints, it assesses the flexibility and balance skills of footballers. It is important for footballers to have optimal movement capacity in order to minimise the risk of injury. For example, deficiencies in hip and ankle mobility can lead to difficulties during sprinting or knee injuries. Squat jump test provides important information about the explosive power of athletes. Uğraş et al. reported a significant increase in leg strength, jumping and flexibility outcomes according to physical performance data as a result of a 10-week preparation programme. Whitley et al. reported an increase as a result of a 10-week pre-season training plan. According to the findings obtained in our study, it can be clearly stated that there is a significant increase in squat jump and strength data and it is in parallel with the literature.

## **CONCLUSIONS**

Squat jump, overhead squat and Yo-Yo tests are important tools to comprehensively assess the physical performance of footballers during pre-season preparation. Each test provides information about the strength, mobility and endurance

levels of football players by focusing on different physiological parameters. Individualised training programmes based on the test results help athletes to improve their deficiencies and reduce the risk of injury. This approach allows for the creation of a team structure that performs well at the beginning of the season and maintains its form throughout.

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