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Articles and Statements

The Acute Effects of Greek Dances on Old People's Self-Esteem

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Abstract

The purpose of the present study was to examine the effect of a single bout of Greek dances on the self-esteem of old people. A hundred and twelve subjects, (89 women and 23 men), 65-88 years old, were separated to an experimental group (n=55) which participated in Greek traditional dances and a control group (n=57) which was discussing and watching television, both for one hour. The State Self-Esteem Scale (Heatherton, Polivy, 1991) was used to measure performance self-esteem, social self-esteem and appearance self-esteem. The scale was completed about 5 min before and after the Greek traditional dances' performance and the discussing and watching television session. For data analysis, *descriptive* analysis, the *non-parametric test Wilcoxon* of the *SPSS ver. 17.0* for windows was used. After dancing, significant increases in performance self-esteem (z=-5.92, p<0.001), social self-esteem (z=-3.16, p<0.01), as well as appearance self-esteem (z=-3.90, p<0.001) were observed. Likewise, no significant difference in control group was observed. Consequently, from the present results it can be said that Greek dances, as a form of physical activity, is an effective factor for the improvement of elderly people's self-esteem.

Keywords: single bout, traditional dance, performance, appearance, sociability, efficiency.

1. Introduction

The importance of self-esteem is great, since people with high self-esteem are in a better mental state and evaluate more positively their personal value, their competence and their relationships with others (Berryman-Miller, 1988; Kim et al., 2002). In addition, people with high self-esteem have fewer health problems, enjoy themselves and participate in a wide variety of activities, feel certain for their ability to deal with difficult situations despite failures and obstacles, are more flexible and adaptable to changing situations, they are also happy, energetic, enthusiastic and enjoy life (Kleon, Wilson, 2007). It is important, therefore, the general assessment made by the individual for themselves, that is, the whole of the thoughts and feelings one has for themselves (Simou, Papanis, 2007) to be positive.

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Typical or basic self-esteem is the most stable aspect of an individual's self-worth emotions and is relatively consistent after adulthood (Crouch, Straub, 1983). State self-esteem, however, refers to the emotions of self-worth of a person subject to change, depending on the particular situation (Butler et al., 1994). Therefore, state or functional self-esteem refers to the changeable type of self-esteem that can be altered, for example in cases of acute or chronic stress, such as illness or unemployment (Crouch, Straub, 1983), or during participation in physical activity, as well as with physical condition (Sharkey, 1997).

Studies on the effects of physical activity have shown that participation in physical activity leads to positive self-perception and to improvement of self-esteem in both children (Gruber, 1986) and adults (Sharkey, 1997). In addition, other studies showed a very high correlation between self-esteem and physical activity (Patitsa et al., 2011; Spence et al., 2005).

It is worth mentioning that from the components of an exercise program, fitness activities were the most effective ones in developing self-perception (Gruber, 1986). Therefore, physical activity and physical condition improve self-perception, since when people take control of their lives, lose weight and improve their strength, stamina and appearance, and they feel better for themselves and their body. This new belief can change the attitude towards life, even the personality of an individual. As activity and physical condition change body image, this renewed belief in the body can be an important step for improved personal relationships. Thus, self-esteem can increase during physical activity, perhaps by improving physical fitness and self-perception (Sharkey, 1997). People who train, therefore, and those who are in a better physical condition, than those who are in a less well-off physical condition, have more positive overall self-esteem, higher self-perceptions and higher bodily perceptions (Berger, 1994). Furthermore, significant correlations have been reported between changes in the parameters of physical condition and self-esteem (Spence et al., 2005). Changes in physical condition lead to increased self-efficacy, enhancing physical competence and resulting in increased overall self-esteem (Sonstroem, Morgan, 1989).

It is also worth noting that self-esteem has an innate effect on anxiety (Sassaroli, Ruggiero, 2005) and on behaviors which harm people's health, such as reduced physical activity, smoking and alcohol. Physical activity, by being associated with the development of more positive self-perceptions, could help individuals reduce common stress responses. Presumably, the feeling of competence, liking someone's self and feeling good about them, are feelings that are conversely related to stress. Instinctively, people with positive self-perceptions or high levels of self-esteem would be less likely to appreciate their skills and talents as insufficient in order to meet the required behavior (Berger, 1994). It is very important, therefore, that the increased feelings of self-esteem achieved through physical activity can lead to a reduction in stress and symptoms of depression (Barron, Kenny, 1986; Ekeland et al., 2004). Consequently, it appears that participating in physical activities is advisable for self-esteem improvement.

However, although the effects of physical activity on self-esteem have been studied to a satisfactory degree (Ekeland et al., 2004; Patitsa et al., 2011; Spence et al., 2005; Sonstroem, Morgan, 1989), the effects of dance, and more specifically the acute effects of Greek traditional dances as a form of physical activity, have not been studied yet sufficiently, especially with reference to a very sensitive age group such as elderly people. Therefore, it remains to examine the effects of Greek traditional dances on old people's self-esteem. Thus, the purpose of this study is to address this issue to old people's self-esteem, by examining the pre- and post-dancing levels of performance self-esteem, social self-esteem and appearance self-esteem.

2. Methods

Sample

From all the Centres of Old People's Open Protection (C.O.P.O.P.) in the city of Thessaloniki, seven were chosen randomly. From the lists of the members kept in each C.O.P.O.P., 140 members, 20 members from each C.O.P.O.P., that fulfilled the inclusion criteria, that is participating only in a group dancing program for learning and performing Greek traditional dances to the C.O.P.O.P. or visiting the C.O.P.O.P. in order to discuss with other members, watch television and pass their time, were randomly chosen. Subsequently, a communication/invitation to each chosen member, in regard to the research was made. After that, a total of a hundred and twenty three (123) members volunteered to participate in the research.

A written informed consent for the participation in the research was obtained from each subject. All the subjects, before the beginning of the research, underwent medical control so that it could be certified that they do not suffer from any cardiovascular or other disease and, also, that they do not take any medication. Additionally, they answered a questionnaire about any health problems, while a research assistant was present in order to give any essential clarifications if there were any questions. Eleven subjects who were found to fulfil the exclusion criteria, that is health problems, or/and medication that could affect the results, or/and extra participation in exercise programs, were excluded from the research. Finally, a hundred and twelve (112) healthy members of the seven different C.O.P.O.P. (89 women and 23 men) participated in the research. Subjects' age ranged from 65 to 88 years (M=67.47, SD=3.98). The subjects were, then, separated to an experimental (group A) (n=55) and a control group (group B) (n=57), according to the following criteria: a) the subjects who had participated only in a group dancing program for learning and performing Greek traditional dances to the C.O.P.O.P. and no other structured dancing or exercise program, constitute group A, b) the subjects who didn't participate in any structured program of dancing or exercise, but were visiting the C.O.P.O.P. in order to discuss with other members, watch television and spend their time, constitute group B. It should be noted that the subjects of the experimental group at the beginning of the research were at the 18th session/lesson of Greek dances attendance.

Procedure

An approval for conducting the research was given from the committee of each C.O.P.O.P., after the aim and the treaties of the research were described. Procedures were in agreement with the ethical standards of the Declaration of Helsinki of the World Medical Association (2000).

All the subjects came to the C.O.P.O.P. where they were members, in scheduled afternoon hours. Before the beginning of the research, a description of general requirements was given and the aim of the research was also described to the participants without any briefing relative to previous research findings. The psychological instrument was also presented and the instructions were explained. The need for absolute honesty and precision was particularly emphasized.

Afterwards, the subjects of the experimental group participated in a group program of Greek traditional dances' performance, each and every one to the C.O.P.O.P. where they were members. Each session of Greek traditional dances was conducted by teachers of physical education with extensive practical experience and was exactly the same in all C.O.P.O.P., with regard to the dances, the number of dances, their duration and the accompanying music, as well as the number and duration of breaks. The performed Greek traditional dances were from different areas of Greece. In order to begin to dance the subjects were holding each other's hands, creating a hemicycle. The performed dances included a variety of simple kinetic patterns with music accompaniment. The dances' intensity ranged from low to moderate, with frequent rhythm alternations, so that the subjects could keep dancing continuously throughout the dance session. Essential breaks of approximately 10 sec in between dances in order to change dance were made. The duration of each dance was about 2.5 to 3 min. The session duration was 60 min in total. The subjects of the control group, on the other hand, were asked to stay in a room all together, free to discuss with each other or watch television. The discussing and watching TV session duration was 60 min in total.

Scale of measurement

The State Self-Esteem Scale (SSES), of Heatherton and Polivy (1991), is a self-rating scale designed to measure state-related changes in self-esteem. The scale facility and brevity allows its fast and repeated use by the researchers even during exercise. The SSES is a 20-item scale that measures a participant's self-esteem at a given point in time. The 20 items are subdivided into 3 components of self-esteem: 1) performance self-esteem, 2) social self-esteem and 3) appearance self-esteem. All items are answered using a 5-point scale (1=not at all, 2=a little bit, 3=somewhat, 4=very much, 5=extremely). SSES demonstrated high internal consistency (α= .92), and the three-factor structure was verified by factor analysis in men and women (Heatherton, Polivy, 1991). SSES was completed about 5 min before and after the Greek traditional dances' performances and the discussing and watching TV sessions. SSES was administered in a counterbalanced order, which

was reversed at the post-test and translated in Greek following a standard procedure involving the discussion of multiple alternative wordings by a group of five bilingual experts.

Data analysis

For the statistical analysis the statistic packet SPSS/PC Version 17.0 for windows was used. The non-parametric test *Kolmogorov-Smirnov* was used to evaluate the normal distribution of the sample. Moreover, descriptive analysis and the non-parametric test *Wilcoxon* was also used to evaluate significant differences between measurements (before and after the Greek traditional dances, and before and after the discussing and TV watching sessions, too). The level of significance was set to $p<0.05$.

3. Results

In Table 1 the anthropomorphological characteristics of the subjects of both groups are presented (Table 1).

Table 1. Sample's characteristics

Parameters	Group A (experimental) Mean±*SD*	Group B (control) Mean±*SD*
Age (years)	65.95±2.04	68.95±4.79
Height (cm)	163.60±5.15	160.65±5.68
Weight (kg)	74.47±7.39	74.21±9.94
Body Mass Index (kg/m²)	27.89±3.20	28.78±3.79

The fluctuation of the performance self-esteem factor as well as the existence of statistical differences between the pre- and post-measurements of Greek dances bout for the experimental group and before and after the discussion and TV watching bout for the control group is shown in Figure 1, as well as in Table 2.

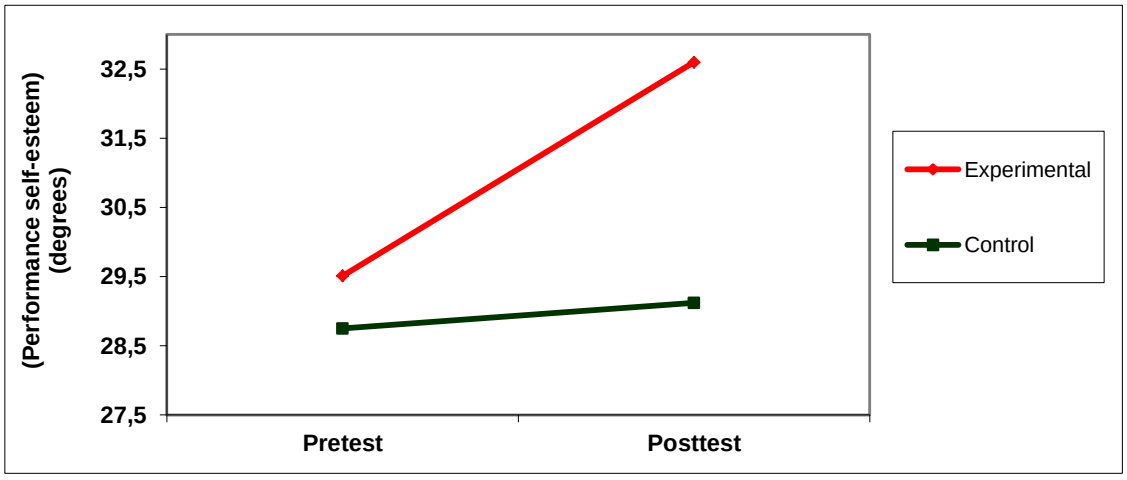

Fig. 1. Performance self-esteem (x±SD)

Performance self-esteem followed a significant upward trend after the Greek dances concerning the subjects of the experimental group, while it remained almost unchanged for the control group after the discussion and TV watching.

Table 2. Performance self-esteem (x±SD)

Group	Pretest (degrees)	Posttest (degrees)	z & p
Experimental	29.51±3.37	32.60±2.44	-5,92 <0,001
Control	28.75±2.75	29.12±3.16	NS

The fluctuation of the social self-esteem factor, as well as the existence of statistical differences between the measurements before and after the Greek dances bout for the experimental group and before and after the discussion and TV watching bout for the control group is shown in Figure 2, as well as in Table 3.

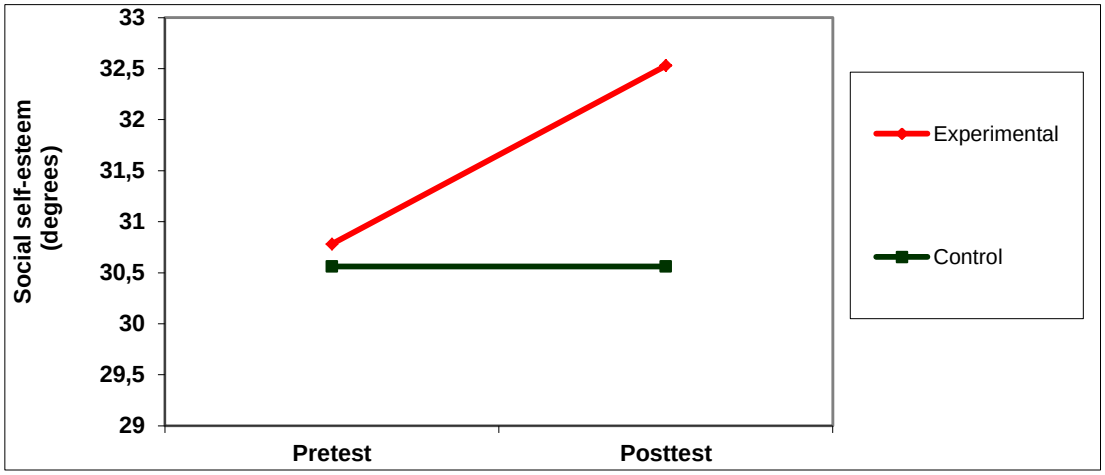

Fig. 2. Social self-esteem (x±SD)

The social self-esteem followed a significant upward trend after the Greek dances for the individuals in the experimental group, while it remained almost unchanged for the control group after the discussion and TV watching (Figure 2, Table 3).

Table 3. Social self-esteem (x±SD)

Group	Pretest (degrees)	Posttest (degrees)	z & p
Experimental	30.78±4.03	32.53±2.92	-3.16 <0.01
Control	30.56±3.22	30.56±3.84	NS

The fluctuation of the appearance self-esteem factor, as well as the statistical differences between the measurements before and after the Greek dances bout for the experimental group and before and after the discussion and watching TV for the control group is shown in Figure 3, as well as in Table 4.

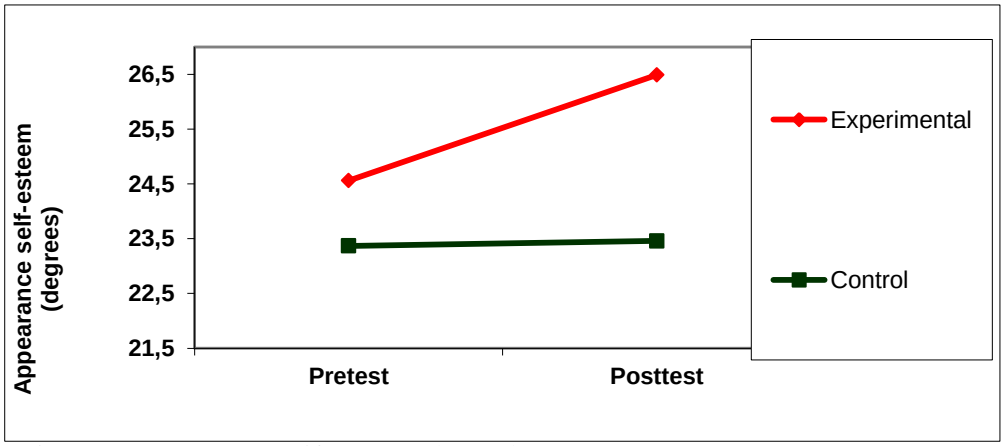

Fig. 3. Appearance self-esteem (x±SD)

The appearance self-esteem had a significant increase after the Greek dances for the subjects of the experimental group, but remained almost unchanged for the control group after the discussion and TV watching (Figure 3, Table 4).

Table 4. Appearance self-esteem (x±SD)

Group	Pretest (degrees)	Posttest (degrees)	z & p
Experimental	24.56±2.79	26.49±3.10	-3.90 <0.001
Control	23.37±3.81	23.46±3.71	NS

Table 5 summarizes the effects of Greek dances bout and of discussion and TV watching bout on the SSES factors studied.

Table 5. Alterations to SSES factors for Group A and B

SSES	Group A	Group B
Performance self-esteem	↑ ***	**NS**
Social self-esteem	↑ **	**NS**
Appearance self-esteem	↑ ***	**NS**

*: p<0.05 **: p<0.01 ***: p<0.001 NS: μη-σημαντική

Table 5 clearly shows the significant positive effect of Greek dances bout on the factors of self-esteem of elderly people. On the contrary, it seems that discussing and watching TV did not have any effect on the factors studied in the control group.

4. Discussion

The results of this research showed that the individuals of the experimental group after their participation in the Greek dances' bout increased significantly the performance self-esteem, the social self-esteem and the appearance self-esteem. So, it could be said that dancing movements strengthen self-esteem (Bunce, 2006; Kowarzik, 2006; Paulson, 2005a; 2005b). In agreement with our study, other studies that used dance programs found that the elderly people who participated in them improved their self-esteem and their mental state and assessed more positively their personal value, their competence and their relationships with others, compared to the control group that lived a sedentary lifestyle (Berryman-Miller, 1988; Kim et al., 2002).

From the results of the present research, it is clear that participation in Greek dances increased significantly the performance self-esteem, the social self-esteem, and the appearance self-esteem of the elderly in the experimental group, compared to those in the control group who

participated in the discussion and sedentary type activities. It can, therefore, be said that the participation in physical activities, in the form of Greek dances, leads to increased emotions of self-esteem. Similar results were found in a program of practice with movements of traditional Korean dances, as moral satisfaction, improvement of self-confidence and of psychological state were observed in old women participants (Kim et al., 2002). Furthermore, Berryman-Miller (1988) found out that the 8-month application of a dancing program to individuals aged 55 to 85 years old, affected their self-esteem and well-being positively and led to mood state improvement.

The mechanisms for the induced improvements in self-esteem appear to be more of psychosocial nature (Taylor, Fox, 2005). It is worth noting that the observed effects of Greek dances are very important since self-esteem has an innate effect against anxiety (Sassaroli, Ruggiero, 2005) and that the increased emotions of self-esteem can reduce the symptoms of depression (Barron, Kenny, 1986). The emphasis on the reduction of depression shows that dance can promote mental health (Paulson, 2009). Moreover, the most positive assessment of the personal value, the competency and the relationships of older people who participated in a dance program are factors which contribute positively to the quality of life (Berryman-Miller, 1988).

In agreement, Bunce (2006) reports that dance therapy for the elderly patients with Parkinson's disease can increase body awareness, self-esteem, communication, mobility skills, and also provide reduction of depression. It has also been found that a program of social / traditional dances helped the old women with dementia who participated, to reconstruct their remaining skills and to present in their personal style the dance movements they were taught and their experiences, to communicate as a group and to try positive emotions (Palo-Bengtsson et al., 1998). It seems that the benefits of therapy via dance movements concern the development of a favorable environment for elderly people with dementia living in nursing homes (Kowarzik, 2006). In addition, Connor (2000) reports that recreational folk dance provides social, physical, creative, cultural and intellectual benefits to the elderly as a moderate form of exercise. All of these benefits can lead the dance participants to an increase in performance self-esteem, as it has been observed in the present study.

As for the sociability that emerges from the dance, it is for many people more than an expression of the whole group/community, since it includes rituals in which group behavior is characteristic, regardless of the social and economic class of every person (O'Connor, 1997; Turner, 1974). The dance, and more specifically the Greek dance that is basically circular dance, can be described as an inner closed social world. The social nature of dance actuates individuals to express the need to hold each other, to touch, to have general contact, and to do things together as a group. Moreover, in dance groups there is a collective spirit and understanding, and this is good as the participants feel they belong somewhere. Moving together is a powerful force in the emotional connection of the individual with the group, which has been attributed to dancing in many historical and social periods (McNeill, 1995). The concept of group/community is not expressed in an oral or written way. It permeates the consciousness of the dancers and affects their social behavior inside and outside the dance (Cooper, Thomas, 2002) and it can be said that it emerges through the increase of the social self-esteem of the participants in the dance, which was observed in this research.

So, it could be said that dancing has a big importance for the elderly people, because they have the chance to enjoy themselves, as they used to, when they were young (Atchley, 1993). Additionally, dancing has been their basic social activity from their adolescence until their aging (Cooper, Thomas, 2002). Besides, Greek traditional dance is an integral part of Greek culture. Moreover, it is one of the most indicative characteristics of the temperament, history and cultural identity of Greek people, because it is connected with the same spontaneous, instinctive expression of human mind and body. Greek traditional dance, music and songs are not just social life expressions and depictions, but also organic and integral elements of social life (Filias, 1999). Greek traditional dance is a familiar and favorite activity for older Greek adults.

Furthermore, in agreement with the present results, Palo-Bengtsson et al. (1998) found that music and dance stimulated social interaction and increased communication among the elderly people who have joined long-term care programs. In addition, dancing creates a sense of group/community involvement among the elderly, providing a chance to dress officially, to change (Cooper, Thomas, 2002; Maristela, Vieira, 2007). Hurd-Clarke et al. (2009) and Twigg (2008) highlight the role of dressing in relation to aging and self-expression as a fundamental aspect of the

experience of incarnating life for the elderly and it can be said to stimulate the appearance self-esteem observed in this research.

On the other side, after the discussing and TV watching session for the control group, the subjects' self-esteem remained unchangeable, while the state of the subjects of the experimental group improved significantly after dancing Greek traditional dances, indicating the significant positive effects of Greek traditional dances on old individuals' self-esteem. Consequently, it could be said that dancing is an effective factor of self-esteem improvement for old people. This is probably happening because dancing contributes to the creation of a special stream state of consciousness which is related to various ecstasy levels, or, in other words, to a state of enthusiasm. Therefore, it appears that dancing is not simply and only the means of body-spirit reconnection. It is a kinetic activity that can, as the primitive, ritual dances, use brain properties in order to connect, via the conceiving rhythm, the internal and the external, that is the individual and the world, a fundamental element in psychotherapy (Schott-Billmann, 1997).

Dancing, also, constitutes a form of exercise. Thus, it is a fact that dancing in the form of a physical activity of moderate intensity, of approximately 3-5 METs, contributes to the improvement of physical fitness (Balady, Weiner, 1987; Klissouras, 2004). Dancing can lead to a calorie loss that amounts to 300-360 Kcal/h, when dancing in a low intensity pace, while when dancing in a more intensive way, individuals may burn from 420 up to 480 Kcal/h (Byrne, 1991; Klissouras, 2004; Papanikolaou, 1993).

Moreover, it has been shown that exercising in Greek traditional dances increased old people's HR from 75.6 bpm at rest to 96.4 bpm in 30 min, and to 103.92 bpm in 60 min, that is the end of Greek traditional dances bout. Thus, old people's HR was increased significantly and approximately 63 % of their HRmax was activated (Mavrovouniotis et al., 2010). This exercise intensity can develop and maintain older people's cardiorespiratory fitness (American College of Sports Medicine, 1998). In particular, the HR exercise benefit range (EBR) for people older than 61 years old is fluctuated from 85 to 139 bpm (Chase, http://www.plu.edu/~chasega/main.htm). Consequently, the physical load caused from the Greek traditional dances is found to be within the EBR for the specific age group. Therefore, Greek traditional dances could constitute a part of a regular exercise program aiming an improvement on physical fitness, and thus on physical benefits for old people (Mavrovouniotis et al., 2010).

In this direction, it was found out that the elderly people, who participated in a Greek dances' program, consider their health better, as well as their health and their physical activity better in comparison with their age peers, meaning the subjects of the control group who didn't participate in a Greek dances' program. So, the value of Greek dances rises from the rank as a form of exercise, the participation in which may be extremely useful in the enhancement of positive definitions of health. Consequently, Greek dances as a physical activity may be extremely useful for elderly people (Mavrovouniotis et al., 2016).

In addition, it has been found that the old people who participate in Greek dances' programs have a better picture for their body limbs and functions, as well as bigger satisfaction than their age peers who do not participate in similar programs (Argiriadou, 2013). Furthermore, it has been found out that Greek dances induce significant decreases in state anxiety and psychological distress, significant increases in positive well-being, as well high levels of enjoyment. Besides, the subjects who enjoyed highly their participation in Greek dances bout had significantly higher positive well-being, and felt lower psychological distress. So, it could be said that the felt and expressed high enjoyment caused by the participation in Greek dances may be a crucial factor in the improvement of the psychological well-being (Mavrovouniotis et al., 2010; Argiriadou et al., 2013).

Consequently, the Greek traditional dances that the people performed in the present study, as an aerobic exercise with music accompaniment, are considered a pleasant form of exercise that helps the participants to escape from their problems. Besides, pleasure/enjoyment from physical activity appears to be a main factor in the improvement of psychological well-being and quality of life, which is closely related to the concept of flow (Berger, 1993; Wankel, 1993). When a person is in the condition of flow, concentrates on a limited field of stimuli, loses the sense of time, forgets personal problems, has a "time out" from the daily routine, feels capable and in control, and has a wonderful sense of harmony with the environment (Colussi, 2002; Csikszentmihalyi, 1991).

5. Conclusion

In summary, it can be said that Greek dances are an effective factor in improving the self-esteem of older people. This may be the case since Greek dances contribute both to improving the physical condition of individuals, as a form of physical activity, and to creating a special conscious state of flow associated with different levels of ecstasy or in other words with a state of enthusiasm, pleasure and well-being.

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Impact of the Essential Oil Inhalation on the Functional Condition Shift of the Minigolf Players

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Abstract

Results of the experimental researches are given. The object of the evaluations was the impact of an inhalation of three mixtures of essential oils (activating, relaxing and placebo) on the functional condition of young minigolf players. The impact of the inhalations and fatigue on the functional condition of the players was determined based on the results of arterial pressure and pulse rate measurements and calculated Kerdo index. In addition, the analysis of impact of each of the three odorants on the game results was done.

It was figured out, that all odorants decrease the processes of excitation in the performance of autonomic nervous system. The greatest effect in the excitation decrease is achieved by inhaling activating odorant, effect of which is similar to effect of fatigue. In addition, various individual differences in the odorants effect on functional indexes were detected. Suggested, that the shift in functional condition may be determined by reflex reaction of an organism to deep breath in addition to biochemical impact of the odorants.

The greatest impact on the decrease of the Kerdo index (comparing with inhalations) is caused by fatigue of the players, which is caused by multiple repeats of the same monotonous gameplay actions within several hours. Speaking of odorants impact on sports achievements, it was calculated, that generally the sports results improve after inhaling activating and placebo oil mixtures.

Similarly to evaluation of shifts in functional condition, various individual reactions of players were detected in the form of sports results on stimulus of inhalation of different odorants.

Keywords: psycho-emotional condition, golf, aromatherapy, sports results, olfactomathics.

1. Introduction

Evaluation and control of the player's functional condition during their competitive exercises is one of the factors, that defines the outcome of the sports contest in different kinds of sports. Functional condition of an organism (FCO) of a sportsman directly relates to their psycho-emotional condition, which has following criteria: stress level, optimal readiness and frustration (Rodionov, 2002; Sopov, 2005). Meanwhile, functional condition and psycho-emotional condition impact on each other. This dependence reveals at its most in the kind of sports, that require high accuracy and, sequently, perfect coordination in performing motional actions of the same type.

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Those kinds of sports include following: shooting, golf, minigolf, darts, curling, bowling etc. In all those sports the result, in the end, is defined by how good a sportsman can dose their motions in the amplitude (effort) and direction of their application.

Control of the FCO during the competitions in those kinds of sports usually includes implementation of the techniques, like psycho-muscular, ideo-motor and autogenous regulations (Sopov, 2005) and it mostly leads to the decrease of the sportsman excitation. In addition to these methods of regulating the FCO and increasing the effectiveness, various methods and combinations thereof are used, based on physiological reflexes with respiratory delays, facial muscle relaxation, deep breathing, arbitrary syncopeies etc. (Korolkov, 2015).

All methods of FCO regulation are ultimately implemented in three ways: passive or active, or a combination thereof. The passive method is carried out at the expense of the information-energy costs of the sportsman: through volitional efforts, self-massage, sensory isolation, visualization, etc. This method includes techniques of psycho-muscle, ideo-motor and autogenous regulation. An active method of regulation of the FCO includes any external influences in the form of tactile, acoustic, thermal, mechanical, odorizing, visual and biochemical impacts. Active methods of FCO regulation include acupuncture, taping, the use of warming ointments, listening to musical compositions, inhalation, the use of various substances and that kind of external impacts. Some of these impacts are prohibited by the World Anti-Doping Agency.

Thus, the use of active methods of FCO regulation is delicate and provocative, since it can create advantages for one athlete who uses such methods over other athletes who do not use them.

The distinctive active ways of changing the FCO include artificial inhalation of vapors of medicinal substances by athletes suffering from asthma, and inhalation of ammonium hydroxide vapor by weightlifters before going to the stage.

In a number of practical studies in sprint, gymnastics and swimming, it was found that inhalations with essential oils have a certain effect on the perception of the kinematic parameters of locomotion (Popov et al., 2011). In some studies were found statistically significant changes in athletic performance, associated with odorizing effects (Sentyabryov, 2009). Meanwhile, essential oils belong to homeopathic remedies and the effectiveness of their influence on the human organism is not established in evidence-based medicine (Astafieva, Kobziev, 2017).

Consequently, it is interesting to study the effect of various odorants based on essential oils for controling the FCO in competitive minigolf activities.

2. Methods and organization of the research

The studies were conducted from the January to April of 2017 to evaluate the effect of essential oils on FCO and sports results when playing on a real field for a minigolf in the Olympic Park (city of Sochi) in March 2017.

Three specially formulated mixtures of essential oils were used (Ovchinnikov et al., 2014): placebo, activating and relaxing. The placebo odorant was the essential oil of the grape bones. The activating aroma composition consisted of a 10 % mixture of essential oils: bergamot, ylang-ylang, lavender, lemon, mint, neroli and clary in grape seed oil. The relaxing 10 % mixture was composed of essential oils of basil, bergamot, geranium, lavender, rosemary and eucalyptus.

The effect was carried out by cold inhalation of the complete composition (odor inhalation of 1-2 drops applied to the cotton sponge). The duration of the odor exposure was three minutes. Inhalations were performed five minutes before the beginning of the measurement of blood pressure (BP) and heart rate (HR) or the performance of game actions.

Measurements of blood pressure and heart rate were carried out using the pressure-gauge Digital blood pressure monitor UA-705.

12 athletes aged 10 to 17 years were examined during the studies of the effect of ether odorants on FCO and sports achievements in minigolf.

To determine the FCO, we used systolic and diastolic blood pressure, heart rate and the value of the calculated Kerdo index. The measurements were taken in the morning hours one hour after breakfast before inhalation and after inhalation of each of the three mixtures, and in the evening after the end of the training sessions before dinner. The measurements were carried out for three consecutive days, which allowed to accumulate enough data for statistical processing and to make a judgment about the effect of fatigue on FCO.

The effect of ethereal odorants on the results of the game was evaluated based on the results of control trainings conducted in competitive mode for two days. Within this period of time, each athlete played at least five rounds after inhalation with each mixture and without inhaling essential oils. The accumulated volume of data on sports achievements allowed further correct statistical processing of the obtained results.

The statistical processing of the sets of research results was carried out using a licensed package of multidimensional data analysis Stadia 8.0. The validity of the statistical hypotheses was checked at a level of statistical significance p = 0.05.

3. Results, discussion and perspectives

Evaluation of the effect of odorants on the FSS was carried out based on the results of multiple measurements of blood pressure and heart rate, calculated Kerdo index before and after inhalation with each odorant. The values obtained were then compared with each other. Using the Kolmogorov criteria, Omega square and Chi square, the validity of the hypothesis "Distribution is no different from normal" was established. This allowed further comparisons of sample means using the Student's test. In addition, the values of the functional condition indicators were compared before and after training, which characterized the effect of fatigue on the FCO. The values of sample means for each condition, odorant and indicator are given in Table 1.

Table 1. The values of sample means before and after inhalations with different odorants

Odorant, condition\ indicator	SYS	DIA	HR	Kerdo index
No odorant	112,63	72,63	83,38	13,04
Activating	111,00	70,00	78,00	4,98
Placebo	110,00	69,50	81,00	8,82
Relaxing	110,50	75,00	81,00	9,95
Fatigue	114,50	77,50	79,00	2,18

As follows from the results of Table 1, as a result of inhalations, despite the composition of the inhaled odorant, the values of heart rate and the Kerdo index decreased in all subjects. This indicates a decrease in the processes of excitation in the activity of the autonomic nervous system. Meanwhile, the sharpest decrease in the Kerdo index in comparison with the norm occurred after inhaling the odorant initially assuming an activating reaction.

The effect of placebo inhalation is approximately the same as on inhalation of a relaxing odorant. It can be assumed that the effect of decreasing excitation processes is caused not so much by the chemical composition of the inhaled odorant, but by the reflex decrease in heart rate caused by deep breathing (Sopov, 2005).

In addition, it was found that the greatest effect in reducing excitation processes is still done by fatigue, which causes a significant intragroup decrease in the Kerdo index. The same results in terms of the effect of fatigue on the performance of minigolf players were obtained in previous studies (Korolkov, 2015).

It was found that the differences in selective mean of functional parameters of heart rate and Kerdo index compared to the norm after inhalation by all odorants and as a result of fatigue are statistically significant.

As a result of paired comparisons of FCO indices in norm, after inhalations and fatigue, it was established that the effect of these effects is individually different. Figure 1 shows a histogram of the distribution of effects from these effects, which caused a decrease in the Kerdo index by more than 10 units.

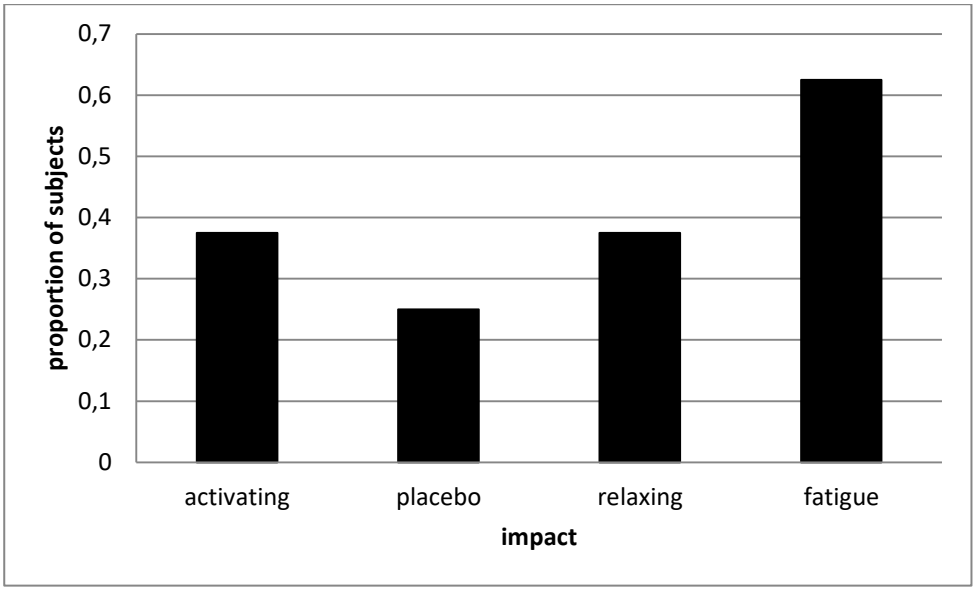

Fig. 1. Distribution of subjects by the effect of various effects on the FCO

According to this figure, inhalation with an activating and relaxing odorant caused a decrease in the Kerdo index in 38 % of the subjects, inhalation of the placebo caused the same changes in 25 % of subjects and fatigue caused the same effect in 62 %. Meanwhile, for some athletes, the same effects of decreasing the processes of excitation arose under the action of various stimuli.

Thus, the use of odorants for controlling the FCO should be carried out with considering the individual reactions of each athlete.

The analysis of the effect of aromatic odorants on the shift in the performance of players was also carried out as a result of repeated practical measurements. Each player at least five times played the game on 15 holes after inhalation with each of the three odorants and without the odorizing effect. Selected average results for each exposure are displayed in Table 2.

According to the data of this table, the best intra-group result was achieved by athletes after inhalation of placebo. In addition, all the average best results were achieved after inhalations, and the results of the game without the odorizing effects were worse. Presumably, we can conclude that the improvement in the results in this case was due to the fact that odorants were inhaled before the game, and not by their biochemical action. That is, the inhalation of odorants before the game has primarily a placebo effect and a reflex reduction in heart rate and Kerdo index as a result of deep breathing, as shown above.

Table 2. Selected average results for different odorizing exposures

Odorant	Activating	Placebo	Relaxing	No odorant
Average result	25,07	24,42	24,64	26,33

Fig. 2 shows the histograms of the distribution of results after inhalation with various odorants. Meanwhile, although the level of statistically significant differences between sample medians was not greater than 0.15, external differences in the distribution of results after inhalations of the activating and placebo odorant as compared with the relaxing one are obvious. Approximately the same effect of the influence of the activating mixture on the decrease in the processes of excitation of players was established in the evaluation of their FCO.

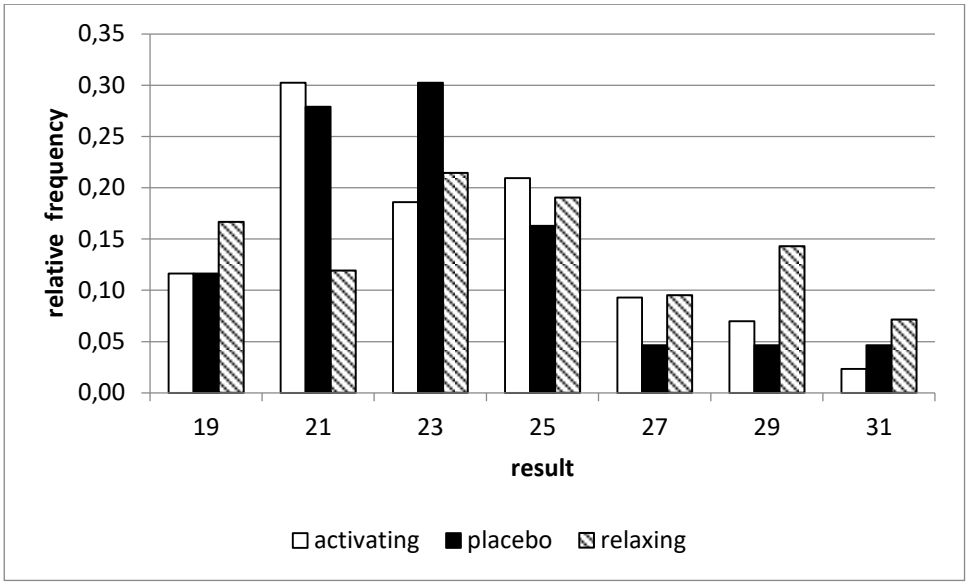

Fig. 2. Distribution of results after inhalation with various odorants

As in the case of the individual effect of odorants on the FCO, their individual impact on the results of the game is also variable. Statistically significant differences in the results of the game compared to the results without inhalations occurred in 50 % of the players after the inhalation with an activating odorant, in 50 % after inhalation of the placebo and in 33 % after inhalation of the relaxing mixture. There were no statistically significant differences in results after inhalations for two players out of 12.

Just as with changing the FCO after inhaling odorants, some players experienced the same effect of the activating and placebo odorant on improving the results of the game.

4. Conclusion

When studying the effect of odorants on the functional condition of athletes, it was found that all odorants, including placebo, lead to a decrease in excitation processes in the activity of the autonomic nervous system. In this case, the greatest effect of reducing excitation is caused by inhalation with an activating odorant, the effect of which is comparable to the effect of fatigue. In addition, various individual differences in the effect of various odorants on the regulation of functional indices have been revealed. It is assumed that changes in the functional state can be determined not only by the biochemical effects of odorants, but also by the reflex responses of the body to deep breathing, which is carried out within three-minute intervals.

It was also found that the greatest influence on the reduction of the Kerdo index, in comparison with inhalations, is caused by fatigue of players, caused by repeated repetition of monotonous game operations of the same type for several hours.

Regarding the effect of odorants on athletic performance, it is established that, on average, the improvement in results occurs after inhalations of the activating and placebo ether mixture. In this connection, it is assumed that this effect can also be caused by reflex reactions to deep breathing, and not only by the chemical composition of the inhaled odorants.

As in the study of changes in the functional condition, various individual reactions of athletes in the form of sports results to stimuli in the form of inhalations with various odorants have been established.

The prospects for further research in this direction include the study of the possibility of reducing monotonous fatigue in minigolf with the help of ethereal odorants of different composition, the effect on the functional condition of certain essential oils, and not their combinations, repeated refining studies of the use of essential oils and their effect on sporting achievements, mental and functional condition of players on large volumes of samples of subjects of the same age and sex.

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The Differences of Kinematic Parameters Triple Jump Between Finalists WCH Berlin, 2009 – WCH Daegu, 2011

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Abstract

Kinematic parameters often crucially influence the performance in athletic disciplines. This is especially evident for top athletes who have almost identical morphological, motor and functional parameters. The differences that affect the sporting result are generally attributed to a better performance technique that is often the consequence of the different values of the individual's kinematic parameters. This study analyzes the differences between the defined kinematic parameters in the discipline triple jump. The sample included 16 male athletes who competed in the finals of the World Championships (Berlin, 2009; Daegu, 2011) and a total of 22 kinematic parameters were selected. The results were obtained by applying the T-test module for small independent samples, confirming the differences between women's finalists in Berlin and Daegu. Statistically significant differences were recorded only in five out of 22 kinematic parameters (23 %). Statistically significant differences were achieved in the rebound angle of hopping (Hop°, T = 3,689; p<0.003); vertical speed of hopping (VVo Hop m/s, T = 5,269; p < 0,000), contact phase duration of hop (T = -3,580; p < 0.003), step (T = -5,193; p < 0,000), jump (T = -1,966; p < 0,071), it is also evident that athletes in Berlin had, on average, shorter time of contact phase in all three parameters (hop, step, jump). An inverse relationship between the speed and the angle of rebounding of the competitors was noticed in both finals, which is a consequence of the speed reduction in each jump, where athletes use a greater swing with free extremities.

Keywords: athletes, World Championship, triple jump, kinematic parameters, differences.

1. Introduction

Triple jump is an acyclic-cyclic movement in structure, and a very demanding and complex athletic discipline characterized by a very high unity of motor skills and abilities (speed, explosive power, coordination, flexibility, balance) that are precisely crucial for successful performance. It is the only jumping discipline that does not require a large explosive effort, but it represents a continuous series of movements, in which each phase depends on the previously performed phase (Jovović, 2006; Schiffer, 2011, Pavlović, 2016). Although each segment of the triple jump can be isolated, it is important that the head has the total activity. During the performance of the triple jump, the synergic effect of the latent and manifest motor space of each triple jumper is very clearly demonstrated. Fatal knowledge and motor abilities (speed-strong abilities, specific forms of endurance, flexibility) jointly define the end result of a triple jump but with a slightly higher motor-endurance result in the end result. No matter how the technique of triple jump is ideal, athletes

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cannot count on top results in this discipline if the listed abilities are not at the required level, and that is top level (Idrizović et al., 2015). Performance in the triple jump is a quantitative expression of factors of both primary and secondary importance. The mastering of a rational and effective technique is a precondition for the greatest realisation of the motor potential of a particular jumper (Miladinov, Bonov, 2004).

To be successful, triple jumpers must possess above average sprint and jumping abilities while at the same time they must have strong muscularity and motor skills (Hayes, 2000). Kreyer (1982) states that the elite triple jumpers of the time achieve the best time at 100m in the interval between 10.4s and 10.7s using a running start of 42-50 m, which depends on their achievements, the acceleration ability and frequency of the step. As with other jumping disciplines, the height of the hips in the rebound affects the efficiency and length of each subsequent phase, i.e. if the hips are higher the amplitude of the flight is higher. The angle under which the hips begin to fly must be as low as possible (below 16°), because through the next phases of the step and the jump the velocity disappears, and the angle of reflection increases automatically, i.e. its explosive power increases with the decrease of the jumper's speed (Schiffer, 2011). The angle of reflection in hopping, stepping and jumping is an individual matter and depends on the morphological, motor dimensions, as well as the control of the triple jump technique, which depends on the modified technique that is applied. With today's top jumpers, the angle of reflection in the hopping phase is from 13°-16°, in the stepping 12°-16°, and in the jumping phase it is 18°-26°. The relationship of these angles with the speed of motion is not linear, but inverse, i.e. with each jump of jumper the speed of movement decreases, and the reflection angle and swing of extremities increases (Pavlović, 2016). The shorter the depreciation and the earlier start of the spring, the body of the jumper moves in a new direction and therefore there is the greater angle of movement.

Since the triple jump is performed in the sagittal level during all jump-phases, there is a disturbance of the equilibrium position, due to the front rotations, unequal work of the hands or landing with incorrectly positioning of the feet (Miller, Hay, 1986). In an attempt to achieve maximum lengths of hopping and stepping, sometimes the jumper dips well in front of the projection of the hips, increasing the reaction of the pad (Rp) and thus interrupts the sequence of the movements (Idrizović, 2010). In order to reduce this effect, the foot and the pad contact must be slightly ahead of the TT projection (hips). This contact requires patience, waiting for the ground to be beneath the leg, and not reaching the ground with the leg. The contact between the feet and pad should be as short as possible, i.e. it must be reflected as soon as possible, and the best way to achieve this is to think of a hopping (I jump - 0,11-0,12sec.) and stepping (II jump - 0,13-0,15 sec.) in terms of reflection, and not on the landing (III jump-0,17-0,19sec) (Jovović, 2006; Pavlović, 2016).

During the rebound, the jumper acts with great forces on the pad, which are manifested in a very short time. In the reflection, certain parts of the locomotor apparatus and in particular the spinal column, suffers from loads that are 4-6 times the weight of the jumper himself. At the moment of reflection that lasts from 0.11 to 0.13 sec. The jumper develops an effort of an average of up to 500 kg (Jovović, 2006; Pavlović, 2016). Regardless to the high technique of athletes, he/she cannot count on top results if he/she does not have a high level of motor skills (all forms of speed, strength, coordination, flexibility). The speed of the triple jumpers from the running start to the landing is relatively large with an average time of about 10 m/s and a tendency of speed falling, which is individual. According to some authors (Jovović, 2006; Idrizović, 2010; Schiffer, 2011; Stanković, & Raković, 2010; Pavlović, 2016), the great influence on the length of the jump has achieved the horizontal velocity during the running start (horizontal component) and the vertical velocity of the bouncing (vertical component) with each reflection and triple jump technique as a whole. This ratio is 3:1, which implies a high speed of running start and a small angle of reflection. The average length of the jumps of today's triple jumpers is 36-38 % - 29-30 % - 33-35 % (Mihajlović, 2010), with the note that there are individual differences among jumpers, where the hopping length is 34-38 %, stepping 28-33 % and jumping 32-34 % (Pavlović, 2016). The mean phase distribution was 36,5 %, 29,3 % and 34,2 % for the hop, the step and the jump respectively (Panoutsakopoulos, Kollias, 2008). The observed phase distribution was similar to that observed in contemporary top competitions (i.e. 2005 WCh in athletics: 36,2 %-29,4 %-34,5 %).

This percentage of the men's finals in Berlin in 2009 was at Idowu (36-30-34%), Evore (37-31-32 %), Copella (34-33-33 %), Taylor (34-29- 37 %), Olson (37-29-34 %), Clayea (33-31-36 %).

These percentage differences in the length of the jumps are conditioned, in addition to the psychosomatic and motor potential of the jumper, by the technique of performing (the hopping is dominant, the jump is dominant or even technique). According to some authors, Jonathan Edwards, the world record holder with 18,29m, had a percentage ratio of jumps (33,10 - 28,50 - 38,40 %) at the time of the record, which was the highest percentage in the third jump compared to the previous record holders. His horizontal acceleration in hopping was 9.48m/s, in stepping 8.39m/s and in jumping 7.20m/s. As a consequence of the decrease in horizontal acceleration, a reflection angle (16-14.5-19°) has been increased, confirming the allegations (Schiffer, 2011; Pavlović, 2016) about the inverse relationship of horizontal velocity and explosive power in the manifestation of hopping, stepping and jumping. Almost identical relationship of these parameters was recorded at B.Wellman (14-17-22°) and P. Idowu (14-13-21°) (Mendoza et al., 2009). They also have a horizontal speed decreasing in each segment of the jump and a reflection angle increasing, which is a confirmation of the inverse relationship of these two kinematic parameters (Hay, 1994; 1997; Yu, 1999). In the triple jump discipline, the explosive power of the jumping type and technical potentials have a significantly higher impact on the end result in triple jump than in the long jump, where there is a positive but not high correlation (r=0,58). However, the research (Panoutsakopoulos, Kollias, 2008) confirms a strong, positive and higher correlation between the speed of the running start and the triple jump (r=0,81). According to some indicators (Hutt, 1989), at a running speed of 10.50m/s in the last 6 meters the predicted result is 17,50m, while for the running speed of 9,40m/s, the predicted result is 14.50m. How important is the speed of the running start in the result performance can be seen in the results of the triple jump recorders. The running start speed in Göteborg of J.Edwards (18.29m) from 11-6m was 9,80m/s, and from 6-1m was 11,90m/s. The same section the recorder Y.Savigne (14,95m) from 11-6m ran at a speed of 9,20m/s, and from 6-1m at a speed of 9,36m/s (Mendoza et al., 2009). It is known that different speeds in running start also give different lengths of long jumps. According to Osolin (2001), it is generally known that an acceleration of 10,0m/s gives a 8m jump length, an acceleration of 9m/s gives 7m, and an acceleration of 8m/s is a score of 6m and the triple jumps should not be higher, and all in the domain of physical and mental possibilities, conative and cognitive characteristics of the contestants (Pavlović et al., 2016). That this fact can be accepted as true is confirmed in the research conducted by Pavlović, Idrizović, Kinov, Joksimović, 2016, who analyzed the differences in the kinematic parameters between the women's finalists in the long jump championships in Berlin, 2009 and in Daegu, 2011. Of all the measured kinematic parameters, the obtained results confirmed the statistically significant differences only at the speed of the second step ($p < 0.05$), while other parameters were not statistically significant. In the case of differences in kinematic parameters between different sexes, then the differences are evident, which was expected and confirmed by the research of Pavlović, Bonacin, Stanković, 2016. They analyzed the differences in the male and female finalists of the World Athletics Championship in Berlin in 2009 in long jumps in order to determine the differences in kinematic parameters. The obtained results confirmed the significant differences between male and female athletes, where 72 % of the analyzed differences in kinematic parameters were in favor of male jumpers. The differences were identified in the running speed of the track section 11-6m and 6-1m, the speed of the second and the first step, and the horizontal impulse rate for the level of significance ($p < 0.001$). Also, the differences in the parameters of the lengths of the third and first steps as well as the vertical velocity of the significance level ($p < 0.05$) were identified. Identical to the long jump, in addition to motor and functional abilities that are quite equable, the kinematic parameters are of paramount importance for the result performance of the competitors in the triple jump. Depending on the performance of the technique, the physical preparation of a jumper, sex, age, motivation and other exogenous and endogenous factors, depend their possible differences in result performance. Mendoza, et al (2008) conducted a biomechanical analysis of triple jump competitions, of all eight male and female finalists during the VI World Athletics Championship in Stuttgart. The obtained kinematic parameters can be used to define the type of jumper, technique and the influence of kinematic parameters on the total result.

Based on the previously mentioned facts of biomechanical parameters and their relationships in the structure of jumps with emphasis on the triple jump emerged the idea of current study. The research is significant, more so, since there have not been any studies that

have dealt with this problem of triple jumps, regarding the possible differences in kinematic parameters between men's finalists of the World Athletics Championships in Berlin in 2009 and Daegu in 2011. The main goal of the study is to determine statistically significant differences in the kinematic parameters between the male athlete finalists at WC in Berlin 2009 and WC in Daegu in 2011.

2. Method

The population defined in the research has included top male athletes in the Triple Jump World Championship in Berlin, 2009 (results mean: 17,28 m) and Daegu, 2011 (results mean: 17,50 m). The sample included a total of 16 finalists, who participated in the Triple Jump Final. The variables of kinematics parameters:

1. Length of 2 steps before take-off- L2SL (m);
2. Length of 1 steps before take-off - L1SL (m);
3. Length of Hop (m);
4. Length of Step (m);
5. Length of Jump (m);
6. Relative distance of Hop (Hop %);
7. Relative distance of Step (Step %);
8. Relative distance of Jump (Jump %);
9. Angle of take-off Hop (Hop°);
10. Angle of take-off Step (Hop°);
11. Angle of take-off Jump (Hop°);
12. Horizontal velocity 2 length –HVLCT 2L (m/s);
13. Horizontal velocity 1 length –HVLCT 1L (m/s);
14. Horizontal velocity Hop-HVLCT Hop (m/s);
15. Horizontal velocity Step-HVLCT Step (m/s);
16. Horizontal velocity Jump-HVLCT Jump (m/s);
17- Vertical velocity Hop –VVLCT Hop (m/s);
18. Vertical velocity Step –VVLCT Step (m/s);
19. Vertical velocity Jump –VVLCT Jump (m/s);
20. Contact of Hop (s);
21. Contact of Step (s);
22. Contact of Jump (s).

Data obtained in the survey were analyzed by standard descriptive methods, and the differences between groups of respondents-finalists were tested using Student's t-test for independent samples. Statistical analysis was done using the statistical program Statistica 6.0.

Table 1a. Parameters of kinematics men finalist WCh, 2009. Berlin (Mendoza et al. 2009)

Atletičar	Rezultat (m)	Stride length (m)					Relative distance %			(°) Angle of take-off ~ (°)		
		2 L	1 L	HOP	STEP	JUMP	HOP	STEP	JUMP	HOP	STEP	JUMP
P. Idowu	17,73	2,58	2,49	6,49	5,41	6,02	36	30	34	14	13	21
N. Evora	17,55	2,68	2,26	6,51	5,41	5,68	37	31	32	16	13	26
A. Copello	17,36	2,41	2,29	6,01	5,77	5,92	34	33	33	13	15	20
L. Sands	17,32	2,92	2,30	6,52	5,20	5,62	38	30	32	15	14	18
A. Girat	17,26	2,49	2,33	6,16	5,41	5,88	35	31	34	15	16	19
Y. Li	17,23	2,30	2,46	6,33	5,24	5,75	37	30	33	16	16	20
I. Spasovkhodsky	16,91	2,55	2,49	6,47	4,80	5,69	38	28	34	14	13	21
J. Gregorio	16,89	2,71	2,62	6,33	5,10	5,72	37	30	33	15	12	20
Mean	17,28	2,58	2,40	6,35	5,29	5,78	36,5	30,37	33	15	14	**22**

Atletičar	Horizontal velocity (m/s)					Vertical velocity (m/s)			The Contact (s)		
	2 L	1 L	HOP	STEP	JUMP	HOP	STEP	JUMP	HOP	STEP	JUMP
P. Idowu	10,47	10,53	9,72	8,48	7,01	2,45	1,94	2,70	0,13	0,16	0,17
N. Evora	10,10	10,13	9,19	8,25	6,50	2,68	1,94	3,14	0,13	0,15	0,19
A. Copello	9,99	10,01	9,49	8,27	6,93	2,27	2,21	2,53	0,11	0,16	0,17
L. Sands	10,25	10,14	9,50	8,52	7,26	2,48	2,10	2,36	0,11	0,15	0,17
A. Girat	9,86	9,88	9,14	8,15	7,06	2,47	2,32	2,45	0,12	0,15	0,17
Y. Li	9,89	9,99	9,18	8,15	6,94	2,64	2,26	2,57	0,11	0,14	0,14
I.Spasovkhodsky	10,06	10,09	9,35	8,24	7,11	2,39	1,97	2,67	0,12	0,17	0,18
J. Gregorio	10,42	10,36	9,42	8,28	7,11	2,48	1,75	2,62	0,11	0,15	0,19

Table 1b. Parameters of kinematics men finalist WCh, 2011. Daegu (Seo et al., 2011)

Atletičar	Results (m)	Stride length (m)					Relative distance %			Angle of take-off ~ (°)		
		2L	1 L	HOP	STEP	JUMP	HOP	STEP	JUMP	HOP	STEP	JUMP
C. Taylor	17,96	2,40	2,37	6,19	5,29	6,62	34	29	37	10	13	18
P. Idowu	17,77	2,52	2,24	6,67	5,64	5,60	37	32	31	13	14	22
W. Claye	17,50	2,42	2,31	5,77	5,43	6,47	33	31	36	11	13	21
A. Copello	17,47	2,51	2,35	6,40	5,38	5,84	36	31	33	14	15	21
N. Evora	17,35	2,39	2,25	6,44	5,18	5,84	37	30	33	13	13	20
C. Olsson	17,23	2,63	2,54	6,37	5,09	5,99	37	29	34	13	13	17
L. Sandsa	17,21	2,59	2,41	6,63	4,77	6,19	38	27	35	13	11	14
B. Compaore	17,17	2,62	2,59	6,32	5,23	5,93	36	30	34	12	14	18
Mean	17,46	2,51	2,38	6,35	5,25	6,06	36,5	29,86	34,12	12	13	**19**

Atletičar	Horizontal velocity (m/s)					Vertical velocity (m/s)			The Contact (s)		
	2 L	1 L	HOP	STEP	JUMP	HOP	STEP	JUMP	HOP	STEP	JUMP
C Taylor	10,25	10,57	9,70	8,61	7,33	1,78	1,92	2,43	0,13	0,17	0,18
P. Idowu	10,36	10,67	9,65	8,11	6,53	2,15	2,05	2,60	0,13	0,17	0,18
W. Claye	10,08	10,27	9,77	8,57	7,33	1,85	1,99	2,76	0,13	0,17	0,17
A. Copello	9,99	9,94	8,14	7,96	6,71	1,88	2,05	2,59	0,15	0,18	0,20
N. Evora	10,16	10,19	9,49	8,35	6,67	2,27	1,89	2,45	0,13	0,17	0,20
C. Olsson	9,95	10,16	9,35	8,07	7,33	2,13	1,87	2,16	0,13	0,18	0,20
L. Sandsa	10,18	10,28	9,36	8,43	7,50	2,20	1,68	1,81	0,13	0,18	0,18
B. Compaore	10,43	10,66	9,71	8,26	6,91	1,97	2,04	2,18	0,13	0,17	0,18

3. Results and discussion

Among the factors that contribute to per-formance in the triple jump are the a horizontal velocity of the body's centre of mass' (BCM) attained during the approach, the conversion of horizontal-to-vertical velocity during the sup-ports and the harmonious relationship between the flight time and the support time among the phases of the jump (Hutt, 1988; Portnoy, 1997; Yu, Hay, 1996). Performance in the triple jump is strongly correlated with the BCM velocity (both horizontal and vertical) and BCM height at the take-offs for the hop, the step and the jump (Al-Kilani, Widule, 1990; Fukashiro, Miyashita, 1983).

Since the hop and the jump exhibit a small variance in the distance of the triple jump (Hay, Miller, 1985), performance is dependent on the optimum execution of the step and particularly the transition between the hop and the step. The success of the execution of the transition from the hop to the step is defined by high velocity, wirde knee angle during the support and short contact time (Jürgens, 1998).

Table 2 shows the results of the differences between men's finalists of the World Championship in Berlin, 2009 and Daegu, 2011. By inspecting the Table 2, it can be concluded that of the total number of analyzed kinematic parameters in five parameters (23 %) statistically significant differences were recorded. Statistically significant differences were recorded at the

stepping angle of rebound (Hop°), T=3,689, p<0,003 where athletes in Berlin had a higher average angle rebound (14,75°) compared to athletes in Daegu (12,43°) which is consistent with the results (Schiffer, 2011; Pavlović, 2016). Also, the vertical velocity in the rebound recorded significant differences in VVo Hop (m/s), T = 5,269; p < 0.000. Athletes in Berlin achieved a higher average vertical speed of rebound (2,48m/s) than athletes in Daegu, (2,04 m/s). Apart from the angle of the rebound and the vertical speed of the rebound, statistically significant differences between the finalists for the level of p<0,001 and p<0,005 were achieved during the contact phase of the take-off (T = -3,580; p < 0,003), the step (T = -5,193; p < 0,000), the jump (T = -1,966; p<0,071), where it is evident that athletes in Berlin had, on average, shorter time contact phase in all three parameters (hop, step, jump). It can be concluded that they also had a larger generated force at the moment of reflection, which is a product of a higher speed of movement.

In relation to Berlin, the Daegu finalists in 2011 had almost identical values. The average length of the jump was 6,35 m (36,5 %), the steps were 5,25 m (29,86 %) and the jump 6.06m (34,12 %). The horizontal acceleration of the jibe was 9,40 (m/s), step 8,30 (m/s) and jump 7,04 (m/s). Here, there is also a reduction in horizontal speed after each leap and an increase in the contact phase duration. Also, the angle of reflection is inverted and increased with a reduction in the horizontal velocity (from 12-19°), and with each jump, the vertical acceleration increased, which was also the highest in the jump (2,37 m/s). It can be concluded that the finalists in Daegu had a higher average jump length, higher horizontal velocity, duration of the contact phase and angle of reflection, which resulted in a larger overall average jump length of 17.46m and the best jump of 17,96m (C. Taylor) versus Berlin and a score of 17,73m (P. Idowu).

Also, the inverted relationship between the speed and the angle of rebounding of the competitors was observed in both finals, which is a consequence of the speed reduction in each jump, where the triple jumpers use a larger swing with free extremities. The contact phase time increases with each subsequent jump, which is also a consequence of a decrease in the speed of movement, with the contact phase lasting longer, as confirmed by athletes in Daegu. The average contact phase for men's finalists at the 2009 Berlin WC was (0,12s) in hopping, (0,15s) in stepping, in jumping (0,17s) and was shorter than the average phase of contact at the WC in Daegu (0,13-0,17-0,19s), which is in line with the research (Pavlović, 2016).

Table 2. Differences of kinematic parameters finalists men (T-test independent sample test)

Men	World Championship	Mean±Std.Dev.	T-value	p Sig. (2-tailed) **0,001;*0,005
2 LS (m)	Berlin	2,58±0,19	1,068	0,305
	Daegu	2,49±0,09		
1 LS (m)	Berlin	2,41±0,13	,860	0,405
	Daegu	2,35±0,10		
Length of Hop (m)	Berlin	6,35±0,19	-,003	0,998
	Daegu	6,35±0,30		
Length of Step (m)	Berlin	5,29±0,28	,263	0,797
	Daegu	5,25±0,28		
Length of Jump (m)	Berlin	5,79±0,14	-2,104	0,055
	Daegu	6,08±0,37		
Hop %	Berlin	36,50±1,41	,597	0,561
	Daegu	36,00±1,83		
Step %	Berlin	30,38±1,41	,651	0,527
	Daegu	29,86±1,68		
Jump %	Berlin	33,13±0,83	-1,300	0,216
	Daegu	34,14±2,04		
Hop°	Berlin	14,75±1,04	3,689	0,003
	Daegu	12,43±1,40		
Step°	Berlin	14,00±1,51	1,198	0,252

	Daegu	13,14±1,21		
Jump°	Berlin	20,63±2,39	1,208	0,249
	Daegu	19,00±2,83		
HVo 2L (m/s)	Berlin	10,13±0,23	-,085	0,934
	Daegu	10,14±0,14		
HVo 1L (m/s)	Berlin	10,14±0,21	-1,315	0,211
	Daegu	10,30±0,25		
HVo Hop (m/s)	Berlin	9,37±0,20	,106	0,917
	Daegu	9,35±0,56		
HVo Step (m/s)	Berlin	8,29±0,14	-,072	0,944
	Daegu	8,30±0,26		
HVo Jump (m/s)	Berlin	6,99±0,22	-,407	0,691
	Daegu	7,06±0,40		
VVo Hop (m/s)	Berlin	2,48±0,13	5,269	0,000
	Daegu	2,04±0,19		
VVo Step (m/s)	Berlin	2,06±0,19	1,614	0,131
	Daegu	1,92±0,13		
VVo Jump (m/s)	Berlin	2,63±0,23	1,602	0,133
	Daegu	2,40±0,32		
Contact of Hop (s)	Berlin	,12±0,01	-3,580	0,003
	Daegu	,13±0,01		
Contact of Step (s)	Berlin	,15±0,01	-5,193	0,000
	Daegu	,17±0,01		
Contact of Jump (m)	Berlin	,17±0,02	-1,966	0,071
	Daegu	,19±0,01		
RESULTS (m)	*Berlin*	*17,28±0,29*	*-1,484*	*0,162*
	Daegu	*17,50±0,28*		

Legend: Mean (average value); SD (standard deviation); T-value (coefficient of t-test value); p Sig. (2-tailed)

An analysis of triple jump technique has shown that at most triple jumpers the increase in the results depends on the increase in the accumulation of the first two jumps, the level of speed-up capabilities and the increase in the speed of the running start. On the basis of the analysis of both finals, it can be concluded that the following percentages of the relationship between the individual lengths of the individual jumps and optimal angles of reflection are optimal in the triple jump of men: first jump-hop (36,25 % and 13,6°), second jump-step (30,12% and 13,8°), the third jump-jump (33,64 % and 19,81°) or the sum of the jumps: I + II = 66,37 %; II + III = 63,76 %, which is in line with the research (Panoutsakopoulos, Kollias, 2008; Stefanović, Bošnjak, 2011; Pavlović, 2016). In addition to the speed of running start and the intensity of the impulse force of the rebound, the rejection of the swing of the arms and the swinging legs on the body of the jumper is significantly influenced by the reactive power of the jumper during all three impulses of the reflecting force, as well as the relation of the individual parts of the body with respect to the pad in all transition positions of the triple jump. The ratio of "length of jumps" of the first ranked from WCh in Berlin, 2009. P.Idowu was 36-30-34%, of the second-ranked N. Evora 37-31°-32 %, and of the third-ranked A. Copello 34-33-34 % with almost identical value of step lengths and the trend of growth of the reflection angle and duration of the contact phase at all three competitors. On the Daegu WCh in 2011, the first-ranked C.Taylor had a ratio of jumping lengths of 34-29-37 %, second-ranked P. Idowu had 37-32-31 %, and third-ranked W. Claye had 33-31-36 % with the trend of the growth of the reflection angle and contact phase at the competitors, which occurs as a consequence of the falling speed of the competitors, longer contact with the surface and compensatory movements with extremities (Pavlović, 2016).

Triple jump is performed according to the rules of the IAAF so that after the running start, the jumper first pounces on the leg with which he is reflected, then leaps on his leg, which will be reflected in the final third jump. During the running start, the jumpers gradually raise the speed of

the running that maximizes in the last steps of the running start, which are similar to the jump steps in the long jump. The reflective leg is placed on a reflecting board in relation to the long jump, and the angle of taking-off at the first jump is 5-7° lower than the angle of the long jump (Idrizović, 2010), which results in a smaller elevation angle.

It is known that the result in the triple jump (flight length) depends on the horizontal velocity, the intensity of the impulse of the rebound force, the angle of the rebound, the height of the TT after each rebound from the ground, and the optimal length of the first, second and third jump (Stefanović, Bošnjak, 2011; Pavlović, 2016). The world's best triple jumpers jumping over 17 m before the rebound reach the speed of over 10m/s. The elevation angle in the triple jump is smaller than at the long jump and ranges from 16°-18°, thanks, in particular, to the large horizontal (about 9 m/s) and the vertical (about 2.5 m/s) velocity at the moment of reflection (Pavlović, 2016). In order to achieve a large horizontal velocity, it is necessary for the jumper to develop the speed of the running start in the last meters over 9 m/s, which is in line with the research (Hutt, 1989; Mendoza et al., 2009). A larger angle of reflection affects the loss of horizontal velocity as well as the lifting of the jumper's center of gravity, causing greater impact forces and muscular strain during the next landing, adversely affecting the next two jumps (step, jump). According to some authors (Tončev, 2001; Pavlović, 2010; 2016), in the setting of a reflective leg, the jumper forces the pressure on the path by the inertia of the body's movement (the average impact of the vertical reaction in the first jump is 3500N, in the second 5000N and in the third 3500N).

Almost identical results have been confirmed in studies by Perettunen, Kyrolainen, Komi, Heionen (2000), which analyze the impact impulse of the lower extremities. The greatest pressure occurs on the fifth and the last part of the foot with the exceptionally large electromyographic activity of the nervous muscular system of legs and hip joints (Stefanović, Bošnjak, 2011), which confirms that the triple jump is an extremely demanding and potentially dangerous discipline. The length of the space which the jumper jumps with the first jump is the largest (more than 35 %), especially because the fact that during the rebounding on the appropriate leg, the TT projection is located just behind the surface of the support. This reduces the intensity of the rebound impulse, i.e. the intensity of the horizontal component of the reaction force of the pad. Due to such a heavy load, the reflective leg and partially the spinal column, bend, causing the stretching of the current muscles, significantly reducing the pressure of the inertial force of the body. As soon as the resistance of elongated muscles exceeds this pressure, a very strong myometric muscle contraction occurs.

The reflective leg and body of the jumper are very fast stretched out in the actual joints, directing the body to the height and forward to the stage of the step which is somewhat shorter (Berlin, Daegu about 30 %). The angle of reflection is below 16°, as has also been shown in this study, and it confirms the statements of some authors (Miller, Hay, 1986; Bowerman et al., 1999; Mihajlović, 2010; Schiffer, 2011; Pavlović, 2016). In Berlin and Daegu, the length of the first jump (hopping) was about 6,35m (36,5 %) which is almost identical with the finalists at the WC in Stuttgart (Mendoza, 2008). The hopping is performed by a reflection of a stronger leg, setting the foot closer to the projection of the center of gravity of the body, somewhat differently than in other jumping disciplines. In this way, it disables the triple jumpers to move upward, and it allows the horizontal speed of movement to be achieved and which is required for two more jumps. By a quick scratching step the leg is set firstly on heel, then with a full foot in the racing, and in the jumping variant, more by the outer vault of the feet on the board, at an angle between 60° and 70°. A slight drop and pushing forward of the pelvis is noticed, without interrupting the action from the running. The first jump (hopping) has a decisive influence on the horizontal speed, especially in the racing variant, followed by a reflection. After the reflection, there is an extension in all three joints of the reflective leg. After this stretching in the joint of the reflective leg the first phase of the flight is formed, characterized by a high-raised swing leg bent in the knee (approx. 103°) in the position of the step with the tendency of moving forward-upward and with a slight inclination of the body forward. This first step should be lower, so as not to disturb the achieved launching speed, which is decreasing (more than 9 m/s).

This is in line with the results of this study where it is evident that the horizontal jump speed (HVoHop) in Berlin was 9,37 m/s and in Daegu 9,35 m/s, with a further downward trend, which is also confirmed by the results of the Mendoza et al (2008).

After the rebound starts the so-called breakthrough pause, in which a jumper tries to hear how successful the rebound was. In the middle part of the flight phase (third of the jump) there is an active shift of the legs, where the swinging leg is lowered forward-downward-backward, with the circular movement of the lower leg, and the stepping leg is strongly bent into the knee forward-upward. This change in the leg is very energetic with the characteristic scratching lowering and elastic setting of the reflective leg on the ground. The reflective leg does not bend too much, it is placed first on the heel and later on the foot, closer to the projection of the TT jumper, so as not to have a greater effect of the reaction of the surface, which would produce a negative effect on the next step (II jump) that the jumper begins with even more energetic swinging of the knees of the swinging leg than in the first jump. The movement of the swinging (forward) leg is forward-upward, taking a position similar to the racing step. In the course of the step, the carcass of the jumper is upright in a jumping variant or in a slight inclination forward. Hands perform compensatory movements depending on the jumper's technique, with the basic aim of being in the best position for the third jump. Hands have an effect of action and reaction to the upper part of the body, when a jumper tries to pass the inertia of movement and achieves a better position for the third jump. Landing at the end of the second jump is attacking and it is important for the entire length of the triple jump, and is the consequence of a significant loss of speed obtained in the first two jumps (about 8,00 m/s), when the jumper with swinging of the hands and the explosive power of the legs strives to achieve as large a reflection angle as possible (Berlin, 20,6º; Daegu 19º), resulting in the greater length of the jump, more than 5,50m (about 34 %). A smaller horizontal velocity allows an energetic rebound using the muscular contractile component as opposed to the dominant elastic in the first two jumps (Stefanović, Bošnjak, 2011).

With a decrease in the speed of movement and an increase in the reflection angle, the contact phase is increased, which was recorded in both athletic championship finals (0,12-0,19s), also evident in the Mendoza et al. (2008); Panoutsakopoulos, Kollias, 2008. The mechanisms based on which the conversion of the horizontal velocity in vertical is performed, are extremely complex and can be defined using a coefficient (Yu, 1999), that is, the ratio of the loss of horizontal velocity in a linear relation with the increase in the vertical velocity, which is confirmed in this study. It has been proven that for the success in triple jump the most important factors are maintaining horizontal speed during the rebound, step, jump, as well as preventing the decay during the depreciation phase in the second jump, the angle of reflection, active hand or arm blockage combined with the free leg swing (Bowerman, Freeman, 1998), which again depends on the selected technique of triple jump.

An analysis of the kinematic parameters of triple jumper athletes points out that athlete finalists in Berlin had a higher average vertical speed of the rebound (2,48m/s), a shorter duration of contact phase in all three jumps and angle of reflection. However, in most of the analyzed kinematic parameters, there were no statistically significant differences between these two finals.

What was common was the fact that the athlete finalists (Berlin, Daegu) used the so-called dominant rebound technique with the dominance of the rebound (I jump-36,50 %), step (II jump-29,86-30,37 %) and jump (III jump-33-34,12 %). The same technique, so-called „rebound dominance“, was also used by the winner of the WC in Helsinki, Polish athlete, Zdislaw Hoffman (17.42 m), with proportions of 38-33-29 % and the winner of the II World Championship in Rome 1987, Bulgarian Hristo Markov (17,92m), with a jump ratio 36-30-34 %. Based on all the kinematic parameters (which did not show statistically significant differences) shown in the tables, it can be concluded that the individual does not adapt to the technique, but the technique must be adapted to his physical and technical potentials, which means that the competitor will choose the technique, not the opposite.

Also, the analyzed biomechanical parameters showed unevenness among athletes, which is the product of their training process and the technique they perform. There is no technique in the triple jump which could be recommended to every jumper, following and taking into account his individual characteristics. The final solution in the rebound dominant, jumping dominant or balanced technique must be the result of the physical and technical qualities of the athlete (Idrizović et al., 2015).

4. Conclusion

The research was carried out with the aim of determining the differences in the kinematic parameters of the triple jumper 16 male athletes, finalists at WCh in Berlin, 2009 and WCh in Daegu, 2011. The obtained results confirmed the differences in most of the measured kinematic parameters of triple jump. However, statistically significant differences were recorded only in five out of 22 (23 %) kinematic parameters. Statistically significant differences were recorded at the hopping angle (Hop°), T=3,689; p < 0,003 where male athletes in Berlin had a higher average angle of rebound (14,75°) compared to athletes in Daegu (12,43°). Also, the vertical velocity in the rebound recorded significant differences in VVo Hop (m/s), T = 5,269; p < 0,000. Athletes in Berlin achieved a higher average vertical speed of the rebound (2,48 m/s) than athletes in Daegu, (2,04 m/s). In addition to the rebound angle and the vertical speed of the rebound, statistically significant differences between the finalists for the level of p<0,001, p<0,005 were achieved during the contact phase of the rebound (T = -3,580), step (T = -5,193), jump (T = -1,966), where it was recorded that athletes in Berlin had, on average, shorter time of contact phase in all three parameters (hop, step, jump). It can be concluded that they also had a larger generated force at the moment of reflection, which is a product of a higher speed of movement. Also, the inverted relationship between the speed and the angle of rebounding of the competitors was observed in both finals, which is a consequence of the speed reduction in each jump, where the triple jumpers use a larger swing with their free extremities. In relation to Berlin, the Daeegu finalists in 2011 had almost identical values. The average length of the jump was 6,35 m (36,5%), the steps were 5,25 m (29,86 %) and the jump 6.06 m (34,12 %). The horizontal acceleration of the jibe was 9,40 (m/s), step 8,30 (m/s) and jump 7,04 (m/s). Here, there is also a reduction in horizontal speed after each leap and an increase in the contact phase duration. Also, the angle of reflection is inverted and increased with a reduction in the horizontal velocity (from 12-19°), and with each jump, the vertical acceleration increased, which was also the highest in the jump (2,37 m/s). It can be concluded that the finalists in Daegu had a higher average jump length, higher horizontal velocity, duration of the contact phase and angle of reflection, which resulted in a larger overall average jump length of 17.46 m and the best jump of 17.96 m (C. Taylor) versus Berlin and a score of 17,73 m (P. Idowu).

In general, it is evident that there are noted the differences between two finals (with or without statistical significance). However, what is confirmed is the fact that the kinematic parameters with the correct technique are the precondition for good results of the competitors as confirmed in previous research (Portnoy, 1997, Jürgens 1998; Panoutsakopoulos, Kollias, 2008; Kyröläinen et al., 2007), of course with good conative and cognitive characteristics (Pavlović et al, 2016).

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Actualization of the Professionally Applied Physical Training of Students with Disabilities

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Abstract

The requirement of readiness for the professional activity of a modern specialist is the expressed application of means of physical culture, related to the character of the forthcoming work. Aspects of application became the theoretical foundation for achieving the necessary level of professional readiness of future specialists, development of professionally important qualities that contribute to a more successful vocational training and further it improvements.

The best way to ensure the optimal development of physical qualities, the formation of applied motor skills that meet the requirements of a particular production, is the professionally applied physical training (PAPT).

Practice shows that in educational institutions of higher education there are poorly developed concepts and methods for the use of PAPT tools and the choice of the classes program, the rational acquisition of training departments, the operative control under the optimal physical load, sufficient in volume and adequate for students with disabilities in health status. Students with deviations in health status of temporary or permanent nature require significant restrictions on physical activity taking into account the performance and functional features, many not fully ready to perform the standard training applied physical training.

In this regard, there is a need to address the issue of the formulation of the specific practical recommendations for the construction of professionally-applied physical training for students with disabilities.

Keywords: students, application, readiness, profession, health, physical culture, system, pedagogy, education, university.

1. Introduction

In the modern period of the development of Russian society, there is a huge number of professions that determine specific demands on workers, and the number of them is constantly increasing. An evidence of this is the current transformations associated with the enlargement of higher education institutions, the transfer of the higher education system to a two-level basis, and the establishment of multi-disciplinary universities (Viktorov, 2017).

In this regard, an essential role is played by ensuring the necessary level of preparedness of future specialists for professional activity: physical development, physical preparedness, functional preparedness. The influence of professional-applied physical training on each of the components of

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the formation of readiness for work in the educational process of the university is constantly being understood, reevaluated, leading to a more holistic view on vocational training (Korovin, 2005).

2. Materials and methods

Under the readiness for professional activity we understand, following the authors (Arkhangelsky, 2000; Bespalko, 2004; Zagvyazinsky, 2008; Nine, 2012; Neverkovich, 2013 and others) – that this is not an innate quality, but a result of special training, indicating that the subject achieves an appropriate level of professional activity, which is the basis for the manifestation of competence and the formation of competitiveness.

The process of man's readiness for professional activity was adjusted along with the growth of civilization, culture, a change in the methods of production, and a natural-science picture of the world. Constant comprehension, re-evaluation leads to a more holistic view of the creation and replenishment of the able-bodied society, and physical culture is included as the basic factor in the formation of motor skills and skills necessary for the realization and expansion of the person's capabilities.

Physical culture was formed as a socially determined region of the general human culture, which is a qualitative, systemic, dynamic state of the person, characterized by a certain level of knowledge and abilities, motivational and value orientations acquired as a result of upbringing and self-education and integrated into practical life, physical and psychophysical health on the basis of medical experience of individual and public disease prevention, effective programs and the health of the population (Balsevich, 2000, Stolyarov, 2001 and others).

In accordance to this, the side of physical culture claimed by society, integrating with education, provides a social need for full physical preparation of the younger generation for work – the main condition of human existence. The result of this integration became the modern physical education.

Physical education is an integral element of physical culture, characterized by widespread experience in the development of an individual and social strategy for mastering knowledge and skills of physical self-improvement, the formation of the need-motivational sphere of an individual (Guzhalovsky, 1999; Natalov, 2001 and others). The process of physical education, as a specially organized pedagogical influence within various educational institutions, made it possible to single out the problem of vocational education as a separate goal of education, aimed at successfully mastering of the chosen profession.

Physical education is the concept of the development of the higher professional educational system, which allows to effectively realize the health and educational potential of physical education, the didactic principle of activity, to build a logical system for the formation of needs, determine the strategy of prophylactic health work, thereby embody a social cultural experience affecting various aspects of man's attitude to his professional training. Traditional emphasis on the physical (motor) component is shifted towards the education through the holistic potential of the physical culture.

The main aspects of the interrelation of physical education and readiness for professional activity which stand on the basis of the unity of training mechanism and adaptation to work are: a) the importance of physical culture in the development of working capacity; b) correction of professional disproportions in a physique; c) prevention of occupational diseases; d) socialization of the individual in the working group. Thanks to this, it is possible to prepare the person for the forthcoming professional activity in the lessons of physical culture by combining various exercises, elements or integral types of physical activity.

The tasks of developing professionally significant physical qualities, teaching of applied motor skills are solved in the professionally applied physical culture (PAPC), as a form that lies in the depth of physical education, on the basis of the principle of the organic connection of physical education with work activity (Il'inich, 2000; Kabachkov, 2010; Korovin, 2011).

Without reducing the positive value of PAPC, we note that this is a physical culture in the whole variety of its means, serving the goals of comprehensive physical training of a specialist (Zholdak, 2000; Menschikov, 2012 and others). However, in this case, PAPC becomes the main, rather than an applied means of professional training and the term application»is used without a strict certainty.

In physical education, the application of physical upbringing is presenting the discovered fact of its suitability and usefulness to the chosen professional activity.

Practice shows that the scientific and methodological support of this process for students with disabilities does not always give the proper effect: on the one hand, students are limited to performing applied educational activities within the range of their health possibilities. On the other hand, the teachers do not possess sufficient level of knowledge necessary for understanding the essence of the pathological processes occurring in the various body diseases, they show unreasonable passivity and inertia in this important work, which has a significant impact on the functional preparedness and, ultimately, on the readiness for the future professional activity.

In our work we give the author's definition of the term "applied physical culture education (APCE)" – it is a pedagogical process that is sufficient in scope and adequate professional and applied physical training, regardless of the factors and conditions of the chosen professional activity, capable of forming professionally in students with deviations in the state of health important qualities that contribute to successful functional preparedness, reflecting the increase in the range of adaptive capabilities of the body.

In conditions of enlarging of the universities, increasing specialties, it is difficult to highlight the most significant physical abilities, motor skills and habits, mental characteristics and personal qualities that ensure the effectiveness of a variety of professional activities, and, consequently, it is difficult to build a professional program for a future specialist (Kabachkova et al., 2015). This circumstance leads to increased attention to applied physical culture education (APCE) as all of the components of highly professional human stability can be fully realized only if there is an adaptation of the genetically conditioned capabilities of the organism to physical activity. In the context of our research, this fact will denote the success of pedagogical activity.

The specialized physical education is a unified educational space in the field of professionally-applied physical training, regardless of the state of health and the conditions of the chosen professional activity. Since the concept of the educational space is not new in pedagogy and is oriented toward the educational result (Cherepov, 2015), contrary to traditional practice, the authors believe that in modern realities the metaprofile approach should aim at stimulating the increase in the adaptive capacity for forming readiness for selected professional activities, including students with health disabilities.

The study of the labor peculiarities of future specialists who study in the teaching units of SUSU, and since 2016 in the new schools and institutes of the National Research University shows that three directions of training specialists coexist and interact within the university: technical, natural and humanitarian. Consequently, it is difficult to compose the recommendations on the formation of the necessary knowledge, physical and special qualities, abilities and skills that contribute to the student's readiness for successful professional activity. The reasons are: merging within the same educational unit of being previously various specialties; the requirements of many professions of similar qualities that can be trained by one method; The impossibility of covering the entire range of working professions with a limited contingent of teachers; The natural transition of students from one specialty to another during 1 and 2 courses of study.

The analysis of the composition of students medical groups at the South Ural State University shows the following pattern of the distribution of morbidity and, consequently, the restriction of physical education: first place – diseases of the musculoskeletal system (34,6 %), the second – cardiovascular system (19,2 %), the third – (15,4 %) respiratory organs, then (11,5 %) with myopia and visual impairment, i.e. the most important diseases for life support.

There is a sufficiently large number of students with diseases of the nervous system, the pathology of the digestive tract continues to increase intensively. Otorhinolaryngology, endocrine system (obesity), kidneys, skin, genitourinary system, oncology are common. There were also cases of lack of physical development and disability. About 22 % of students have from two or more negative deviations.

At the same time, it should be noted that there is an undefined number of students who have serious health restrictions, but who deliberately did not provide the educational institution with any information about their limitations of health opportunities.

Despite a wide range of available research on the positive impact of the organization of professional and applied physical education in educational institutions of a wide range of professional activities (V.I. Il'inich, V.A. Kabachkov, S.S. Korovin and others), technologies and

techniques that focus on the professionally applied physical education of students with disabilities are poorly developed.

The goal of the study is to modernize the readiness for professional activity by building a unified educational space for metaprofile physical education and to justify its effectiveness for students with disabilities.

In the study, students of SUSU (NIU) and South Ural State Institute of Arts named after P.I. Tchaikovsky referred to the main and preparatory groups took part. Well-known and widely used functional tests were used to assess the speed of adaptation of the body to physical activity or mainly showing the development of any quality.

Taking into the consideration that the physical training that underlies the MPE has a multifaceted and systematic impact on the body, Serkin's test was used as an integral criterion covering all aspects of the process, and for the purpose of timely correction, as well as for evaluating the functional state of the organism (three-stage respiration delay). Each stage of this sample unites the important categories of the functional state: 1 stage – physical possibilities, 2 stage – physical abilities, 3 stage – energy resources. This allows Serkin's test to be used as an assessment of the effectiveness of MPEs for readiness for selected professional activities (Yanchik, Yanchik, 2015).

In the 1-2nd semesters conditions are created for the formation of a unified educational space for the metaprofile physical education of students with disabilities. Taking into account the record of the individual opportunities, carried out according to morpho-functional indicators, the MPE is enriched with information about the features of physical training, physical exercise parameters, determining adaptive effect, improving physical fitness against the background of limited health opportunities.

In the 3-4th semesters, students of all medical groups using a variety of physical exercises, the content of which is selected taking into account health opportunities, rely on the information obtained at the previous stage of education. Such consolidation of knowledge forms, and knowledge – in action allows providing positive dynamics of morphological and functional capabilities and reserves of students with limited health opportunities, orienting them not only to mastering knowledge, but also to practical ways, models of activity development. Thus, students improve their physical condition and preparedness, improve their physical skills, and acquire skills of self-control and self-education. Elements of the uniform educational space of MPE are the forms of physical exercises that are regulated by the educational standard and independent occupations for the professionally applied physical training.

In the 5-6th semesters, the practical work on the basis of its own value position allows students to consolidate the special skills of metaprofile physical culture education, acquire the necessary and permissible professional and applied skills in situations requiring direct and compulsory participation, thereby fixing the close relationship of physical performance with a functional state of a person.

3. Discussion

We do not dispute the opinion of the authors (Dyakova, Mironov, 2015) who believe that it is HPC, being a means of complex treatment of various diseases and prevention of exacerbations, which remains the main method of training that contributes to the social adaptation of the body of students with limitations in health.

However, relying on the generalized data of domestic (Apanasenko, Popova, 2000) and foreign (Gudrun, Pauw, 1996) scientists, we come to the conclusion that a main part of metaprofile physical culture education for students with disabilities, as well as for students of the main medical group, is physical education and other forms of training activities. It should be understood that pedagogy does not have so many tools to influence the future professional, what is more, physical exercises and knowledge that allow them to be used, occupy a special place, including students from different medical groups in the activity of forming readiness for the profession, which makes physical culture the only means of participation in the healing process. This mechanism provides a selective increase in functionality, due to the constant impact on the body of physical activity.

When comparing the indicators of the level of physical readiness with the functional state of various body systems of students with disabilities, it is noted that the normative indicators of the morphofunctional development of the individual are not a reasoned reason for determining the

difference in the state of human health. This is justified by the fact that the basis for the separation of students into medical groups is based on the nosological principle, when the doctor does not take into account the level of physical preparedness. Despite the different approaches to the formation of medical groups, classes with such students are conducted without taking into account the optimization of physical activity in accordance with the normalization of the functional condition; therefore teachers at each department of physical education have the opportunity to develop their own program for conducting practical classes.

Based on the foregoing, it is objectively established that the results of physical development (anthropometric measures according to generally accepted indicators) of students of the studied educational institutions testify to the accordance with age norms. We agree with V.I. Zagvyazinsky (2010), that the rapid development of science and technology does not allow to provide the preparing of specialists in any educational institutions ahead of their time. Therefore, an essential principle of the vocational education system becomes the development of professional forms of thinking that determine attitudes toward the chosen profession, readiness for professional activity. That is why this direction is realized directly in the process of physical education with the disabled students through the development and improvement of physical qualities, motor abilities, which in turn stimulate the processes and functions of the body and body systems.

4. Results

The conducted Serkin's test showed significant differences ($p < 0.05$) in the first stage of the girls training (1-2 semesters) (Table 1) of CMG SUSU and CMG SUSIA and in the 2nd and 3rd stages of the test, which may indicate a sufficiently high aerobic capacity.

Table 1. Three-stage breath holding

University, group	Serkin's test		
	1stage	2 stage	3 stage
	BH, rest (s)	BH, after exercises	BH, recovery
SUSU, CMG (m)	86,5	38,9 %	73,6 %
SUSIA, CMG (m)	77,3	29,3 %	79,9 %
SUSU, CMG (f)	39,6	53,9 %	85,9 %
SUSIA, CMG (f)	36,7	31 %	62 %
SUSU, SMG, (m)	63,4	36,3 %	78,9 %
SUSIA, SMG, (m)	57,2	38,6 %	79,7 %
SUSU, SMG, (f)	32,5	42,8 %	67 %
SUSIA, SMG, (f)	31	46,3 %	74,8 %

The result of the first year of training shows that students of different groups often have different physical possibilities. However, the importance of the personal theoretical knowledge for the rapid adaptation of one's organism in difficult professional conditions and the awareness of the necessity of activity in the direction of the work of those systems of the organism that are not involved in the pathological process, contributes to the prophylaxis and strengthening of the whole organism. This becomes the first element of the unified educational space of metaprofile physical education, as well as the formation of preparedness for professional activity as a systemic effect.

In the 3-4th semesters, there are significant differences ($p < 0,05$) in the Serkin's test of the young men of the CMG SUSU and SUSIA from the results of the 1-2nd semesters at the third stage. This can serve as the evidence of an increase in the adaptive capacity of the body. As for students with various health problems, this means the formation of motor qualities in accordance with the functional capabilities of the body systems. Depending on the functional state, training ability and the course of the disease, the exercise stress was initially of low intensity, then- of average, thus this technique of conducting the lessons led to the fact that the organism of the practitioner had to adapt to the created conditions.

SMG SUSU students of both sexes in the sixth semester shows the higher results and significantly differ from their own results at the 2nd semester at all stages of the Serkin test. This convincingly indicates that SMG students have higher functional and reserve capabilities of the body by the end of the third year.

The obtained results allow to assume that within the Institute of Sport, Tourism and Service (ISTIS) established at SUSU, it is possible to form a unified educational space for metaprofile physical culture education, according to which a person's preparedness for professional activity is formed through physical training that promotes the development of basic physical qualities, functional stability and resistance of the human body. The process is being phased, at each stage it is supposed to conduct a certain pedagogical work, which is aimed at bringing the student to a higher level of adaptive capabilities of the body and, consequently, the formation of readiness for professional activity.

Our opinion coincides with the opinion of many scientists (Balsevich, 2008; Kazin, 2014; Moskovchenko, 2007 and others) that the adaptation of an organism is one of the conditions for not only differentiating the load, but also its optimization. Conducting the Serkin's test convincingly indicates that the common group results, regardless of gender and level of physical condition, shows a tendency to increase adaptive shifts and the adequacy of physical activity. In particular, in SMG groups, this is expressed in an increase of respiratory arrest at stage 2, which indicates that students with limited health abilities have been able to tolerate hypoxic conditions and economical work of the respiratory and muscular systems, thereby justifying the effectiveness of this approach for preparing readiness for future professional activities.

5. Conclusion

1. Applied physical education is the pedagogical process which transfers the values of professional physical culture, determines the formation of readiness for future professional activity, and has its own specific characteristics for students with disabilities, who engaged in physical culture and mass sports.

2. The specifics of the formation of the unified educational space of the APE is that it is not reserved within any particular branch of science, but it is distributed in many of its spheres to indicate the concretization of general methodological regulations, the substantive aspect of justifying factors, self- knowledge through the process of professional education.

3. The pedagogical functions of applied physical education for students of the common medical group and for students with disabilities coincide in the unity and continuity of the means and methods aimed at improving physical conditions, and that makes it possible to predict the realization of the main goal of professional education - the formation of readiness for the future professional activities.

4. Applied physical education is a new stage of the development of professionally-applied physical training, which forms readiness for professional activity during the work with students of various medical groups due to the adaptation of the body to physical activity, which is not related to specific professional functions, and not to the degree of expression (volume and intensity) motor activity.

5. The great importance in mastering the technique of applied exercises for students with disabilities, with parallel elimination of functional failure of organs and systems, improving the working capacity of the organism, has the opportunity to use mechanotherapy or work with simulators and exercises with their own weight, significantly increasing the effectiveness through the use of non-traditional means and methods in the process of studying with students of this category.

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