

Original Research

Gym Versus Home-Based Training During Transition Period in Adolescent Soccer Players: Effects on Physical Performance

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Submitted: 4 January 2022 Revised: 25 January 2022 Accepted: 23 February 2022 Published: 9 June 2022

Abstract

Background: After the in-season period where trainings and games are consistent, players have the rest period, during which the volume and stress are reduced, which allows physical and mental recovery. Instead of having too much free time in transition period, the players should work on their fitness, in order to reduce the side effects of inactivity in transition period. The modern soccer demands the highest quality professional and scientific approach, especially with adolescents. Hence, the aim of this study was to determine gym versus home-based training during transition period in adolescent soccer players. **Methods:** The sample of participants was 34 adolescent male soccer players (16–18 years old). They were randomly allocated to experimental (GYM; N = 16) and control group (HOME; N = 18). The transition period itself lasted 3 weeks and it was separated by a weekly micro cycle, where players have done different activities each week. The procedures have included anthropometry (body height, mass and Body Mass Index), flexibility (sit and reach), vertical jump tests (countermovement jump, countermovement jump with arm swing and squat jump), running speed (sprint at 5 m, 10 m and 20 m) and agility (Illinois Agility Test). Kolmogorov-Smirnov test was used for distribution normality, while a repeated measurement (2 × Analysis of variance) was used to calculate the interactions, major effects for time (pretest *vs.* posttest) and group (GYM *vs.* HOME), with additional Cohen's effect size. **Results:** The study results showed that physical performance variables, in both groups, were partially maintained, while in while running speed and agility showed small deterioration. **Conclusions:** It is crucial to carefully design the trainings and to work on the shortcomings of soccer players in transition period, because that is the only period when they can make up due to lack of time.

Keywords: off-season; young players; speed; agility; explosive power; BMI

1. Introduction

The modern soccer and the growing demands impose the need for the highest quality professional and scientific approach, both in terms of the selection of future young soccer players and concern about the application of training technology in working with adolescent age categories [1]. In order to achieve top soccer results, it is necessary to fully, mutually permeate the highest levels of technical, tactical, physical and psychological preparedness [2]. The mutual relationship between these components aims at comprehensive preparation, both for individuals and the whole team [3]. The identification and development of adolescent soccer players with potential to reach the professional elite status has become tremendously important in the last years [4].

It has been determined that there are variations associated with maturity between young soccer players who were born in the same year, but in different months [5]. The reasons for that can be found in the different biological age of the players, as well as in the previous experience and the level of skills of the young soccer players, which significantly contribute [6].

Each soccer season is generally based on the three periods: pre-season, in-season and off-season [7]. After the in-season period where trainings and games are consistent, players have the rest period, which usually lasts from four to six weeks [8], i.e., the off-season during which the volume is reduced. According to Requena *et al.* [9], this period in many ways depends on internal factors, such as en-



vironmental conditions and external factors, such as international competitions. It is also characterized as a period of reduced stress, which allows physical and mental recovery [10]. Therefore, it should be understood as a chance for the players to recover, as well as a renewal for the next season [11].

The demands placed on the players during the season are very high and cause a lot of stress, which is why the coaches need to find optimal training strategies to be applied in the transition period [12]. Instead of having too much free time, the players should work on their fitness base, which allows them to gain more muscle strength, endurance and agility [13]. In this regard, athletes should follow training programs in transition period in order to reduce the side effects of inactivity [14]. It is very important that athletes maintain their current muscular strength built during the previous season, so that the body does not start from ground zero again during the upcoming pre-season [15]. In order to stay in shape during the off-season, the athletes should perform elements of form such as endurance, strength and power [16]. According to Mujika *et al.* [17], maintaining the optimal physical performance adolescent soccer players can reduce sudden jumps in training load, which occur during the pre-season. Given that the periodization is influenced by the physical performance and physiological status of a player at the beginning of the season, which was acquired during the transition period, it is of great importance to choose the adequate methods [11].

There are several studies about different training effects in soccer during transition period [18–20]. Some of them showed reducing in physical performances during the transition period in soccer [18], while there are studies which did not find the effects of training in this season period [19–21]. Requena *et al.* [9] researched the effects of 7 weeks of training in transition period in professional soccer players and reported maintained functional performance during high-intensity activities. Vassilis *et al.* [21] reported that the 4 weeks of detraining period in elite youth soccer players (15 years old) does not have any significant effects to their anthropometric characteristics and isokinetic strength of their lower limbs. Additionally, only one study reported positive effects of 5 weeks training on strength performance (~2–30%), while endurance and repeated sprint ability declined (~7.5–15%) [22].

The majority of the mentioned studies were performed by adult athletes, while there is a small number of youth participants, specifically adolescent. Based on the knowledge of the authors, there is a lack of studies focusing on the short effects of training in the physical performance of adolescent soccer players. The conditions of the trainings during the transition period are different due to the lack of any kind of supervision. There is an assumption that during this period, a lot of disturbing factors may affect the efficiency of the training program. Hence, our aim was to determine the effects on physical performance of gym (GYM)

versus home-based (HOME) training during transition period in adolescent soccer players.

2. Materials and Methods

2.1 Participants

The sample of participants for this study counted 34 adolescent male soccer players (16–18 years old). All of them are competing at the highest level of soccer competition in Serbia, as a part of a professional soccer club “Spartak” from Subotica. The participants are randomly allocated to experimental (GYM; N = 16) and control group (HOME; N = 18). Table 1 shows in close characteristics.

2.2 Procedures

All the procedures were conducted in the transition period, where all participants had similar training program. The sessions were realized between 9–11 AM and the initial and final measurements were measured by the same assessor. Before testing physical performance, players were measured for height and body mass. This procedure was performed in well-ventilated and bright room with optimal temperature. The first testing session have included a flexibility test (sit and reach), vertical jump tests (CMJ, CMJA, SJ), assessment of running speed (sprint at 5 m, 10 m and 20 m) and agility (Illinois Agility Test) on the field. Measurements were performed on a soccer field in convenient weather conditions (without rain, fog or wind) in one day. Since all players were familiar with the testing procedures, a standardized warm-up for 20 min was conducted before testing (low-intensity running, acceleration runs, skipping and hopping exercises).

2.2.1 Anthropometry

Body height, body mass and body mass index (BMI) were measured by a standard protocol and by the same researcher. A fixed stadiometer (+0.1 cm, Holtain Ltd., Crosswell, UK) was used to measure body height, a digital balance (+0.1 kg, ADE Electronics Column Scales, Hamburg, Germany) for body mass, and InBody 230 (Biospace Co. Inc., Seoul, South Korea) Bioelectrical Impedance Analyzer (BIA) for BMI.

2.2.2 Flexibility

For assessing the lumbar and hamstring flexibility, sit and reach (SaR) test was used. The procedure was described elsewhere [23] and the average result was taken from two trials, with 30 sec pause in-between [24].

2.2.3 Vertical Jump

Using a portable optical system (Optojump Next; Microgate, Bolzano, Italy), vertical jump performance was assessed. Participants performed a countermovement jump (CMJ), countermovement jump with arm swing (CMJA) and squat jump (SJ), presented elsewhere [25]. Before testing, players performed 2–3 repetitions of all jumps as a

Table 1. Participants and group in close characteristics (mean \pm standard deviation).

| Group | Age (years) | Height (cm) | Body mass (kg) | Training routine (n of sessions per week) | Training experience (years) |
|-------|----------------|-----------------|----------------|-------------------------------------------|-----------------------------|
| GYM | 16.6 \pm 1.5 | 179.1 \pm 5.6 | 68.5 \pm 7.2 | 5/6 | 7.1 \pm 1.4 |
| HOME | 16.9 \pm 1.0 | 178.4 \pm 5.9 | 70.3 \pm 7.0 | 5/6 | 6.9 \pm 1.7 |

practice and in real measuring, each player performed 3 maximal CMJ, CMJA and SJ, in that particular order. The best result was used for data processing. Validity and reliability of the portable vertical jump device was also reported elsewhere [26].

2.2.4 The Running Speed

Using infrared timing gates, 20 m sprint effort was determined with photocell gates (Microgate, Polifemo Radio Light, Bolzano, Italy). From a standing start, participants were instructed to run as quickly as possible over the 20 m distance. Since the participants were positioned 0.5 m behind the timing lights, when they crossed the first gate, the timer was automatically activated. Our study evaluated best crossed time in 5 m and 20 m, where participants performed two trials, with a 3 min rest in-between, while the best result was used for data processing.

2.2.5 Illinois Agility Test

Illinois Agility Test (IAT) was conducted to assess the agility performance. Start, two running points and finish were marked with four cones, with a distance of 3.3 m from one another. The starting position of participants was lying face down. On command "Go!", the main task of a participant was to run as fast as possible between cones without knocking any of them. The participants repeat the test three times and the best result was used for the analysis [27].

2.3 Training Protocol

The transition period itself lasted for 3 weeks and it was separated by a weekly micro cycle. Every one of micro cycle is explained and presented in Tables 2,3,4.

2.4 Statistical Analysis

SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) was used for the analysis of the data obtained. Kolmogorov-Smirnov test was used for distribution normality. A two way repeated measure ANOVA was used to calculate the interactions and major effects for time (pretest vs. posttest) and group (GYM vs. HOME). The effect size was tested using Cohen's d within each group and classified as follows: 0.2 trivial; 0.2–0.6 small; 0.6–1.2 moderate; 1.2–2.0 large; 2.0 very large and 4.0 extremely large [28], and partial eta (η) squared between the groups (0.01 = small effect, 0.06 = medium effect and 0.14 = large effect) [29].

3. Results

Table 1 shows the descriptive data of the physical tests performed by adolescent soccer players, while Table 5 shows the pre-test and post-test differences for all physical performance tests, percentage of change from pre-post test and effect size for within-subjects factor (ES%).

Results have showed significant time effect for BMI ($p = 0.02$), with no interaction effects. Moreover, 5, 10, 20 m running speed and IAT ($p < 0.001$) showed decrease in both groups. In term of SaR, CMJ, CMJA and SJ, there were no significant effects of time or interaction ($p > 0.05$).

4. Discussion

The aim of this study was to investigate the effects of GYM vs. HOME based training on physical performance in adolescent soccer players during transition period. To the authors knowledge, this study is the first one that reports the effects of training program in two groups during the transition period in adolescent soccer players. The main finding was that the 3 weeks of training in transition period did not prevented the decline in some performance. However, the results for vertical jump tests showed promising results after three weeks of transition period training program. Such finding can help coaches compile a training plan and program for this part of the season for adolescent soccer players.

Our study results partially support Koundourakis *et al.* [18], who reported significant declines in aerobic, strength and sprint performance, but in the other hand they also support results of authors who report the maintenance of physical performance itself, during transition period [19–21].

In our study, we noticed that after a three-week training period the body mass maintained and increased the BMI. Nevertheless, increments in body mass were not significant and similar results were noticed in other studies [16,22]. We have also not found an interaction or time factor between groups GYM and HOME in body mass soccer players. Regarding to this, we have not found any significant effects on body mass in both groups (+0.8–0.9%), which supports the study results Requena *et al.* [9], who reported the maintenance after the 7 weeks aerobic and strength training in top level professional soccer players. Additionally, this result is not in accordance with Sotiropoulos *et al.* [30], who reported decreased physical performance ($t_{56} = 24.91$, $p < 0.005$) after 4 weeks training in professional soccer players of the Greek Premier Division. All of the mentioned studies included adult soccer players, while our study includes adolescent soccer players. Duri-

Table 2. First micro cycle.

| M | T | W | T | F | S | S |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Strength and stretching (20 min) | | 9 AM outdoor training | Strength and stretching (20 min) | 9 AM outdoor training | Strength and stretching (20 min) | Day off |
| (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | | (5 min dynamic warming up, 10 min jogging (30–40%), 5 min stretching exercises, 10 min jogging (30–40%), 5 min stretching exercises, 10 min jogging (30–40%) and a 5 min stretching exercises) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | (5 min dynamic warming up, 10 min jogging (30–40%), 5 min stretching exercises, 10 min jogging (30–40%), 5 min stretching exercises, 10 min jogging (30–40%) and a 5 min stretching exercises) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | |

Table 3. Second micro cycle.

| M | T | W | T | F | S | S |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 9 AM outdoor training (5 min dynamic warming up, 12 min jogging (30–40%), 5 min stretching exercises, 12 min jogging (30–40%), 5 min stretching exercises, 12 min jogging (30–40%) and a 5 min stretching exercises) | Day off | 9 AM outdoor training | Strength and stretching in the evening hours (20 min) | 9 AM outdoor training (5 min warming up or running with ball or in pair, 5 min static stretching, 10 min jogging, 3 min static stretching + 3 min juggling, 10 min running + repeated sprint 6 × 100 run in 20–25 sec (rest between run-ups up to 60 sec.), jogging or juggling or 5 min technics in pair, 10 min running + repeated sprint 6 × 100 run in 20–25 sec (rest between run-ups up to 60 sec.), jogging or juggling or 5 min technics in pair and 5 min stretching.) | Strength and stretching in the evening hours (20 min) | Day off |
| Strength and stretching in the evening hours (20 min) (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | | (5 min dynamic warming up, 12 min jogging (30–40%), 5 min stretching exercises, 12 min jogging (30–40%), 5 min stretching exercises, 12 min jogging (30–40%) and a 5 min stretching exercises) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | Strength and stretching in the evening hours (20 min) (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | |

Table 4. Third micro cycle.

| M | T | W | T | F | S | S |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 9 AM outdoor training no. 1 | Strength and stretching in the evening hours (20 min) | 9 AM outdoor training no. 2 | Strength and stretching in the evening hours (20 min) | 9 AM outdoor training no. 3 | Strength and stretching in the evening hours (20 min) | Day off |
| (5 min warming up, 5 min static stretching, 15 min jogging or juggling or technics in pair, 3 min static stretching + 3 min technics, 15 min medium tempo run (100 m in 30 sec.), 3 min static stretching + 3 min technics, 15 min medium tempo run and 5 min stretching) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | (5 min warming up, 5 min static stretching, 15 min jogging, 3 min static stretching + 3 min juggling, 5 min mobility (just like the start of warming up for the game in polygon with 4 cons), 3 min static stretching + 3 min juggling, 5 min coordination in 10 m (all types of skips), 15 min accelerations (2 series, 3 reps. 10 m; 2 series, 3 reps. 20 m; 2 series, 3 reps. 30 m; 2–3 min break between series; stretching exercises and juggling as a break), 6 min juggling and 5 min stretching) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | (5 min warming up, 5 min static stretching, 10 min jogging, 3 min static stretching + 3 min juggling, 10 min repeated sprint 6 × 100 m in 20–25 sec (60 sec break in-between, technics in pair or juggling), 6 min jogging, repeated sprint 6x100 m in 20–25 sec (60 sec break in-between), 6 min jogging and 5 min stretching) | (3 sets, 2 min rest, 30 sec pull-ups, 10 × push-ups, 20 × back hyperextension, 20 × sit-ups, 20 × squats and 5 × high jumps with knees to chest, with 30 sec rest between exercises) | |

Table 5. Mean values \pm SD and differences for GYM vs. HOME group before (pre) and after (post) 3 weeks of experimental period.

| | GYM (N = 16) | | | | HOME (N = 18) | | | |
|----------------|----------------|-----------------|-------|--------|-----------------|-----------------|-------|--------|
| | PRE | POST | %DIFF | ES (%) | PRE | POST | %DIFF | ES (%) |
| Body mass (kg) | 68.5 \pm 7.2 | 69.0 \pm 7.0 | +0.8 | 0.13 | 70.3 \pm 6.9 | 70.9 \pm 6.9 | +0.9 | 0.15 |
| BMI | 21.1 \pm 1.4 | 21.7 \pm 1.5 | +2.7 | 0.38 | 21.3 \pm 1.7 | 21.3 \pm 1.5 | +0.4 | 0.23 |
| SaR (cm) | 38.8 \pm 3.2 | 37.8 \pm 3.2 | -2.5 | 0.29 | 36.4 \pm 5.7 | 36.5 \pm 4.5 | +0.2 | 0.34 |
| 5 m (s) | 1.0 \pm 0.05 | 1.25 \pm 0.09 | +20.8 | 3.02* | 1.0 \pm 0.05 | 1.2 \pm 0.10 | +19.6 | 2.52* |
| 10 m (s) | 1.8 \pm 0.07 | 2.0 \pm 0.08 | +14.1 | 3.33* | 1.8 \pm 0.07 | 2.0 \pm 0.12 | +12.9 | 2.34* |
| 20 m (s) | 3.1 \pm 0.11 | 3.4 \pm 0.11 | +11.1 | 3.09* | 3.0 \pm 0.12 | 3.3 \pm 0.15 | +9.9 | 2.21* |
| IAT (s) | 14.8 \pm 0.3 | 15.8 \pm 0.6 | +6.3 | 1.91* | 14.8 \pm 0.37 | 15.8 \pm 0.63 | +7 | 2.01* |
| CMJ (cm) | 35.9 \pm 2.9 | 35.6 \pm 3.3 | +1.2 | 0.13 | 34.9 \pm 3.8 | 35.5 \pm 3.6 | +1.9 | 0.15 |
| CMJA (cm) | 40.2 \pm 4.0 | 40.5 \pm 4.2 | +0.7 | 0.07 | 40.9 \pm 4.9 | 41.4 \pm 5.6 | +1.3 | 0.13 |
| SJ (cm) | 33.6 \pm 3.2 | 34.6 \pm 6.8 | +3.1 | 0.21 | 31.1 \pm 3.9 | 32.3 \pm 4.3 | +3.8 | 0.29 |

BMI, body mass index; SaR, sit and reach; 5 m, 10 m, 20 m, running speed at 5 m, 10 m and 20 m; IAT, Illinois Agility Test; CMJ, countermovement jump; CMJA, countermovement jump with arm swing; SJ, squat jump; PRE, pre-test; POST, post-test; %DIFF, percentage of change from pre- to post-test; ES, effect size for within-subjects factor; *, significant effect of time at $p < 0.05$.

ng the season, adolescent soccer players have 5–6 training sessions per week and a competitive match, which is more than in our program during the transition period. During the competitive part of the season, the total caloric consumption is much higher and due to the caloric surplus, in order to satisfy the increased energy demand of the athletes, it is normal for some parameters of body composition to change during the period of decline in sports form [31].

The optimal execution of technique is important for joint flexibility [32]. According to Hawkins *et al.* [33], flexibility and sport performance are highly correlated and the risk of injuries is increased by suboptimal flexibility. In our study, adolescent soccer players only maintained flexibility performance in SaR test and this might be the result of training in the transition period. As we have already mentioned, more informed coaches are trying to make more effective and interesting training as well. What is more, higher level players are more ambitious and pay more attention to their physical fitness [34]. To the authors knowledge, there is no study in which the mentioned test, regarding to the mentioned fact, this result can be used practically in transition period.

We have found significant decrements in 5 m (ES = 75), 10 m (ES = 75.7) and 20 m (ES = 75.4) running speed, with factor time, but no interaction effect between groups. Our study is in agreement with Koundourakis *et al.* [18], who reported significant increases in time (10 m and 20 m sprint), which means worsening results and speed performance reduction. In addition, Requena *et al.* [9] reported maintenance of running speed tests (15 m and 30 m), as well as maximal aerobic speed. One of possible reasons for this result might lie in the fact that participants from mentioned studies was professional soccer players, who has long season behind [35]. It can be considered that deterioration in

sprint associated with deterioration in explosive leg strength at the CMJ and CMJA tests [36]. Also, one of the possible reasons may be the non-existence of specific high-intensity sprinting activities during the transition period. However, the differences between our and previously recorded results may be related due to the growth of the tested participants, as well as due to the rank of the soccer players' competition. Our training program was not aimed at developing and maintaining speed, but the primary goal was endurance, so that later in the preparation period, coaches could more easily raise their sports form.

Since our study showed that the both groups significantly decreased their agility performances and none of the relevant studies did not conducted agility test in transition period, further studies are needed.

In the current study, explosive power of the lower limbs was the only performance that has improved slightly, but without interaction or time effect. Therefore, we found increase for SJ in GYM (+3.1%) and HOME (3.8%) group. Additionally, the improvements in CMJ and CMJA were much lower (0.1–1.9%). According to the study results, Requena *et al.* [9] showed maintenance after the 7 weeks aerobic and strength training between the 3 testing sessions. It is also reported that the training in transition period might result in a vertical jump reduction [21]. Therefore, contrary to our findings, Koundourakis *et al.* [18] found a significant declines in CMJ and SJ after the 6 week detraining period in professional soccer players. These discrepancies in results can be ascribed to different age categories and training programs, likewise different strength training status during the transition period [37]. According to the previous research [38], which has reported that fast muscle fibers are closely connected to maximal strength, also show that that may be related to jumping ability and explo-

sive actions. All of these studies were performed by adult soccer players, except Vassilis *et al.* [21] whose participants were young soccer players (~15 years old). The effects of training on explosive strength in our study were consistent with the training plan and program for maintaining this parameter during the transition period. A type of an aerobic training that was applied during the 3 weeks was low intensity aerobic training, which aimed to maintain the current level of adolescent soccer players and lay the foundation for the beginning of the preparation period after the break. Additionally, maturation might be the possible reason for the heterogenic results between the studies [39]. Probably the duration of the training program may be the reason for the absence of training adaptations and possible progress. Therefore, short programs like in the current study were not enough to improve the strength performance in adolescent soccer players [40]. However, the results for vertical jump test gave promising results for future studies.

The main limitation of the current study may lie in a wide age range. Accordingly, adolescent soccer players may have different physical performance because of maturation, which can greatly affect the results because when assessing physical performance, growth and maturation are considered the main confusing factors [41]. Another limitation can be a short duration of the training program, which can be the reason for the obtained results. The transition period lasted 3 weeks with no organized training, during which young players had individual, home-based trainings. In addition, the main aim of the program was not to achieve better performance, but to compare training programs in two different conditions. Additionally, training groups did not have any supervising from coaches nor researchers except for brief report from the players.

5. Conclusions

The study results showed that a three-week training program could prevent a total decline of sports form expressed through the parameters of physical performance in adolescent soccer players during the transition period. Hence, it is crucial to carefully design the trainings and to work on the shortcomings of soccer players in transition period, because that is the only period when they can make up due to lack of time.

Author Contributions

MS, DĐ and SA—conceptualization; NT and GS—methodology; IK—software; NT—validation; ZT and TVi—formal analysis; NT and TVi—investigation; MS, DĐ and SA—resources; IK and TVi—data curation; MF—writing - original draft preparation; IK and TVi—writing - review and editing; MF—visualization; NT and ZT—supervision; GS—project administration. All authors have read and agreed to the published version of the manuscript.

Ethics Approval and Consent to Participate

We have received the approval for the experimental protocol realization, from the institutional ethics committee from the University of Novi Sad (ref no: 13/1042). A written consent from was obtained from the players and their parents.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

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