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Acute physiological responses and performance following subsequent CrossFit ‘CINDY’ workout with Zea Mays juice

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Faculty of Medicine and Defence Health, National Defence University of Malaysia

Faculty of Sport Sciences and Coaching, Universiti Pendidikan Sultan Idris, Malaysia

Abstract

Purpose: The purpose of this study was to investigate the physiological responses and performance following subsequent repeated high intensity exercise with consumption of Zea mays juice (ZM).

Material: Total of seventeen participants involved in the study. They were physically active who had cardio and strength training at least 3 times per week. The age of participants was 21.8±1.7 years old, body weight 65.4±11.2 kg and height 169.7±7.2 cm. Crossfit ‘CINDY’ exercise were repeated between two hours of rest. Treatment beverage of (ZM) juice vs Carbohydrate-electrolyte (CE) drinks were consumed immediately after exercise in double blind cross over manner. Number of complete set of exercise, heart rate, blood lactate and rate of perceived exhaustion (RPE) were recorded at the end of each exercise session.

Results: Total number of complete ‘CINDY’ exercise significantly increased in ZM juice group during second bout of exercise compared to CE drink group. There were no significant difference in heart rate, blood lactate and RPE in both groups.

Conclusions: ZM juice has potentials an alternative recovery beverage to promote subsequent repeated exercise within short rest time.

Keywords: Zea mays, recovery beverage, performance, physiology responses.

Introduction

High intensity exercise with repeated bout session within short period of time need proper recovery plan to support performance [1]. Athletes that involved in repeated event within short rest time such as swimming, sprinter, combat sports, badminton, squash and team sports like hand ball and futsal, need to recover as fast as possible in order to promote performance during each stage of competition [2]. During the competition, the athletes usually have less than 2 hours before performing the next event. Therefore they need to consume enough energy and fluid in order to prepare their body for the next game [3, 4]. Recovery food or fluid that contains carbohydrate, protein and mineral such as sodium were proven to fasten recovery [3, 5]. Liquid form of recovery meal was preferred [6] for better acceptance and absorption due to short time in between games and appetite suppression issue after high intensity exercise. For that reason palatable beverage is warranted [7, 8] in promoting total intake of recovery beverage.

CrossFit is a fitness training that incorporates resistance (e.g. deadlift, power clean, snatch etc.) and endurance (e.g. rowing, running, cycling) activity within single bout [9, 10]. It is designed to complete the exercise task within short period of time in high intensity environment. There are exercise tasks involved in CrossFit workout which is called workout of the day (WOD). They ‘named’ the exercise so that it is easy to monitor the progress. One of the WOD was named ‘CINDY’ which consists of pull up, push up and squat. Physiology and metabolic response of ‘CINDY’ had been classified as moderate to vigorous intensity exercise [11, 12] according to American College of Sports Medicine guideline [13]. The classification was similar to the games environment where athletes need to give their performance best at each stages to go further round. Therefore practice on recovery plan is warranted to support performance toward the final round.

An electrolyte carbohydrate drink is well known for its benefit to rehydrate and recovery [14–16]. Presence of protein had been proven in supporting muscle synthesis[17, 18], thus fasten muscle recovery [19]. ZM juice is a beverage that made up of sweet corn that contains carbohydrate, protein and sodium. The nutrient contents showed that the beverage could be proposed as an alternative recovery beverage. Therefore this study was to investigate the ability of ZM juice as a recovery beverage in promoting subsequent high intensity exercise within short rest time.

Materials and Methods

Participants

The protocol of this study was reviewed and approved by University Pendidikan Sultan Idris Research Committee. Total of seventeen active male university athletes participated in this study. They are actively represented University as hockey and football players. The participants were physically active who had cardio and strength training at least 3 times per week. This is to ensure the participants familiar with high intensity and strength exercise. The trial was conducted upon their free time with no competition the day before the test. The participants were told to refrain from heavy exercise and protein supplement (if any) 24 hour prior to the testing day.

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Procedures

The participants were briefed about the test together with demonstration of exercise protocol done by the research assistant. When the participants agreed to be a volunteer, they sign in the consent form and self-reported medical health status form. The participants were given different types of beverage during each session. The beverage was prepared by the research assistant without researcher knowledge. The participants were asked to record their 24 hours diet intake (a day before trial) during the first session of trial and were reminded to consume the same type and amount of food during the second trial.

The participants were given standard breakfast 2 hours before the trial. This is to mimic the recommendation of before exercise snack. They were allowed to consume plain water in between before the trial. Upon arrival in the gym, they produced urine sample for urine specific gravity (USG) assessment. Participants who had USG reading more than 1.020, 300 ml plain water were given and waited for the next urination. The participants started the exercise when USG result showed well hydrated condition (USG >1.020) (20).

Self-warm up and stretching were done for 10 minutes before starting the Crossfit ‘CINDY’ exercise. The participants need to do 3 types of exercise regime (5 times modified pull up, 10 times push up, 15 times squad) for 20 minutes as much repetition as possible. Verbal instruction and support were given to the participants during ‘CINDY’ exercise. All of them wore heart rate monitor (CHR Casio, Japan) during the exercise. Immediately after finished the 20 minutes of exercise, the participants reported rate of perceive exhaustion (RPE) by pointing the number at the chart and heart rate reading was recorded. The finger prick blood was taken for lactate assessment using lactate Pro 2 test strips (Arkray, Japan) and portable lactate analyzer (Lacate Pro 2, LT1730 COSMED, Italy).

Table 2 shows the participants characteristic. The age of participants was 21.8±1.7 years old with their body weight 65.4±11.2 kg, height 169.7±7.2 cm, and BMI 22.3±2.4 kg/m². Inbody assessment showed that their body fat percentage was 15.1±7.4%. Their VO$_{2max}$ was 39.3±5.5 ml/kg/min.

![Figure 1: Schematic diagram of the trial](image-url)
Consumption of both beverages did not affect any changes for those three variables. We assumed that all participants gave their full effort during both session of ‘CINDY’ exercise by similar heart rate values. The result of blood lactate accumulation showed that exercise intensity was high and both beverages did not able to reduce it within two hours of rest. RPE score showed that subject felt the same level of difficulty during both sessions of exercise within both treatment beverage (mean score ZM juice, EX1=6.6±1.9, EX2=6.8±2.3; CE drink, EX1=6.5±1.9, EX2=6.2±1.9)

**Table 2. Participants characteristic (N=17)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21.8±1.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>65.4±11.2</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>169.7±7.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.3±2.4</td>
</tr>
<tr>
<td>Percentage of fat</td>
<td>15.1±7.4</td>
</tr>
</tbody>
</table>

**Figure 1.** Mean total number complete set of ‘CINDY’ exercise.

**Figure 2.** Mean value of heart rate (beat/minute).

**Figure 3.** Mean value of blood lactate (mmol/L).
Inferential analysis showed a significant different in total of number complete set of ‘CINDY’ exercise between ZM juice and CE drink treatment, \( F(1.16)=10.84, p= .005, \eta^2=.404 \) and interaction between type of drinks and exercise performed, \( F(1, 16)=4.70, p=.046, \eta^2=.227, \) but no significant difference between two exercise bout, \( F(1, 16)=0.08, p=.929, \eta^2=.001 \). Consequently, type of drink had a significant effect on the performance of the participants between subsequent repeated exercise bouts by increasing the total number of complete set of ‘CINDY’ exercise during the second bout of exercise.

**Discussion**

The aim of our study was to determine the effect of ZM juice on subsequent high intensity exercise-Crossfit ‘CINDY’ performance compared to CE drink. The study was designed to mimic sports competition that has several repeated heat within short rest time. Recovery beverages that are capable to rehydrate and promote muscle recovery are warrant in order to promote subsequent performance [21]. The ZM juice was proposed as recovery beverage because it contains carbohydrate, protein and sodium that are essentials for recovery [14, 22]. The combination of carbohydrate and protein beverage was established in promoting performance [2, 23, 24]. Most of the study proposed whey [18, 25, 26] and milk based [27–30] as recovery/rehydration choices. Unfortunately, this type of beverages are not applicable for those individuals who are vegan and lactose intolerance. Therefore, ZM juice would be a better choice to meet the recovery requirement as it is a plant based beverage.

The significant effect of ZM juice on recovery was due to its nutrient content. ZM juice contains carbohydrate and protein that promote recovery by enhancing glycogen repletion and muscle synthesis [31, 32]. Types of sugar of ZM juice were mixture of saccharides (glucose and fructose) that utilize different oxidation pathways. A mixture of saccharides promotes greater absorption rates [6, 33] compared to individual saccharide that presence in CE drink (sucrose). The ratio of carbohydrate to protein content in ZM juice was 1:4 (CHO-9.8g/100ml; Prot=2.4g/100ml). The ratio was similar as in the study of vy and colleague [34] whereby they found out subsequent time to exhaustion after cycling exercise was longer compared to carbohydrate alone. This is due to a better rate of glycogen synthesis when protein was exist [31]. On the contrary, reviewed by McLellan et al [24] stated that protein ingestion provides no further ergogenic effect when sufficient carbohydrate was delivered during exercise. Unfortunately high carbohydrate amount need to consume in meeting the recovery recommendation which usually unpalatable after exhaustive exercise. [3]. A combination of carbohydrate and protein beverage was also promoting fluid retention [35] and better accepted [36].

![Figure 4. Mean score Rate of Perceive Exertion (RPE).](image)

<table>
<thead>
<tr>
<th>Variables</th>
<th>CINDY</th>
<th>Heart rate</th>
<th>Blood lactate</th>
<th>RPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZM juice vs CE drink</td>
<td>( F(1, 16)=10.84, p=.005, \eta^2=.404^* )</td>
<td>( F(1, 16)=2.77, p=.115, \eta^2=.148 )</td>
<td>( F(1, 16)=2.46, p=.136, \eta^2=.133 )</td>
<td>( F(1, 16)=4.16, p=.058, \eta^2=.206 )</td>
</tr>
<tr>
<td>Between two repeated exercise bout</td>
<td>( F(1, 16)=.008, p=.929, \eta^2=.001 )</td>
<td>( F(1, 16)=0.029, p=.867, \eta^2=.002 )</td>
<td>( F(1, 16)=0.154, p=.70, \eta^2=.010 )</td>
<td>( F(1, 16)=0.061, p=.808, \eta^2=.004 )</td>
</tr>
<tr>
<td>Interaction between beverage and exercise</td>
<td>( F(1, 16)=4.70, p=.046, \eta^2=.227^* )</td>
<td>( F(1, 16)=1.027, p=.326, \eta^2=.060 )</td>
<td>( F(1, 16)=0.48, p=.50, \eta^2=.029 )</td>
<td>( F(1, 16)=0.206, p=.656, \eta^2=.013 )</td>
</tr>
</tbody>
</table>

Data is significant when \( p<.05 \)
Most of the study claim that protein from animal which is whey promote greater muscle synthesis [18, 37, 38] compared to plant sources [39]. Generally, whey is preferred due to types of essential amino acid present compared to plant base food and supplement. It was established that essential amino acid-leucine was the main amino acid that plays a role in promoting positive net protein balance and muscle synthesis in strength and endurance exercise [17, 40, 41]. ZM juice contains leucine [42] that positively supports the proposed usage of ZM juice as recovery beverage. After all, ZM juice will also benefit to vegan individual that limited to animal sources but yet desire to meet the recovery objective.

There were no significant different in heart rate, blood lactate and RPE were found in this study. Hall et al [43] found that heart rate and RPE were significantly lower during second bout of cycling exercise in carbohydrate+ protein group compared to carbohydrate only. The dissimilarity of this result was due to different exercise intensity used within this study. Even though ‘CINDY’ was done in 20 minutes, type of activities was different compared to endurance cycling. ‘CINDY’ mainly used whole body strength and endurance compared to cycling that focused on lower body muscle. The result of this study was similar with the findings by Goh et al. [2] when they used similar calorie content in different carbohydrate: protein ratio treatment beverage where heart rate and RPE during second bout of exercise were not significant different. Besides, we speculate that the insignificant different in heart rate, blood lactate and RPE in both trials indicated that the participants had given the same effort when given different beverages. This situation met the real competition environment.

**Conclusion**

ZM juice is able to promote second bout of exercise within short rest time period. The ability of ZM juice to boost recovery from first bout exercise session is warranted for better physiology adaptation and performance enhancement. Natural food source of ZM juice gave a better choice for all age group of active individuals as when food supplement is limited to young athletes. At the same time lactose intolerance and vegan individuals will get the benefit from ZM juice in meeting recovery requirement.

**Highlights**

The practice of recovery meal/beverage should be applied during regular training for better adaptation and acceptance. Athletes should have an idea on type of food or beverage that is suitable and able to promote their sports performance. Natural food based is preferred as it is safe and nutritious with nutrients for our body.

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**Conflict of interest**

The authors declare no conflict of interest.

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The Turkish adaptation of leisure facilitator scale: a validity and reliability study

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim of this study to test the reliability and validity of “Leisure Facilitator Scale” (LFS) for Turkish university students.

Material: The sample included 111 female and 132 male, and totally 243 faculty of sport sciences’ students for this study. The LFS which consists of 3 subscales and 27 items was used to collect data. Besides descriptive statistics, confirmatory factor analysis was applied to test the factor structure of LFS. Pearson's product-moment coefficients were used to examine correlations between the factors. For determining the reliability of the scale Cronbach Alpha coefficient was calculated.

Results: Analysis indicated that the Turkish version of the LFS constituted of 3 subscales and 16 items. Totally 11 items were excluded from the Turkish version because of lower factor loadings. Factor loading values of the items ranged between 0.49 and 0.76. Cronbach Alpha values were calculated as 0.79, 0.66, 0.78 and 0.86 for the subscales and total scale respectively.

Conclusions: In conclusion, results indicated that “Leisure Facilitator Scale” Turkish adapted form can be used as a valid and reliable measurement tool to examine the factors that facilitate leisurely participation of students.

Keywords: leisure, facilitators, adaptation, university students.

Introduction

Many researchers studying leisure argue that each individual should physically and mentally experience leisure free from the stress of everyday life and each individual has the right to freely choose a leisure activity [1, 2, 3]. Kraus [4], likewise, defines leisure as the time period in which individuals satisfy their feelings of emotion, pleasure and entertainment by freely choosing their activities, and thereof fulfill their self-realization by unveiling their potential. Several others also conducted studies suggesting that participation into leisure activities provides the individual multiple benefits such as physical and mental well-being, happiness, socialization and relaxation [5, 6]. Not every individual, however, share the same benefits from the leisure activities equally. Crawford and Godbey [7] define this situation with the categorical constraints by labelling them “personal, interpersonal and structural” constraints in leisure participation.

The factors that constraint or limit participation into leisure activities have significant role in understanding an individual’s activity behavior and in establishing a causality link between the individual and the activity. In this respect, it is first essential to comprehend the leisure constraints approach in order to understand the causes of participation/non-participation in leisure activities and the relations between these causes and aforementioned factors [8, 9]. According to this approach, the non-participation factors involve the personal factors such as the needs, past experiences, beliefs and attitudes; interpersonal factors such as the family, social environment and friends; and structural factors such as the finances, facilities, socio-economic status, ethnic composition and gender roles [7, 10, 11]. For other researchers [12, 13], however, the leisure constraints approach can sometimes be a limited approach in understanding leisure behavior. People usually participate into these activities not because they are stripped off all the constraints and become free but the leisure time space is a free zone. On this issue, Kim et al. [14] suggested that the factors that facilitate participation into leisure activities should be investigated as well as the constraints in order to explain the nature of participation into leisure activities and to ensure a wider participation. Likewise, the strategy model developed by Hubbard and Mannel [15] posited that having some constraints for activity participation does not necessarily mean that the individual will not participate in leisure activities. Individuals can develop some strategies for coping with the constraints and participation can be realized. Actually, the underlying phenomena behind the strategic choices are the facilitating factors for leisure activity participation [16]. It is observed by some researchers that determining the facilitating factors of leisure participation has significant role in explaining the participation/non-participation behavior since the strategy models that aim to explain the participation behavior of the individuals in leisure activities in terms of leisure constraints and the ways to cope with these constraints are interrelated with the facilitating factors in essence [14, 17]. In regard to this point, investigating the facilitating factors for leisure...
participation carry important weight.

The survey of the literature on the leisure facilitators reveal the fact that most of the studies date fifteen years back [13, 18, 19] while the number of studies on the same topic in Turkey is very limited [20, 21, 22]. In the Turkish case, it is probably due to the lack of an adapted scale to measure the facilitating factors for leisure activity participation. Therefore, the purpose of this study is to adapt the Leisure Facilitator Scale developed by Kim et al., [14] into Turkish and examine the psychometric properties of the scale. The results of this study can help opening a new dimension for future studies that target increasing the participation of individuals into the leisure activities.

Leisure Facilitators

Opposite of the concept of “leisure constraints”, the leisure facilitators can be defined as those factors that facilitate participation in and increase the number of repetition of leisure activities while strengthening the urge for participation and providing the chance to benefit from the advantages of the activities [23]. Korotkov et al. [24], likewise, defined leisure facilitators as the facilities that help access the activities for participation and leisure satisfaction. That is to say, if an individual participates into an activity he/she definitely possesses some facilitating factors and if he/she cannot participate into an activity he/she must be facing some personal, interpersonal or structural constraints [13, 25]. If we are to formulate the leisure facilitators and constraints, the formula can be stated as 3C1P. “P” denotes participation or non-participation and “3C” denotes the personal, interpersonal and structural causes. All three causes determine the participation or non-participation behavior [26].

The personal facilitators relating to the personal characteristics, interests, beliefs and attitudes were defined by Raymore [13] deriving from the model developed by Crawford et al. [23]. The personal facilitators are the determining factors in the selection of the activities and they include the personal expectations and choices of the individual. The interpersonal facilitators are those factors helping an individual’s participation in an activity as a person or in a group by the effect of the factors such as family support, social environment or peer group, in interaction with one’s environment. These facilitators rely on the fact that individuals are interdependent and in interaction in their social environment [27]. Lastly, the structural facilitators are considered as the factors that encourage the individual in activity participation such as the social and physical conditions and the social belief systems. The ethnic background, gender, facilities, socio-economic status and health status can be counted under this category. The climate condition, media, transportation and easy access to the facilities can also be grouped as structural factors. In order to understand the structural factors as a whole, the structure and viewpoint of a society need to be understood [13]. The factors such as the demographic characteristics, the education system and institutions that encourage the individuals into activity participation also constitute a significant role [28]. The survey of the research conducted in different demographic settings and different cultures demonstrates that the facilitators can be influenced by the demographic factors and their effects on the individuals can vary [18, 19, 20, 21].

Material and methods

Participants.

The research sample consisted of 243 university students (111 female students and 132 male students) who were enrolled in three different faculty of sport sciences. The ages of the participants ranged between 17 and 27, and the age average of the sample was 20.57 ± 2.16.

Research Design.

The survey method, which is widely used in descriptive research models, was applied in this study. This method is generally executed on large groups and it targets to reveal the opinions and attitudes of individuals in a group on a case or a phenomenon [29, 30]. The data collection technique in the study was applying questionnaires, a technique which is also often utilized in studies using the survey method [31].

The data collection tool was the Leisure Facilitator Scale (LFS) developed by Kim et al., [14]. For the usage rights of the scale, the permission of the author was obtained via electronic mail. The original form of the LFS was constituted in three sub-dimensions (personal facilitators, interpersonal facilitators and structural facilitators) and involved 27 items in total. The scale items were scored as (1) ‘Unimportant’, (2) ‘Rather Unimportant’, (3) ‘Rather Important’, (4) ’Important’ and (5) ‘Very Important’. In adapting the LFS into Turkish the intercultural scale adaptation steps were followed [32]. In this respect, first we checked out whether the target concepts were existent in the present culture or not. Then, we tried to decide whether our evaluations on the results would prove meaningful or not. Upon positive opinion, the next step was to generate the Turkish form of the scale items. While generating the form, translation and back translation methods were used. The generated form was sent to the academic experts in scale development discipline and it was applied on a pilot sample of 35 students to check the clarity and comprehensibility of the scale statements.

The LFS was made fit for the reliability and validity analysis after the abovementioned steps. The application of the data collection tool over the participants required the permission of the students’ professors and department and faculty chairs. After the permissions were obtained the questionnaires were filled before the class hours.

Statistical Analysis.

The statistical analyses were executed through SPSS 20 ve AMOS 19 package programs. In order to provide proofs for the factor structure confirmatory factor analysis was made [33]. The correlations between the factors were examined using Pearson Correlation Analysis to provide proof for the validity of the scale. For examining the reliability of the total scale and the sub-dimensions of the tested model internal coherence coefficients were
calculated. For determining whether there was significant difference between the scores obtained from the scale according to some variables MANOVA was used for the groups independent from the parametric tests. Finally, skewness and kurtosis values and Levene test scores were examined in order to determine whether the data met the preconditions of the parametric tests [34].

**Results**

In this study, a confirmatory factor analysis was performed in order to validate the three-factor structure that was consisted of 27 items. When the items with low factor loaded value and high error variance (items 6, 7, 8, 10, 11, 15, 16, 17, 18, 19, 26) were omitted from the scale and the CFA was reapplied, improvements were spotted in the fit indices (Table 1). The item factor load values varied between 0.49 and 0.76.

Table 1 presents the Cronbach Alpha internal coherence coefficients for the sub-dimensions and the total scale, and the correlation between the factors. The correlations measured between the scale scores varied between 0.40 and 0.84. The Cronbach Alpha coefficients for the total scale and the sub-dimensions were calculated as 0.86, 0.66 and 0.79, respectively.

Table 1. Confirmatory Factor Analysis Scores

<table>
<thead>
<tr>
<th>χ²</th>
<th>df</th>
<th>χ²/df</th>
<th>GFI</th>
<th>CFI</th>
<th>IFI</th>
<th>TLI</th>
<th>RMR</th>
<th>SRMR</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.02</td>
<td>100</td>
<td>1.92</td>
<td>0.91</td>
<td>0.92</td>
<td>0.90</td>
<td>0.08</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

The mean of the total scores and the standard deviation value for the participants subject to the LFS were 3.72 and 0.61, respectively. When the LFS scores were analyzed on factorial basis, it was observed that the highest average (3.94) was scored on the ‘personal facilitators’ sub-dimension and the lowest (3.42) on the ‘interpersonal facilitators’. The skewness and kurtosis coefficients, on the other hand, demonstrated that the data met the normalcy assumption for the preconditions of the parametric tests (Table 3).

The MANOVA scores demonstrated that the basic effect of the gender variable on the LFS sub-dimensions was significant [λ=0.964, F(2, 998)=3.239, p<0.03]. In our study, ANOVA was also applied in order to detect which dependent variables contributed significantly to the multi-variable structure. It was concluded that ‘personal facilitators’ scores [F(1, 241)=4.416, p<0.05] and ‘interpersonal facilitators’ sub-dimension scores [F(1, 241)=4.459, p<0.05] significantly varied in terms of gender main effect. In all sub-dimensions where significant variation was noted the average scores of the male participants were higher than those of the female participants (Table 4).

<table>
<thead>
<tr>
<th>LFS (Subscales)</th>
<th>PF</th>
<th>IPF</th>
<th>SF</th>
<th>Total</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Facilitators (PF)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>Interpersonal Facilitators (IPF)</td>
<td>0.40&quot;</td>
<td>1</td>
<td></td>
<td></td>
<td>0.66</td>
</tr>
<tr>
<td>Structural Facilitators (SF)</td>
<td>0.55&quot;</td>
<td>0.54&quot;</td>
<td>1</td>
<td></td>
<td>0.78</td>
</tr>
<tr>
<td>Total</td>
<td>0.78&quot;</td>
<td>0.82&quot;</td>
<td>0.84&quot;</td>
<td>1</td>
<td>0.86</td>
</tr>
</tbody>
</table>

**Table 2. The Sub-dimensional Correlation and Internal Coherence Scores of the LFS**

<table>
<thead>
<tr>
<th>Sub-dimensions</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Min. – Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Facilitators (PF)</td>
<td>3.94</td>
<td>0.69</td>
<td>-0.77</td>
<td>0.85</td>
<td>1.40-5.00</td>
</tr>
<tr>
<td>Interpersonal Facilitators (IPF)</td>
<td>3.42</td>
<td>0.85</td>
<td>-0.33</td>
<td>-0.52</td>
<td>1.00-5.00</td>
</tr>
<tr>
<td>Structural Facilitators (SF)</td>
<td>3.80</td>
<td>0.71</td>
<td>-0.53</td>
<td>0.41</td>
<td>1.00-5.00</td>
</tr>
<tr>
<td>Total</td>
<td>3.72</td>
<td>0.61</td>
<td>-0.38</td>
<td>-0.25</td>
<td>1.98-5.00</td>
</tr>
</tbody>
</table>

**Table 3. The Distribution of the Scale Scores**
Discussion

According to the results of the CFA for providing evidence for the factorial structure of the LFS, the three-factor and 27-item structure could not be verified. On the other hand, 16-item and three-factor structure proved statistically and theoretically suitable. Based on the fact that χ²/sd ratio was under 3, it was observed that there was perfect fit between the data and the model [35]. The GFI value as 0.91 denoted perfect fit whereas the values of CFI as 0.92, IFI as 0.92, TLI as 0.90, RMR as 0.08, SRMR as 0.06 and RMSEA as 0.06 implied acceptable fit [36]. The result of the analyses made to determine the reliability level of the scale demonstrated that the reliability coefficients obtained from the sub-dimensions of the scale were generally adequate for the reliability of the test scores [37]. The value obtained for the “interpersonal facilitators” sub-dimension of the scale was 0.66 and this value within the acceptable limits was accordable with the value of 0.61 obtained in the original version of the LFS [14]. Another finding derived for the factor structure of the LFS was positive and medium/high level correlation between the sub-dimensions of the scale.

The second objective of the study was the analysis of the LFS scores of the participants according to the gender variable. In this respect, whereas there was no significant difference at the `structural facilitators` sub-dimension the scores of the other sub-dimensions differed significantly according to the gender variable. The average scores of the male participants were higher than the scores of the female participants. This result were similar to the studies in the literature. This situation might have arisen from the fact that the male participants of the study group might have benefited more actively from the personal and interpersonal facilitators in the leisure activities they preferred.

Conclusion

In conclusion, this study suggests that the Turkish adaptation of the Leisure Facilitator Scale can be a valid and reliable measurement tool in determining the leisure facilitating factors of the individuals for the age group (ages 17-27) concerned. The adapted scale can also be a guiding tool for future studies on this issue. On the other hand, since the study sample was composed of only students from faculty of sport sciences it can be considered as a limitation of the study. With its three sub-dimensions and 16 items, for the adapted LFS to be accepted valid and reliable for the entire Turkish culture, further complementary studies with samples from different age groups would be needed.

Conflict of interest

The authors declare no conflict of interest.

Table 4. The MANOVA Scores According to the Gender Variable

<table>
<thead>
<tr>
<th>Female (n=111)</th>
<th>Male (n=132)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFS (Subscales)</td>
<td>Mean</td>
</tr>
<tr>
<td>Personal Facilitators (PF)</td>
<td>3.84</td>
</tr>
<tr>
<td>Interpersonal Facilitators (IPF)</td>
<td>3.30</td>
</tr>
<tr>
<td>Structural Facilitators (SF)</td>
<td>3.78</td>
</tr>
</tbody>
</table>

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Adaptation of foreign female students to physical activity based on the dexterity development

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to analyze the influence of physical qualities of foreign female students on their adaptation to physical activity. It is supposed to apply an individually-differentiated training program for this purpose.

Material: the comparative analysis of foreign female students from Turkmenistan, Tajikistan and Kazakhstan (n = 60) – an experimental group and females from Russian regions (n = 119) – a control group. It was applied the standards of the All-Russian sports complex “Ready for Labour and Defence” by levels (bronze, silver and gold badges) to determine the physical development level. It was applied the system of intragroup rating, which includes monitoring of students’ activity at each practical class of physical education. Mathematical and statistical data processing was performed applying Chi-square (χ²) at p<0.001, p<0.01 and p<0.05.

Results: the speed and flexibility qualities are not sufficiently developed in students from Near Abroad. Comparative monitoring statistically proved the positive impact of the experiment on the implementation of the author’s individually-differentiated program. The study significantly revealed that foreign female students statistically improved performance indicators of individual physical development. Female students adapted to the implementation of the educational process of physical education in the multicultural environment of the university.

Conclusions: the application of the coordination qualities development program allowed to statistically prove its more significant effect in comparison with the program of speed qualities improving. The students’ dexterity development program could be applied in the process of adaptation to the physical activity at the university.

Keywords: dexterity, foreign students, physical qualities, adaptation, physical education, individualization, rating.

Introduction

The distinctive feature of modern Russian higher education institutions is the growing number of foreign students. The foreign students’ study is an important part of university activities [1]. The foreign students’ study is a specific indicator of the university, institute, or faculty status [2]. The quality of Russian higher education and the conditions of study correspond to the needs of foreign prospective students [3]. Problems of foreign students’ adaptation to the study process are an important element in the vocational training system [4].

In this context, it is especially important for the foreign student to realize the significance of the sociocultural factors’ impact. These factors are able to provide each student with the opportunity to maximize the realization of his interests and abilities, ensuring a healthy lifestyle [5]. The physical education and sports is one of the factors of resolving the multicultural modern development of students. Physical education and sports appear in government documents as a mandatory academic discipline [6]. It is designed to harmonize the physical and spiritual potential of the student; ensure the formation of full physical and mental health; to achieve the required level of functionality, general physical fitness, high working capacity [7]. The important task is to increase the availability and effectiveness of study in multicultural groups. This is especially important for pedagogical universities. Improving the process of foreign students’ adaptation is promoted by various approaches in physical education classes [8]. Its solution requires an individually-differentiated approach; integration of modern pedagogical, psychological and physical education and sports knowledge; implementation of the multiculturalism principles, integration and synergy [9, 10]. Physical exercises should consider the individual cognitive interests and emotional comfort of students [11]. Classes should allow students to realize intercultural interaction [12].

Researchers identified contradictions in professional pedagogical education [1, 5]. Contradictions were observed between approaches devoted to improving the adaptation of foreign female students and the lack of the methodological basis development of physical activity. [13] The purpose of the study is to analyze the influence of physical qualities of foreign female students on their adaptation to physical activity. For this purpose, it is supposed to apply for an individually-differentiated training program.
Materials and methods

Participants

The study involved: foreign female students from Turkmenistan, Tajikistan and Kazakhstan (n = 60) [experimental group (EG)]; females from Russian regions (n = 119) [control group (CG)]. The students of the EG were divided into two equal groups according to the individual level of physical qualities development: EG1 (n = 30) and EG2 (n = 30). The survey was conducted among female students and teachers of physical education (n = 123). The purpose of the survey is to identify the physical activity features of foreign female students.

Design of the study

The experiment was performed on the Physical Education and Life Safety Department of the Glazov State Pedagogical Institute (Glazov, Udmurt Republic, Russia). The All-Russian sports complex “Ready for Labour and Defence” (GTO) by bronze, silver, and gold badges were applied to determine the level of physical development: speed – 100 m; endurance – 2000 m run; strength – pull-up / chin-up test (low crossbar), quantity of times; dexterity – forward bend (standing position), cm; flexibility – shuttle run (3 x 10 m).

The results of academic groups’ ratings in physical education of foreign female students from the EG were analyzed at the first stage of the study (2016-2017 academic year). The study at the Pedagogical Institute is performed in various specialties and directions. Therefore, regulatory requirements were individual for each faculty and group. The system of intragroup rating included monitoring of students’ activities at each practical class: performing special exercises; technical and tactical elements of various sports; professional applied physical education; performance standards for each physical quality [6]. All semesters summed up the final result in each academic group: 30% of students with very high scores among their academic group received the “high” status; 30% of students with high scores received the “medium” status; other students received the “low” status.

The author’s program of the physical qualities development was implemented in the EG during one academic year (2017-18 academic year). The program was applied in the final part of the practical class. In this part of the class, the EG performed special tasks on the physical qualities development (5-7 minutes) in one of two classes per week. Group EG1 carried out special tasks for the development of speed (special running exercises, exercises for the reaction and frequency of single motor action, acceleration uphill, acceleration downhill, exercises with weights) [14, 15]. Group EG2 performed a set of exercises for the development of dexterity: 1) exercises with unusual starting positions; mirror exercise; exercises with changing speed and rate of motor actions; 2) space changing for the exercise; complication of exercises with additional motor actions. The training process in each class included three main stages.

The first stage was aimed at improving spatial accuracy and coordination of motor actions in any speed mode. Coordination exercises were performed on the interaction of individual parts of the body: with a skipping rope, with balls (tossing and catching a tennis ball, dribbling two balls simultaneously, throwing at a target); walking and jumping (over the bench with wall ball, dribbling, performing jumps with a 90° turn, from side-to-side jumps, jumps over obstacles).

The improvement of spatial accuracy and coordination of motor actions in short periods of time was implemented at the second stage:

- special outdoor games (the first student jumps, and the second student rotates a rope under his feet (different speed of rope rotating); the repeat of the previous exercise (the rope is rotated over the first student’s head);
- run with different tasks (jump the ball in motion); gymnastic movements (forward roll) without a ball, (forward roll) with a ball; to toss a ball – forward roll – to catch a ball), shuttle run.

The third stage finished with the complication of motor actions in the second stage. The third stage was associated with improving the ability to perform the motor actions accurately and fast in unexpectedly changing conditions: gymnastic exercises in pairs, acrobatic exercises, run with obstacles, certain elements of sports games for the development of coordination [16, 17].

Students of the CG were engaged in the “Approximate program in physical education” or played in the final part of the class in sports games.

Statistical analysis: mathematically-statistical data processing was performed applying χ-square ($\chi^2$) at $p<0.001$, $p<0.01$ and $p<0.05$. The statistical insignificance of the differences between EG1 and EG2 was established at $p>0.05$ before the beginning of the experiment.

Results

It was revealed that foreign female students (focus group, n = 60) received the “low” status. It was established the significance of the difference between the EG and the CG in $\chi^2$ at $p<0.001$. This confirms the differences between the level of physical and sports activity of the represented target groups. It was revealed the reason for the lack of female students’ adaptation from the Near Abroad to the implementation of physical education and sports activities. The insufficient physical fitness of female students is expressed in the weak level of certain physical qualities development. Table 1 represents the percentage results of the physical qualities development level of females from the Near Abroad (EG) and females from the Russian regions (CG). These females studied in the same groups as the focus group students.

The results of the physical qualities testing of the EG and the CG demonstrated that speed and dexterity qualities are not sufficiently developed in students from the Near Abroad.

The students’ activity rating in each practical class of physical education was analyzed during and after the experiment. Comparative monitoring results at the end of the 2nd semester of the 2017-2018 academic year are presented in Table 2:
The obtained results confirm the effectiveness of the author’s individually-differentiated program implementation for the physical qualities development in the final part of the physical education practical class. It is determined more significant positive impact of the experiment on the dexterity development. It was significantly revealed that foreign female students of the experimental group improved the quality of special exercises and technical-tactical elements performing in sports games; tests indicators of individual physical development. These female students mastered certain aspects of professional-applied physical education and adapted to the implementation of physical activities.

Discussion
The results of our study are correlated with the results of other studies on the effect of active physical education on the effectiveness of the students’ professional training implementation in high school [18]. Researchers experimentally proved the improvement of physical fitness and health condition of foreign female students at the university, conducted applying the innovatively advanced motor action mode. Foreign females with an active motor position are significantly ahead of their peers in functional characteristics [1]. Only the implementation of a systematic educational and extracurricular physical education and recreational activities can enhance the effect of positive social and psychological adaptation of foreign students in higher education [4]. Therefore, our study does not contradict these trends. Our study offers the individually-differentiated approach to the physical education classes’ design. The basis of such classes is the availability of study in multicultural groups in the pedagogical university.

Our results correlate with the opinion of a number of Russian and foreign experts concerning the individualization and differentiation of education. The basis of such study is various social and national-regional characteristics [19]. The most important issues are the individualization of physical training and sports training [20]; motivation level to keep healthy lifestyle [8]; the physical and mental performance level and physiological parameters [21]. Such studies support results that have been significantly proven in our study. Special tasks for the development of dexterity during 5-7 min have a positive effect on the further implementation of physical education activities of female students in the class.

Recently, many authors have found that physical exercises affect cognitive thinking operations, the students’ performance, the students’ adaptation to the educational process at the university [22]. Systemic development of individual physical qualities has a significant positive impact on student performance [23]. Certain aspects of our individually-differentiated program update the physical education and sports orientation of the vocational training of females [24]. It is defined that physical education classes create a positive psychological environment for physical education implementation at a
higher level. The authors emphasize the interrelation of physical activity with the implementation of training tasks during the academic day [18]. It is noted that physical exercises increase the level of psychological health, the success of training [25]. Our results are positively correlated with other scientific studies of this problem. The proposed exercises’ design in our study motivates and engages all students into cognitive physical education and sports activities. Our program considers the individual educational interests and emotional comfort of students. It is considered the interrelation level of students’ skills, allowing to realize intercultural educational interaction.

Our research helps to solve the problem of the readiness of physical education teacher to pedagogical interaction with foreign students. There are empirical studies on the implementation of modular advanced training programs. Such programs are aimed at the development of the subjective position of the trainer-teacher. The application of programs increases the level of pedagogical interaction of a teacher with foreign students [11, 26, 27]. Studies demonstrate that coordination training affects significantly the technical and tactical development [14, 24] and the athletes’ performance in many sports [28]. Our study supplemented the information on the relationship of motor abilities with the skills and abilities formation processes to perform physical exercises. The study demonstrated that the most informative are indicators of coordination abilities development. The level of coordination abilities development to a greater extent determines the ability of students to master the technique of motor actions and forms a high level of students’ professional readiness for physical activity.

Conclusions
The application of the individually-differentiated program for the coordination qualities development demonstrated its more significant effect in comparison with the training process for improving speed qualities. This creates prerequisites for further study of the phenomenon of individually-differentiated physical education and sports activities realization with foreign students in methodological, content and organizational aspects. Practical experience in the development of students’ dexterity could be applied in the professional activities of a physical education teacher at Russian or foreign university. This allows to improve the quality of the pedagogical interaction of the teacher with foreign students in the process of their adaptation to physical activity at the university.

Conflict of interest
The authors declare no conflict of interest.

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Analysis of the physical development and somatotype of girls and females involved into dancing and gymnastic sports

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The comparative analysis of the physical development and somatotype of girls and females involved in dancing and gymnastic sports (acrobatic rock and roll, sports aerobics).

Material: The study involved 45 girls and females. Group 1 – acrobatic rock and roll (n = 25, age – 13.00 ± 0.41 years); Group 2 – sports aerobics (n = 20, age – 19.70 ± 0.59 years). It was determined the length and body weight. It was evaluated the level and harmony of physical development. The bioimpedance method was applied to determine the composition of muscle and fat tissue, the level of visceral fat. It was evaluated the body mass index, water composition in the body. The results are evaluated by applying parametric and non-parametric statistical indicators.

Results: The average level of physical development dominates in athletes. Its specific gravity is: group 1 - (64.00 ± 9.60)%; group 2 - (50 ± 11.18)%. Rather high prevalence of the level below the average: group 1 - (20.00 ± 8.00)%; group 2 - (25.00 ± 9.68)%. The proportion of athletes with harmonious development was: group 1 - (64.00 ± 9.60)%; group 2 - (50.00 ± 11.18)%. The disharmony of physical development due to overweight: group 1 - (20.00 ± 8.00)%; group 2 - (30.00 ± 10.25)%. The disharmony of physical development due to underweight: group 1 - (16.00 ± 7.33)%; group 2 - (20.00 ± 8.94%). The average values of fat tissue reflect its normal composition in both groups. In group 1, was determined the normal for the age fat composition in (52.00 ± 9.99)%; low level of fat had (48.00 ± 9.99)%. In group 2, the normal fat composition was found in (75.00 ± 9.68)%%. The increased fat composition was (15.00 ± 7.98)% of female athletes. The reduced fat composition was (10.00 ± 7.61)% of female athletes. The level of visceral fat in athletes of group 2 was within the age norm. Female athletes of group 1 were characterized by virtually no visceral fat. The specific gravity of muscle tissue in all athletes was above the average for this age group. Group water composition in both groups was average.

Conclusions: Most athletes have an average harmonious physical development. Deviations of physical development are most often associated with underweight. It is determined the increase in the composition of muscle mass above the average age standards for all female athletes. The composition of fat tissue in 52% of female athletes of the younger group corresponded to the average value. The rest of the athletes had a fat composition below normal. In the older group: 75% of athletes had an average fat composition; 15% of athletes had a reduced fat composition; 10% of athletes had a high fat composition. It was determined the significant differences between groups. The female athletes of group 1 had smaller values of body length, body weight, the specific gravity of fat tissue and visceral fat, body water composition, and body mass index. Females of group 1 had a big specific gravity of muscle tissue. The application of the bioimpedance method has significantly expanded the data obtained in the analysis of anthropometric indicators and indices. This method can be recommended for monitoring the functional condition of athletes dancing and gymnastic sports.

Keywords: physical development, somatotype, bioimpedance method, acrobatic rock and roll, aerobics.

Introduction

Physical fitness of athletes is one of the main indicators of sporting success. It is determined by the morphofunctional condition - a complex criterion for the interrelation of the structure and function of the organism. The reflection of the structure is the features of physical development. The functional condition is assessed by the level of physical and mental performance. Thus, the study of these components provides information for the analysis and prediction of the athletes’ condition.

The necessity to monitor the functional condition of athletes determines the relevance of the selection of informative and valid tests for control. Thus, Volodchenko et al [1] proved the application of biochemical studies of saliva in the kickboxing athletes’ condition monitoring. Korobeinikov et al [2] determined the high informational significance of the studies of the psycho-emotional condition of athletes. The results of Podrigalo et al [3] confirmed the high information composition of the physical development indices in predicting the success of

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the martial arts athletes.

The integral criterion of physical development is recognized as the condition of the somatotype. It is estimated by the specific gravity of the main components of the body (the composition of muscle and fat tissue). Currently, the various methods are used to assess the somatotype. The bioimpedance method is one of the most informative and valid ways to assess somatotype.

Dopasj et al [4] studied the body composition of elite martial arts athletes. It is emphasized that this is one of the main factors of sporting success. The application of discriminant analysis allowed us to create a body structure model reflecting the specifics of martial arts.

The literature review devoted to the analysis of the bioelectrical impedance vector (BIVA) was conducted by Castizo-Ollier et al [5]. It was analyzed sources included in the database PubMed, SPORTDiscus and Scopus. BIVA is a new technique which has potential in sports and physical exercise. Kalnina et al [6] confirmed the suitability of the bioimpedance method for population studies. Every fifth child in the sport has a reduced level of body fat. It is proposed to apply this indicator for the prevention of health disorders.

Santos et al [7] conducted a comparative analysis of the elite athletes’ body applying bioimpedance and other methods. The bioimpedance method has great informative significance and reliability.

The promising direction of the application of this method is the study of the correlations between the lifestyle characteristics and the athletes’ condition. Carvalho et al [8] evaluated the correlations between sports, sleep quality and adolescent eating habits. It was also evaluated the impact of sports activities on weight and body structure. It is proposed to apply the bioimpedance method in complex studies devoted to the study of lifestyle.

The results of Nykanen et al [9] indicate the promise of applying the bioimpedance method in a comprehensive analysis of the nutrition characteristics and motor activity of military personnel. Ramos-Jimenez et al [10] applied the bioimpedance method to analyze the body composition of young people. It was confirmed the proximity of the obtained results by the bioimpedance and densitometry methods. Studies by Koury et al [11] confirmed the effectiveness of the bioimpedance method in assessing the body composition of young athletes. It was confirmed the correlations between biological maturity and body composition.

Ramon Alvero-Cruz et al [12] applied the bioimpedance method for a comparative analysis of changes in the body composition of athletes and non-athletes. Intensive training for 6 weeks led to an increase in fat-free mass in football players.

The comparative analysis of the body composition of men and women football players was performed by Mascherini et al [13]. The application of the bioimpedance method has confirmed that increasing the level of sportsmanship reduces gender differences in body composition.

The results of Meleleo et al [14] confirm the effectiveness of the bioimpedance method in monitoring the athletes’ condition. The control during the year confirmed the greater objectivity and reliability of these indicators in comparison with the indices of physical development. Mala et al [15] used the bioimpedance method to evaluate the effectiveness of intensive weight reduction of judo athletes in preparing for competitions.

Dance and gymnastic sports are characterized by intense aerobic loads, combined with high power loads. Chernozub et al [16] confirmed the presence of the expressed effect of loads in these sports on the morphometric characteristics of the athletes’ body. This necessitates the analysis of the specific gravity of muscle and fat tissue. These morphological indicators illustrate the condition of power, power endurance, and other important physical qualities.

The purpose of this work was a comparative analysis of the physical development and somatotype of girls and females involved in dance and gymnastic sports (acrobatic rock and roll, sports aerobics).

Materials and methods

Participants.

The study involved 45 girls and females, divided into two groups depending on the sport. Group 1 - 25 women of acrobatic rock and roll, age (13.00 ± 0.41) years. Group 2 - 20 girls who were engaged in sports aerobics, age (19.70 ± 0.59) years. Differences in age are significant (p <0.01). The level of sportsmanship in group 1: 76% are Candidate Master of Sports, 24% - 1 athletic title. The level of sportsmanship in group 2: 5% - International Master of Sport, 55% - Candidate Master of Sports, 40% - athletes 1-2 athletic titles. All athletes gave informed consent to participate in the research and the use of personal data.

Design of the study.

The design of the study presupposed the definition of anthropometric indices, components of the somatotype, the calculation of morphometric indices and indices applying special formulas.

The determination of mass and length of the body was carried out in accordance with international standards [17]. The evaluation of the level and harmony of physical development was carried out applying official standards for school-age children [18] and young people [19].

The bioimpedance method was applied to assess the characteristics of the somatotype. It was applied the body composition monitor OMRON BF-511 (Japan). It was determined the specific gravity of muscle and fat tissue, the percentage of visceral fat, the basal metabolic rate value.

The calculation of body mass index is carried out by the formula:

$$\text{BMI} = \frac{\text{BM}}{\text{BL}^2} \quad (1),$$

where BMI - body mass index, $\text{kg/m}^2$, BM - body mass $(\text{kg})$, BL - body length (m).

In people older than 18 years, 19-24 values are considered as the norm, and in schoolchildren – according to standardized normative values [20].

The water composition in the body was calculated by...
the formula:
\[
WCB = 10.313 + 0.252 \times BM + 0.154 \times BL \tag{2},
\]
where WCB – the water composition in the body, l, BM – the body weight, kg, BL – the body length (m).

The analysis of the results of the water composition was performed according to standardized standard values [21].

**Statistical analysis**

Statistical analysis of the obtained data was carried out applying licensed MS Excel. It was determined the descriptive statistics of the following indicators: arithmetic average, standard deviation, and error of the mean. The relative indicators determined the prevalence of the trait and its error. The significance of differences in the groups was evaluated applying the parametric Student’s t-test (t) and the non-parametric Wilcoxon-Mann-Whitney test (U).

**Results.**

The results of anthropometric indicators and components of the somatotype are presented in table 1.

Group analysis of the main anthropometric parameters demonstrated that the body length of the athletes refers to the average level, the body weight of the athletes corresponds to the length of the body. The individual analysis revealed that the average level of physical development prevails in athletes. Its specific gravity is (64.00 ± 9.60)% in group 1 and (50.00 ± 11.18)% in group 2. The quite high prevalence is below average, respectively (20.00 ± 8.00)% and (25.00 ± 9.68)%. The level above the average is set for (8.00 ± 5.43)% of female athletes of group 1 and (15.00 ± 7.98)% of female athletes of group 2. The quite high prevalence is below average, respectively (20.00 ± 8.00)% and (25.00 ± 9.68)%. There were no athletes with a high level in group 1. In group 2, the specific gravity of athletes with a high level was (5.00 ± 4.87)%.

Similar results were obtained in the analysis of harmony. The specific gravity of athletes with harmonious development was (64.00 ± 9.60)% 1 group and (50.00 ± 11.18)% 2 groups. The disharmony of physical development due to excess body weight is set in (20.00 ± 8.00)% 1 group and (30.00 ± 10.25)% 2 group. The disharmony of development due to the lack of body weight was found in (16.00 ± 7.33)% 1 group and (20.00 ± 8.94)% 2 groups.

Average body mass index values illustrate the normal level of this indicator. The individual analysis of body mass index demonstrated that most of the female athletes had normal physical development. Their specific weight was (56.00 ± 9.93)% 1 group and (85.00 ± 7.98)% 2 group. In group 1, there was a deviation of body mass index to a deficit (32.00 ± 9.33)% and inanition of the body (12.00 ± 6.50)% In group 2, the normal composition was found in (10.00 ± 6.71)% and overweight in (5.00 ± 4.87)%.

The average values of fat tissue reflect its normal composition in both groups. The individual analysis confirmed the similarity of the results to body mass index. In group 1, the normal for the age fat composition was set at (52.00 ± 9.99)% (48.00 ± 9.99)% had a low-fat level. In group 2, the normal composition was found in (75.00 ± 9.68)% (15.00 ± 7.98)% of female athletes had a high fat composition. (10.00 ± 7.61)% of female athletes had a reduced fat composition.

The visceral fat level in athletes of group 2 was within the age norm. Female athletes of group 1 were characterized by no visceral fat.

The specific gravity of muscle tissue in all athletes was above the average for this age group.

Group water composition in both groups was average. The individual analysis showed that in group 1 (80.00 ± 8.00)% of female athletes had an average water composition, (12.00 ± 6.50)% of female athletes were deficient in water composition, (8.00 ± 5.43)% of female athletes had excessive water composition. In group 2, these weights were, respectively, (70.00 ± 10.25)% (5.00 ± 4.87)% and (25.00 ± 9.68)% The basal metabolic rate did not have significant differences between the groups.

It was determined the significant differences between the groups for most of the studied parameters. This is confirmed by parametric and non-parametric criteria. The

### Table 1. The results of anthropometric indicators and components of the athletes’ somatotype.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1 group (n=25)</th>
<th>2 group (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body length, cm</td>
<td>154.30±2.14¹</td>
<td>165.00±1.36</td>
</tr>
<tr>
<td>Body mass, kg</td>
<td>44.45±2.14¹</td>
<td>57.20±1.72</td>
</tr>
<tr>
<td>Specific gravity of fat tissue,%</td>
<td>17.11±8.42</td>
<td>27.34±8.91</td>
</tr>
<tr>
<td>Specific gravity of muscle tissue,%</td>
<td>35.40±10.69</td>
<td>30.45±9.20</td>
</tr>
<tr>
<td>Basal metabolic rate value, kcal</td>
<td>1284.32±20.64</td>
<td>1223.87±65.87</td>
</tr>
<tr>
<td>Body water composition, l</td>
<td>21.75±0.54¹</td>
<td>24.98±0.43</td>
</tr>
<tr>
<td>The specific gravity of visceral fat,%</td>
<td>0.00</td>
<td>2.95±3.38</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>16.87±0.17¹</td>
<td>21.24±0.41</td>
</tr>
</tbody>
</table>

Note. 1 – the differences between groups are significant (p <0.01).
female athletes of group 1 had smaller body lengths (t = 4.21, p < 0.01; U = 96, p < 0.01), body mass (t = 4.64, p < 0.01; U = 86, p < 0.01), specific gravity of fat tissue (U = 60, p < 0.01) and visceral fat (t = 11.08, p < 0.01; U = 3, p < 0.01), body water composition (t = 5.50, p < 0.01; U = 0, p < 0.01), body mass index (t = 4.81, p < 0.01; U = 8, p < 0.01). The significant increase of the muscle tissue was confirmed according to the specific gravity in athletes of the group 1 (U = 56, p < 0.01).

Discussion

Comparison of the athletes’ condition of related sports is widely applied in sports science. This allows to determine the specific effect of the sport on the athletes’ body, to select the most informative tests and functional tests. Podrigalo et al [22] conducted a comparison of the psychophysiological characteristics of athletes of different types of martial arts. The analysis allowed to identify the most informative tests suitable for monitoring the functional condition of athletes.

The results of Romanenko et al [23] confirmed the suitability of determining the choice reaction time for screening selection in martial arts.

Rovnaya et al [24] considered the specifics of synchronized swimming. The authors tested a system of tests to assess the functional condition of the athletes’ respiratory system. It was confirmed significant differences depending on the level of skill.

In our study, we evaluated the physical development of female athletes of acrobatic rock and roll and sports aerobics. They belong to the group of dance and gymnastic sports but have significant differences in the level of physical activity. There are differences in the degree of development of physical qualities which are important for success (power, endurance, speed). The condition of the somatotype can be assessed as a complex characteristic, reflecting the interrelation of these qualities. This significantly increases the information composition of this assessment.

A similar study was conducted by Durkalec-Michalski et al [25]. The authors studied the correlations between body composition indicators and physical performance.

Analysis of the main anthropometric parameters allows to conclude that the average level of athletes’ physical development is dominant. Contrast deviations are quite rare. This is due to the peculiarities of sports, their command character. The absence of contrast differences in the physical development of athletes improves the aesthetic perception of the team.

Similar results were obtained by Reguli et al [26]. The authors analyzed the body composition of aikido athletes. It was determined the proximity of the basic parameters to the standards typical for non-athletes.

Among female athletes dominated persons with harmonious physical development. In our opinion, this reflects the aesthetic orientation of studied sports. Harmonious physical development implies the optimal proportions of the human body. At the same time, disharmony is established due to underweight and due to overweight. Perhaps this is due to the peculiarities of lifestyle, the maintenance of reduced diets, the level of physical activity during training.

This assumption is supported by the results of determining body mass index. The majority of athletes were characterized by a normal level of this indicator. However, in group 1 there was a significant deviation to deficiency, there were athletes with inanition of the body. Group 2 had the same tendency, although it was less expressed. In our opinion, this may be due to the age of the participants. The females of the group 2 consciously chose a nutrition strategy. In addition, the specifics of acrobatic rock and roll could necessitate a tight control of body weight. Less weight increases the performance of acrobatic elements.

The use of bioimpedance method allowed us to significantly expand the data obtained in the analysis of body mass index. In this, our results coincide with the data of Girsh et al [27]. The authors emphasize the promising application of the bioimpedance method in sports medicine, its advantages over the definition of body mass index.

The composition of muscle and fat tissue should be assessed as the primary prognostic indicator. The results obtained coincide with the analysis of body mass index, confirm earlier assumptions. Athletes have a tendency to reduce the level of fat in the body. This tendency is more pronounced in group 1. The results are closely correlated with results of Kalnina et al [6]. In our opinion, this illustrates the effect of intense physical loads on the body.

Similar data are given by Gutierrez et al [28]. The authors evaluated the effect of regular physical exercises on adolescent body composition. Non-athletes had a higher body fat composition.

At the same time (considering the age of female athletes in group 1), these data can be assessed as a risk factor for impaired sexual maturation. The almost complete absence of visceral fat in athletes of group 1 should also be assessed as a risk factor for health.

The muscle composition above average is the result of intense training. It reflects a fairly high level of sportsmanship athletes.

Similar results were obtained in da Silva Morais et al [29]. The authors studied the component composition of the body to assess the performance of judo athletes. It is concluded that the features of the somatotype are fundamentally important for increasing physical performance.

Similar results are obtained by Delaney et al [30]. The purpose of the authors was to determine the most effective method for quantifying changes in muscle mass in rugby athletes. It was confirmed the high informational content of bioelectrical impedance analysis, determination of muscle mass index and prediction equations based on the skinfold thickness.

Determining the level of water composition in the body of athletes allows to conclude about the normal hydration of the body. In addition, this once again confirms the assumptions made about the proximity of the condition
of the somatotype to the average. Individual deviations caused by deficit or excess of water, perhaps stipulated by the peculiarities of maintaining the drinking regime.

Similar data were obtained by Carrasco-Margenot et al. [31]. They used the bioimpedance method to assess the condition of synchronized swimming athletes. It is confirmed the pronounced effect of physical loads on the condition of homeostatic hydration.

The basal metabolic rate reflects the energy cost of maintaining the homeostasis of the body. The proximity of these values in groups should be evaluated as evidence of the stability of the condition, the absence of serious violations. The absence of differences between groups can be considered as evidence of the normal course of growth and development in more young athletes.

The results of the comparison of the studied parameters indicate a higher level among experienced female athletes. This can be explained by a number of factors. First of all, it is age, the experience of training, the condition of the processes of growth and development, especially lifestyle.

At the same time, the comparison suggests the importance of applying the bioimpedance method. This correlates with the available literary data. The results obtained by Nascimento-Carvalho et al. [32] confirmed the perspective of applying the bioimpedance method for assessing the athletes’ preparedness in martial arts.

The bioimpedance method confirms the assumptions made in the analysis of physical development. For younger athletes, intensive training leads to a reduction in fat tissue. This is particularly evident when assessing the level of visceral fat. Fat tissue is one of the main water depots in the body. This leads to a decrease in its composition in young athletes. This condition of athletes (considering their age) should be assessed as a risk factor for health.

Similar results were obtained by Salazar-Martinez et al. [33]. The authors conducted an analysis of the functional condition of young football players. The design of the study included the determination of the specific gravity of body fat applying an OMRON analyzer. It was determined that young athletes had an average level of fat, characteristic for this age group (6-14%).

**Conclusions**

The analysis confirmed that most athletes have moderate harmonious physical development. This is due to the peculiarities of sports, their command character and reflects the aesthetic orientation of the sports studied. Deviations of physical development are most often associated with underweight. This is confirmed by the analysis of body mass index. The application of the bioimpedance method defined an increase in the muscle mass composition above the average age standards for all athletes. The composition of fat tissue in 52% of female athletes in the younger group corresponded to the average value, in the rest it was below the norm. In the older group, 75% of athletes had an average fat composition, 15% of female athletes had a lower fat composition, and 10% of female athletes had an increased fat composition. It was determined significant differences between groups. The female athletes of group I had fewer values of body length, body weight, specific weight of fat tissue and visceral fat, body water composition, and body mass index. Female group I had a higher specific gravity of muscle tissue. The condition of the somatotype components illustrates the effect of physical loads on the body, reflects the specifics of the studied sports.

The application of the bioimpedance method has significantly expanded the data obtained in the analysis of anthropometric indicators and indices. This method can be recommended for monitoring the functional condition of athletes involved in dancing and gymnastic sports.

**Conflict of interest**

The authors declare no conflict of interest.

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Comparison of three different methods of active and inactive recovery and also sport massage on Aspartate Aminotransferase and aldolase enzyme activations and some hematological blood features in female runners

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: Recognizing the periods of rapid recovery and quick return of the body to the normal condition is of particular importance and has been of much interest to the instructors and athletes. The aim of this paper was the comparison of three different of active and inactivate recovery and also sport massage on Aspartate Aminotransferase and Aldolase enzyme activations and some hematological blood features in female runners.

Material: The present study was applied research & carried out in a semi-experimental manner. This paper's Statistical population includes female semi-professional runners in Tehran & sampling is done randomly. First, they informed people and asked who were interested to participate in this study. The participants past some basic levels and finally 30 participants (age 18-24 years) semi profession female student runner have been chosen as the sample of this study by their consent randomly. The researchers divided them randomly in 3 groups as active recovery runners, inactive sport massage recovery group and inactive seated group that included 10 participants in each. The importance of this study has been tested by one-way analysis.

Results: The results showed that there is not a meaningful relation among 3 recovery methods for changing Aspartate Aminotransferase and Aldolase enzyme, blood Iron and Red blood cell. But there is a meaningful relation among inactive, soft and massage recovery in changing of White blood cell, Hematocrit and Hemoglobin.

Conclusions: The results of this study showed that the recovery of the primary state through activity compared to the passive state of the effects It's better. According to the results of this study, it seems considering the effect of recycling on the recovery process in athletes, all three types of recycling methods can be used after the athletics competition & it is recommended that coaches and athletes use these methods more quickly for early onset.

Keywords: aspartate aminotransferase, aldolase enzyme, recovery, sport massage.

Introduction

Recent advances in the field of physical education and sports science and its spread among various societies have attracted researchers’ attention to the factors influencing physical activity. Researchers have paid so much attentions to the recent progresses in physical education and sport science recovery or returning to the first base is one of the most important features [1]. Review of Researches on sports success shows that many factors play a role in the development of sports athletes [2]. One of the indicators is successful sport performance, which, apart from the special sports exercises in that discipline, is influenced by other variables, and if not taken into account, the effects of exercise can not affect the athlete’s success. One of the most significant variables is the type of recovery or return to the initial state of practice. Meanwhile, using different kinds of recoveries like active recovery, inactive recovery, massage, electric stimulation, using cold water bag, stretching exercise or a combination of all are so important [3, 4].

During complicated hard exercises and competitions, athletes are in exposed of increasing levels of metabolic scum and Traumatic cell features [4]. Small mechanical damages may happen because of different body activities and even in such competitions and exercise that include feet kick to the ground is something inevitable; Therefore, knowing about fast body recovery and returning it to the pre-exercise form and doing normal sport activities is so important [5]. Having a productive exercise session or being in routine competition in professional sport is a base that can prevent from pre-exercising or action reduce [6].

A bad recovery after an exercise session may lead to dysfunction in next exercise session and also long bad recoveries will lead to exhaustion that eventually a bad over exercising situation [7, 8]. Meanwhile, using of different kinds of recoveries such as active, inactive and massage has been super important. Active recovery and massage were being more paid attention among instructors and athletes. The active recovery is popular after a light exercise or even after a serious competition. It is believed that this kind of recovery can improve the performance [9]. Active recovery makes high blood flow that leads to a faster returning in normal.

On the other hand, Massage is being used massively as a relaxing and treating way for athletes to pre- sport,
between and post preparation in competitions and finally returning to the normal form [1, 5]. The most important sport massage benefits are the positive massage influence on sport performance, decreasing recovery time to the normal form after exercise and muscle damages. Energy reserves recovery through high blood flow that lead to a better performance in future competitions. Many sport instructors are considering massage in and during the competitions [10]. There is a positive influence on athletes’ performance with a faster recovery period by using massage in recess time for different activities that is done in routine [1, 5]. But you should be aware that sport massage cannot improve body situation after an abnormal exercise [11].

Active recovery means the body returns to its basic level by doing active performance (stretching and fast running for 35 to 40 minutes) after a session of hard exercise. Inactive recovery means the body returns to its basic level by exercise or competition (slow walking, sitting) after a session of exercise. These kinds of recoveries may effect on different metabolic body parts that will change the body situation to continue the exercises or competitions for future sessions that lead to positive or negative effects in further exercising sessions or competitions [4]. These days, most of the athletes use Sport massage as a kinds of recovery to return to the basic form. In this way, by using the sport massage technics after the exercise or a competition, sport massage will start and continue as necessary [1].

Hemoglobin is a protein in red blood cells that transports oxygen from the lungs to the body tissues and carbon dioxide from tissues to the lungs; an iron-containing respiratory pigment of vertebrate red blood cells that consists of a globin composed of four subunits each of which is linked to a heme molecule, that functions in oxygen transport to the tissues after conversion to oxygogenated form in the gills or lungs, and that assists in carbon dioxide transport back to the gills or lungs after surrender of its oxygen [12]. Basically, iron is one the most important component in RBC structure. 30 percent of the iron known as ferritin and stores in the liver, bone marrow and spinal cord. Small percent of body iron is known as transferrin that is responsible to transport iron in enzyme structure and blood cell; Hematocrit is responsible to measure the number of all red cells in blood. In fact, hematocrit is made up of red cells in percent. White cell is produced in lymph nodes, thymus and bone [13]. The white cell numbers in each m2 is been estimated around 7000 that is so small in comparison of red cells. White cells are responsible to defend the body, they recognize the external pathogen factors and destroy them in different possible way and also there are many kinds of white cells such as neutrophils, lymphocytes, monocytes, Eosinophils and basophils [13].

Red cells are produced in liver, spleen and lymph nodes during the Embryonic and will be made in bone marrow at the final Embryonic months and post birth. Red cells are responsible to transport the oxygen and carbon dioxide. There are more than 5 million of them in one in m3 [9]. AST is being secreted from liver hepatocytes and naturally there is been secreted in different body parts such as liver, heart, muscles, kidney and brain. This enzyme penetrates to blood in case of liver and muscle damage and it’s level will increase in blood [14]. The normal level of AST is about 5-40 liter in a unit of serum. When body has a hard exercise, it leads to external muscle damages in skeleton muscle that after 12 hours will increase the AST and remain in our body for 5 days [15].

In this way, the kind of recovery can be related on muscle or cell damage decreasing that can effect on athlete’s success. In any sport activity, cell damage starts to secret more than normal in body and if after the competition or exercise it remain in high normal, it can overshadow the athlete’s success and performance. ALD is known as an enzyme that is in the heart and Skelton muscles. This enzyme has an important role in changing glucose to lactate and also the level of cell damage and liver issues will increase by this enzyme, too [16]. Athlete’s power for doing daily exercises depends on how fast his physiology muscle situation will return to normal [17]. Body will return to the normal form through body liquid replacement, energy storage, damaged body tissue recovery and Metabolic waste disposal [9]. Being aware that sometimes athletes have to participate in more than one competition have many practice sessions to being prepared in just one day in a very short interval, it is very important to know the best recovery way that leads to less sport damages [18].

The levels of athletes’ performance during exercising sessions and even in competitions will increase with a good procedure to return to body normal after the exercise; One the necessary practice factor is recovery [19]. When an athlete reaches to the base performance, athlete starts to practice or compete and this is very important due to metabolic and physiologic situation from practice from the base level, the performance will be decreased and when the body form returns to normal (recovery), body system try to back everything to normal and even more than normal (adjusting) and that is what every athlete needs after training sessions. These situations only happen in recovery phase and it is necessary to use the right kind of full detailed recovery [20]. If any athlete cannot use the right recovery after training or competition, definitely will not reach to adjusting level or even maybe will not reach to the base level, either and that means bad performance and cell, muscle damages [17]. Small mechanical damages from different body activities and even in competitions that involve kicking a lot to the ground is inevitable. By using suitable technics, the effects of damages and also Traumatic cell features and metabolic waste from body activities will go through disposal and removal ways that is the most fundamental recovery technics [21]. After the competition or exercise, these features may reach to a higher normal level and it may put the athlete’s health and performances in future years if it continues during the exercise or competition. Previous studies mostly have been done on genius athletes to review the active and inactive recovery, but there is been less attention about
sport massage. So, this is important to be concerned about this matter. By using these recovery post practice or competition technics, we can stop the long term damages in higher levels in the body. Paying attention about this is so important for athlete’s health and performance. Therefore, by choosing the right recovery will probably have a positive effect on results. We are aware that there is a proven effect about active recovery against inactive one. there should be much more studies about how to do active and inactive recovery or how should evaluate the results and also what kinds of athletes should be study on.

Hence, we should study more about Traumatic texture and cell so, we should pay more attention about some hematological factors like hemoglobin, hematocrit, iron, red and white cells, AST and ALD. The researcher is going to study 3 methods of active, inactive recovery and sport massage on ALD, AST enzyme activity and some other blood homological on female runners.

**Materials and Methods**

**Participants**

This is a practical study and it has been used the semi experimental method in crossover way. The sample includes 30 (age 18-24 years) semi profession female student runner by their consent randomly. The data has been gathered by using demographical features questionnaire (physical activity, sport background, health evaluation and medical records) and standard valid laboratory equipment for evaluating the biochemical blood factors like refrigerator, centrifuge machine and counting ELISA Reader machine.

**Procedure**

After the recoveries, the third blood test have been taken. For analyzing the data, we used Kolmogorov-Smirnov Test for checking data normality, One-way analysis of variance test to check the average differences and intergroup changing in positive level P<0.05 by SPSS22 software.

**Results**

There was a meaningful relation of White blood cell

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measuring time</th>
<th>Groups</th>
<th>Slow Running Group</th>
<th>Massage group</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell</td>
<td>Before practice</td>
<td>1137±6530</td>
<td>771±5930</td>
<td>1312±6890</td>
</tr>
<tr>
<td></td>
<td>After practice</td>
<td>982±8660</td>
<td>662±8310</td>
<td>1236±9490</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>1525±6190</td>
<td>593±6490</td>
<td>1401±7400</td>
</tr>
<tr>
<td></td>
<td>Before practice</td>
<td>0.61±5.73</td>
<td>0.67±5.73</td>
<td>0.82±5.19</td>
</tr>
<tr>
<td></td>
<td>After practice</td>
<td>0.75±6.34</td>
<td>0.69±5.89</td>
<td>1.05±5.96</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>0.63±6.19</td>
<td>0.63±5.70</td>
<td>0.90±5.67</td>
</tr>
<tr>
<td></td>
<td>Before practice</td>
<td>2.00±15.21</td>
<td>2.07±15.54</td>
<td>2.22±13.85</td>
</tr>
<tr>
<td>Red blood cell</td>
<td>After practice</td>
<td>2.46±17.45</td>
<td>2.18±18.88</td>
<td>2.95±16.41</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>2.49±16.70</td>
<td>2.11±15.69</td>
<td>2.47±15.25</td>
</tr>
<tr>
<td></td>
<td>Before practice</td>
<td>44.97±98.70</td>
<td>48.75±122.30</td>
<td>52.43±118.90</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>After practice</td>
<td>31.75±117430</td>
<td>34.84±137.60</td>
<td>45.73±146.20</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>34.50±115.10</td>
<td>34.62±124.20</td>
<td>45.67±142.30</td>
</tr>
<tr>
<td>Blood Iron</td>
<td>Before practice</td>
<td>5.49±46.23</td>
<td>5.94±46.68</td>
<td>6.68±41.63</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>After practice</td>
<td>6.25±53.22</td>
<td>6.10±47.97</td>
<td>8.86±49.31</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>6.61±50.80</td>
<td>5.90±47.36</td>
<td>7.45±45.91</td>
</tr>
<tr>
<td></td>
<td>Before practice</td>
<td>2.02±4.08</td>
<td>1.75±4.88</td>
<td>1.69±4.21</td>
</tr>
<tr>
<td>ALD</td>
<td>After practice</td>
<td>1.09±1.84</td>
<td>0.39±1.62</td>
<td>0.67±1.60</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>1.24±2.87</td>
<td>0.90±2.63</td>
<td>1.18±2.41</td>
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<tr>
<td>ASD</td>
<td>Before practice</td>
<td>12.25±26.80</td>
<td>14.03±29.80</td>
<td>12.22±28.00</td>
</tr>
<tr>
<td></td>
<td>After practice</td>
<td>10.68±29.30</td>
<td>14.46±30.20</td>
<td>12.93±32.90</td>
</tr>
<tr>
<td></td>
<td>After recovery</td>
<td>10.89±31.80</td>
<td>14.02±32.30</td>
<td>11.29±33.20</td>
</tr>
</tbody>
</table>
Table 2. One-way analysis of variance test results for variables in post-test.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistical index</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell</td>
<td>Between groups</td>
<td>7646000</td>
<td>2</td>
<td>3673000</td>
<td>3.75</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>26400000</td>
<td>27</td>
<td>977851</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>33750000</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Between groups</td>
<td>1.17</td>
<td>2</td>
<td>0.58</td>
<td>0.92</td>
<td>0.41</td>
</tr>
<tr>
<td>Red blood cell</td>
<td>Within groups</td>
<td>17.22</td>
<td>27</td>
<td>0.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>18.39</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>Between groups</td>
<td>12.75</td>
<td>2</td>
<td>74.41</td>
<td>1.44</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>176.67</td>
<td>27</td>
<td>51.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>189.42</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td>Between groups</td>
<td>148.82</td>
<td>2</td>
<td>73.47</td>
<td>1.41</td>
<td>0.27</td>
</tr>
<tr>
<td>Blood Iron</td>
<td>Within groups</td>
<td>38830.40</td>
<td>27</td>
<td>1438.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>43201.86</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASD</td>
<td>Between groups</td>
<td>0.35</td>
<td>2</td>
<td>0.17</td>
<td>0.29</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>16.38</td>
<td>27</td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16.73</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. One-way analysis of variance to check three different recovery results on variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistical index</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood cell</td>
<td>Between groups</td>
<td>7348382</td>
<td>2</td>
<td>3674191</td>
<td>3.75</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>26390000</td>
<td>27</td>
<td>977358</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>33740000</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Between groups</td>
<td>0.12</td>
<td>2</td>
<td>0.06</td>
<td>0.77</td>
<td>0.47</td>
</tr>
<tr>
<td>Red blood cell</td>
<td>Within groups</td>
<td>2.21</td>
<td>27</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.33</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>Between groups</td>
<td>4.74</td>
<td>2</td>
<td>2.37</td>
<td>4.52</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>14.15</td>
<td>27</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>18.90</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td>Between groups</td>
<td>40.06</td>
<td>2</td>
<td>20.03</td>
<td>4.10</td>
<td>0.02</td>
</tr>
<tr>
<td>Blood Iron</td>
<td>Within groups</td>
<td>6281.40</td>
<td>27</td>
<td>232.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7001.46</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASD</td>
<td>Between groups</td>
<td>27.46</td>
<td>2</td>
<td>13.73</td>
<td>1.24</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>297.50</td>
<td>27</td>
<td>11.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>324.96</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALD</td>
<td>Between groups</td>
<td>0.29</td>
<td>2</td>
<td>0.14</td>
<td>0.10</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>40.04</td>
<td>27</td>
<td>1.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>40.34</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
amounts in semiprofessional female runner’s blood in all three groups in post-test results. First, the post-test difference has been computed in all three groups (P=0.03, F=3.75). The Red blood cell, Hemoglobin, Hematocrit & iron post-test amounts in female semiprofessional runners was checked by ANOVA one way and there was not a meaningful relation on posttest female semiprofessional runners in all three groups (F=0.92, P=0.41), (F=1.44, P=0.25), (F=1.41, P=0.27), (F=1.52, P=0.23). There is not a meaningful relation of ASD & ALD in all three groups. (F=0.21, P=0.80), (F=0.29, P=0.74).

The LSD follow up test results shows that there is a negative relation between recovery and inactive rest recovery group in White blood cell (P=0.01). As you see in table 3, there is not a meaningful relation among three recovery groups for Red blood cell & iron (F=0.77, P=0.47), (F=1.54, P=0.23). The results showed that there was a meaningful relation among three recovery methods in female semiprofessional runners’ Hemoglobin & Hematocrit changing (F=4.52, P=0.02), (F=4.10, P=0.02). LSD follow up results showed there is a meaningful relation among soft recovery and inactive rest recovery groups (P=0.006). The results showed that there is not a meaningful relation among three recovery methods on ASD & ALD female runners’ blood changing. (F=1.24, P=0.30), (F=0.10, P=0.90).

Discussion

A person’s ability to do the daily exercises depends on how fast the muscles will return to normal phase; This will lead the body return to normal phase by replacing body liquids, energy save and muscle damaged Restoration [13]. Furthermore, with more relaxing and a good nutrition, body will be able to recover the endangered Immune system [11]. Following the right recovery procedure to get back to normal phase after the exercise, the levels of sport performance during practice sessions and in competitions will increase and more important thing is that the body strength will improve.

Recovery will be difficult and complicate after a long term activity and we are able to categorize it in three phases. First phase is called fast level and will happen in first 30 minutes after practice. Then, there is a middle phase that will last 2 hours after the practice and the last phase is the longest that will happen during 20 remain hours and before the next practice session [23].

When the athlete has a few recovery time between the 2 competitions, the fast recovery will be of importance because the athlete’s best performance on next competition will depends on her fast recovery in a short amount of time [24]. This phase starts when the person finishes her practice and will continue for about 30 minutes. During this time, body will have a slow metabolism and starts to before practice normal level. The heartbeat, breath and body temperature will decrease gradually to resting phase. The blood levels of hormones such as cortisol and testosterone that were up during the exercise will decrease. The muscles’ activity starts to replacing CPR and ATP that have been used as energy store, simultaneously. body will start to excrete the extra lactic acid that might be aggregated in muscles.

Most of this lactic acid will penetrate to blood that may become to glucose in liver and inactive muscles. The participants can make body cooling down, metabolic and physiologic procedures faster by light exercises. The exercise will use 40 to 60 percent oxygen for 5 to 10 minutes to keep a faster blood circulation. Keeping the blood circulation higher than normal in this phase will help to excrete lactic acid and transport it to the parts to make more energy [25]. Most body parts and organs like liver, muscle system, active muscle, nervous system, hormonal system, glycogen and muscle tri glyceride and energy system will be under pressure during the competition or a practice session. It is obvious that recovery during or after the sport activity will have a great impact on energy lost levels recovery, blood pH, muscle and body temperature and etc.

Athletes believe that different kind of recoveries and sport massage can have a positive influence on their performances and decrease the return time to normal phase and it can improve the next competition results [26]. Reports shows that there is a physiologic, biomechanics, neurologic and psychologic positive massage effects on body. Nonetheless, based on recent studies there has been a few one about recovery and massage effects to improve muscle exhaustion and increasing sport performance among athletes.

A person’s ability to do daily exercises depends on how fast her muscles return to the normal. In this way, body can return to normal phase by replacing liquid, energy saving and muscle damaged recovery. Body can improve its immune system by enough rest and good nutrition. With a right recovery procedure, body will return to the normal phase very quickly after the exercise sessions and competitions and more important than that body’s general health and strength will improve [27].

The results showed that there is not a meaningful relation among 3 recovery methods for changing Aspartate Aminotransferase and Aldolase enzyme, blood Iron and Red blood cell. But there is a meaningful relation among inactive, soft and massage recovery in changing of White blood cell, Hematocrit and Hemoglobin. The results are consistent with the findings of researchers such as Nobahar & Mirdar, Moenedoor et al [28, 29].

Study of Melekzadeh et al said the amount of combined recovery effect in blood lactate purification, combined and inactive recovery to improve the ability, combined recovery in ability average, combined and active recovery in minimum ability, active combined recovery and sport massage in exhaustion factor, combined recovery and sport massage in exhaustion understanding and having more power are some of other kinds of recovery types. They concluded that combined recovery is the most effective one in blood lactate purification and anaerobe performance improvement, exhaustion understanding and powerfulleness toward active and inactive recovery and also sport massage [4].

Nobahar & Mirdar research results showed that AST amount increased after the 1st, 4th and 7th days of practice...
and it was a meaningful relation but it had a meaningful decreasing after 24-hour rest and there was a meaningful relation with control group on practice days. The amount of CPK increased on 4th and 7th practice days except the first day. The amount of LDH also increased on 7th day and after 24-hour rest based on basic levels and also in all levels of blood testing after the practice toward control group. The researchers understood that not paying attention to recovery time based on exercise difficulty may lead to muscle damage and slow performance. These results were Non-aligned with other studies and it is because of the other non-relevant factors such as athlete’s perorations, recovery time and etc. [28]. Moenedeoor et al concluded that returning to normal phase will be categorized in four stages like inactive rest situation, active perorations, recovery time and etc [28].

Conflict of interest
The authors declare no conflict of interest.

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The influence of circuit training on the development of strength and speed-power abilities in basketball players of 18-19 years old

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to determine the influence of circuit training on the level of strength and speed-strength abilities development in basketball players of 18-19 years old at the pre-competitive and competitive stages of the training process.

Material: athletes (n = 32) were divided into 2 groups of 16 people. The pedagogical experiment lasted 7 months. Tests were applied to determine speed-power abilities: standing long jump test (broad jump, cm); vertical jump test. Strength was evaluated by the following tests: pull-up bars; hanging leg raises (stall bars).

Results: it was determined that power and speed-power abilities are leading in basketball. It was proposed the set of physical exercises performed on the principle of circuit training. It was confirmed the expediency of the circuit training applying for the development of power and speed-power abilities in basketball players. It is established that the circular training in the preparatory and final parts of the training increases the speed and speed-strength indicators of basketball players.

Conclusions: It is recommended the circuit training applying at the pre-competitive and competitive stages of the training process.

Keywords: basketball, circuit training, strength abilities, speed-strength abilities, athletes.

Introduction

Power and speed-power abilities are one of the leading components of basketball players’ physical fitness. The high level of their development has a positive effect on the physical and technical readiness of athletes [1-3]. The most favorable period for the development of strength abilities in males is age after 16 years. The most favorable period for the development of speed abilities is observed much earlier [4, 5]. Therefore, the age of 18-19 years can be considered favorable for the experiment.

In the modern scientific literature was accumulated extensive knowledge devoted to the peculiarities of the strength and speed qualities development in athletes of various sports in the course of many years of training [6–9]. Numerous publications provide experimental data on the peculiarities of the various training modes influence and the human body responses to the performance of power and speed loads [10–13].

However, the generally accepted forms of training organization become the same type and familiar to the athletes. Therefore, it is necessary to search for new forms and promising approaches to the training process organization. Such an approach is especially important in the pre-competitive and competitive stages.

Circuit training is one of the modern forms of exercise. Such training effectively solves the problems of the interconnected development of physical qualities, strength and speed-strength abilities. Performing the usual training motor actions in a circle allows you to repeat them repeatedly and in a complex with a large motor density [14].

Circuit training sets are widespread in sports, among schoolchildren and overweight people [15-18]. In basketball, there are studies that confirm the effectiveness of the circuit training applying in the training process [19, 20].

The purpose of the work is to determine the influence of circuit training on the level of development of power and speed-power abilities of basketball players of 18-19 years old at the pre-competitive and competitive stages of the training process.

Material and methods

Participants: Basketball players took part in the study (n = 32, age - 18-19 years old). The athletes were divided into 2 groups: control (CG) and experimental (EG). The study lasted 7 months.

Procedure:

Control tests were performed at the beginning and at the end of the experiment according to the following tests: standing long jump; vertical jump; pull-up bars; hanging leg raises (stall bars) [21, 22].

Circular training was applied in the EG during the preparatory and final parts of the training: in the pre-competition period - 2 times a week; in the competitive period - once a week. The group was divided into 4 subgroups, which were located in different sectors. The peculiarity of the experiment was that EG athletes moved from one sector to another with a basketball ball. The flow method was applied. In the first sector, the athletes carried out the following tasks: barrier jumps single leg (low barriers) (20 push-offs with each foot); high bar squat vs. low bar squat (10-20 times ); rope jumps (100-150 times); vertical jumps with a touch of a basketball hoop (10 jumps). In the second sector, exercises with a bar were performed (weight was 30-40% of the athlete’s weight): close grip barbell bench press) (up to 50 cm) - 5x5 times; seated barbell military press - 5x5 times; calf raise in standing position - 2x20 times; incline bench press (45
degrees) - 5x5 times. In the third sector, the following exercises were performed: barrier jumps single leg (20 push-offs each foot); box jumps down (60 cm height) - followed by a vertical jump with a touch of a basketball hoop; shots (distance to the basketball backboard was 1.5 meters, 15-20 shots). In the fourth sector, the following exercises were performed: eurofit sit up test (hands with the ball are placed in front of the chest) - 2x10 times; single leg lateral barrier jump, low barriers (20-30 push-offs); parallel bar dips - 3x5 times.

**Statistical analysis:**

The results were processed in Excel (Student’s t- test, the result was significant at p <0.05).

**Results**

The level of athletes was about the same in comparison of the initial indicators. The differences between the groups were not significant (p> 0.05). The analysis of the results revealed that a positive trend was observed in all tests of the EG and the CG groups. However, the dynamics of their changes was different (Table 1).

In the test “Standing long jump” the result improved: in the EG from 247.6 ± 2.81 (at the beginning of the experiment) to 269.6 ± 2.76 (at the end of the experiment). The result improved in the CG from 244.15 ± 3.93 (at the beginning of the experiment) to 256.1 ± 2.93 (at the end of the experiment). The increase in the test result is significant in both groups (p <0.05). However, at the end of the experiment, athletes from the EG were ahead in the athletes' test result from the CG (t = 2.4; p <0.05).

The indicators in the test “Vertical jump” also increased in both groups: in the EG - from 60.7 ± 3.2 to 67.06 ± 3.3 (p <0.05); in the CG - from 61.6 ± 2.53 to 63.5 ± 3.85 (the result is unreliable, p> 0.05). Intergroup comparison showed significantly reliable results for the athletes of EG (t = 3.38; p <0.05).

Significantly reliable changes revealed in both groups in the “Pull-up bars” test: in the EG - from 9.4 ± 0.63 to 13.0 ± 0.62 (p <0.05); in the CG - from 8.9 ± 0.69 to 10.8 ± 0.62 (the result is unreliable, p> 0.05). The resulting difference in the increase of groups’ indicators is significantly reliable for the EG (t = 2.5; p <0.05).

The result improved in both groups in the test “Hanging leg raises (stall bars)”. In the EG, the increase was from 11.3 ± 0.66 to 20.5 ± 1.27 (p <0.05). In the CG - from 12.2 ± 1.04 to 15.2 ± 1.12. The final comparison at the end of the experiment revealed the advantage of the EG (t = 4.66; p <0.05).

The results analysis of the final test revealed that the athletes of the EG were significantly ahead of the athletes of CG in all tests (p <0.05).

These data confirm that the increase in all indicators during the experiment was significantly higher in the EG than in the CG. This is a strong argument in favor of the circuit training applying for basketball players of 18–19 years old at the pre-competitive and competitive stages of the training process.

**Discussion**

At the present stage of basketball development, the increased sportsmanship requires technical skills from athletes for competitive actions and the concentrated development of physical qualities. The main elements of most integral motor actions in basketball are speed and strength [3, 22-23]. With the simultaneous improvement of strength and speed in terms of training the jumping ability is also improved. The jumping ability is a form of speed-power abilities expression [24-27]. The need for local effects on certain sets of muscles increases to provide the necessary strength and speed-strength training [28-31]. The following exercises are performed in this training where the power abilities reach a maximum by increasing the speed of muscle contraction: rope jumping; “Short” and “long” jumps over barriers; exercises with bar; squats; exercises with small weights bar [32].

The effectiveness of the circuit training applying is complex. It helps to increase athletes’ skills, to fight actively against obesity, and to develop the physical qualities in children and adults [15-18]. The generalization of experimental data allows us to conclude that it is advisable to apply the sets of circuit training for athletes at different stages of readiness. This approach is effective in

**Table 1. Comparative analysis of indicators in basketball players of 18-19 years old**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Group</th>
<th>Before experiment</th>
<th>After experiment</th>
<th>t; p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing long jump (cm)</td>
<td>EG</td>
<td>247.6±2.81</td>
<td>269.6±2.76</td>
<td>t=5.59; p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>244.15±3.93</td>
<td>256.1±2.93</td>
<td>t=2.39; p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>t; p</td>
<td>t=0.74; p&gt;0.05</td>
<td>t=3.38; p&lt;0.05</td>
<td>–</td>
</tr>
<tr>
<td>Vertical jump (cm)</td>
<td>EG</td>
<td>60.7±3.2</td>
<td>67.06±3.3</td>
<td>t=2.6; p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>61.6±2.53</td>
<td>63.5±3.85</td>
<td>t=1.23; p&gt;0.05</td>
</tr>
<tr>
<td></td>
<td>t; p</td>
<td>t=0.74; p&gt;0.05</td>
<td>t=2.4; p&lt;0.05</td>
<td>–</td>
</tr>
<tr>
<td>Pull-up bars (times)</td>
<td>EG</td>
<td>9.4±0.63</td>
<td>13.0±0.62</td>
<td>t=4.07; p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>8.9±0.69</td>
<td>10.8±0.62</td>
<td>t=2.04; p&gt;0.05</td>
</tr>
<tr>
<td></td>
<td>t; p</td>
<td>t=0.54; p&gt;0.05</td>
<td>t=2.5; p&lt;0.05</td>
<td>–</td>
</tr>
<tr>
<td>Hanging leg raises (stall bars) (times)</td>
<td>EG</td>
<td>11.3±0.66</td>
<td>20.5±1.27</td>
<td>t=6.42; p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>12.2±1.04</td>
<td>12.6±1.12</td>
<td>t=0.26; p&gt;0.05</td>
</tr>
<tr>
<td></td>
<td>t; p</td>
<td>t=0.73; p&gt;0.05</td>
<td>t=4.66; p&lt;0.05</td>
<td>–</td>
</tr>
</tbody>
</table>

Notes: the significant changes in indicators are highlighted.
basketball [19-20]. Currently, the volume of training and competitive loads has increased significantly. It doesn’t always correspond to the level of athletes’ physical fitness. We have proposed to perform a set of physical exercises for the development of strength and speed-strength abilities in basketball players of 18-19 years old (circuit training). The performance of such exercises is most effective at the pre-competitive and competitive stages of the training process.

We have proposed another organizational scheme for circuit training:
- The alternation of four sectors, in which there were also four “stations” (tasks). Athletes performed all activities in each sector and then moved to another sector.
- Athletes were evenly distributed across all sectors and at the same time began to perform exercises.
- Moving from one sector to another the athletes drive the ball.
- Athletes performed maximum intensity exercises 1-2 times a week.

Thus, the purpose of the research is achieved and confirmed by the results of a pedagogical experiment.

Conclusion
The obtained data are confirmed by the results of the experiment and indicate a significant effect of the circular training on the absolute improvement of all the studied indicators in the EG. The results of the study are new, relevant and promising for further study. The circuit training at different stages of many years training is recommended for coaches.

Conflict of interest
The authors declare that there is no conflict of interests.

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The effect of 8 week resistance exercise on some anthropometric measurements and body composition to Sedentary Women

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Abstract

Purpose: The aim of this study is to determine the effect of resistance exercise program applied to eight weeks on some anthropometric measurements and body composition in sedentary women.

Material: Fifteen volunteer women with a mean age of 20.67 ± 1.29 years were included in the study. After asking the participants whether there are any health problems before the exercise program, detailed information was given and the exercises were implemented correctly and efficiently. Participants were given a 45-minute resistance exercise for 3 days a week. In order to compare the data obtained (Wilcoxon Test) was applied to compare descriptive statistics with pre- and post-exercise values via using SPSS 22.0. Before and after the exercise program (Weight, Hip circumference, calf circumference, chest circumference, waist circumference, shoulder circumference and BMI) were measured.

Results: According to the findings of the study, it was determined that there was a significant difference between the anthropometric measurement and body composition values of the exercise program applied before and after the exercise program of the participating women (p> 0.05).

Conclusions: In conclusion, the effects of regularly performed exercises, especially aerobic and resistance exercises done for women, on persons are seen in the literature and research essays. Deterioration in the body composition of women is seen depending on age and excessive weight.

Keywords: Sedentary Women, weight, BMI, fat and obesity.

Introduction

Today, it preserves its reality that unhealthy nutrition culture, being far from bodily movement and the sedentary living approach, as a result of these, are introduced by technological developments. Sedentary life increases the emergence probability of cardiovascular diseases, deformation in the joints, backbone disorders, depression, and many more diseases. These negative results made that it is mandatory that individuals tend to exercise for maintaining body and spiritual health [1].

Exercise is effective for burning the fats in our bodies with respect to provide energy and prevents excessive loss in the muscle tissue during weight workout [2]. It is required to continue the exercise program for at least 8 weeks in order to ensure loss in the fatty tissue. It should be continued lifelong to become the life standard [3].

Exercise is considered as one of the basic principles of healthy life. A healthy life with exercise can only be possible if the exercise programs are done according to the purpose [4]. Regular exercise is very important for a healthy, active aging. In the advanced ages, physical capacity is closer to the threshold value and even minimal decreases negatively affect daily activities such as getting out of the chair. An added disease attack may make an elder, who was healthy beforehand, dependent and immobile. The way to prevent such unwanted incidents is the regular physical exercises. Even in the very advanced ages, the physical capacity may be increased via regular physical activity [5]. One of the exercise types used for burning fats and increasing muscle mass and preferred intensely by large masses is resistance exercises (RE).

Resistance exercise (RE) workout is a special workout method, consisting of exercises designed for increasing the muscle power, muscle strength and muscle force. When resistance exercise workout is mentioned, mainly strength workout or weight workout are thought of. Together with this being correct, strength workout consists of only a form of RE workouts: anything that ensures that muscle works more or harder can be classified as RE workout. Stretching made by using surgical pipes, elastic band workouts and the workouts made by throwing medicine ball are also described as RE workout [6].

The improvements in the muscle force and strength as a result of a resistance workout is smaller for women compared with the one observed in men. The resistance workout causes big increases in the body composition and muscle size especially for women [7].

Even though there are similarities in the body composition, organs and members in the body, every person has a physical composition different from each other. Body composition refers different tissues, expressed as generally muscle, fatty, bone, and residual masses, forming the total body mass. However, in the physical fitness tests, the body composition is usually assessed as the fatty tissue and the body tissue, separated from fat [8]. Waist girth is an indicator of the deep fatty tissue. When compared to the top leg and hip girth, it is used as an indicator of the fatty tissue and muscle distribution level. Higher the ratio of the waist girth to the top leg and hip
girth, higher the diabetes risk. On the other hand, waist girth has a high correlation with the weight/length², which is an indicator for fatness [9]. In the studies performed, it is shown that body fat amount, increased with the age, can be decreased by increasing physical activity [10].

It was thought that there may be positive changes which may be created by resistance exercises in the sedentary women’s some anthropometric measurements and body compositions. For this purpose, in this study, the effect of 8 week resistance exercises on some anthropometric measurements and body composition.

**Material and Methods**

**Participants**

Fifteen volunteer women with a mean age of 20.67 ± 1.29 years were included in the study.

**Research Design**

After asking the participants whether there are any health problems before the exercise program, detailed information was given and the exercises were implemented correctly and efficiently. Participants were given a 45-minute resistance exercise for 3 days a week. The pre-final test model was used in the research. For this purpose, length, weight, body mass index (BMI), diameter and girth measurements were taken from sedentary women just before and just after the workout program lasted for 8 weeks.

**Length and weight measurement**

The measurement of the tallness lengths of the athletes, participating in the study, was done while the head is in the Frankfort plane, with bare feet, posture is in a perpendicular position and from the vertex of the head during a deep inhaling and the assessment was recorded in cm (0.1 cm). The body weight measurements were taken with bare feet in g (0.01 g) when there are only shorts on the participants.

**Diameter measurements**

**Chest girth:** the measurement was done at the level of rib 5 and 6 (at the level of nipple of men) while the arms are slightly open to the sides [11].

**Hip girth:** the measurement points were determined after the pressure applied to the soft tissue by approaching the tool from the sides while the subject is standing up, slightly opened the arms to the sides. It was measured by placing the big caliper on the iliac crest (of femora) [12].

**Shoulder girth:** it was measured from the most obvious parts of the shoulder bones such that caliper with curved edge comes parallel to the ground while the subject is in the anatomic position [13].

**Circumference measurements**

**Waist girth:** measurement of the waist girth was measured in the narrowest part of the waist and recorded in cm while the subjects, with thin and light clothes, are standing up, the waist is in loose position, arms are hanged on the sides, the legs are close [14].

**Hip girth:** was measured at the symphysis pubis level from the front and maximal protrusion of the hip muscles from the behind [15].

**Chest girth:** the chest girth measurements was measured as breathed half out by placing the measurement band, when the arms are opened to the sides, 2.5 cm over the nipples, in the position with legs opened to the shoulder width, while the breast body is at perpendicular position and lowering the arms and recorded as cm [11].

**Body mass index (BMI)**

The body composition can be referred as the combination of body fat mass and lean body mass [16]. In our study, in order to find out the body fat percentage measurements of the participants, we assessed with the device in the TANITA model, depending on the individuals’ BIA basic conditions.

**Exercise and Workout Program:** The training program, which lasted 8 weeks, consisted of 60 minutes of resistance exercises program, 3 days a week. After 10 minutes of warm-up in each exercise period, the exercises in Table 1 were applied. The applied program was completed with 5 minutes cooling exercises.

**Table 1. Types of exercise, duration and shape**

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push up with exercise band</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>Shoulder movements with exercise</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>band</td>
<td></td>
</tr>
<tr>
<td>Squat with exercise band</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>Thrust movement with exercise band</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>Stand out squat with exercise band</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>Penguin movement with exercise band</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>Baseball swing movement with</td>
<td>2*12 sets</td>
</tr>
<tr>
<td>exercise band</td>
<td></td>
</tr>
</tbody>
</table>

**Statistical analysis**

SPSS 22.0 package software was used in the analysis of the data obtained. In order to determine the differences between the pre-test and final test values of the study group, Wilcoxon test, one of the non-parametric tests, was used.

**Results**

**Table 2. Age and tall statures of the sedentary women participating in the research**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>N</th>
<th>Average</th>
<th>St. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>15</td>
<td>20.67</td>
<td>1.29</td>
</tr>
<tr>
<td>Tall stature (cm)</td>
<td>15</td>
<td>159.47</td>
<td>4.80</td>
</tr>
</tbody>
</table>

Considering the physical characteristics of the women, participating in the research, in the Table 1, the age, length and body weight were determined respectively as: 20.67±1.29 years, 159.47±4.80 cm.

According to the findings obtained, it was determined that the exercise program applied affected positively some anthropometric measurement results compared to the pre-test results and this effect is statistically significant (p>0.05).
Assessing the results of the research, it was determined that the exercise program applied significantly changed the body composition in sedentary women compared with the pre-test results and this changes is statistically significant (p>0.05).

Discussion
The effect of the regular exercise on the cardiovascular risk factors, diabetes, dyslipidemia, and hypertension treatment is well-known [17]. In addition to all these diseases, together with the sedentary life, there are obesity, disorders with respect to aesthetics, and psychological disorders occurring as a result of these. It is seen that the exercise programs applied in a planned way are an efficient way used for correcting the energy balance deteriorated in the treatment of diseases linked with obesity, emerged, and excessive weights.

In our research, it was done in order to determine the effect of the 8 week resistance exercise program on the body compositions and some anthropometric measurements of women. Following the preliminary test and 8 week resistance exercise program, done, of the sedentary women, a significant difference was found in favor of final tests between the final test VA, BKI, fat percentage and some circumference measurement tests (p<0.05).

Erbaş [18] researched the effect of regular, aerobic exercise protocol for 6 months on 54 middle aged, sedentary women. He applied 3 tests as the preliminary test before the workout, the interim test after 3 months and final test after 6 months. After the exercise protocol made, it was found out that the interim test is meaningful compared with the preliminary test, the final test with both the preliminary and intermediary test between the preliminary test, intermediary test and final test values of SKB, DKB, VA, VYO, BKI, and EKK measurements.

Table 3. Comparison on some circumference measurement values of the women

<table>
<thead>
<tr>
<th>Measurements (cm)</th>
<th>Sequences</th>
<th>N</th>
<th>Sequence average</th>
<th>Sequence total</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight pre-test – final test</td>
<td>Negative sequences</td>
<td>14b</td>
<td>7.96</td>
<td>111.50</td>
<td>-2.92**</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>1</td>
<td>8.50</td>
<td>8.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip girth pre-test - Final test</td>
<td>Negative sequences</td>
<td>12b</td>
<td>6.50</td>
<td>78.00</td>
<td>-3.12**</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calf girth pre-test - Final test</td>
<td>Negative sequences</td>
<td>14b</td>
<td>7.50</td>
<td>105.00</td>
<td>-3.34**</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest girth pre-test - Final test</td>
<td>Negative sequences</td>
<td>15b</td>
<td>8.00</td>
<td>120.00</td>
<td>-3.41**</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist girth pre-test - Final test</td>
<td>Negative sequences</td>
<td>14b</td>
<td>8.36</td>
<td>117.00</td>
<td>-3.24**</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>1</td>
<td>3.00</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder girth pre-test - Final test</td>
<td>Negative sequences</td>
<td>13b</td>
<td>7.00</td>
<td>91.00</td>
<td>-3.27**</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p<0.01

Table 4. Wilcoxon test results in the BMI and fat percentage parameters of the women

<table>
<thead>
<tr>
<th>Measurements (cm)</th>
<th>Sequences</th>
<th>N</th>
<th>Sequence average</th>
<th>Sequence total</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI Pre-Test – Final test</td>
<td>Negative sequences</td>
<td>14b</td>
<td>7.50</td>
<td>105.00</td>
<td>-3.30**</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>8.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat percentage pre-test - Final test</td>
<td>Negative sequences</td>
<td>15b</td>
<td>8.00</td>
<td>120.00</td>
<td>-3.40**</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Positive sequences</td>
<td>0</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equal</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p<0.01
the subjects. This research aligns with our study and found significant results between pre-test and final test measurements.

In another research, Rogers and Gibson [19] has researched the effect of 8 weeks, 3 days a week, 60 minute Pilates mat exercise program on body composition, flexibility and muscular endurance for the healthy, recreationally active adults. The Pilates exercises consists of 7 start, 13 medium, 8 advance level exercises done with at most 10 repetitions. The cases in the control group in the research consisted of individuals who did uncontrolled cardiovascular and strength training for 60 minutes for 3 days a week in gym. The fat percentage of the cases in the Pilates group was found as 23.5 ±5 on the average before the training and the fat percentage of the cases in the control group as 23.7 ±6 on the average. The chest, waist, hip, right calf and arm girth measurements of the cases were measured by using Gullick tape, the chest, abdomen and thigh of men and triceps, suprailliac and thigh skinfold thickness of women by skinfold caliper. It was found out that the exercise program, also applied in our study, affects the anthropometric measurement results positively compared with pre-test results and this effect is statistically meaningful.

In the study done on 30 obese sedentary by Lafortuna et al. [20], a six week weight loss program was given to the individuals and statistically meaningful decrease in the body mass was found in the measurements made after six months (p>0.05). This study also aligns with the result of our research.

**Conclusion**

In conclusion, the effects of regularly performed exercises, especially aerobic and resistance exercises done for women, on persons are seen in the literature and research essays. Deterioration in the body composition of women is seen depending on age and excessive weight.

**Conflict of interest**

The authors declare that there is no conflict of interests.

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The determination of cooperative teacher’s knowledge problems: training device and attractiveness of Tunisian student-teachers

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Abstract

Purpose: This study was to explore the impact of the cooperative teacher’s (CT) knowledge on attractiveness of Physical Education Student Teachers (PE-ST) believed to be important for a successful process of learning to teach and training device in the workplace. The CT is considered, a key element, a person of alternation between academia and training contributing to the formation by advice and support that take place during the teaching practice. The Cooperative Teacher must have a style; develop a training contract, master interview techniques and make evaluation.

Material: Data were collected with 302 student teachers (202 males and 100 females) after professional training. A descriptive/exploratory methodology based on a questionnaire consisting of twenty questions was used. The value of Cronbach alpha index is 0.729.

Results: Globally supported the hypotheses. Male and female student teachers in the internship shared several perceptions. However, significant differences emerged. Student-teachers’ perception of CT knowledge and practice developed relatively professional skills as well as the feeling of discomfort which can lead to work stoppage. However, the impact of CT knowledge on attractiveness was significant. The inefficiency advice between actors in the professional life and several aspects of CT knowledge are provided. In addition, data are provided indicating that overall there are more similarities than differences between male and female student teachers over a response number. Data also shows that females who participate in the internship may be at risk for discomfort, incapability and doubt their practices.

Conclusions: This study will encourage Teacher’s to reflect on their own knowledge, training device and to include them in the process of educational development.

Keywords: professional training, teaching practice, knowledge, discomfort.

Introduction

Studies of the process of becoming a teacher and professional skills development have received significant attention in the last decade, trying to explain the complexities of this phenomenon. However, questions remain as to how well higher education institutions prepare the Student Teachers (PE-STs) to meet the challenges and requirement of work environments. Thus, professionals know how to put their skills into action in all situations, able to think in action and to adapt and dominate any new situation [1, 2, 3]. Though, skills are deployed in a professional context [4, 5, 6]. Tardif [7] claimed that the internship is the foundation of the professional skills of the teachers; it is the opportunity to put pedagogical, didactic and disciplinary knowledge for learning professional practice. In addition, the process of learning to teach develops self and class understanding and enriches teaching practices and professional thinking [8]. In this context, Brawdy & Byram [9] suggest that future teachers should be given the opportunity to acquire appropriate teaching skills and develop the practical experience of teaching in schools. Teaching skills are rooted in the personal history of teachers, and can only be learned through practice [10]. According to Desbiens et al. [11] the internship is alternating and continuous with other training times. It is the training time that promotes a familiarization with the dynamics of school and class, and the construction of professional action.

In the workplace, the cooperative Teacher (CT) is considered a person of alternation between academia and training, contributing to the formation by advice and support [12, 13]. This support requires experience and skills in terms of accompaniment such as knowing how to communicate, reflect on its action, observe, solve problems and evaluate the trainees’ learning [14]. This is corroborated by a number of studies in different disciplines. For instance, Boutet & Rousseau [15] opined that the characteristics of an effective CT are: experience, self-confidence, openness to theoretical contributions and reflection, coherence and acceptance to be questioned. Carlier [16] assumed that the CT and PE-ST exchange academic and practical knowledge to guide the verbalization of PE-ST’s action by asking questions that they have put in place. He suggests that CTs recognize the existence of two types of knowledge and try to exploit them optimally. The aim is to train an independent teacher with specific, specialized skills based on rational, recognized, science-based knowledge, legitimized by the University or explicit knowledge derived from practices [1, 17].

Vandercleyen et al. [18] highlight the dual role of CT, to be able to explain their own pedagogical concepts to...
The first goal consists of portraying the trainees’ appreciations regarding the supervision of their teaching activity has served as an introduction to professional life. In Tunisia, university aim is to help PE-STs articulate the process of teaching learning in schools. We answered through this research the following questions: the knowledge of the CT transformed in to discomfort? What impact do they have PE-STs?

Materials and Methods

Participants

The research involved a cohort of 302 PE-FTs, 202 (66.9%) males and 100 (33.1%) females, from total 314 PE-STs studying in the Higher Institute of Sport and Physical Education (ISSEP) Tunis (there are only 3 ISSEP, in Tunisia each has their own teaching practice modality). Twelve participants did not participate in the study. All participants in this study were volunteers. They were recruited from a single Higher Institute of Sport (Tunis). The group of participants consisted of the third year PE-FT. The ages of the participants varied from 21 to 23 years old and the mean age was 21.62 (SD = 0.67). Nearly half of the participants carried out their teaching practice in an urban high school (N = 49, 16.2%), 69.5% (N = 210) in a semi-urban high school and 14.2% (N = 43) in a rural setting. More than half of the participants (N = 187, 61.9%) did not have any further contact with the work world, while 38.1% (N = 115) had some previous professional experience, mainly in education (teaching, training) and hotel sector. That experience was part-time. They were registered in an introductory practicum to professional training in Tunisia (introductory practicum applied to pedagogy), that is ended, in the last year, by the Fundamental License of Physical Education [13]. This activity serves as an introduction to professional life. The activity lasts two semesters: four hours per week on Tuesday or Thursday for a cumulative total time of 116 hours of teaching [30, 31]. Participants are not paid to participate in the research. They were not informed about the purpose and conception of the research.

Measures

This quantitative study explored the PE-STs appreciations regarding the supervision of their teaching practice. The first goal consists of portraying the trainees’ overall perceptions about the advice provided by CT; their appreciations levels about theoretical and practical knowledge advice supplied, as well as the most negative aspects of their supervision process. The second goal comprises identifying the impact of the cooperative teacher’s knowledge on attractiveness of student teachers. We used the questionnaire consisting of two dimensions in which we have grouped the different types of questions to clarify and give PE-STs the opportunity to share their preoccupation such as CT knowledge impact.

Data were collected through the questionnaire adapted from Inventory of Experiences and Perceptions at Teaching Practice, designed by Caires & Almeida [32], consisting of 20 items: according to a 4-point Likert-type scale ranging from 4 from 1 (never) to 4 (usually) that were tested in a pilot study. The questionnaire includes 3 subscales which describe the training device in teaching practice on three different aspects: (i) The theoretical knowledge (evaluates trainees’ perceptions of the referring to EP objectives and programs, pedagogical advice, choice situations, student evaluation, analysis Base on theoretical approaches); (ii) The practical knowledge (evaluates trainees’ perceptions of the CT conscious of success and failure points, how to communicate and motivate students, transmits experience in sports training, false and transmits general knowledge); (iii) Attractiveness of the profession (evaluates the impact of the CT Knowledge on future-teachers’ professional orientation, stopping work, the feeling of strong anger, the urge to cry). We have grouped the different types of questions to clarify and give PE-FTs the opportunity to share their preoccupation such as CT knowledge and attractiveness impact. Following the quantitative responses obtained from the questionnaire, we analyzed these data using the statistical software SPSS 16 (Statistical Package for social science).

Procedures

First of all, the permission was granted by the Director of ISSEP Tunis and teachers to realize the current study. Then, the researcher collected the PE-STs, explained the stages of the study and the different questions in the questionnaire for PE-STs, oversaw the privacy and uniqueness of answers. In this study, we presented to the PE-STs the different steps of this research to know the phases of the questionnaire. PE-STs were not informed of the purpose and design of the research. PE-STs are questioned by allowing them the freedom to respond, they can express themselves at their ease. Our data was analyzed using a statistic constant.

Statistical Analysis

Analyses were performed using statistical software SPSS 16 (Statistical Package for social science) program. The following variables were calculated using descriptive statistic: frequencies, percentages, and Cronbach alpha index. Assessment of statistical significance between male and female student teachers was performed using a Chi-square. Correlation between CT’s knowledge and attractiveness of PE-ST was applied. A p value less than 0.05 was considered statistically significant.
Results

The CT knowledge

The theoretical knowledge (TK)

Eight items emerged from the data collected and were illustrated in Table 1: Item 1) CT proposes PE-ST to refer to the EP objectives, Item 2) CT proposes PE-ST to refer to the official programs, Item 3) CT transmits advice on the pedagogical aspect, Item 4) CT transmits PE-ST students mastery advice, Item 5) CT transmits PE-ST student security advice, Item 6) CT transmits PE-ST advice of choice situations, Item 7) CT talk about student evaluation, Item 8) CT’s analysis based on theoretical approaches.

Table 1. The different items of the CT theoretical knowledge

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CT proposes PE-ST to refer to the EP objectives</td>
<td>30.5</td>
<td>26.5</td>
<td>27.8</td>
<td>15.2</td>
<td>0.132</td>
<td>5.606</td>
</tr>
<tr>
<td>2. CT proposes PE-ST to refer to the official programs</td>
<td>23.8</td>
<td>16.9</td>
<td>27.5</td>
<td>31.8</td>
<td>0.504</td>
<td>2.345</td>
</tr>
<tr>
<td>3. CT transmits PE-ST pedagogical advice</td>
<td>6.6</td>
<td>12.9</td>
<td>34.1</td>
<td>46.4</td>
<td>0.010</td>
<td>11.409</td>
</tr>
<tr>
<td>4. CT transmits PE-ST students mastery advice</td>
<td>13.6</td>
<td>14.6</td>
<td>33.4</td>
<td>38.4</td>
<td>0.866</td>
<td>0.729</td>
</tr>
<tr>
<td>5. CT transmits PE-ST security advice</td>
<td>7.3</td>
<td>16.9</td>
<td>32.5</td>
<td>43.4</td>
<td>0.094</td>
<td>6.392</td>
</tr>
<tr>
<td>6. CT transmits PE-ST advice of choice situations</td>
<td>10.3</td>
<td>23.5</td>
<td>40.4</td>
<td>25.8</td>
<td>0.416</td>
<td>2.844</td>
</tr>
<tr>
<td>7. CT talk about student evaluation</td>
<td>16.2</td>
<td>29.5</td>
<td>34.8</td>
<td>19.5</td>
<td>0.671</td>
<td>1.548</td>
</tr>
<tr>
<td>8. CT analysis Based on theoretical approaches</td>
<td>28.1</td>
<td>26.5</td>
<td>29.8</td>
<td>24.5</td>
<td>0.000</td>
<td>19.928</td>
</tr>
</tbody>
</table>

The practical knowledge (PK)

Eight items emerged from the data collected and were illustrated in Table 2: Item 1) CT conscious of PE-ST success and failure points, Item 2) CT impose these ideas to PE-ST, Item3) CT learns PE-ST how to communicate with students, Item 4) CT learns PE-ST how to motivate students, Item 5) CT transmits his experience in sport training, Item 6) CT compare his experience to PE-ST, Item 7) CT false PE-ST knowledge, Item 8) CT Transmits general knowledge.

Table 2. The different items of the CT practical knowledge

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CT conscious of PE-ST success and failure points</td>
<td>10.3</td>
<td>16.2</td>
<td>36.8</td>
<td>36.8</td>
<td>0.304</td>
<td>3.635</td>
</tr>
<tr>
<td>2. CT impose his ideas to PE-ST</td>
<td>12.9</td>
<td>19.9</td>
<td>30.5</td>
<td>36.8</td>
<td>0.587</td>
<td>1.932</td>
</tr>
<tr>
<td>3. CT learn PE-ST how to communicate with students</td>
<td>17.5</td>
<td>22.5</td>
<td>33.4</td>
<td>26.5</td>
<td>0.374</td>
<td>3.118</td>
</tr>
<tr>
<td>4. CT learn PE-ST how to motivate students</td>
<td>11.6</td>
<td>21.9</td>
<td>38.1</td>
<td>28.5</td>
<td>0.331</td>
<td>3.422</td>
</tr>
<tr>
<td>5. CT transmits PE-ST how to motivate students in sports training</td>
<td>40.7</td>
<td>28.8</td>
<td>16.9</td>
<td>13.6</td>
<td>0.110</td>
<td>6.023</td>
</tr>
<tr>
<td>6. CT compare his experience to PE-ST</td>
<td>36.1</td>
<td>26.5</td>
<td>22.8</td>
<td>14.6</td>
<td>0.038</td>
<td>8.422</td>
</tr>
<tr>
<td>7. CT false PE-ST knowledge</td>
<td>34.1</td>
<td>27.2</td>
<td>26.8</td>
<td>11.9</td>
<td>0.014</td>
<td>10.677</td>
</tr>
<tr>
<td>8. CT transmits PE-ST general knowledge</td>
<td>9.6</td>
<td>21.2</td>
<td>44.7</td>
<td>24.5</td>
<td>0.978</td>
<td>0.197</td>
</tr>
</tbody>
</table>

Significant gender differences were also found for CT transmits PE-ST pedagogical advice ($X^2 = 0.010, P = 11.409$; females stronger), CT analysis Based on theoretical approaches ($X^2 = 0.000, P = 19.928$). No significant gender differences were found for CT proposes PE-ST to refer to the EP objectives ($X^2 = 0.132, P = 5.606$), CT proposes PE-ST to refer to the official programs ($X^2 = 0.504, P = 2.345$), CT transmits PE-ST students' mastery advice ($X^2 = 0.866, P = 0.729$), CT transmits PE-ST security advice ($X^2 = 0.094, P = 6.392$), CT transmits advice of choice situations ($X^2 = 0.416, P = 2.844$), CT talks about student evaluation ($X^2 = 0.671, P = 1.548$).
**Table 3. The attractiveness of the profession**

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consider another professional orientation</td>
<td>54.6</td>
<td>22.8</td>
<td>13.9</td>
<td>8.6</td>
<td>0.866</td>
<td>0.732</td>
</tr>
<tr>
<td>2. Consider stopping work in an internship</td>
<td>58.9</td>
<td>20.5</td>
<td>15.9</td>
<td>4.6</td>
<td>0.227</td>
<td>4.339</td>
</tr>
<tr>
<td>3. Have the feeling of strong anger, the urge to cry</td>
<td>31.1</td>
<td>22.2</td>
<td>32.1</td>
<td>14.6</td>
<td>0.000</td>
<td>22.00</td>
</tr>
<tr>
<td>4. Have thought to be in a bad situation</td>
<td>23.2</td>
<td>30.5</td>
<td>32.5</td>
<td>13.9</td>
<td>0.909</td>
<td>0.544</td>
</tr>
</tbody>
</table>

**Table 4. Correlations between the CT theoretical knowledge and the PE-ST attractiveness**

<table>
<thead>
<tr>
<th>Items</th>
<th>Correlation</th>
<th>TK1</th>
<th>TK2</th>
<th>TK3</th>
<th>TK4</th>
<th>TK5</th>
<th>TK6</th>
<th>TK7</th>
<th>TK8</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP 1</td>
<td>Pearson Correlation</td>
<td>.036</td>
<td>.043</td>
<td>.048</td>
<td>.005</td>
<td>.108*</td>
<td>-.020</td>
<td>-.036</td>
<td>.118*</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.266</td>
<td>.227</td>
<td>.201</td>
<td>.463</td>
<td>.031</td>
<td>.362</td>
<td>.265</td>
<td>.020</td>
</tr>
<tr>
<td>AP 2</td>
<td>Pearson Correlation</td>
<td>.043</td>
<td>.046</td>
<td>.015</td>
<td>.108*</td>
<td>.024</td>
<td>.009</td>
<td>.016</td>
<td>.124*</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.229</td>
<td>.212</td>
<td>.400</td>
<td>.030</td>
<td>.339</td>
<td>.435</td>
<td>.392</td>
<td>.016</td>
</tr>
<tr>
<td>AP 3</td>
<td>Pearson Correlation</td>
<td>.043</td>
<td>-.019</td>
<td>-.074</td>
<td>.088</td>
<td>-.003</td>
<td>-.038</td>
<td>.008</td>
<td>-.042</td>
</tr>
<tr>
<td></td>
<td>N</td>
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<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.226</td>
<td>.369</td>
<td>.100</td>
<td>.065</td>
<td>.481</td>
<td>.254</td>
<td>.444</td>
<td>.233</td>
</tr>
<tr>
<td>AP 4</td>
<td>Pearson Correlation</td>
<td>-.010</td>
<td>-.027</td>
<td>-.043</td>
<td>.070</td>
<td>.006</td>
<td>-.074</td>
<td>-.084</td>
<td>.054</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.431</td>
<td>.320</td>
<td>.228</td>
<td>.112</td>
<td>.459</td>
<td>.100</td>
<td>.073</td>
<td>.175</td>
</tr>
</tbody>
</table>

Note: **. Correlation is significant at the 0.01 level (1-tailed). *. Correlation is significant at the 0.05 level (1-tailed).
“CT impose his ideas to PE-ST” (r=0.019; p=0.120), “CT compare his experience to PE-ST” (r=0.016; p=0.124), “CT false PE-ST knowledge” (r=0.025; p=0.113) and “CT’s analysis Based on theoretical approaches” (r=0.013; p=0.129). “Have the feeling of strong anger, the urge to cry” was only significantly associated with “CT false PE-ST knowledge” (r=0.000; p=0.237). “Have thought to be in a bad situation at the internship” was only significantly associated with “CT false PE-ST knowledge” (r=0.000; p=0.204).

Discussion
Le role of CT is to provide a training quality in terms of teaching practice for student-trainees that meet the challenges and requirements of work environment as a whole, which have not been recognized. Thus, the purpose of this research was to identify CT knowledge problems (academic and experiential knowledge) and analyze the impact on attractiveness of student teachers (PE-STs) which are believed to be important for a successful teaching and training device in the workplace.

According to our results, the workplace is the learning environment in which the trainee student is located and integrates the material device, the objects of knowledge or know-how, previous acquisitions and the memory of the class. In this context, the concept of didactic contract is central, concentrating the rules that organize the teacher / student / knowledge relationship. It is the anchor from which didactic observation can be structured [33]. As part of the training contract, Carlier [16] suggests clarifying the mutual expectations between PE-ST and CT according to the internship objectives. The CT must take the initiative of establishing the contract: “Me, Cooperative Teacher, what are my strengths, my specificities? What can I honestly and modestly bring to you, which you will not find elsewhere? “ [14]. According to Darnis & Magendie [34], CT adopts an investigative posture and leads the trainee to use his theoretical knowledge, to mobilize them, to confront them with obstacles encountered in the field. In order to properly guide the verbalization of his action, Carlier [14] suggests that the CT establish a trusting relationship and a communication contract with PE-ST. He notices CT enters the trainee’s intimacy through questioning. From his first contact with trainees, Mouton [35] notes that the organization and conduct of the internship that sets up EA will influence the effectiveness of advice and their appropriations.

Our results, Also, showed knowledge problems between CT and PE-ST. Crinon [36] suggests not to lead PE-ST to mourn his practice, rather to lead him to rethink and deepen the meaning through a reflexive return on the discipline and its meaning: by asking what it means to do physical education (PE) with this class? One must ask: How, despite everything, make them do PE?

According to Schon [37] the paradigm that has dominated the research is the reflexive teacher. Moreover, the valued training practices are those that promote reflexivity. In this sense, Paquay [38] asks a question: what strategies to train reflexive practitioners? In these studies, he discovered that the means of training reflexive teachers are multiple: first of all, to carry out a situational diagnosis. Then, produce instrumental approaches to teaching in reference to a theory. Finally, prepare lessons by explaining the choices and associate PE-ST to evaluate their courses. In addition, He noted that the critical point of a formation of “reflexive teacher” is the accompaniment by experienced CT who are accustomed to think of their practices. Concretely, if the internships are prepared, supervised and exploited. They can contribute to the professionalization of reflexive teachers.

Dugal & Amade-Escot [39], also, described each CT attitudes in these interactions. He noticed that the CT adopted three dominant attitudes in these post-lesson interviews: attitudes of investigation, evaluation and decision-making. However, Tannehill & Zakrajsek [40] noticed that the communication structure during the meetings between the CT and PE-ST was organized around suggestions for the improvement of the PE-ST practice rather than around a dynamic that encourages reflection. Also, they stated that CTs meet PE-STs once

Table 5. Correlations between the CT practical knowledge and the PE-ST attractiveness

<table>
<thead>
<tr>
<th>Items</th>
<th>Correlation</th>
<th>PK1</th>
<th>PK2</th>
<th>PK3</th>
<th>PK4</th>
<th>PK5</th>
<th>PK6</th>
<th>PK7</th>
<th>PK8</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP 1</td>
<td>Pearson Correlation</td>
<td>-.075</td>
<td>.025</td>
<td>-.041</td>
<td>.060</td>
<td>.017</td>
<td>.118*</td>
<td>.070</td>
<td>.084</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.096</td>
<td>.334</td>
<td>.241</td>
<td>.151</td>
<td>.386</td>
<td>.020</td>
<td>.113</td>
<td>.072</td>
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<tr>
<td></td>
<td>N</td>
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</tr>
<tr>
<td>AP 2</td>
<td>Pearson Correlation</td>
<td>-.083</td>
<td>.120*</td>
<td>-.073</td>
<td>.000</td>
<td>.060</td>
<td>.124*</td>
<td>.113*</td>
<td>.129*</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.075</td>
<td>.019</td>
<td>.104</td>
<td>.497</td>
<td>.149</td>
<td>.016</td>
<td>.025</td>
<td>.013</td>
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</tr>
<tr>
<td>AP 3</td>
<td>Pearson Correlation</td>
<td>-.077</td>
<td>.085</td>
<td>-.056</td>
<td>-.006</td>
<td>.038</td>
<td>-.042</td>
<td>.237*</td>
<td>.091</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>.090</td>
<td>.071</td>
<td>.167</td>
<td>.457</td>
<td>.253</td>
<td>.233</td>
<td>.000</td>
<td>.056</td>
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</tr>
<tr>
<td>AP 4</td>
<td>Pearson Correlation</td>
<td>-.066</td>
<td>.052</td>
<td>-.052</td>
<td>.012</td>
<td>.039</td>
<td>.054</td>
<td>.204*</td>
<td>.059</td>
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<td></td>
<td>Sig. (1-tailed)</td>
<td>.128</td>
<td>.185</td>
<td>.185</td>
<td>.416</td>
<td>.250</td>
<td>.175</td>
<td>.000</td>
<td>.155</td>
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</tbody>
</table>

Note: **. Correlation is significant at the 0.01 level (1-tailed). *. Correlation is significant at the 0.05 level (1-tailed).
a week in a formal way (scheduled meeting to talk about ES intervention).

Dugal & Amade-Escot [39] found that attitudes of understanding, support and interpretation were less observed. They advanced as interpretation that the frequently attitudes observed in the post-lesson interviews referred to attitudes about their role as teachers of PE, which led to confusion with the CT role. This interpretation is consistent with that proposed by Pelpel [41].

The discomfort, stress, distress and dropout professional in the workplace can be provided by CT knowledge. Our results demonstrate that the impact of CT knowledge problems and attractiveness was significant.

Paquay & Wagner [42] found that the internship is an opportunity for PE-ST to conform to traditional practices, to discover recipes and to gain practical knowledge entirely cut off from theory. He argues that only a reflexive analysis would allow a transposition and an adaptation of this practical knowledge to new situations. Calderhead [43] state that insecure PE-ST cling to these “practical knowledge” to the point that they become hermetic to any theorizing.

In describing the forms of joint commitments and interactions, Trohel et al. [44] noticed that the CT is not trained in the role of tutor; they act according to their professional experience in teaching physical education. Darnis & Magendrie [34] propose to train mentors in counselling skills so that they are able to encourage reflective analysis in ES and engage in an active search for solutions to problems encountered. Thus, The CT must secure and support the PE-ST, both materially and psychologically. Rajuan et al. [45] opined to introduce trainees to students and to give them as much information as possible about the program and materials.

In most countries, according to Paquay [46], the teaching profession tends to be considered a profession. Thus, a professional is a person who performs intellectual acts autonomously and responsibly. The professional is autonomous since he is able to self-regulate and guide their action and learning through critical analysis of the results of his practice. Wideen [47] defines the teacher as a strategist who updates his basic knowledge and tries a new approach to improve the efficiency of his practice. Perrenoud [48] state that this is the ability to capitalize on the experience and reflect on its practice to reorganize it. The practitioner according to Tardif [49] constitutes an experiential knowledge in evolution. Paquay [38] found that the theoretical and pedagogical skills are acquired through long training.

Conclusion

This article focuses on the role of supervisory knowledge in the professional development of future teachers. In addition, it describes a teacher development monitoring framework, reflect on teaching practices, and reflection on a more integrated knowledge of theory and practice of the teaching profession. The questions addressed in this study will encourage CT to reflect on their own knowledge, training device and to include them in the process of accompaniment of PE-STs. Our results reflect the views of all the population of PE-ST exercising their traineeship in schools of Tunis. In light of our results, it is possible to make a statement concerning CT teaching practice and share PE-ST preoccupation such as knowledge impact. We are far from an ideal accompaniment situation and PE-ST problems that life must draw the attention of the priority of the internship responsible. Furthermore, the hypothesis is verified: CT teaching practice can be characterized by a high variability, namely knowledge on a scale Frequency converter.

According to some of the literature, CT was a person of alternation between academia and training, a key element on the student teachers’ emotional balance and support for teaching at time of the teaching profession [50, 30, 51]. It is in the knowledge interchange setting that the student teachers seem to find more adequate answers emerging during the practice, helping him/her to overcome the confusion and discomfort, the feelings of incapability and doubt their practices [6, 52-54].

In Tunisia, we saw that teaching practices offer relatively favorable climate training. This statement should hold the attention of CT, supervisors, university teachers and people in charge of training, and get them to think a light of PE-STs preoccupation. So, teaching practices are calling for new developments in the near future. Data from PE-STs provide lighting and additional lines of investigation to improve teaching practices.

Conflict of interest

The authors declare no conflict of interest.

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