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ADAPTATION OF SWIMMERS BY USING PROGRESSIVE SYSTEMS

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Abstract. Regardless of the sports discipline concerned, adaptation provides neurophysiological improvements. In terms of physical effort, molecular biology mentions some gene replications in trained muscle cells or other cells. For example, nerve tissue cells improve their functions through the constant practice of physical exercise. Tigroid (Nissl) bodies and glial cells (neuroglia) adapt providing better integration of neural signals into the motor cortex. A series of biochemical reactions take place there, resulting in the transformation of chemical energy into mechanical energy necessary to the muscles. Adaptation must thus ensure the gradual structural and functional improvement of all body organs and systems that favour or limit performance capacity. When the volume, intensity and complexity of the effort provided by our athletes are optimal and constant, they adapt. In this regard, certain specific training principles must be strictly observed. Among them, the principle of progressivity is particularly important, because the training is based on increasing physical and psychological demands. Taking into account the new educational approaches in swimming sports training, this principle can be put into practice through several progressive training systems to which we shall refer in this paper.

Keywords: swimming, adaptation, training principles, progressive training systems.

Introduction

Adaptation is a polymorphic and unlimited process, a homeostatic balancing, a “set of processes and activities helping to make the transition from a less stable to a more stable balance between the body and the environment” (Epuran, 1990). Through repeated physical exercise, adaptation gradually leads to the concentration of stimuli in the motor cortex, to accelerated biochemical reactions, to an increased enzymatic support of energy metabolism, to increased glycolytic deposits and capacity of muscle buffer systems – phosphate, protein and bicarbonate, the protein one being the most important, because it achieves 75% of the entire buffering process (Guyton & Hall, 2006). In response, a higher level of providing physical effort is reached. Thus, through sports training, the whole body adapts: the effort is a neuromuscular one, any motor act being of a psychomotor nature, because the mental plane fuses with the physical plane when performing movements.

Adaptations take place when the exercise intensity, duration (in terms of volume) and density optimally strain muscle fibres. It is then that progressive adjustment to specific demands occurs seamlessly and without health (physiological) problems:
- the central nervous system controls faster, stronger and more precise movements;
- muscle fibres require more glycogen and O2 for more intense contraction;
- ketogenesis is accelerated;
- respiratory and circulatory systems support the O2 transport chain (the Szent Györgyi-Adolf Krebs cycle of tricarboxylic acids or respiratory chain decomposes citric acid resulting in the oxidation of nutrients – sugars, fats, proteins; by oxidative conversions, acetate is produced, which is subsequently used in oxidative phosphorylation processes for the production of ATP);
- the amount of myoglobin and the mitochondrial network increase;
- the heart develops, being forced to pump more blood;
- new capillaries open; Strauzenberg and Schwidtmann (1976, cited by Bitang, 2008) report the lowest heart rate (29 bpm) in athletes, which is not explained only by their increased heart volume, but also by the involved vegetative changes, among which we mention the increase in O2 consumption at the level of peripheral energy substrates, due to the opening of non-functional capillaries;
- enzymes, as catalysts of biochemical reactions, increase quantitatively etc.

All these adjustments raise the energy metabolism rate, and the muscles become stronger (in the case of swimmers, they exert greater water pressure), more resistant (through intense gas and nutritional exchange at the mitochondrial level) and more efficient (muscle strength and endurance ensure stabilisation of a correct swimming technique, and the range of motion does not decrease when the race speed increases).
As shown in Figure 1, adaptation is related to the principle of overcompensation (McArdle, Katch, & Katch, 1996).

![Figure 1. The principle of overcompensation (Bompa, 2008)](image)

There is a general adaptation syndrome called “post-aggressive reaction” (Seyle, 1956, cited by Bota, 2000). According to Avramoff (1980), this syndrome has three stages:

1. alarm reaction – a non-specific spontaneous response, which represents the beginning of the adaptation reaction. The athlete is hyperactive, unadapted and has sympathetic-adrenergic nerve reactions (increased adrenalin, low catecholamines) called “fight or flight reactions”;
2. resistance reaction – if the training is appropriate, the adaptation state is established. The body responds economically, and the athlete becomes resistant, adapted, homeostatically balanced;
3. burnout reaction – when the body can no longer withstand physical effort. The athlete is exhausted, unadapted and has a “wear and tear reaction”. This may lead to various adaptation traumas or disorders: neurosis, high blood pressure etc. It is not compulsory to pass through this stage.

In the training of athletes, the adaptation, disadaptation and readaptation sequence should be avoided (Figure 2). To note that disadaptation refers to the “structural and functional regression processes” (Weineck, 1994).

![Figure 2. The adaptation, disadaptation and readaptation sequence](image)
Issues addressed

Adaptation of performance swimmers through progressive systems

Adaptations occur within about 6-8 weeks. They depend on hysteresis (the phenomenon by which the state of a system induced by a certain cause does not depend only on the magnitude of that cause, but also on the previous states through which the system has passed), namely on the tendency of a body to return to the initial state after exercise. What matters is the entry into the overcompensation phase, a state that is only possible through a qualitative recovery process.

But adaptation can be continuous if some training principles are observed. Among these principles of biological essence, we shall contextually present the principle of progressivity and its derived systems – progressive systems that can ensure the coherent adaptation of swimmers.

The principle of progressivity refers to the gradual increase of effort. “The training load should be increased throughout the programme” (Fox, 1989, cited by Wilmore, Costill, & Kenney, 2008). Thus, the curve of load increment has an ascending trend. According to this principle, exercise intensity should be increased before the sensation of decrease, of “ease” in the physical executions occurs. This sensation is perceived when specific metabolic processes have been overstressed for several days and then the effort has been kept constant.

The dialectics of performance consists in progressively increasing efforts until reaching maximum, permanently changeable levels. This increase is based on developing the functional capacity of the body, on its power of adaptation to the surrounding environment.

This is an easily applicable principle by differently dosing the duration of the interval (swim distance or number of repetitions), the average swim speed (speed interval), the rest break or concomitantly two to three exercise parameters. The ways of implementing the principle of progressivity are called “progressive systems”:

1. If progressivity is achieved by increasing the working time (the swim distance per repetition or the number of repetitions per set), this is to the benefit of aerobic power. The interval requires a certain volume of work and is called “volume interval”. A progressive system aims to constantly increase the swim distance or the number of repetitions per set, the type of volume interval being ideal for long-distance swimmers. Its effects are recorded over the course of 16 weeks, followed by an adaptation plateau (Nikitin, 1997, cited by Maglischo, 2003, p. 424). The big advantage is the prevention of overtraining, swimmers being protected physically, but most of all emotionally.

2. If progressivity is based on increasing the average aerobic swimming speed, this is called “intensity interval or repetitions”, where first of all fast-twitch, white, pale, phasic, glycolytic fibres will be trained, but, to a small extent, slow-twitch, strongly oxidative, red fibres too. This is the most difficult form of progress, because few athletes are willing to “consume” themselves physically, but mainly mentally. They prefer other progressive systems that are less stressful, although the effects of the intensity interval are recorded within the shortest time, in the first 4 to 6 weeks. However, overcoming personal limits through the setting called “pushing the envelope” (exacerbating the effort to break the speed barrier) is absolutely necessary for sprinters. They should rest very well and have a high-protein diet (proteins with an energetic, plastic, reconstructive role) during this type of training.

Intensity intervals are the basis of short sprint – USRPT (Ultra-Short Race Pace Training). In the USRPT, which has lately become popular, creatine phosphate (CP) does not recover during the rest period and “forces” to intensify the rate of aerobic mechanisms. This is a form of athletic training that saves many hours that otherwise should be spent in the pool. For example:

- the 60 x 25m swim with departure every 30 seconds is supported as follows: 20% ATP-CP (anaerobic alactacid), 30% anaerobic lactacid (glycolysis) and 50% aerobic pathways (Figure 3), while
- the 60 x 25m swim with departure every 60 seconds is supported as follows: 40% ATP-CP (anaerobic alactacid), 20% anaerobic lactacid (glycolysis) and 40% aerobic pathways (Figure 4).
1. If progressivity is based on decreasing the rest break between repetitions, this is called “density interval”. Middle-distance swimmers (200m) train using this progressive system; since the send-off time is decreasing, anaerobic mechanisms are highly demanded.

2. Progressivity also involves changing several exercise parameters, and this is called “combination interval”. Although stressful, considering that the body must cope with many increasing stimuli within the same repetition sequence, this is frequently used. Depending on the modified indices, they cause the intensification of anaerobic or aerobic mechanisms. Thus, specialists recommend for:
   - sprinters – intensity and density intervals; distances only range from 25 to 50m, without reducing speed;
   - long-distance swimmers – volume and density intervals; everything that is over 400m will be used in their specialised training;
   - middle-distance – density, but also combination intervals – increases in volume and density.
Conclusions

Adaptation is an unlimited and polymorphic process. It requires a permanent adjustment effort. The functional and structural adaptation of swimmers is based on the laws of musculoskeletal, but also psychological physiology. From a psychological point of view, mental adaptation is the balancing of assimilation schemes through the constant adjustment to new stimuli. Cognitive adaptation, which is superior to any type of organic adaptation, is possible when the athlete understands the training tasks, because they manage to build an “infinitely broader and more stable environment” (Epuran, 1990).

By observing the principle of progressivity in the training of swimmers, adaptation is easily established through the application of progressive systems. They develop more or less both energy pathways – the aerobic and anaerobic ones, depending on the emphasis; according to the Pasteur effect, a metabolic pathway does not inhibit the other, they work alternately dominantly providing caloric energy at a time. For instance, for the 16 x 6 seconds with departure every 1:30 minutes, energy is provided differently in the first sprint compared to the 16th one. In the first sprint, the athlete will use approximately: 40% anaerobic lactacid (glycolysis), 46% ATP-CP (anaerobic alactacid), 6% ATP, 8% aerobic pathways. In the 16th sprint, they will use: 9% anaerobic lactacid (glycolysis), 49% ATP-CP (anaerobic alactacid), 2% ATP, 40% aerobic pathways (Maglischo, 2015).

In terms of distance or number of repetitions, in order to intensively use the cardiovascular and respiratory systems with no severe depletion of anaerobic energy sources (which would cause a decrease in intensity or interrupting the effort), a moderate number of repetitions is recommended, thus maintaining exercise intensity in the anaerobic lactacid or higher aerobic zone. We can state that this intensity stimulates the glycolytic capacity of white muscle fibres and the increase in the oxidative capacity of both white and red types of fibres.

Adaptation is a complex compensatory process that results from correctly guided educational interventions. Without observing the training principles, especially the principle of progressivity, adaptation does not occur, and the “performance reserve” is prematurely consumed.

References
POLE VAULTING – THE INFLUENCE OF SOMATIC AND MOTOR INDICES ON PERFORMANCE

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Abstract. Pole vaulting has been present on the Olympic athletics programme since the first edition of the modern Olympic Games – Athens 1896 and also since then has been considered the most spectacular discipline in athletics. Its complexity is due to both the athlete-pole interaction and the diversity of motor acts that form the kinematic chain of vaulting. Unlike the events where the results depend on the energy efficiency of the body (sprint races) and possibly on the adopted strategy (middle-distance and long-distance races), in this case, performance is determined by several factors. Taking into account their large number and their original way of combining according to the particularities and personal style of each athlete, this paper tries to determine their weight and degree of manifestation in the vaults performed by the Romanian athletes. The analysis of certain somatic and motor factors, in terms of impact on pole vaulting, can lead to the identification of potential causes for the low level of performance in our country, but also of the main directions of training.

Keywords: pole vaulting, somatic indices, motor indices, sports performance.

Introduction

Physical education and sports, and particularly specific educational movement activities, are an essential factor of intellectual, affective and physical development (Geambașu, 2015, p. 9).

Specialist literature, particularly the contemporary one, has debated several aspects, from stature (size) and range of motion to maximum bending induced to the pole, the forces applied to the box, or the angles formed between segments when clearing the crossbar (Frère et al., 2012).

Thus, in the period between 1960 (the moment of transition from rigid pole to flexible pole) and 1993, which is marked by the exclusive participation of men in this event, the factors mentioned in the literature include: the height of the vaulter’s centre of gravity above the ground at take-off, the stiffness of the pole, the initial horizontal velocity, the initial vertical velocity, the initial and final translational kinetic energy, the magnitude of overturning, the energy stored into the pole, the angle at which the drive leg is raised and maintained during take-off etc. (Vaslin & Cid, 1993).

After the 2000 Sydney Olympics, it was highlighted the importance of both the run-up (approach) velocity and energy stored into the pole. At the first Olympic participation of women in this event, it is noted the different weight of the previously presented factors in the global economy of the vault, depending on gender. Thus, the run-up velocity plays a more important role in women’s event, while the pole work makes the difference in men’s competition (Linthorne & Weetman, 2012).

More recent studies based on data from the 2009 European Junior Championships conclude that the body position when releasing the pole (as a pattern of the degree of technical mastery) and certain velocity parameters have a major influence on male sports performance, while the vaulting height for female athletes in the same competition is predominantly determined by the maximum degree of pole bending, the velocity of last stride and the time required to reach the maximum height of the body’s general centre of gravity (GCG) (Gudelj et al., 2015).

Purpose. Our paper aims to identify the main directions of training, in terms of the impact that certain somatic and motor factors have on pole vaulting.

Hypothesis. Although the analysed motor and somatic indices influence directly or indirectly the vaulting result, the determining factor remains the degree of technical mastery, and in the context of a very large difference in levels, the comparison with similar data collected from international competitions will reveal different weights in the index-performance causality relationships.

Material and methods

This paper is based on the systematic quantitative documentation of the literature, which is used as a support for an ascertaining correlation study conducted during the demonstrative “Urban Pole Vault” event held in Mamaia, in 2015. The majority of active pole vaulters in our country (from children to seniors) were invited to the demonstration, the gala aiming to promote pole vaulting and athletics in general, as well as attract new people to practice this event/sport.
Participants in the study. The study was carried out on a sample made up of 13 vaulters (6 boys and 7 girls), with performances ranging from 4 m to 5.20 m (males) and 3.20 m to 4 m (females), aged 18 to 31 years and 23 to 25 years, respectively. Three attempts were measured for each competitor, taking into account each one’s attempt with the best final velocity (10 m - 5 m).

The collected data were related to each athlete’s personal record in order to establish a connection between the level of manifestation of certain specific motor qualities and the individual performance capacity.

The somatic indices used were: stature, range of motion, weight and body mass index.

The motor indices used were the following: approach velocity, take-off distance, grip height and 1RM/body weight ratio (as an expression of relative strength).

The approach velocity developed by athletes was measured using a system of 6 photoelectric cells placed two by two on each side of the running area, at each timing point: 5-, 10- and 15-m away from 0 line (the line perpendicular to the approach direction of the box where the pole is planted).

The take-off spot, namely the distance from the take-off point (the tip of the vaulter’s shoe) to 0 line, was visually identified when performing the vault, by reference to control lines previously drawn on the approach surface and checked after the competition, for each analysed attempt, through video recording.

The grip height, stature, weight and 1RM values for the exercises included in the study were provided to us by each vaulter.

Results and interpretation

The recorded data were summarised in Tables 1 (males) and 2 (females). The arithmetic mean was calculated for each field, and the below-average values for the motor indices were marked in bold, red colour. The same marking was used for body mass indices that did not fit into normal values (according to the World Health Organisation, they range between 18.50 and 24.99).

Table 1. Somatic and motor indices – Males

<table>
<thead>
<tr>
<th>Name (Initials)</th>
<th>Personal record</th>
<th>(V_{10-5}) (m/s)</th>
<th>(V_{15-10}) (m/s)</th>
<th>(\Delta V) (m/s)</th>
<th>Take-off distance (m)</th>
<th>Grip height</th>
<th>Half-squat/ Weight</th>
<th>Snatch/ Weight</th>
<th>Supine press/ Weight</th>
<th>Stature (m)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.A.R.</td>
<td>5.20</td>
<td>6.32</td>
<td>7.24</td>
<td>0.92</td>
<td>3</td>
<td>4</td>
<td>2.12</td>
<td>1.06</td>
<td>1.06</td>
<td>1.81</td>
<td>66</td>
<td>20.15</td>
</tr>
<tr>
<td>P.B.</td>
<td>5</td>
<td>6.25</td>
<td>6.84</td>
<td>0.59</td>
<td>3</td>
<td>4</td>
<td>2.40</td>
<td>1.13</td>
<td>1.47</td>
<td>1.81</td>
<td>75</td>
<td>22.89</td>
</tr>
<tr>
<td>S.V.</td>
<td>4.9</td>
<td>7.04</td>
<td>7.04</td>
<td>0</td>
<td>3.25</td>
<td>4.1</td>
<td>2.57</td>
<td>1.00</td>
<td>1.71</td>
<td>1.79</td>
<td>70</td>
<td>21.85</td>
</tr>
<tr>
<td>F.A.R.</td>
<td>4.8</td>
<td>6.84</td>
<td>7.04</td>
<td>0.2</td>
<td>3</td>
<td>4</td>
<td>2.74</td>
<td>1.10</td>
<td>1.64</td>
<td>1.82</td>
<td>73</td>
<td>22.04</td>
</tr>
<tr>
<td>C.V.A.</td>
<td>4.7</td>
<td>5.37</td>
<td>6.75</td>
<td>1.38</td>
<td>3.25</td>
<td>4</td>
<td>2.67</td>
<td>1.07</td>
<td>1.47</td>
<td>1.85</td>
<td>75</td>
<td>21.91</td>
</tr>
<tr>
<td>R.B.C.A.</td>
<td>4</td>
<td>5.74</td>
<td>6.75</td>
<td>1.01</td>
<td>3</td>
<td>3.9</td>
<td>1.75</td>
<td>0.87</td>
<td>1.03</td>
<td>1.76</td>
<td>63</td>
<td>20.34</td>
</tr>
<tr>
<td>Mean</td>
<td>4.77</td>
<td>6.56</td>
<td>6.94</td>
<td>0.68</td>
<td>3.16</td>
<td>4.06</td>
<td>2.51</td>
<td>1.04</td>
<td>1.40</td>
<td>1.80</td>
<td>70.23</td>
<td>21.53</td>
</tr>
</tbody>
</table>

Table 2. Somatic and motor indices – Females

<table>
<thead>
<tr>
<th>Name (Initials)</th>
<th>Personal record</th>
<th>(V_{10-5}) (m/s)</th>
<th>(V_{15-10}) (m/s)</th>
<th>(\Delta V) (m/s)</th>
<th>Take-off distance (m)</th>
<th>Grip height</th>
<th>Half-squat/ Weight</th>
<th>Snatch/ Weight</th>
<th>Supine press/ Weight</th>
<th>Stature (m)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. L.</td>
<td>4</td>
<td>6.02</td>
<td>7.04</td>
<td>1.02</td>
<td>3</td>
<td>3.8</td>
<td>2.96</td>
<td>0.74</td>
<td>1.11</td>
<td>1.72</td>
<td>54</td>
<td>18.25</td>
</tr>
<tr>
<td>L. I. D.</td>
<td>3.6</td>
<td>6.02</td>
<td>6.94</td>
<td>0.92</td>
<td>3</td>
<td>3.8</td>
<td>3.08</td>
<td>0.58</td>
<td>0.96</td>
<td>1.70</td>
<td>52</td>
<td>17.99</td>
</tr>
<tr>
<td>P. I. C.</td>
<td>3.5</td>
<td>5.10</td>
<td>6.25</td>
<td>1.15</td>
<td>2.75</td>
<td>3.6</td>
<td>2.22</td>
<td>0.65</td>
<td>1.11</td>
<td>1.67</td>
<td>54</td>
<td>19.36</td>
</tr>
<tr>
<td>B. A.</td>
<td>3.5</td>
<td>4.9</td>
<td>6.41</td>
<td>1.51</td>
<td>2.60</td>
<td>3.7</td>
<td>1.89</td>
<td>0.66</td>
<td>0.75</td>
<td>1.61</td>
<td>53</td>
<td>20.45</td>
</tr>
<tr>
<td>C. A. A.</td>
<td>3.4</td>
<td>5.88</td>
<td>6.66</td>
<td>0.78</td>
<td>2.75</td>
<td>3.7</td>
<td>2.07</td>
<td>0.78</td>
<td>0.95</td>
<td>1.71</td>
<td>58</td>
<td>19.84</td>
</tr>
<tr>
<td>I. A.</td>
<td>3.2</td>
<td>5.49</td>
<td>6.57</td>
<td>1.08</td>
<td>3</td>
<td>3.9</td>
<td>1.85</td>
<td>0.56</td>
<td>0.83</td>
<td>1.70</td>
<td>54</td>
<td>18.69</td>
</tr>
<tr>
<td>D.A.</td>
<td>3.2</td>
<td>5.61</td>
<td>6.57</td>
<td>0.96</td>
<td>2.5</td>
<td>3.6</td>
<td>2.20</td>
<td>0.70</td>
<td>0.90</td>
<td>1.60</td>
<td>50</td>
<td>19.53</td>
</tr>
<tr>
<td>Mean</td>
<td>3.49</td>
<td>5.57</td>
<td>6.63</td>
<td>1.06</td>
<td>2.8</td>
<td>3.72</td>
<td>2.32</td>
<td>0.67</td>
<td>0.95</td>
<td>1.87</td>
<td>53.57</td>
<td>19.16</td>
</tr>
</tbody>
</table>
Analysing the degree of association between variables in relation to the personal record, significant associations were found in the male sample for the V10-5 velocity values (0.70), grip height (0.51), half-squats (0.55) and stature (0.54), while in the female sample, significant correlations were recorded for V10-5 velocity (0.59), half-squats (0.74) and supine press (0.60) (Constantin, 2017).

To compare the association relationships established at national level with those established at international level, we used the data provided by the International Association of Athletics Federations (IAAF) and specialised national federations regarding the approach velocity, athlete’s personal record at the moment of velocity measurement, take-off distance, stature and weight for the following international competitions: US National Championship, 2002 (Lindeman, 2004), Helsinki World Championship, 2005 (Schade et al., 2007), Berlin World Championship, 2009 (Helmar, 2009), Daegu World Championship, 2011 (Young-Sang, 2011).

For female vaulters, it was noted a strong association between the V10-5 velocity value at the end of approach and the personal record at the moment of measurement (Spearman correlation index – 0.54). The way in which the degree of association varies over time may indicate that the influence of velocity decreases with the increase in the degree of technicality.

In the correlation matrix achieved separately for each international competition used in this study, other interesting correlations were also observed: the V10-5 variables and the take-off distance correlated twice in the 4 competitions where values were available, once positively – 0.65 and once negatively – 0.53.

For male athletes, the data from international measurements did not show any significant association of the variables taken into account (velocity on the last metres, take-off distance, weight, stature) with the personal record. However, there are interesting correlations for each competition: significant interdependences of velocity and height with the personal record in 2002 (0.59; 0.50) and 2005 (0.54; 0.55), as well as the influence of velocity and take-off distance in 2009 (0.56; -0.58) or the influence of take-off distance and BMI in 2011 (0.71; 0.55) (Constantin, 2017).

To facilitate analysis of the large amount of data, Spearman’s coefficients for the entire international and national sample, for the velocity, take-off and stature variables, were comparatively synthesised in Figure 1.

![Figure 1. Correlation between indices and personal record](image)

According to Colton’s empirical rules (1974), the correlation coefficient can be interpreted as follows: for values between ±0.25 and ±0.50, the relationship between variables is poor; for values between ±0.50 and ±0.75, the relationship between variables is moderate, and over 0.75 (or below -0.75), the relationship is strong. The above figure includes three components for each category (international female, international male, national female, national male). Summarised, they reach or exceed the value of 1.5 (3x0.5 – a moderate relationship between variables) only in the case of native vaulters. For the international sample, this indicates the more complex determination of performance through the influence of the technique.

In females, the difference between national and international samples is about 0.5, the largest gap being caused by the stature variable. Differences between the correlation coefficients of the velocity and take-off variables are minimal (0.05 and 0.08, respectively), which suggests the similar importance of these components in the dynamics of female vaults, in both the 3m-4m and 4.35m-5.06m performance areas. The fact that stature has no influence on international performances (Spearman correlation coefficient – 0.11), compared to its almost moderate influence for the native sample (correlation coefficient – 0.45), can be attributed to the possible lack, among the Romanian athletes, of the abilities needed to overcome the handicap represented by their smaller stature (Constantin, 2017).
The same reasoning can also be applied in the case of the very large differences noticed in male athletes (an overall difference of more than one unit). Regarding stature, a corroborating explanation would be the large difference between the averages of international and national samples (1.86 vs. 1.80).

Considering the 1RM/body weight values of the Romanian athletes in three strength tests (half-squats – for the relative strength of lower limbs, snatch – for the relative general strength applied to the biomechanical chain, which is similar to the one specific to the event, and supine press – for the relative strength of upper limbs), we checked the degree of association (Spearman’s correlation index) between the obtained results and the personal record of vaulters, as seen in Figure 2.

![Figure 2. Correlation between relative strength indices and personal record](image)

We note that three of the six representative columns exceed the 0.5 significance threshold, namely: half-squats/ body weight in both males (0.55) and females (0.74), and supine press/ body weight in females (0.60). The other three are in the category of low correlations, with values between 0.3 (snatch – female) and 0.33 (snatch and supine press – male).

As regards the females, it is noted that the relative strength values for the lower body and upper extremities (in both cases, on the biomechanical pressing chain) influence the maximum height reached by the athlete, while the values achieved in the snatch style have only a poor relationship with optimal performance (Constantin, 2017).

According to Herman (2007, p. 138), the height reached by a vaulter can be regarded as the sum of four component heights: H1 – height of the GCG at take-off, H2 – height at which the GCG is raised while the athlete maintains contact with the pole, H3 – height at which the GCG raises after releasing the pole (height of the flight), H4 – difference between the height of the crossbar and the maximum height reached by the GCG.

A more accurate explanation of the reasons for choosing the exercises to assess strength will also clarify the statistical result. Thus, the pole-entry phase (H1) involves a pushing movement of the take-off leg (similar to the bilateral one when performing half-squats), as well as the pushing movement of the arms (basically differing from the supine press biomechanics only by the angle at which the arm extension is performed).

The motor act similar to the snatch style includes two flight phases (pulling and overturning), which are decisive for reaching maximum height (H3), and a vaulter’s technicality is given by the difference between the grip height and the vaulting height (H3+H4, H4 having low positive or negative values), only one of our female athletes managing to jump over the grip level (with only 10–20 cm).

In these conditions, we can make the following statements:

- the strength needed to perform the pulling and overturning, assessed by the ratio between the 1RM value for snatch and body weight, has little influence on the final result, because the required vaulting movement is not performed or is partially and/or incorrectly performed;

- the strength needed at pole entry (H1), assessed by half-squats and supine presses, influences the final result, because, by decreasing the H3+H4 weight in the vaulting height, the importance of H1+H2 increases. Based on good entry, one can safely increase the pole grip and stiffness, these being the two ways to quickly improve the vaulting height under poor technical conditions.

In males, the only strength assessment test whose result has a significant association with the vaulting height is represented by half-squats. Thus, the relative maximum strength of the legs has a beneficial influence on performance, a phenomenon that can be explained by its high degree of association with the run-up velocity (the increase in strength of the lower body leads to an increase in the length and frequency of strides) and the take-off distance (an expression of vertical jump under specific conditions) (Constantin, 2017).
We believe that, with an average ratio of 1.04 (snatch) and 1.40 (supine press) between the 1RM value and body weight, athletes are at a level that allows them to properly perform the technical elements predominantly conditioned by the upper body. Therefore, in this case, once the relative strength of the upper body has been developed to the point allowing the execution of movements, it no longer causes discrimination of the heights reached.

Discussions and conclusions

Although the multitude of variables in the pole vaulting equation does not yet allow an accurate definition of the “recipe” for a valuable vault, one can identify some aspects/ trends, which, in relation to the technique of the event, indicate the training direction to be followed in the future.

The anatomical and physiological differences between the two genders play an important role, because a large part of the movements to be performed are based on the upper body muscles, whose development is genetically conditioned.

For females, the strength values are positively associated with the vaulting result only after they have reached the minimum level required to perform the appropriate technical elements.

For males, the statement is valid only as regards the lower body strength.

Since strength is a well-trainable motor quality, the conclusions drawn from the obtained results will refer to the possibilities of optimising the training.

Thus, for females, developing the upper body strength through accessible and general means is a priority, in order to create the possibility of performing certain (specific) movements. Only then is it possible to use the technical elements aimed at the specific muscle development, but without neglecting to continue the training of the shoulder girdle, torso and limbs through simple general means (Linthorne & Weetman, 2012).

The general-specific sequence must also be observed in male athletes, the general phase being necessary for a much shorter period of time, which decreases considerably according to the criterion of efficiency, after passing to the specific phase.

The need for this differentiation of training becomes even more obvious if we take into account that the problems encountered by senior female vaulters in reaching a certain position or performing a certain movement are similar to the difficulties encountered by boys aged 14-15 years.

Good velocity in the last part of the approach is required to safely perform the vault and reach the highest possible height.

The vertical jump (analysed in terms of distance to the mat where the take-off is performed) and stature show a moderate degree of association for the female and male national samples. It is again about an essential conditional factor, but whose power of determining the result decreases with the increase in the performance level. In the same context, the stature factor is also found.

For international male athletes, where the level of conditional abilities is the highest of the four categories taken into consideration, no significant associations with the vaulting height could be established for any of the parameters described. Therefore, the degree of technical mastery is, in this case, the decisive factor.

For international female athletes, velocity at the end of approach is still associated with the vaulting performance. This may be due to both their lower technicality compared to men and the lower velocity that generally can be reached by women.

Consequently, anthropometric particularities can influence the pole vaulting performance as long as the required motor qualities are not developed at an appropriate level. Also, the motor qualities analysed in this paper influence the pole vaulting result until they reach the level of manifestation necessary for the correct technical execution. From this point on, the determining factor is the degree of technical mastery.

References


THE EFFECTIVENESS OF PHYSIOTHERAPEUTIC TREATMENT IN THE RECOVERY OF THE COLLATERAL LIGAMENT LESION

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Abstract. The knee represents that part of the lower limb where the calf-thigh bonding mechanism occurs and has a complex functionality. The knee joint should be mobile and supple to allow flexion and extension of the lower limb. It must also be very stable, since its role is to support all body weight. In this paper, we performed two studies. The first retrospective study was conducted in the period 2012-2015 at the Târgu Mureș Emergency Clinical Hospital, Orthopaedics and Traumatology I, and the second, at the Târgu Mureș Rheum Care Foundation, between 29.02.2016 and 30.05.2016. The first study was performed on a sample of 70 subjects and the second was performed on a sample of 10 subjects. As research methods we used: bibliographic study, statistical analysis, the questionnaire, observation, evaluation and testing, Ultrasound Electrosurgery (USS) and Transcutaneous Electrical Nerve Stimulation (TENS). As a means of evaluation, we used the Lysholm Scale, thigh diameter measurement and goniometer testing. The results of the first study indicated that: 50% of patients had collateral ligament lesions of all grades; 34% of patients - medial collateral ligament lesions + cross-ligament lesions; 16% of patients - medial collateral ligament + meniscus lesions. The purpose of study number two was to prove the effectiveness of physiokinetic treatment in the recovery of second-degree collateral ligament lesions.

Keywords: collateral ligament, physiotherapy, treatment, knee joint.

Introduction

The knee joint is located at the lower limb, having a dual role in walking: on the one side, it ensures statics through great stability during the support, and on the other side, it ensures foot elevation to orient it according to the unevenness of the ground at the time of balance (Marcu & Dan, 2006).

Medial collateral ligament rupture represents the total or partial ligament tissue interruption. This may or may not be accompanied by other soft tissue lesions. The medial collateral ligament can be ripped off by placing the knee joint in valgus or by excessive external rotation.

The knee joint has as particularity the presence of the meniscus to achieve articular congruence between the femur and the calf bones. In the knee joint, there are two collateral ligaments: medial and lateral. More common cases of lesions appear to the medial collateral ligament than the lateral collateral ligament (Hidi, Pop, & Gergely, 2015).

Rupture of the collateral ligaments

The tibial or medial collateral ligament connects the medial condyle of the femur with the medial condyle of the tibia, having a deep layer that forms the fibular and tibial ligaments of the meniscus (Enciulescu, Brânzaniuc, & Butilcă, 2004). It is the main static stabiliser of the medial part of the knee and provides resistance to valgus pressure, as well as internal and external rotation (DeGrace & Thomas, 2013; Warren, Marshall, & Girgis, 1974; Marchant et al., 2011), and rupture of the collateral ligament represents the total (complete) or partial (fibrillar) interruption of ligament tissue that may be a solitary lesion or may be associated with other soft tissue lesions (Hidi, Pop, & Gergely, 2015).

The medial collateral ligament is made up of oblique and parallel fibres. The parallel anterior fibres of the medial collateral ligament have a distinct vertical margin, whereas the back fibres become more oblique in orientation. The femoral insertion of the medial collateral ligament is approximated 1 cm in front of the adductor tubercle. Its parallel fibres diverge distally to the anteromedial tibial crest approximately 4.5 cm from the medial line of the joint, with the fibres mixed tangentially with the tibial periosteum, behind the “goose claws” (Miyamoto, Bosco, & Sherman, 2009; Robinson et al., 2004; Wymenga et al., 2006). In front, the bursa is located between the superficial and deep medial collateral ligament. The deep medial collateral ligament consists of meniscus-femoral and meniscus-tibial ligaments. Although the layers are presented as distinct structures in the middle of the third part of the medial knee, they are mixed together posteriorly, together with the semimembranosus muscle tendon sheath to form the posterosmedial capsule.

From a biomechanical point of view, the superficial collateral medial ligament is the first safety system against valgus pressure on the knee. It has been shown that this cross-section of the medial collateral ligament results in 2 to 5 degrees of laxity or 3 to 5 mm of joint opening when valgus stress is applied, whereas, between the transverse...
section of the medial collateral ligament and the posteromedial capsule, laxity is between 7 and 10 degrees, which reveals the functional coordination of these two structures. During flexion, the anterior and posterior portions of the medial collateral ligament are subjected to varying degrees of force. Anterior fibres are tense when the femoral insertion is rotated upwards during flexion. In the opposite, posterior fibres rotate underneath the anterior fibres during flexion and thereby they remain relaxed. During extension, anterior fibres are relaxed, and posterior fibres are contracted. Most biomechanical studies and calculation models have concluded that the level of tension in the medial collateral ligament varies with location (e.g., femoral origin, middle section, tibial insertion) and the amount of flexion being tested (Miyamoto, Bosco, & Sherman, 2009; Gardiner, Weiss, & Rosenberg, 2001). The greatest pressure on the medial collateral ligament occurs during valgus production, with the forces concentrated near the femoral insertion. This finding correlates with clinical data showing that femoral insertion is the most commonly affected part in medial collateral ligament lesions. In addition, the superficial medial collateral ligament plays a secondary role in the resistance against external rotation and anterior/posterior translation. At the same time, the deep medial collateral ligament is a secondary stabiliser against valgus pressure (Miyamoto, Bosco, & Sherman, 2009). The incidence of medial collateral ligament lesions, especially those of grade 1 and grade 2, is probably much higher than that reported.

Medial collateral ligament lesions can be encountered in both contact sports and non-contact sports when applying valgus pressure during flexion of the knee. Additional mechanisms causing medial collateral ligament lesions are the pivotal external rotation, a hit in the anterolateral part of the knee or a knee joint dislocation. Medial collateral ligament lesions can be associated other knee joint structures, such as other ligaments or meniscus, thereby increasing the severity of lesions (Miyamoto, Bosco, & Sherman, 2009).

With a severe injury to the medial collateral ligament, deterioration of other anatomical structures of the knee should be considered. The possibility of damage to other ligaments increases with the degree of collateral ligament lesion. According to Fetto and Marshal (1978), in a study of 265 patients, the risk of having an associated ligament lesion was 20% with a first-degree collateral ligament lesion, 53% with a second-degree medial collateral ligament lesion, and 78% with a third-degree collateral ligament lesion.

The most common combination of lesions is between the medial collateral ligament and the anterior cruciate ligament, comprising 7-8% of all knee ligament injuries (Tibor et al., 2010; Shelbourne & Carr, 2003) and 70% of all multiligament knee injuries (Kaeding et al., 2005). Many studies have shown that the second most common combination of injuries is that between the medial collateral ligament and the posterior cruciate ligament, comprising about 1% of all knee ligament disorders (Tibor et al., 2010; Shelbourne & Carr, 2003), although a large study conducted by Kaeding et al. (2005) shows that this combination is the least common, accounting for only 0.4% of all multiligament injuries.

Medial collateral ligament lesions are clinically classified according to their grades, which refers to the value of the common line of the joint opening when applying valgus pressure, and to their degree when referring to the quality of the endpoint where laxity exists. The American Medical Association (1996) states that the clinical grade is assessed with valgus pressure applied to the knee joint at 30° flexion.

A grade 1 lesion is defined between 0-5 mm of valgus laxity, which corresponds to stretching and a minor rupture of the medial collateral ligament. In the first-degree lesion, there is a rupture of the medial collateral ligament, which is not accompanied by instability. The second-degree lesion is defined between 6-10 mm of valgus laxity, and this examination is correlated with a significant rupture in the medial collateral ligament. In the second-degree lesion, laxity increases in valgus and a firm endpoint appears. The third-degree lesion has an articular line opening of more than 10 mm, which also corresponds to a total rupture of the medial collateral ligament. In the third-degree lesion, there is significant laxity and an endpoint that cannot be assessed (American Medical Association, 1966; Clancy et al., 1998).

There are several collateral ligament classification systems that use a clinical combination of valgus laxity and the quality of the endpoint, which is found in the MRI (Magnetic Resonance Imaging) examination to describe the severity of the lesion. This is not a standardised classification method, but many orthopaedists use this system to combine elements to describe a lesion. The most common system used defines the first-grade lesion as a microscopic rupture of the superficial medial collateral ligament, without instability or laxity at the time of application of valgus pressure, with an intact ligament on MRI and a periligamentous oedema (Clancy et al., 1998; Marchant et al., 2011; Miller et al., 1998). The second-grade lesion appears as an incomplete rupture at both sides of the ligament and with an interruption in the superficial fibres of the medial collateral ligament. This causes 5-15° instability in valgus at 30° flexion, but without instability in rotation or extension. The second-grade lesion is characterised by a firm endpoint by an MRI demonstrating a partial rupture of the superficial medial collateral ligament and surrounding oedema. The third-grade lesion refers to the complete collapse of the medial collateral...
ligament by more than 15° instability in valgus at 30° flexion and an undetermined endpoint. Here again, there can be instability in both rotation and extension. The MRI demonstrates the total rupture of the medial superficial ligament, together with a periarticular oedema (Clancy et al., 1998; Marchant et al., 2011; Miller et al., 1998).

The **purpose** of the first study was to set a more accurate hierarchy of the medial collateral ligament pathology and its association with other pathologies in these joints.

The **purpose** of study number two was to prove the effectiveness of physiokinetic treatment in the recovery of second-degree collateral ligament lesions.

The **hypothesis** of the study is that total kinetic recovery of the medial collateral ligament can be achieved following the implementation of a properly structured and applied physiokinetic program.

**Material and methods**

In our research, we used the following methods: bibliographic study, statistical analysis, the questionnaire, observation, evaluation and testing.

The **research sample**

The first study was performed on a sample of 70 subjects and research number two was performed on a sample of 10 subjects (Table 1).

**Procedure**

**Place of research.** Two studies were conducted. The first retrospective study was done during the period 2012-2015 at the Târgu Mureș Emergency Clinical Hospital, Orthopaedics and Traumatology I, and the second, at the Târgu Mureș Rheum Care Foundation, between 29.02.2016-30.05.2016.

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Male</td>
</tr>
<tr>
<td>T.T.</td>
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<td>Male</td>
</tr>
<tr>
<td>S.N.</td>
<td>40</td>
<td>Female</td>
</tr>
<tr>
<td>R.M.</td>
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</tr>
<tr>
<td>D.E.</td>
<td>35</td>
<td>Male</td>
</tr>
<tr>
<td>R.A.</td>
<td>41</td>
<td>Female</td>
</tr>
<tr>
<td>D.A.</td>
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<td>Male</td>
</tr>
<tr>
<td>L.O.</td>
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<td>N.C.</td>
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<td>Male</td>
</tr>
<tr>
<td>S.S.</td>
<td>25</td>
<td>Male</td>
</tr>
</tbody>
</table>

Table 1. **The sample of subjects from research no. 2**

The sample of subjects was divided into two groups (Table 2).

<table>
<thead>
<tr>
<th>Group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. **The sample of subjects per group**

The exclusion criteria were the following:
- Osteoarthritis in the knee joint;
- Fractures of the bones that make up the knee joint;
- Infections localised to the knee joint;
- Over 45 years of age.

The inclusion criteria were the following:
- Insufficiency in the knee joint;
- Functional knee joint deficiency;
- Age between 10 and 45 years.

The experimental group was applied the physiokinetic treatment. It includes physical exercise plus electrotherapy. Electrotherapy consisted of ultrasound (USS) and Transcutaneous Electrical Nerve Stimulation.
(TENS). The physiokinetic program was performed 5 times a week, and the recovery time was variable from patient to patient.

The physiokinetic program was personalised for each patient, depending on their physical activity, work environment and physical needs. The physiokinetic program was based on two concepts, the first on the recovery of osteoarticular pathology in athletes, published by Hidi, Pop and Gergely (2015), and the second, published by Giannotti, Rudy and Graziano (2006).

The control group was recommended to wear a knee joint orthosis for a month. Upon their return, one could notice the inefficiency of this orthosis and its repercussions on the muscular level.

The proposed physiokinetiic treatment consisted of a set of therapeutic exercises aimed to improve muscular strength in the affected lower limb, to fully restore the joint range of motion and stability, and to improve proprioception and neuromuscular control. Ultrasound electrotherapy was mainly focused on accelerating local metabolic functions, as well as accelerating healing and Transcutaneous Electrical Nervous Stimulation (TENS) in order to relieve pain.

**The therapeutic exercise program**

- **Week 1**
  1. Quadriceps contraction
     The patient is in the initial dorsal decubitus position and performs isometric contractions of the quadriceps. Dosage: 15 repetitions x 10 seconds / repeat
  2. Flexion / Plantar dorsiflexion
     The patient is in the initial dorsal decubitus position, with full knee extension and flexion and plantar dorsiflexion. Dosage: 3 series x 15 reps (flexion / dorsiflexion)
  3. Extension of the knee joint
     The patient is in dorsal decubitus, with a ball under the knee and the heel attached to the bed, and performs extension of the knee joint. Dosage: 3 series x 12 reps
  4. Flexion of the coxofemoral joint
     The patient is in the initial dorsal decubitus position and performs flexion of the coxofemoral joint. Dosage: 3 x 10 repetitions
  5. Abduction of the coxofemoral joint
     The patient is in the initial lateral decubitus position and performs abduction of the coxofemoral joint, with the knee in extension. Dosage: 3 x 10 repetitions
  6. Adduction of the coxofemoral joint
     The patient is in the initial lateral decubitus position on the affected limb. The healthy limb is flexed over the affected one. Adduction is performed at the level of the coxofemoral joint with the affected limb. Dosage: 3 series x 10 reps
  7. Flexion of the knee joint
     The patient is in dorsal decubitus, with the affected limb in extension, and performs flexion of the knee. Dosage: 3 x 10 repetitions

- **Week 2**
  1. Extension of the knee joint with weight
     The patient is in dorsal decubitus, with a ball under the affected knee. The patient executes extension of the affected knee, with a 2-kg weight to the ankle joint. Dosage: 3 x 10 repetitions
  2. Coxofemoral flexion with weight
     The patient is in dorsal decubitus, with the affected limb in extension. Flexion is performed at the level of coxofemoral joint, while having a 2-kg weight to the ankle joint. Dosage: 3 x 10 repetitions
  3. Coxofemoral abduction against resistance
     The patient is in dorsal decubitus, with lower limbs flexed and an elastic band to the knee joint that hinders the abduction movement. Abduction is performed at the level of coxofemoral joint. Dosage: 3 x 10 repetitions
  4. Coxofemoral adduction against resistance
     The patient is in the initial dorsal decubitus position, with lower limbs flexed. The patient executes adduction of the lower limbs against an elastic ball. Dosage: 3 series x 12 reps
  5. Pelvis elevation
     The patient is in the initial dorsal decubitus position, with lower limbs flexed, and executes torso elevation movements. Dosage: 3 series x 6 reps
  6. Skateboard extensions
The patient is in the initial position sitting on a chair. With the lower limb flexed on a skateboard, the patient performs extension of the knee joint. Dosage: 3 x 10 repetitions

7. Flexion of the knee against resistance

The patient is in the initial ventral decubitus position, with the lower limb in extension. The knee flexion movement is performed against resistance by the physical therapist. Dosage: 3 series x 8 reps

- Weeks 3 and 4
  1. Squats
  The patient is in the orthostatic position, with upper limbs in extension, and patient performs squats. Dosage: 3 x 10 repetitions
  2. Coxofemoral flexion/ extension/ abduction/ adduction against elastic
  The patient is in the orthostatic position and executes flexion, extension, abduction and adduction movements of the coxofemoral joint against elastic resistance. Dosage: 3 series x 10 reps/ flexion/ extension/ abduction/ adduction

3. Ankle elevation on the stepper

The patient is in the orthostatic position, with the tiptoes on a stepper, and performs plantar flexion movements. Dosage: 3 x 10 repetitions

4. Isometry with lower limbs at 90º flexion to the wall

The patient is in orthostatic position, leaning back against a wall. The patient executes flexion of the knee joint with the back leaning against the wall until reaching a 90º angle between the femur and the tibia. The position is held for 30 seconds. Dosage: 5 x 30 seconds

5. Squats on the balance ball

The patient is in orthostatic position on two balls designed to improve balance and stability and performs squats. Dosage: 3 x 10 repetitions

6. Jumping on the stepper

The patient is in orthostatic position in front of a stepper, jumps on it, and then returns to the initial position. Dosage: 3 series x 10 front / back jumping

**Evaluation methods.** To evaluate the patient’s condition and progress during the physiokinetic program, the Lysholm Scale (Figure 1) was used. This scale indicates some very important parameters for patient recovery and shows exactly the progress of the patient.

![Lysholm Score](https://example.com/lysholm-score.png)

**Figure 1. Lysholm Score (n.d.)**
To evaluate the thigh muscle condition, we used the thigh diameter measurement. This indicates that muscles are restored and will be compared with the lower lateral counter limb. To assess recovery of the functional deficit in the knee joint, goniometer testing was used.

**Results**

The first study was performed on a total of 70 patients, and the results are presented below:

- 50% - 35 patients - collateral ligament lesions of all grades;
- 34% - 24 patients - medial collateral ligament lesions + cross-ligament lesions;
- 16% - 11 patients - medial collateral ligament + meniscus lesions.

Research number two was performed on a sample of 10 subjects. The average age was 29.5 years, the lowest being 11 years, and the highest 41 years. The average age of patients in the experimental group was 24.1 years, and the average age in the control group was 35 years (Table 3, Figure 2). The 8 patients were from urban areas, and 2 patients, from rural areas. There were 7 male and 3 female patients. The right lower limb was affected in 8 cases, while the lower left limb, in only 2 cases.

Table 3. *The average age of patients*

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>24.1 years old</td>
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<tr>
<td>Control group</td>
<td>35 years old</td>
</tr>
<tr>
<td>Average</td>
<td>29.5 years old</td>
</tr>
</tbody>
</table>

![Figure 2. The average age of patients](image)

Average recovery time was 26.5 days in the experimental group, while the control group needed an average of 44.5 days after removal of the orthosis for complete kinetic recovery (Table 4, Figure 3).

Table 4. *Average recovery time*

<table>
<thead>
<tr>
<th>Group</th>
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<tr>
<td>Experimental group</td>
<td>26.5 days</td>
</tr>
<tr>
<td>Control group</td>
<td>44.5 days</td>
</tr>
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</table>
To see the effectiveness of the physiokinetic program and the kinetic progress, the Lysholm Scale was used (Table 5, Figure 4).

### Table 5. Lysholm Scale

<table>
<thead>
<tr>
<th>Group</th>
<th>Lysholm Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Pre. Prog – 43.8</td>
</tr>
<tr>
<td></td>
<td>Post. Prog – 93.4</td>
</tr>
<tr>
<td>Control</td>
<td>Pre. Prog – 45.8</td>
</tr>
<tr>
<td></td>
<td>Post. Prog – 64</td>
</tr>
</tbody>
</table>

To evaluate the effective recovery of the thigh muscles, the thigh diameter was measured. After the recovery program, patients in the experimental group had 97% of the right thigh diameter contra lateral, and patients in the control group had 83% of the thigh diameter contra lateral. In order to observe recovery of the knee-joint functional extension, goniometer testing was performed (Table 6, Figure 5).

### Table 6. Extension testing

<table>
<thead>
<tr>
<th>Group</th>
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<tr>
<td>Experimental</td>
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<tr>
<td></td>
<td>Post. Prog. 178</td>
</tr>
<tr>
<td>Control</td>
<td>Pre. Prog. 158</td>
</tr>
<tr>
<td></td>
<td>Post. Prog. 153</td>
</tr>
</tbody>
</table>
Conclusions

The hypothesis of our study was confirmed, as the efficiency of the physiotherapeutic treatment in recovering the collateral ligament lesion was proven. Following a properly applied kinetic program, we have demonstrated that physiotherapeutic treatment is superior compared to other types of therapies.

The patients who received this treatment had a much shorter recovery time, and the tests performed proved to be excellent. It has been shown that the lower right limb is more often affected than the left one and that male gender is more prone to this pathology than the female one.

Following the first study, it has been confirmed that this pathology is not a solitary one and may bring with it another pathological condition of the knee, namely the ligament rupture or the meniscus rupture. This pathology does not have a limited sample of patients, as an age, on the contrary, it can protect from an early age to maturity.

The age difference in favour of the experimental group denotes a much greater opening towards the kinetic therapy of young people compared to the control group. Performing kinetic therapy leads to total recovery of the affected limb, but the lack of it can even aggravate the situation. This finding results from the extension testing, the value at the measurement performed immediately after the injury being higher than that achieved after wearing an orthosis and in the absence of a kinetic program.

Recommendations for the prevention of this pathology are based on a prophylactic program to improve lower limb muscles, especially in performance athletes, but also in people performing moderate exercise, and the avoidance of rough ground, which may trigger the mechanism that causes this condition. Avoiding trauma in the lateral part of the knee joint is also an important protective factor.

References


TECHNICAL ASPECTS OF THE BOCCE GAME

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Abstract. Releasing the ball to a target is the oldest game known to mankind. From Egypt, the game moved to Greece, and from there it was taken over by the Romans who spread it throughout the Empire. The Roman influence in bocce was kept in the name of the game – bocce. Today, the game is part of the category of sports disciplines where the precision of movement is decisive in achieving higher results. The game technique includes simple motor skills (ball picking, basic position, ball cupping, ball releasing) aimed at handling the pallino and the bocce according to the gaming rules. All the technical elements are subordinated to the goal – releasing the pallino to the proper area and then releasing the bocce balls in optimal conditions for them to stop as close as possible to the pallino. The bocce game is played by people with and without disabilities, men and women, young and old. If played frequently, the bocce game contributes to the education of the fitness components, but it is also a means of social integration.

Keywords: bocce, history, technique.

Introduction

Releasing the ball to a target is the oldest game known to mankind. Since ancient times the Egyptians were practicing a form of this game by using polished stones. The first graphic representations with figures releasing balls or polished stones dated back from 5200-5000 B.C. in Egypt (Mackey, 1987; World Bowls - WB, 2015). Today, the bocce game looks different than its predecessor, but the goal remains the same: releasing a ball as close as possible to a target. The current rules of the game revolve around this goal.

From Egypt, the game headed for Greece around 800 B.C. (WB, 2015). The Romans learned the game from the Greeks and spread it throughout the Empire. The Roman influence over the bocce game is still kept today in the name of the game – bocce. It derives from the Latin word “bottia”, which means “the chief” (Bocce Association of America - BAA, 2018).

In Rome, the beginning of this game was played with coconuts brought by Romans from North Africa or with balls made of olive tree wood (United State Bocce Federation – USBF, 2018). In its current form, bocce was first played in 264 B.C. during the Punic War, when the Roman soldiers used it as a means of relaxation (Finzi, 2016). It was played by teams that could be made up of 2, 4, 6 or 8 people. During the reign of Emperor Augustus (63 B.C.-14 A.D.), the bocce game became an “exclusive” sport played only by nobility (BAA, 2018).

Due to the territories they owned, the Romans spread the game in Europe, but also in Asia and the northern part of Africa. It was considered a means of relaxation, but also of strengthening health, being played and recommended by Hippocrates as well (BAA, 2018). Originally played widely in Europe, the bocce game was gradually banned in some states (France, the Venetian Republic, England – USBF, 2018; BAA, 2018), as the games would take time away from military exercises and archery practice, with negative influence on national security (USBF, 2018).

Unlike these states, in the UK the game has grown a lot, being played on grass. Over time, the ball game (bowl) has had great followers, and among them were Elizabeth I, W. Shakespeare (referring to this game in three plays; WB, 2015) or Sir Francis Drake. The passion of this military commander was so great that, as reminded in a legend, he would postpone the preparation of the defensive against the Spanish Army in order to finish a bowl game (WB, 2015; USBF, 2018; BAA, 2018).

Over the centuries, there have been prohibitions for playing the game in the UK too. Since 1541, the game was played only at home or during Christmas, and the law was abolished only in the mid-nineteenth century. The English spread the bowl game to all of their colonies and set rules that distinguish it from the bocce game. Among these we mention the shape of the balls that are flattened, which allows them to take circular trajectories.

Much later, the restriction regarding this game was cancelled in France as well, where the Montpellier Medical School stated that “bocce was the best exercise to prevent rheumatism” (BAA, 2018).

Today, the game is very popular and is spread all over the world under various variants: bocce, bowls, petanque etc.

Due to its simplicity and accessibility, releasing a ball to a target has become a sport discipline also practiced by people with disabilities. The bocce game became one of the sports recommended by the International Special Olympics for being played by mentally retarded people. Through a systematic educational and training process,
this sport discipline provides people with intellectual disabilities with an easy and simple way to maintain or improve their health, to educate their fitness components and to highlight their skills. Moreover, it gives the players more confidence in their own forces and contributes to the education of the team spirit and of emulation.

**Topic addressed**

**Bocce game technique**

The bocce game is part of the category of sport disciplines where the precision of the movement is decisive in achieving higher results.

The bocce game technique includes simple motor skills aimed at handling the pallino and the bocce balls pursuant to the rules of the game. All the technical elements are subordinated to the goal – releasing the pallino to the proper area and then releasing the bocce balls in optimal conditions for them to stop as close as possible to the pallino. That is why the improvement of the technique is of great importance, because it conditions the efficiency of each release.

The description of the technique started from the Special Olympics Bocce Coaching Guide – SOBCG (2005). The information taken from this Guide was supplemented with data from publications presenting the technique of the bowling game (Szocs, 1971; UCFS – The Union for Physical Culture and Sport, 1967; Black, 1969; Mackey, 1987) as there are some common technical elements.

The bocce-game specific technique includes:

- **Picking the ball** - is the technical element with which the player is in possession of the ball. It is a simple and easy to learn element.
  
  During the competition, the bocce balls are placed in the launch area next to the device that delimits the court. The player moves to the ball, flexes the torso or knees, and holds the ball with both hands from the sides. Picking the ball is done with your fingers spread, your hands “cupping” the ball. UCFS (1967, p. 234) and Black (1969, p. 79) recommend holding the ball with both hands for better control of it and for eliminating any possibility of dropping the ball (the ball has a diameter of 107-110 mm). Furthermore, Mackey (1987, p. 19) believes that the distribution of the ball’s weight between both hands does not cause premature tiredness of the releasing arm and negative consequences on ball control during release.

  Picking can be done with one hand, but it is much more difficult and requires extra attention. The ball can be given to the player in their hand if they have a severe disability.

  Learning and improving this technical element does not require any special exercises, but extra attention from the beginning so that the player does not drop the ball.

- **Basic position** – it is important in the bocce game and, together with the other technical elements, allows for accurate and precise releasing of the pallino and of the bocce ball(s). It must provide the player with a good visibility of the pallino and/or of the other balls already released and it helps them have a clear picture of the path the ball should move on all the way to the pallino.

  Not all players use the same basic position, but the basic mechanism is the same (Black, 1969, p. 81). SOBCG (2005, pp. 38-42) mentions the standing position and the walking position.

  1. **Standing position** – the player stands with their legs apart in sagittal plane, the lower limbs in slight flexion, the weight equally distributed on both legs. The distance between the legs may be equal to the thoracic antero-posterior diameter or the legs may be further apart. The position should be comfortable, easy to maintain and stable.

    The front foot does not have to step (according to the rules) on the foul line. The trunk is slightly bent, and the back is rounded to a relaxed position. The shoulders are parallel to the foul line. The eyes look to the centre court line (if the pallino is being released) or to the pallino (if the balls are being released). The arm holding the ball is slightly bent, the ball being ahead. The other arm is stretched next to the body.

    2. **Walking position** – is a continuation of the standing position. When the arm holding the ball goes to the back, the player simultaneously takes a step forward with their rear leg (the foot on the side of the arm releasing the ball; SOBCG, 2005, pp. 45-46).

    The two positions described above are used when the player wants to make a release in which the ball moves gently on the surface of the court and gets as close as possible to the pallino in order to score points (the pointing shot).

    The walking position can also be executed with several steps (four steps; SOBCG, 2005, p. 48). In this case, the player leaves the edge of the court and is careful to take the steps to the foul line. The sequence of movements
(SOBCG, 2005, p. 48) is: the first step simultaneously with moving forward the arm holding the ball, step two simultaneously with swinging backwards the arm holding the ball, step three simultaneously with swinging the arm forward and step four simultaneously with releasing the ball. This position is used when the player wants to scatter the opponent's balls away from the pallino or when they want to move the pallino away from the opponent's balls (the hitting shot).

Regardless of the basic position chosen, the release arm performs a swing motion going forward, backward and again forward. Thus, the ball shall have the proper speed. The other arm maintains the balance of the body.

Another action the player must perform depends on the basic position chosen. Before preparing for the walking position or after positioning themselves for the standing position, the player must look towards the court and to decide on the path that the ball has to move on to the desired point [desired point – we use this expression when we talk about releasing the pallino in the court (according to the rules) or of the bocce ball(s) to the pallino].

It is very important that the player does not go beyond the foul line in front of them. Otherwise, the release is cancelled.

- **Cupping the ball** – consists of the contact between the releasing hand and the ball. It must be executed in such a way as to allow the best control of the ball in order to release it to the desired point.

SOBCG (2005, p. 35) recommends the cupping the ball underside. In this case, the fingers are spread as a fan over the ball, except for the thumb that is positioned laterally to support the ball (Figure 1). According to SOBCG (2005, p. 36) the hand may be in supine or prone position according to the game. Some players may not be able to hold the ball because their hand is too small. In this case, players shall not use cupping of the ball in prone position (SOBCG, 2005, p. 36)

![Figure 1. Cupping the ball – hand in prone position (adapted by Szocs, 1971, p. 25)](image1)

- **Releasing the ball** – it is the element through which the ball is launched and it rolls on the playing surface (Figure 2) to the desired point.

![Figure 2. Releasing the ball (adapted after Szocs, 1971, p. 34)](image2)

There are several systematisations of releases in the literature. In order to bring us closer to the specificity of the bocce game, we have used the classification made by Corneșanu (1970, pp. 53-56), who states that there are two categories of releases:

 **a. Free Releases (Remote).** With them, the emphasis is put on how to release the ball without watching the space or the place where the ball stops;

 **b. Guided Releases.** With them, the emphasis is put on the releasing, on the intensity and accuracy of execution etc. The place where the ball has to stop is delimited by different signs (sectors, geometric shapes etc.). In turn, these releases can be:

 **b.1. Target Release** – the ball is released to horizontal or vertical targets. The horizontal target is specific to the bocce game. The player can release the ball while facing the target, with their back to the target (between their
legs) or with their side towards the target. The ball can also be released with one hand (during the game) or with both hands (during training lessons, especially for players who cannot hold the ball in one hand).

**b.2. Release Followed by Recovering the Ball** – means that the player releases the ball and then moves next to the ball. The movement can be done behind the ball or laterally, in standing position or on their knees and both hands (Grigore, Solomon, & Bedo, 1996, p. 39).

This type of release is not specific to the bocce game because it violates the rules. The player can remain two steps behind the foul line. After releasing the ball, they can step forward, but they are not allowed to touch the foul line.

**b.3. Releasing From One Player to Another** – it can be executed by one player, two players or a group. The release can be done with one hand or both.

This type of release is not allowed during the bocce competition, but it can be used during training lessons.

Black (1969, p. 85) presents another systematization of how to release the ball. It is based on the position of the fingers on the ball at the time of release. The fingers' position determines three different types of releases (Black, 1969, p. 85) that influence the rolling of the ball on the ground after leaving the player's hand.

1 – **Straight Ball Release** – the position of the hand on the ball: the thumb is positioned at 12.00 hours and the other fingers at 6.00 hours. The ball rolls on a straight path in the direction chosen by the player (Figure 3.A);

2 – **Hook Ball Release** – the position of the hand on the ball: the thumb is positioned at 10.00 hours and the other fingers at 4.00 hours. K. Black (1969) believes that this type of release has two advantages: the movement of the ball is made on a straight trajectory, followed by a change of the direction of the ball on a counter-clockwise trajectory (Figure 3.B). In this case, the ball may get closer to the pallino in an angle greater than in a Straight Ball Release;

3 – **Back-up Ball Release** – the position of the hand on the ball: the thumb is positioned at 1.00 hours and the other fingers at 7.00 hours. Black (1969, p. 85) says that it is a less used form of release because it requires an external rotation of the arm, the release having a left trajectory compared to the Straight Ball Release, drawing a wide arc (Figure 3.C). Black (1969, p. 85) also says that this type of release is difficult to control and is not recommended for beginners.

SOBCG (2005, p. 44-46) describes two types of releases:

1 – **Pointing Shot** – it is a soft release. It is used when the player rolls the ball softly because they want it to get as close as possible to the pallino and to accumulate points;

2 – **Hitting Shot** – it is a forceful release. It is used when the player wants their ball to get the opponent's ball(s) away from the pallino or the pallino away from the opponent's balls.
Another point of view belongs to Szocs (1971, p. 37), who recalls several types of releases. Of these, we believe that the **Straight Line Release** (Figure 4) is most often used in the bocce game. To execute this type of release, the player positions themselves on the foul line, in line with the pallino, and releases the ball directly to it.

![Figure 4. Straight Line Release](image1)

**The Diagonal Release** (see Figure 5) can also be used, where the player is on the foul line diagonally to the pallino. The ball is released to the pallino.

![Figure 5. Diagonal Release](image2)

**Conclusions**

The boccé game is a sport discipline that can be played by people with and without disabilities. Moreover, it is played by men, but also by women, young and elderly (Coutinho & Acosta, 2009).

The game technique is simple and does not require extra effort to be executed. At the same time, it contributes to the development of fitness components with direct effects on the quality of life.

Due to the fact that each team has four balls that have to be released, the bocce game is a means of social integration, because it can be played in pairs (two players) or in teams (four players) that release the balls one at a time.

**Acknowledgments**

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**Authors’ contributions**

All authors contributed equally to this study and should be considered as main authors.

**References**


THE IDEAL TEACHER THROUGH THE EYES OF UNEFS STUDENTS

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Abstract. The purpose of our paper is to contribute to complementing the image of the ideal teacher. Being a teacher involves the existence of an appropriate combination of knowledge, abilities and attitudes. The literature focuses on the notions of “pedagogical skill”, “pedagogical vocation”, “pedagogical gift”, “pedagogical tact” when addressing the main quality of a teacher. Teachers with outstanding professional performance have a high emotional quotient. Instead, the lack of teacher’s emotional intelligence in the classroom may result in uncontrolled reactions, with the manifestation of negative tactless emotions, mnemonic blocks in front of the students or improper decisions in relation to the educational situation. The study included 233 students at the National University of Physical Education and Sports in Bucharest, who were asked to list three qualities of the ideal teacher. The highest rate of student responses focuses on the need for teachers to be sympathetic (in their direct relationship with students) and show patience and calmness. Other attributes valued by students are: communication skills (the teacher should be a good speaker, have a rich vocabulary, give explanations that can be understood by students), be a good listener, be empathetic, manage well the relationship with students – getting along with them and being persuasive; the teacher’s intelligence, level of training and competence: passion, involvement/dedication (the teacher should love his or her profession); kindness and respect (the teacher should be friendly and respectful to students); fairness (the teacher should be impartial, honest).

Keywords: teacher, student, social perception, qualities.

Introduction

The human is not a solitary being, but a social one, needing to have a purpose and to be useful, integrated, connected, affiliated, to belong to an entity or reference group (Geambaşu, 2018, p. 5).

Being a teacher involves the existence of an appropriate combination of knowledge, abilities and attitudes. All three should be present to be effective at work. Among the characteristics that condition a good start in the teaching career, we mention the following: passion for the work carried out, continuous learning, ability to analyse, plan and innovate, ability to focus on the learning outcomes and to solve problems, teamwork skills, understanding group dynamics and effective communication.

The teacher should be permanently concerned with improving the teaching activity carried out, namely the content of the subjects taught, the didactic strategies and the teaching methods and means in order to enhance their formative outcomes. The teacher is the most important resource of the school. The teacher’s activity is largely related to its direct formative impact on students. But to achieve the student “modelling”, the teaching profession needs to be regarded:

- as a mission requiring personality qualities and spirit of dedication;
- as a professional activity requiring training and career development.

But what does it mean to be a good teacher? In our country, we mention the research studies conducted by the “Soros Foundation” Romania, namely the Public Opinion Barometer, in 2004 (Table 1), and the “Education 2000+” Centre, in 2010 (Figure 1) (Voicu, 2010). The former highlights the responses of the population (1790 people – the society’s opinion), which we might call the parents’ responses, while the latter reveals the perspective of 505 teachers from 20 schools in 5 counties. Both studies address pre-university education, which makes it difficult to extrapolate the results to a wider population.

Table 1. The “Soros Foundation” Romania, Public Opinion Barometer (2004)

<table>
<thead>
<tr>
<th>For a teacher to be considered good, what do you think is the most important? (open question, one single choice)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>To be well trained</td>
<td>32%</td>
</tr>
<tr>
<td>To have pedagogical skills</td>
<td>14%</td>
</tr>
<tr>
<td>To love his or her job, to have a vocation</td>
<td>12%</td>
</tr>
<tr>
<td>To be honest, fair</td>
<td>6%</td>
</tr>
<tr>
<td>To be authoritarian, demanding, severe</td>
<td>5%</td>
</tr>
<tr>
<td>To be sympathetic, indulgent, tolerant</td>
<td>5%</td>
</tr>
<tr>
<td>To be well paid</td>
<td>4%</td>
</tr>
<tr>
<td>To have good results</td>
<td>4%</td>
</tr>
<tr>
<td>To be serious</td>
<td>4%</td>
</tr>
</tbody>
</table>
To be clever, intelligent 3%
To possess communication skills 2%
Other 5%

<table>
<thead>
<tr>
<th></th>
<th>first option</th>
<th>second option</th>
<th>third option</th>
</tr>
</thead>
<tbody>
<tr>
<td>well-trained professionally</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocation, gift, calling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pedagogical skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>patience, calmness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fairness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Essential characteristics of the ideal teacher – The perspective of 505 teachers (2010)

Figure 1 partially reflects the distribution of response rates for the surveyed teachers. Thus, 35% have mentioned that good professional training is the first of the three essential characteristics of the ideal teacher, 14% – vocation, 12% that the teacher should have pedagogical skills, 9% – patience, and 5% – fairness. Regarding the second characteristic (marked with green), 16% indicated good professional training, 9% – vocation, 15% – pedagogical skills etc. Concerning the third essential characteristic of the ideal teacher, the figure should be read in a similar way.

Bloch (1968) refers to pedagogical art as being based on a “gift” that teachers possess to a greater or lesser extent. He emphasises the importance of teacher training, which can help develop “the gift of teaching others”. Hubert (1965) talks about the importance of “pedagogical vocation”, which involves pedagogical love, awareness of the responsibility towards the student and all mankind, as well as the belief in cultural values, and Stefanovic (1979) makes reference to pedagogical tact in his research. This quality of the teacher, which contributes to forming the personality of students, involves:

- motivating students to get good results at school;
- having appropriate behaviours towards students and encouraging them to show socially desirable behaviours;
- providing an optimal climate for the instructional-educational process;
- paying attention to the personal development of students.

Thus, the literature focuses on the notions of “pedagogical skill”, “pedagogical vocation”, “pedagogical gift”, “pedagogical tact” when addressing the main quality of a teacher. Pedagogical skill refers to those attributes of teacher’s personality that allow them getting the best outcomes in various circumstances; this individual particularity helps the teacher translate into practice the best ways of transmitting knowledge and stimulate, in the case of students, their need for knowledge (Marcus, 1987). Mitrofan (1988) establishes the following components of pedagogical skill, components which are integrated into the teacher’s personality structure:

- scientific competence – refers to the existence of good specialised training;
- psycho-pedagogical competence – considers the ability to make the learning material accessible to students, the ability to understand the student’s inner universe, the identification of appropriate training methods and means, while taking into account the variety of educational situations;
- psychosocial competence – is ensured by the ability to establish appropriate relationships with students, to effectively communicate with them, as well as the ability to adopt different behaviours and roles, depending on the educational context.

Teachers with outstanding professional performance have a high emotional quotient (Roco, 2004). Instead, the lack of teacher’s emotional intelligence in the classroom may result in uncontrolled reactions, with the manifestation of negative tactless emotions, mnemonic blocks in front of the students or improper decisions in relation to the educational situation (Neacșu, 2010). As far as students are concerned, low scores on emotional
intelligence are associated with high scores in the case of depression and anxiety. We now better understand why teachers should also pay attention to emotional issues, which, along with the cognitive, social and motor ones, make up a whole. This whole is, on the one hand, under the sign of self-education, but on the other hand, is the prerogative of education provided in a formal environment. Paraphrasing Diderot, we can ask: Where is the school that teaches you to feel?

Emotional Intelligence (EI) is thus a metacognitive structure that influences the efficiency with which both a student and a teacher use mental, volitional or attitudinal skills (verbal or behavioural responses). Mayer, Salovey and Caruso (2000) define emotional intelligence as the ability to process emotional information, which involves perception, understanding and control of emotions. In 1997, Bar-On (who was the first to use the term “emotional quotient” in his doctoral thesis, before it became so popular), referring to the measurement of EI, attached importance to five areas: interpersonal skills, intrapersonal skills, stress management, adaptability and general mood. Emotional potential can be stimulated, and the emotional quotient can be raised above average, which is particularly important for professions that require a good EI quotient – for instance, the teaching profession.

We present below a daily training programme for the development of emotional intelligence (adaptation after Segal, 2002), which is useful to both teachers and students:

- Give priority to your body care: professional hydration, balanced diet, physical movement, sufficient rest;
- Feel with your body, not your mind (focused sensory perceptions);
- Be aware of your emotions and reactions on the physical level; identify your personal feelings, differentiate them and accept them;
- Show openness in your familial and professional relationships, learn to listen and read body language (to better understand communication);
- Develop your empathy (understanding the thoughts and feelings of others), ensure your word-feeling unity;
- Act so that you feel useful;
- Use positive re-signification in unfavourable situations, use change as an opportunity to evolve;
- Regardless of obstacle/difficulty, keep a positive view of the environment, appeal to humour, laugh and relax.

It is good for teachers to form their emotional skills by taking into account the following components of emotional intelligence described by Goleman (2001, 2004):

1. Self-awareness – effective teachers should be aware of the emotions they experience at different moments of the lesson, have self-confidence and be able to self-assess realistically.
2. Self-control – good teachers control their emotions and feelings so that learning is facilitated, not stopped.
3. Motivation – teachers should have quality initiatives, persevere in overcoming blocks and channel their energy resources to reach the set objectives.
4. Empathy – a teacher should also be attentive to students’ points of view, understand them and effectively relate to them.
5. Social skills – the teacher should possess the necessary skills to control his or her reactions when relating to students in order to convince them of the essential aspects of the lesson and to negotiate/adjust the differences when required by the educational situation.

Table 2 briefly presents the psychological profile of a male teacher and a female teacher who have a high emotional quotient (adaptation after Block, 1995).

Table 2. The psychological profile of a male teacher and a female teacher who have a high emotional quotient

<table>
<thead>
<tr>
<th>High emotional quotient (EQ)</th>
<th>Male teacher</th>
<th>Female teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male teacher</td>
<td>He has a rich affective life, is thoughtful and balanced in his relationship with students. He feels comfortable with himself and in the school environment where he carries out his activity. He is socially responsible and successfully gets involved in solving the problems that occur in the classroom. He considers the moral aspects in the educational contexts in which he is involved.</td>
<td>She is sociable, feels good in her skin and adapts well to stressful situations. She easily establishes social contacts, is funny, spontaneous and natural. She tends to be affirmative (positive), directly expresses what she feels and is socially balanced. She is self-confident and rarely has anxious reactions.</td>
</tr>
</tbody>
</table>
The purpose of our paper is to contribute to complementing the image of the ideal teacher, highlighting what an ideal teacher means “in the eyes” of students from the National University of Physical Education and Sports (UNEFS) in Bucharest.

Material and methods

Participants

In our descriptive case study, 233 UNEFS students expressed their opinions. The 138 first-year students and 95 second-year students (58% male and 42% female), with an average age of 19.8 years, were asked to list three qualities of an ideal teacher in the academic environment (particularly at UNEFS Bucharest). We highlight that the UNEFS students (unlike students from other faculties) interact with teachers during both theoretical classes and practical classes (performed on the playing field). We chose to investigate the perception of first-year and second-year students (and not those in the final years or following a Master programme), because we have found that, at this point, students have a stronger tendency to drop out of studies.

Procedure

Trying to complement the image of the ideal teacher, we investigated, between October 2017 and February 2018, a number of UNEFS students. The instructions were the following: “Please write three qualities of the ideal teacher from UNEFS Bucharest. The order in which you list these three qualities is not important. Please do not write your name on the sheet”. Confidentiality and anonymity were thus ensured, the participants freely expressing their point of view on the three attributes of a teacher thought to be ideal.

Results

The obtained results are shown in Figure 2.

![Figure 2. Qualities of the ideal teacher from UNEFS Bucharest](image)

Analysing the responses of students, we noticed the need for teachers to be sympathetic, show patience and calmness, possess communication skills, be good listeners, be empathetic, manage well the relationship with students, be intelligent and competent, have a good level of training, be passionate and dedicated (the teacher should love his or her profession), be kind and fair (impartial, honest).
Discussions and conclusions

In an attempt to answer the question “What does it mean to be a good teacher?”, we investigated a number of UNEFS students. We have noticed that the highest response rate for the UNEFS first-year and second-year students focuses on the need for teachers to be sympathetic (in their direct relationship with students) and show patience and calmness. Other attributes valued by students are: communication skills (the teacher should be a good speaker, have a rich vocabulary, give explanations that can be understood by students, be a good listener, be empathetic, manage well the relationship with students – getting along with them and being persuasive); the teacher’s intelligence, level of training and competence; passion, involvement/dedication (the teacher should love his or her profession); kindness and respect (the teacher should be friendly and respectful to students); fairness (the teacher should be impartial, honest).

At the level of pre-university education, we can find (see the introductory part of the paper) that the teachers’ perspective on the portrait of a good teacher is very close to that of parents. Thus, professional training, pedagogical skills and vocation, calmness, patience, fairness, severity or indulgence are very important. Other authors, such as Coats, Swierenga and Wickert (1970), investigating how the responses of 42,810 students were grouped, highlighted the charisma factor, considered to significantly influence the success of a teacher. Beck (1967) analysed the perceptions of 2,108 sixth-grade students. Their conclusion was that middle-school students saw the successful teacher as a friendly, warm, supportive, flexible person able to discipline them and effectively motivate them. A good teacher is creative, analysing past situations to improve the future learning situations in which students will be involved and ensures the relationship between what he or she teaches and the external environment of the classroom (Woolfolk, 1987).

The responsibility of a teacher starts from knowing the theoretical part (the age particularities of the students) and continues with applying this knowledge according to the environmental demands, by using appropriate methods (Geambașu, 2015, p. 3).

The results of our research come to complement the image of the ideal teacher seen, this time, through the eyes of university students. But further studies are needed to capture the possible differences in the perception of the ideal teacher by students in the final years or integrated into different Master programmes, as compared to first-year and second-year students.

We have found that the literature mentions the following characteristics of a successful teacher: “pedagogical skill” and “vocation”. From our point of view, these dimensions represent synthetic formations that condense qualities such as: love for profession, communication skills, openness to new experiences, patience, fairness in evaluation and charisma – the charismatic teacher generates ambivalent feelings, is simultaneously attractive and threatening, protects but also frightens.

Thus, the teacher should be a specialist in “behavioural surgery”, in the context in which the most important factor affecting the students’ outcomes is their low motivation for learning.

Authors’ Contributions

All authors contributed equally to this study and should be considered as main authors.

References


IMPROVEMENT OF PHYSICAL TRAINING FOR FOOTBALL GAME
IN THE 12-14 YEARS AGE GROUP

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Abstract. This paper deals with the increase of motor skill indicators up to a high level, in terms of football-specific training as an extracurricular activity, in the case of 12 to 14 years old children. A pedagogical experiment was organized to this end in Alexandria School Sports Club (CSS), with a number of 28 football players aged 12 to 14 years, divided into two groups: the experimental group, who worked according to the selected and planned content, and the control group, who worked differently, using the traditional means. The following fitness tests were used to assess the development level of the motor skills: 50 m speed running (flat race) (sec), endurance running 1000 m boys (sec) and standing long throwing of the rounders ball (m). The results of the fitness test assessment highlight better indicators of the control group in the initial testing and bigger progress in performance and score for the experimental group in the final testing. A supplementary number of technical elements and their associated exercises (which are more complex and involve a higher number of reps of the execution procedures) included in the extracurricular training hours resulted in superior indicators as for the running speed and endurance, specific skilfulness or the ability to control the ball, the speed of reaction, execution and movement.

Keywords: football, extracurricular training, physical training, technical and tactical training, performance.

Introduction

Football has become the most popular and widespread sport practiced all over the world; it belongs to team sports and is a spectacular game carried out according to relatively simple and accessible regulations, trying to make the most of the physical, technical-tactical and mental skills of the players (Gheorghe, 2010; Apolzan, 2013; Preda, 2014). The unusual attraction to football is mainly explained by its extreme simplicity, which makes it largely accessible (Motroc, 2008). The deep knowledge of the tendencies always present throughout the course of a football game is highly important for the establishment of some priorities in the technical and tactical content of the game, among other factors of the training, and also for a more correct orientation of the player instruction and training, consistent with the tendencies and priorities, resulting in increased quality of the team and players in all components of the game – physical, technical, tactical and psychological ones (Cojocaru, 2002; Balint, 2008; Barbu, 2008; Izvernar, 2013).

The multilateral physical development of children is the basis of sports training and specific fitness for the future high performance in football, which consists in a permanent and progressive development of the set of physiological functions by means of training sessions adapted to each motor skill, particularly at the beginning. The purpose is to increase endurance and strength, to develop speed, to improve mobility and coordination, and thus to build a perfectly healthy and harmoniously developed body. By the multilateral training, coaches obtain a good and solid basis of general development of their students, which is necessary for the rapid achievement of performance (Ploșteanu, 2010; Drăgan, 2012).

The multilateral sports structure takes into account the general training of the body and the football game technique as well. This structure is divided into two categories: general physical training and specific physical training. In the general physical training, the larger the working potential is, the more easily the body adapts to the increasingly high physical and mental demands (Dima, 2007).

The general and specific physical training are organically related; they are a coherent whole that conditions the player’s accomplishment. Supplementary factors are used to reach high physical training, such as vitamin supply, diet and high-altitude training sessions. In the case of children and juniors, specific physical training lessons can be planned: lessons for coordination and skilfulness, speed and aerobic endurance (recommended for juniors up to 14 years old) and lessons for strength and intensity endurance, indicated after 14 years old. The thorough specialisation and the specific physical training means do not exclude the general physical training, which is also necessary later on, when players will be included in the high performance circuit (Melenco, 2007; Stroe, 2010).

The development of motor skills is an important factor of the training specific to the football game, because it reveals, by a higher percentage, the physical and technical-tactical potential of the player on the football field. There is a relationship between all components of the game and technical training; all these components are based on the physical factor, namely on the level of development and manifestation of the motor skills (Gheorghe, 2010; Sirca, 2011; Bordei, 2012).
The motor action is based on these motor skills manifested in various forms. Each motor skill has its own morphofunctional substratum. The basic motor skills are the following: speed, coordination ability (skilfulness), endurance and strength (Bota & Prodescu, 1997).

**Purpose of the paper:** monitoring the increase of indicators related to the motor skills required by extracurricular football activity in children aged 12 to 14 years.

**Paper hypothesis:** we consider that the introduction of an additional number of technical elements (included in exercises of higher complexity) in the extracurricular training program and the increase in the number of reps of the execution procedures will lead to the achievement of better indicators in terms of running speed and endurance, specific skilfulness or ability to control the ball and speed of reaction, execution and movement.

**Material and methods**

A research was conducted to highlight the role of specific physical training in increasing motor skill indicators. The experiment was organized in Alexandria School Sports Club (CSS) from April 10, 2017, to April 20, 2018, with a group of 28 football players of 12 to 14 years old, split into two groups: a) the experimental group, which was trained according to the selected and planned content, using modern methods and football-specific means, b) the control group, which was trained in a different way, using the traditional means for motor skill education, according to a schedule.

The experiment was carried out in three stages:
- The first stage: April 10 - April 20, 2017, which included the initial testing and initial assessment of motor skill development for both groups of children (experimental and control ones); motricity tests were the topic of the training sessions.
- The second stage: April 21, 2017 - April 9, 2018 – the experiment itself, which consisted in implementing the planning documents; the effective experimentation of the means and methods; the increase of motor skill development level, which is also the topic of the research.
- The third stage: April 10 - April 20, 2018, which included the final tests, the recording and ordering of data to process them by the statistical and mathematical method.

In both groups (experimental and control ones), the means and methods were used respecting the plans of the yearly macro-cycle and the half-yearly mezzo-cycles regarding the development of motor skills.

A diverse methodology was used during the experiment. The following methods were included:
- Bibliographic study of the specialised literature;
- Pedagogical observation, based on a series of findings related to the executions of players during the training sessions, their skills and abilities, the working conditions, the external factors influencing the activity of players, their mental abilities etc.;
- Pedagogical experiment, focused on confirming the information of the paper hypothesis;
- Statistical and mathematical method and graphical representation method.

**Organization of the training process with the group of 12-14 years old children**

Similar to other categories of players, the basic form of preparation for 12 to 14 years old children is the training session, supplemented by children’s independent activity in friendly and official games. As for the groups under 14 years old, it is recommended to organize three training sessions per week, each one lasting up to 120 minutes. Therefore, the coach must use these 120 minutes with maximum efficiency, aiming at children’s sports orientation. In these conditions, the initial selection at 14 years old will be really efficient, given the good training level of the children.

The group of 12 to 14 years old children was trained in conditions similar to the real game, with teams of 14 players. The duration of a training session is 90 minutes, out of which: 30% is assigned to technical skills; 20% is assigned to tactical skills; 10% is reserved for theoretical training, and 10% are necessary for psychological training. The purpose is to create a team of 22 players (including 8-10 players of national level) in the end of the training session.

The tests listed below were used for assessing the development of motor skills:
- 50 m flat course speed running (sec) with crouch start: children run two by two along the central tracks. The time of each competitor will be recorded starting with the sound signal and ending when the chest gets beyond the finishing line;
- 1000 m endurance running - boys (sec): the children run on measured and marked ground;
• standing long throwing of the rounders ball (m).

Results

Table 1 and Figures 1, 2 and 3 show the results of motor skill assessment in football players aged 12-14 years, regarding the 50 m speed running, 1000 m endurance running and throwing of the rounders ball.

Table 1. Results of motor skill assessment in football players of 12-14 years old

<table>
<thead>
<tr>
<th>No.</th>
<th>Fitness tests</th>
<th>Group</th>
<th>Initial testing (x; ±S)</th>
<th>Final testing (x; ±S)</th>
<th>Parametric test (t; P)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Perf. Score</td>
<td>Perf. Score</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>50 m speed running (sec)</td>
<td>E (n=14)</td>
<td>7.36; ±0.30</td>
<td>7.15; ±1.56</td>
<td>6.108; ±0.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C (n=14)</td>
<td>7.33; ±0.31</td>
<td>7.26; ±1.54</td>
<td>1.632; ±0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-C (t; P)</td>
<td>0.243; ±0.365</td>
<td>1.004; ±1.05</td>
<td>0.05; ±0.05</td>
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</tr>
<tr>
<td>2.</td>
<td>1000 m endurance running (sec)</td>
<td>E (n=14)</td>
<td>180.43; ±0.09</td>
<td>180.34; ±1.37</td>
<td>7.327; ±0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c (n=14)</td>
<td>180.37; ±0.10</td>
<td>180.32; ±1.66</td>
<td>4.275; ±0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-C (t; P)</td>
<td>1.395; ±0.099</td>
<td>0.652; ±1.364</td>
<td>0.05; ±0.05</td>
</tr>
<tr>
<td>3.</td>
<td>Rounders ball throwing (m)</td>
<td>E (n=14)</td>
<td>37.71; ±4.23</td>
<td>41.93; ±3.15</td>
<td>11.519; ±0.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C (n=14)</td>
<td>38.07; ±3.60</td>
<td>39.14; ±3.08</td>
<td>2.519; ±0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-C (t; P)</td>
<td>0.240; ±0.294</td>
<td>2.364; ±1.805</td>
<td>0.05; ±0.05</td>
</tr>
</tbody>
</table>

Note: E - experimental group, C - control group

The analysis of the statistical-mathematical calculations has revealed the following results (Table 1 and Figure 1): regarding the 50 m speed running (n=14, x; ±S), the experimental group has a mean of 7.36; ±0.30 sec and a score of 7.86; ±1.56 points in the initial testing, while the control group has 180.37; ±0.10 sec and a score of 8.07; ±1.54 points; there are insignificant differences between groups at p > 0.05, in both performance and score; in the final testing, the experimental group improved the mean by 0.21 sec (7.15; ±0.31 sec) and achieved a score of 8.86; ±1.41 points. The control group improved by 0.7 sec (7.26; ±0.26 sec), with the score of 8.43; ±1.34 points; there are insignificant differences between groups at p > 0.05, in both performance and score. Regarding the differences between means of the tests in the experimental group, there is a significance at p < 0.001, in both performance and score, while the control group has insignificant differences in performance and significant differences in score, at p < 0.05.
Concerning the 1000 m endurance running (n=14, x; ±S) (Figure 2), the experimental group has a mean of 180.43; ±0.09 sec and a score of 7.00; ±1.88 points in initial testing, while the control group has 180.37; ±0.10 sec and a score of 7.07; ±1.89 points; there are insignificant differences between groups at p > 0.05, in both performance and score; in the final testing, the experimental group improved the mean by 0.9 sec (180.34; ±0.07 sec), with the score of 8.78; ±1.37 points; the control group improved by 0.5 sec (7.26; ±0.26 sec), with the score of 8.00; ±1.66 points, and significant differences between groups in performance, at p < 0.05, and insignificant ones in score, at p > 0.05. In terms of differences of the means between tests, in the experimental and control groups, they are significant at p < 0.001, in both performance and score.

As for the rounders ball throwing (n=14, x; ±S) (Figure 3), the experimental group has a mean of 37.71; ±4.23 m and a score of 7.14; ±2.07 points in initial testing, while the control group has 38.07; ±3.60 m, with a score of 7.36; ±1.78 points; there are insignificant differences between groups at p > 0.05, in performance and score as well; in the final testing, the experimental group improved the mean by 4.22 m (41.93; ±3.15 m), with the score of 8.93; ±1.21 points; the control group improved by 1.07 m (39.14; ±3.08 m), with the score of 7.93; ±1.68 points, and insignificant differences between groups at p > 0.05, in performance and score as well. Regarding the differences of the means between tests, the experimental group has significant differences at p < 0.001, and the control group, at p < 0.05, in performance and score as well.

Discussions and conclusions

The theory and methods of the football game deal with a large range of problems related to school football, mass football, performance football and elite football. This research tries to find the most effective ways, means and methods enabling these value categories to optimally achieve their specific instructive-educational tasks and objectives (Dumitrescu, 2016; Savu & Moisescu, 2017; Greco et al., 2017; Hůlka, Weisser, & Bělka, 2018; Lebedev et al., 2018; Imas et al., 2018).

The extracurricular training program must include objectives, as well as individualised action and control systems, for the creation of the football player. These programs will be developed taking into account, in the first place, the age particularities of players aged 12-14 years; the methods, exercises and their dosing in each training
session will be selected depending on these particularities. For this purpose, supplementary aptitudes and knowledge are required and they can be acquired only if the time assigned for both the collective and individual training is entirely used (Staicu, 2011).

In terms of current level of knowledge related to young football players’ performance training within the extracurricular classes of physical education and sport, the curriculum must take into consideration the specific issues of acceleration of the biological development phenomenon, correlated to the training process. In this way, it will be found out that players aged 12 to 14 years have a special biological potential that enables them to meet the requirements of the training program, provided that a methodological rationalisation is made. Therefore, the components of the integrative game model can be taken over and adapted. They become a reference model or prospective model for the players.

The effect of practicing performance sports includes the effect of specific physical training with the following targets: consolidation of health, development of body functions, development of motor skills, preparation of the body for complex movements and activities (Ciorsac, 2011). In this context, it is worth mentioning the real evolution of the physiological, motor and psychological indicators throughout the experiment, namely: very good results for speed; the skilfulness manifested in spatial-temporal orientation is almost similar to the adults’ one; the efforts of aerobic endurance with moderate intensity are well tolerated. It is recommended to do exercises for the development of external muscles, because it has been found out that the relative strength of players stagnates or even regresses; as to the other motor skills, mobility has the lowest values in boys aged 13-14 years (Ciolcă, 2009).

There were also revealed the improvements in the basic training components related to:

- the tactical training – by learning and enhancing the individual and collective tactical elements (which are the basis for attack and defence) performed fast and fluently; stimulation of tactical thinking by school games; participation in official competitions that help to build and promote the players;
- the technical training – strengthening the basic technical procedures in attack and defence for the development of universal players;
- the physical training – further development in terms of quality of the muscles in general and of the lower limb muscles (extensors and the muscle groups involved in technical executions); improvement of the motor skills for increasing general endurance and strength and their contribution to football; prevention of accidents.

The following training topics and objectives were proposed for increasing the sports performance: kicking the ball, taking over the ball, leading the ball, dribbling, protecting the ball, dispossessing the opponent, throwing the ball from the touchline, headers, general coordination – running, mobility, flexibility, finishing, combinations between 2-3 players, marking and non-marking, ball passing, doubling and helping the player with the ball; organization of the game per positions: defenders, midfielders, forwards; organization of the game with tasks for each position and games with numerical superiority or inferiority.

The results of the fitness test assessment highlight better values in the initial testing of the control group and bigger progress in performance and score for the experimental group in the final testing.

Given the elements shown above, we can draw the conclusion that the football players of 12 to 14 years old have sufficient formative availabilities for achieving team performances provided that the training objectives are enriched for this category of athletes.

At the same time, it is necessary to improve the training strategies by modelling the exercises and using additional forms of individual training. We propose a more efficient training program for the players, with new objectives and strategies, meant to reach the intended goals and obtain performances in the extracurricular football game.

The introduction of an additional number of technical elements (included in exercises of higher complexity) in the extracurricular training program and the increase in the number of reps of the execution procedures resulted in higher indicators in terms of running speed and endurance, specific skilfulness or ability to control the ball and speed of reaction, execution and movement, which confirms the research hypothesis.

Acknowledgements

This is an extended version of the study included in the topic of the doctoral thesis of the first author from the State University of Physical Education and Sport of Chisinau, Moldova. We express our gratitude to the children who participated in the study conducted in CSS Alexandria, Teleorman County, and agreed to take part in this research; the fitness testing is part of the training methodology.
References


STUDY ON THE HUMAN BODY’S CENTRAL AXIS. DAY-TO-DAY LIFE VERTICALITY

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Abstract. This paper addresses a case study involving two subjects, a man and a woman, both of them practicing yoga regularly and having experience with such types of exercises. They were tracked for one month and, after each set of stretching exercises, their height was measured in centimetres. We were interested in the way in which the spine responded to elongation exercises, as well as the mind-body interaction during exercise, even if science is far from elucidating a philosophical rather than scientific problem. We emphasised that a minimal set of elongation exercises, together with short relaxation breaks during which the subject focuses on his/her own post-exercise bodily sensations, for no more than 30 minutes a day, can lead to a healthy and relaxed spine, can prevent vertebral compression and, consequently, all negative implications that may result from gravitational compression. The challenge for further research on this theory is the practice of a special elongation program over a period of more than 2 years, using the most appropriate measurements to get the best health effects.

Keywords: spine, dehydration, compression, elongation, physical exercise.

Introduction

The spine is the central axis of the human body, the value scale of the human being. It also represents, beyond the anatomical and physiological aspects, the somatic expression of our mind. Just as the neural tube divides and unifies the left and right asymmetries, being both a command centre for the transmission of information and the representation of mental and spiritual feelings.

Since the central axis is subject to gravity, it has the inagrate but amazing task to ensure the 3D balance between kyphosis, lordosis and scoliosis, but especially in elongation. It is well known that, as the human body grows older, its height decreases through dehydration and oxidative degeneration processes.

But what if, each morning, no longer than 15 minutes, we worked a minimal set of elongation and integration of the spine, on the one hand, and of the entire body, on the other hand, listening to the intelligence of our body? (Lysebeth, 2004, pp. 10-20; Price, 1993). Is this a way to preserve our verticality throughout time, thus avoiding spinal dysfunctions and normal aging degradation?

Material and Methods

Participants

The research subjects are a male aged 30 years and a female aged 37 years. Both of them practice yoga regularly and have experience with such types of exercises (future studies that will involve people practicing such exercises for the first time may lead to different results).

Procedure

This study is the result of a one-month research conducted in 2013. Measurements were used to assess (in centimetres and millimetres) the height dimensions with a height measuring instrument, both before and after the execution of exercises sets (presented below).

Exercises were performed in the morning, considering normal body stiffness at this time of day, compared to body flexibility for the rest of the day. Moreover, the height is higher in the morning than in the evening because of dehydration and the compacting effect of gravity, an issue also taken into account.

The applied method consists in performing daily, for 15-30 minutes, elongation exercises for the spine (Goyal, 1992). Short relaxation intervals, called “self-listening to the body”, were included between exercise series. Both subjects strictly followed the exercise protocol.
The first exercise (Vasilescu, 2000) starts in the lying down position. The right hand is extended, together with the left leg. The palm is flexed backwards at 90 degrees, and the left leg is in maximum dorsal flexion. Elongation is performed diagonally to the body during a few breaths, then the opposite hand and leg (left hand and right leg) will execute the extension.

Details on the exercise method: elongation will be performed gradually, not in a hurry, the mind of the subject being focused on exercise. Elongation performed slowly and carefully is more effective than when performed rapidly (in a military style). For better elongation, subjects must relax the muscles not involved in the exercise, avoiding their unnecessary contraction. For example, while the left hand - right leg pair is involved in the exercise, the other pair, the right hand - left leg, is completely relaxed on the floor.

The facial and tongue muscles are also perfectly relaxed. The lips are open. Elongation is much more effective as the rest of the body, which is not involved in elongation, is more relaxed.

Such an exercise performed in the conditions described above (relaxation, focus etc.) is more efficient if its duration is increased. We aim to conduct further research on the measurable results of this approach.

The second exercise that involves the spine and detaches the vertebrae is “vertebral rolling” (Vasilescu, 2000) (Figure 2).

The starting point is sitting with the knees extended, the feet in maximum dorsal flexion and the heels firmly fixed on the floor. The upper limbs are initially extended parallel to the body, with the elbows flexed and carried overhead and the face of the palm overhead.

The head is gently pushed by the hands, so it has a small movement of “exiting” from the shoulders (similar to an extraction), the back of the neck is stretched, and the chin moves slowly backwards. From this point, the exercise starts: the upper body is slowly laid down on the floor, rolling one vertebra after another. The intention is to lay down the upper body in a straight line on the floor, to align and roll each vertebra, one after another, from the lumbar to the thoracic and cervical areas of the spine. The heels will remain on the floor for all the duration of the exercise, and the knees are totally stretched. The breath is kept normal, without apnea, throughout the exercise and the rolling speed is kept constant. Ideally, it is maintained the same relaxation of the rest of the body, as described in the previous exercise. Several rolls are followed by short breaks to recover after exercise. The abdominal muscle tone is significant during this exercise, and the exercise efficiency is higher as the exercise speed is slower. Getting back to the original position is done with the upper limbs extended at the elbow, starting over the head until the upper body reaches an angle of 90 degrees from the lower limbs on the floor and from the hands, which reach a position parallel to the ground.
The third spinal stretching exercise was described for the first time by Suren Goyal (1992) (Figure 3). The starting position is lying on the back. The right knee is bent until the foot reaches the level of the left knee. Then, the right foot (toe area) is “attached” the popliteus space of the left knee (see the above picture). The upper limbs are at 90-degree flexion to the shoulders, perpendicular to the upper body, with the elbows extended, and the hands are joined together with the fingers intertwined. The whole body rolls over on the left side, so that the body sits on the left side, and the right knee is a fixed anchor for an exercise landmark. The upper limbs are at 180° to the body, with the elbows extended. Now, the real exercise begins with 4 fundamental elements:

- The right knee is fixed on the floor (inspiration);
- Hands towards the head (inspiration);
- Heels towards the opposite side of the head (inspiration);
- Shoulder blades towards the floor (expiration).

After a few repetitions, the entire pattern will be equally performed two times on the opposite side, alternately.

Lying on the back, in a symmetrical anatomical posture, with the knees extended, the heels together, the toes relaxed. The arms are close to the body touching the ribs, and the forearms are at 30-45° abduction. The palms are up and open. The whole body is symmetrical with the chin, belly button, pubis, heels on the same line. The head, with the cervical area, is stretched.

**Results**

The results of measurements after the minimal set of exercises indicate an elongation of about 1 centimeter. Certainly, the elongation of the spine may vary according to the patient’s health status, age and height, as well as the patient’s experience with such exercises. Along with the spinal elongation, an improvement in general mobility is observed, although it has not been measured in the research (but it was mentioned in the reports of the two subjects). The initial height of the two subjects was 180 cm for the male participant (subject no. 1) and 172 cm for the female participant (subject no. 2).

Elongation (Δy) is defined as the difference module between the length of the spine before exercise and its length after exercise (Δy=y2-y1). Elongations of the two subjects over a month are presented in Tables 1-4.
Table 1. Elongation in days 1-15 for subject 1

<table>
<thead>
<tr>
<th>Day</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
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<tbody>
<tr>
<td>Δy (cm)</td>
<td>1</td>
<td>0.9</td>
<td>1.1</td>
<td>1</td>
<td>1</td>
<td>0.8</td>
<td>1.2</td>
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<td>0.9</td>
<td>1</td>
<td>1</td>
<td>1.1</td>
<td>0.9</td>
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Table 2. Elongation in days 16-30 for subject 1

<table>
<thead>
<tr>
<th>Day</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
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<tbody>
<tr>
<td>Δy (cm)</td>
<td>1</td>
<td>1</td>
<td>0.9</td>
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</table>

Table 3. Elongation in days 1-15 for subject 2

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<th>3</th>
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<th>5</th>
<th>6</th>
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<th>10</th>
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<th>12</th>
<th>13</th>
<th>14</th>
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</thead>
<tbody>
<tr>
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<td>1.1</td>
<td>1</td>
<td>1</td>
<td>0.8</td>
<td>1.1</td>
<td>1</td>
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<td>1</td>
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Table 4. Elongation in days 16-30 for subject 2

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<td>1</td>
</tr>
</tbody>
</table>

Discussions and conclusions

As our research topic is strictly about the elongation of the spine, we shall not insist on the effects of these exercises on the internal organs, muscles, joints, or on the mental level. We just mention that they exist and will be included as a theme in our further studies.

A special mention related to the second exercise: the balance between the spine and the abdomen. Vertebral rolling works on the antagonist muscles, the abdominal and lumbar ones, and therefore the idea of balance is clear in this type of exercise.

The human being is a whole, and the human body is an organism, not a mechanism, so the synergic concept is needed in our way of understanding. In this argument, the interdisciplinarity tendency applies together theories from physics + economy = econophysics; math + grammar and biology + physics = biophysics, psychology, theology = the synergy concept. The whole is more than the sum of parts, representing not just the sum of parts, but their interaction.

The body-mind issue is complex and far from being resolved. There are different approaches, from neurophilosophy (Churchland, 2007; Dennett, 1986) to the quantum brain theory (Penrose, 2006; Stapp, 1998). Beyond understanding this mechanism, it is important to stress the great potential of the mind-body interaction by observing the placebo effect, for example the Tummo Tibetan practice (Price, Finniss, & Benedetti, 2008; Benson et al., 1982).

We underline the importance of self-listening after each exercise as a rest of the body assisted by the brain, as a spectator to the own exercise echo inside the body.

We listen, capture and receive, for a few seconds to a few minutes, the whole rainbow of sensations inside the sky of the body. In this sense, self-listening is a form of relaxation, rehabilitation, disconnection, disjunction, in which inner attention is an act of progressive increase in efficiency.

A minimal set of elongation exercises, together with short relaxation breaks during which the participant focuses on his/her own post-exercise bodily sensations, for no more than 30 minutes a day, can lead to a healthy and relaxed spine, can prevent vertebral compression and, consequently, all negative implications that may result from gravitational compression.

Future studies will provide possible measurements of the positive effects of elongation methods on the spine, as well as of the self-listening to the body after exercise.

References


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SPORT AT THE BORDER WITH ART

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Abstract. The topic of placing sport at the border with art can be found in numerous philosophical analyses, based on the association between culture, education and physical activities. In a broad sense, the culture of a society includes education and the level of knowledge, moral and spiritual values, the arts, traditions and habits, also including sports. The connection between sport and art has a positive effect on increasing the number of direct and indirect participants in each of them. The aim of this paper is to underline the dimensions of sport as an act of culture, from the standpoint of its interdependence with the art. Some of the identified aspects relating to sport and art were: aesthetic values, performance, universal language, talent, freedom of expression, creative spirit, emotions, self-satisfaction and passion. Sport is a promoter of aesthetic values not only in the case of top performance, but also in leisure activities.

Keywords: sport, art, culture, values, education.

Introduction

Clearly differentiated from art or assimilated with it, sport often raises questions related to its belonging to arts or its inclusion into an independent field. Is sport an art or can we rather talk about the art of sport? (Dragnea & Teodorescu, 2002, p. 62) Do we encounter sport in art or art in sport? Do we appreciate art and the sporting show to the same extent? Here are just a few themes of reflection that have concerned specialists in philosophy and sociology, but also specialists in the field of human motricity science.

Topic addressed

The sport-culture-education relationship

The issue of sport-art synergy has been the subject of numerous philosophical analyses, based on the association between two elements belonging to the culture of a society: art and sport. In a broad sense, the culture of a society includes education and the level of knowledge, moral and spiritual values, the arts, the principles guiding the individuals, their traditions and habits. In this context, sport becomes an act of culture, from an educational point of view, but also from the standpoint of its interdependence with art.

![Figure 1. Sport-culture-education relationship](image)

The association of sport with education and culture is found in one of the fundamental principles of Olympism, which is described in the Olympic Charter as follows: “Olympism is a philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind. Blending sport with culture and education, Olympism seeks to create a way of life based on the joy found in effort, the educational value of good example, social responsibility and respect for universal fundamental ethical principles” (International Olympic Committee, 2015, p. 13).

Olympism brings again to the forefront the sport-culture-education triad, in the context of performances achieved by outstanding champions, about whom we can metaphorically say that they master the art of sport. Moreover, the sporting show at the Olympic Games joins the field of human motricity performance with the arts, starting from the magnificent opening and closing ceremonies and continuing with the sublime created in the
Olympic arenas during competitions and demonstration galas. Staging a dance show or conducting a large-scale sports competition involves capturing the audience with elements of originality, providing the protagonists with optimum conditions to express their motor abilities, being concerned with creating a festive atmosphere and reaching perfection at organizational and performance levels. In this context, beyond the value of sports practice in motor, performance and sanogenetic terms, sport becomes the creator of a show loaded with symbols and meanings (Duret, 2008, p. 3).

Pierre de Coubertin was the one who tried to bring art closer to Modern Olympics, supporting in Paris, in 1906, the idea of organizing a Pentathlon of Muses, namely an art competition including the categories of music, literature, sculpture, painting and architecture. This proposal was received with strong resistance and was not easily accepted; however, it was put into practice in 1912, at the Stockholm Olympics. The event was replaced in 1956, at the Melbourne Olympics, by an Art Festival, considering that the assessment criteria for this competition were arbitrary and that it was not about a contest between works of art (Hughson, 2010). The Cultural Olympics, preceding the Barcelona 1992 Olympic Games, began in 1988. This Olympics involved a series of artistic and cultural events developed throughout the four years before the Barcelona Olympics, when the already established Art Festival took place. In 2008, at the Beijing Olympic Games, we find again the Olympic Art Competition (Bulatova, Bubka, & Platonov, 2013, p. 210). At the next editions, the Olympic cultural programme is kept for both the Summer Olympics and Winter Olympics.

Since ancient times, sport has been a source of inspiration for various arts, contributing to their development. We mention here Myron’s “Discus Thrower”, Mandy Long’s collection of ceramic sculptures, the autobiographical literary creations of some world champions (e.g. Andre Agassi - 2009), photo exhibitions illustrating performers in sports arenas (e.g. Rob Galbraith - 2009), sports-themed movies (e.g.”Million dollar baby” - 2004), paintings and posters (e.g. LeRoy Neiman - 1984 Olympics posters), design of Olympic medals (e.g. Muhamad Farid Husen -2018 Youth Olympics), involvement of scriptwriters, directors, choreographers, actors, singers, ballet dancers etc. in the opening and closing ceremonies of large-scale competitions (e.g. Fernando Meirelles, Daniela Thomas, Andrucia Waddington, Deborah Colker -2016 Rio Olympics).

The bivalent connection between sport and art has a positive effect on increasing the number of direct and indirect participants in each of them, being a promoter of culture among citizens (Figure 2). On the one hand, certain social groups with reduced income and low education level have limited access to cultural events and artistic activities, being somehow marginalised from this point of view. Thus, there may be socioeconomic situations where individuals are confronted with elitism and the high requirements of the “cultural capital” of traditional artistic activities. On the other hand, sport, which is more accessible in terms of both participation and show, becomes an act of culture through which the distance between people and art, generated by certain educational and socioeconomic limitations, is reduced (Long & Sandle, 2018).

![Figure 2. Sport as an act of culture](image)

Duret (2008, p. 28) analyses the sporting show as a process that makes the society theatrical, starting from the premise that big competitions provide an ideal and embellished image of a society that wants to be perceived in this way. The country organizing a large-scale competition often makes considerable efforts to present in due time, for both participants and the audience, new sports arenas with the most modern facilities, comfortable accommodation, infrastructure and easy access to sports centres, to ensure public safety and to control any disturbing factor of a civilised society etc. The greatness of the sporting show and implicitly the good organization of an international competition create a certain image on that society, which sometimes hides the dysfunctions and
daily problems of its citizens. This image is to be promoted and propagated over a relatively long term, being a symbol of that country’s power at the world level.

**Sport as a generator of aesthetic values**

Sport is at the border with art because it is a generator of aesthetic values that are perceived and appreciated more or less subjectively by specialists, athletes or spectators, depending on each one’s experience, affective structure, culture, education, level of information etc.

The debate on sport and art in the postmodern period starts from the idea that motor activities have gradually passed from the sphere of ethics (which was the basis of ancient traditional Olympism) to the field of aesthetics. This transition is considered as a “signum temporis” of a more general phenomenon that marks the evolution of society, where aesthetics is increasingly important (Zowislo, 2007). This approach does not exclude ethics from the sports practice, but brings to the forefront the aesthetic values of motor actions and the transformation of sport into an act of culture.

In a broad sense, aesthetic values derive from the way in which individuals see the world around them without analysing the utility of phenomena or objects, but through their beauty and grace and the feeling of pleasure triggered by watching them. From this perspective, aesthetic values in sport are not necessarily provided by the effectiveness of movement in terms of the achieved result, namely winning a point or a competition, but by the way in which certain motor acts and actions are performed. Even if all sports activities can be analysed from an aesthetic perspective, only certain sports have artistic execution standards and specific regulatory requirements for performing technical skills that result in particular aesthetic values (Morgan, 2007, p. 18). Basketball enthusiasts, for example, can be impressed by a technical-tactical structure ended with an unsuccessful basket throw, they being able to admire the beauty of the created situation and the solutions found by the players. However, in terms of performance, the official result is the one on the scoreboard, not the one perceived by the spectators.

On the other hand, there are sports where the rigors of technical execution generate the beauty of movement and give aesthetic value to the execution. Thus, the aesthetic attributes of specific technical skills make certain sports, such as rhythmic gymnastics, dancesport, figure skating and synchronised swimming, to distinguish from other activities and get closer to the realm of arts. Besides, in their case, the competitive result has a distinct artistic component scored by the jury and with a major importance in deciding between contestants.

All individuals have the ability to perceive certain aesthetic values and develop some aesthetic sense throughout their lives (Talebzadeh & Jafari, 2012), depending on their experiences, social models, educational factors, family environment, professional field etc. Given that sport is an educational process, motor activities can be regarded as effective instruments in acquiring values and forming the aesthetic sense from the earliest age.

Several studies highlight that the aesthetic values of sport are neglected and marginalised compared to performance results, which are quantifiable and directly measurable. Their authors believe that it is about a stereotype, a bias with roots in the exact sciences, according to which everything that is not statistically quantifiable does not exist. The emotions generated by the beauty of the sporting act, the feelings experienced during a competition, either in the sports arena, on the podium or in the stands, cannot fit into the exact limits of any statistics and often cannot be precisely described in words. The transfer of aesthetic experience from sport to other fields has positive effects on the development of society as a whole, considering that “post-sports practices” widen the aria of the individual’s contemporary culture (Tan, 2018).

Sports that have an artistic component abound in aesthetic values and question their belonging to sport or art (Grigore, 2012, p. 36). The beauty of gesture and the virtuosity of movements, the perfect fusion between technical skills, expressivity, costumes and musical accompaniment, the emotion generated by the choreography message are just a few aspects through which these activities get closer to art.

If we consider that art mobilises the area of individual sensitivity to beauty and that the artistic, aesthetic value of a gymnastics exercise, for example, falls within the same aria, we identify the subjectivism with which the sporting act is lived and perceived. Thus, in the sports branches found at the border with art, the value of executions is strongly influenced by the subjectivism of people who make the assessment.

Artistic sports allow expressing a superior form of the performance capacity, where body expressivity accompanies as a shadow the accuracy of technical skills. The difficulty of elements in a competition exercise is not visible in the athletes’ facial and gestural expressions, but it transmits safety, ease and fluency, a high level of technicality, as well as elegance in expressing the motor “discourse”. These aspects provide mastery and virtuosity, resulting in the aesthetic attributes of movement and implicitly the closeness to the realm of arts.

Art involves free creative spirit, innovation and discovery of symbols, forms of expression, ways of conveying an ideology, visions, certain concepts or emotional states etc. A similar aspect is encountered in artistic sports,
where competition choreographies are nothing else but valuable artistic creations that generate aesthetic values and are meant to convey a specific message. The creative act is a form of manifestation of the self, is freedom in expressing some hidden sides of the soul and/or mind, based on an inspirational act. Just as a poet is guided by inspiration to give words the most appropriate form to express a certain idea, a choreographer also needs inspiration to give movements a shape through which to convey a certain compositional message. For the creation act, sport becomes a means of artistic expression through which the choreographer manifests this side of personality, a language to communicate a certain vision. The difference lies in the fact that, in performance sports, the creative act must be subordinated to the athletes’ performance capacity and the competition rules. If the painter has infinite possibilities to combine colours on the canvas, for the choreographer, the creative act is conditioned by the capabilities of the athletes who are to stage it and is restricted by the provisions of the competition rules.

Sport is a true promoter of aesthetic values not only in the case of top performance, but also in leisure motor activities. Authors such as Tainio (2018) support the idea that sport for all should not be reduced to rational practice, where only benefits related to health, body composition, vitality and good ageing are being pursued. Sports experience in itself is loaded with personal emotional meanings, providing the participant a state of catharsis, but this issue occupies a secondary place in contemporary culture. Focusing attention only on the wellbeing of the individual and the social utility of leisure motor activities suppresses the deep meaning of human movement and the aesthetic value of the motor act, although the appreciation of these valences is full of subjectivism. A sequence of physical exercise in nature, such as jogging or mountain bike, can produce unique sensations that go beyond the borders of a scientific analysis of the effort load or its physiological effects. The personal satisfactions brought by such a form of motor activity have a considerable contribution to perceiving the exercise parameters and reaching a state of mental wellbeing (happiness, joy, fulfilment). Leisure sports activities develop creativity and contribute to achieving personal excellence (Beal, 1995), objectives that also belong to the field of arts.

Aesthetic experience in sport also captures the athletes’ vitality, moral values, game strategies and the expression of their performance capacity as a whole. In relation to art, the potential of sport, as a meaningful practical experience of man, should be appreciated (Elcombe, 2012).

From a hermeneutic perspective, sport, viewed as a synergy of aesthetic valences, does not reduce to the beauty of gesture, but the phenomenon is added the deep meaning of the motor act and the possibility to use movement as a universal language (Edgar, 2012). Just as art is considered a means of conveying a message to anyone, regardless of the individual’s social and educational condition (Froggett et al., 2011), sport represents a language for communicating aesthetic, moral and sporting values, which is made available to all citizens. Analysed together, sport and art form a distinct cultural language (Chatziefstathiou, Iliopoulos, & Magkou, 2018), which favours the creation of new social and urban spaces.

On the other hand, social competitivness no longer characterises only the field of sport, but also marks the realm of arts. There, competition has become fierce in the last decade, leading to the constant training of artists, regardless of the art embraced. For example, classical dance, which eminently belongs to the arts, is a subtle trigger of a wide range of feelings, emotions and affective states, and nothing can compare to it in generating a similar inner state, against the background of an exceptional bodily technique. The shift into the realm of performance was achieved by pushing the dancers’ mental, physiological and motor limits towards the field of sports science and through their complex training. In 1975, Dr James A. Nicholas (cited by Kottler, 2014) analysed 61 motor activities and ranked ballet as the most physically and mentally demanding. The training of a ballet dancer has been extended from classical study to rigorous physical training, and technical training was complemented with acrobatic gymnastics elements. In addition, the competitive side of classical dance has become increasingly highlighted in recent years by regularly organizing competitions and festivals for all age groups (e.g. school Olympiads, scholarships in dance academies from abroad). In the opposite direction, sports with a strong artistic component use the means of ballet to form the specific body posture and acquire the basic technique of pirouettes and jumps, but also the classical dance steps as connection elements between technical skills. The training of athletes is quite often completed by a classical dance choreographer. We can add here the example of demonstration galas after the closing of rhythmic gymnastics competitions, which resemble the spectacular dance festivals.

Some studies analyse similarities between sport and art, such as institutionalisation or the fact that both can be performed on stages or arenas and can be presented for a public. In others, specialists promote the idea that sport itself can be regarded as an art (Platchias, 2010). From this point of view, the beautiful and sublime in sport can be interpreted in the light of Kant’s philosophy, being generated by extrinsic motivation (competition) and intrinsic motivation (seeking the meaning of life), in the individual’s attempt to confront with the challenge of infinity. This
perspective is presented by Gorichanaz (2016) in one of his studies, where he talks about the aesthetics and beauty in marathon and ultra-marathon races. The application of Kant’s theory to sport is based on the categories of aesthetic judgement, the involvement of athletes’ volitional processes, the participants’ cognitive and creative experience, the generation of moral values, freedom of expression, respect and beliefs in sport, emotion, the beautiful and sublime etc. (Schmid, 2013).

As regards the public, the range of emotions generated by the sporting show is very wide. During a competition, spectators can quickly switch from joy to sadness, from annoyance to happiness, from worry to relief, from indignation to despair (Duret, 2008, p. 31). In sports, arousing the public’s emotions is triggered by the evolution of athletes in the competition arenas and the decisions made by the referees/judges. This awareness process remains a positive experience as long as negative emotions are well managed and do not degenerate into conflicts that would instantly diminish the value of the sporting show.

Conclusions

At the end of our considerations, we present Figure 3, which highlights the main aspects through which sport is at the border with art.

![Figure 3. The table of elements through which sport is at the border with art](image)

Sport at the border with art remains a cultural phenomenon with a strong social impact and beneficial effects on the evolution of society. As part of this phenomenon, the individuals involved in various sports activities reflect these effects, manifesting themselves at a superior level, regardless of the field. Therefore, any participation in the sporting act enriches the individual, first at a personal level, and then the benefits are propagated at the community level.

References


EVALUATION OF TECHNICAL EFFICIENCY IN COMPETITIVE RHYTHMIC GYMNASTICS THROUGH INFORMATION TECHNOLOGY

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Abstract. Planning training in rhythmic gymnastics is a complex process aimed at achieving optimal sports performance. Information technology gives the coach an efficient means of controlling activity, in terms of training programming and evaluation, by facilitating the processing of a significant amount of data, the quick and objective analysis of recorded parameters and graphical visualisation. To optimise training in the group event, we used computer programs to develop a training analysis method that highlights at any moment the individual technical level of gymnasts, with reference to each element of the group exercise, the work performed during a technical training lesson and the number of errors for each difficulty element during the full exercise. An observer entered the information into the computer as the subjects were performing their actions. This option allowed easy database manipulation and flexibility in combining, subdividing, rearranging and transforming the collected data. Measurement included the recording of quantitative indicators, calculation of specific quantitative indicators and analysis of qualitative data. The result analysis reveals that gymnasts achieve the best performance after 10-11 full repetitions of the competition routine; there is a lack of constancy in the average scores for execution over a week; individual efficiency recorded over a week shows oscillations, better values being recorded at the end of the week, when competitions are also scheduled. This method provides the opportunity to have a clear and objective vision of training, monitor each gymnast, compare her results with those of the group, save much time and intervene whenever needed.

Keywords: rhythmic gymnastics, information technology, optimisation, training method.

Introduction

In recent years, the use of information technology in the field of performance sports has become a common practice that provides the opportunity to develop, systematise and process large amounts of information in a short time (Meinberg, 1994; Allowy & Mills, 1985; Togninalli, 1993).

More and more attempts are being made to obtain information from training and competition. The information is processed, evaluated and then turned into feedback for athletes in order to increase their technical and tactical efficiency (Manos & Grigore, 2010); however, its practical use is rather sporadic for structural reasons generated by financial problems, the lack of specialized staff or acceptance-related reasons (Perl & Lames, 1996).

Computer science and technology provide valuable tools and methods for developing sports-specific feedback systems on performance, which often allow presenting the results in real time (Baca, 2003). Feedback systems acquire, determine and present information on the motor task performed, which is not directly observable. Information is either restricted to overall performance measures (“knowledge of results”) or provides specific data on how a movement is performed or should be corrected (“knowledge of performance”) (Baca, 2008).

Advances in modern technology have made it possible to augment and improve the feedback that athletes receive during training and competition. Feedback information about movement is generally expected to allow systematic corrections in the performance. It should enable athletes to modify their movements and produce optimum performance. (Liebermann et al., 2002)

As regards rhythmic gymnastics, the optimisation of training remains a topical issue (Durand, 1992a, 1992b; Fialova, 1994).

The purpose of our research was to optimise the training of female gymnasts, members of the national rhythmic gymnastics team for the group event, by exploiting the opportunities provided by computer programs. At the same time, we aimed to develop a training analysis method able to highlight at any moment the individual technical level of gymnasts with reference to each element of the group exercise, the actual work performed during a technical training lesson and the number of errors for each difficulty element during the overall exercise. This method of qualitative and quantitative analysis of the data recorded during the preparation for group events allows the coach’s direct intervention in the training and also the monitoring of each individual gymnast (Manos, 2016).

Methods

This applied research aimed to determine technical efficiency in rhythmic gymnastics.

Required materials: an IBM laptop to record the data after each full execution of the competition routine, a Windows - Excel software program (version 14.0) to process the data and an Epson Stylus C64 inkjet printer to list
the results and distribute them to the interested team members. The indirect method of data collection was used (Franks & Goodman, 1986a, 1986b), meaning that the information was entered by the observer as the subjects’ actions were being developed. This option enabled easy database manipulation and flexibility in combining, subdividing, rearranging and transforming the collected data.

The content of our research included three stages:
1. The recording of quantitative indicators: on an observation sheet, the exercises performed during a training session were recorded horizontally and numbered. In the columns, there were listed the difficulty elements performed both separately and from throws to exchange apparatus (“B” and “C” levels), as well as high-risk elements. The database was coded and structured to allow for the information processing.

2. The calculation of specific quantitative indicators: it used formal statistical methods. This step resulted in a brief description of the entire set of measurement-related information.

Specific quantitative indicators (Table 1):
- body elements (BE);
- actions for specific apparatus handling (AH);
- exchange by throwing – “B” and “C” levels of difficulty (EB, EC);
- “risk” elements in the individual work (RE);
- ½ exercise (½ E);
- full exercise (FE);
- full exercise + ½ exercise (FE +½ E).

Table 1. Structure of the training microcycle no. 2 within the basic preparatory stage no. 1 (7-13 September)

<table>
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<th>Tuesday</th>
<th>Wednesday</th>
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<td>T1 T1</td>
<td>T1 T2</td>
<td>T1 T2</td>
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<td>EB</td>
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<td>2x20</td>
<td>2x20</td>
<td>2x20</td>
<td>2x20</td>
<td>2x20</td>
<td>80</td>
</tr>
<tr>
<td>RE</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td></td>
</tr>
<tr>
<td>5*</td>
<td>-</td>
<td>2x10</td>
<td>3x10</td>
<td>2x10</td>
<td>3x10</td>
<td>2x5</td>
<td>2x5</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2. Structure of the training microcycle no. 3 within the basic preparatory stage no. 1 (7-13 September)

<table>
<thead>
<tr>
<th>Date</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1 T2</td>
<td>T1 T1</td>
<td>T1 T1</td>
<td>T1 T2</td>
<td>T1 T2</td>
<td>T1 T2</td>
<td>T1 T2</td>
<td></td>
</tr>
<tr>
<td>Time</td>
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<td>17-20</td>
<td>-</td>
<td>17-20</td>
<td>17-20</td>
<td>17-20</td>
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<tr>
<td>BE</td>
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<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td>20 3'y</td>
<td></td>
</tr>
<tr>
<td>5*</td>
<td>10x5</td>
<td>10x5</td>
<td>8x5</td>
<td>8x5</td>
<td>8x5</td>
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<td>8x5</td>
<td>220</td>
</tr>
<tr>
<td>BE + AH</td>
<td>10x5</td>
<td>10x5</td>
<td>10x5</td>
<td>8x5</td>
<td>8x5</td>
<td>8x5</td>
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<td>240</td>
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<td>7x5</td>
<td>7x5</td>
<td>7x5</td>
<td>7x5</td>
<td>155</td>
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<tr>
<td>C</td>
<td>5x5</td>
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<td>5x5</td>
<td>5x8</td>
<td>5x8</td>
<td>5x8</td>
<td>5x8</td>
<td>200</td>
</tr>
<tr>
<td>5*</td>
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<td>-</td>
<td>-</td>
<td>5x8</td>
<td>5x8</td>
<td>5x8</td>
<td>5x8</td>
<td>72</td>
</tr>
<tr>
<td>EB</td>
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<td>4x8</td>
<td>4x8</td>
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<td>4x8</td>
<td>4x8</td>
<td>176</td>
</tr>
<tr>
<td>20 3'y</td>
<td>4x10</td>
<td>-</td>
<td>-</td>
<td>4x8</td>
<td>4x8</td>
<td>4x8</td>
<td>4x8</td>
<td>137</td>
</tr>
</tbody>
</table>
The most important indicators (loss of apparatus, inaccuracies, penalties and points obtained) were calculated for each gymnast, the entire group and each training lesson. Subsequently, the recorded values were related to the number of exercises performed and were expressed as a percentage.

The method of calculating specific quantitative indicators (Table 2) is the following:

- training time (t);
- amount of combinations performed (AC);
- amount of individual work elements (Ind. AWE = BE + AH + RE);
- amount of exchanges by throwing – “B” and “C” levels of difficulty (AET = EB + EC);
- amount of groups of elements representing parts of the exercise (AGE / P = ½ E + ½ E);
- general index of the work amount during training (GAT), which is determined according to the formula:

  \[ GAT = \text{Ind. AWE} + \text{ALE} + \text{ALE} / P + \text{AEC} \]

  where:

  - Ind. AWE – amount of individual work elements;
  - ALE – amount of link elements;
  - ALE / P – amount of link elements and parts of the exercise;
  - AEC – amount of elements executed in combinations.

Table 2. Quantitative indicators – Examples for the precompetitive and competitive mesocycles (MSC)

<table>
<thead>
<tr>
<th>Periods / Stages Structures</th>
<th>Precompetitive stage</th>
<th>Competitive stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSC 9</td>
<td>MSC 16</td>
</tr>
<tr>
<td>Full amount of combinations (AC)</td>
<td>17.5±4.8</td>
<td>28.0±4.72</td>
</tr>
<tr>
<td>Amount of elements performed individually (AE ind.)</td>
<td>422±4.8</td>
<td>360±24</td>
</tr>
<tr>
<td>Amount of throws – “B” and “C” levels of difficulty (AT)</td>
<td>120±17.0</td>
<td>150±26</td>
</tr>
<tr>
<td>Amount of combinations and parts of the exercise (AC / P)</td>
<td>120±4.1</td>
<td>16.3±2.5</td>
</tr>
<tr>
<td>Total amount of elements (TAE)</td>
<td>1330±107</td>
<td>1430±107</td>
</tr>
<tr>
<td>Total amount of elements per minute (TAE / min)</td>
<td>3.12±0.11</td>
<td>4.065±1.8</td>
</tr>
<tr>
<td>Amount of combinations (AC / hours)</td>
<td>9.1±1.0</td>
<td>10.7±0.9</td>
</tr>
</tbody>
</table>

3. Assessment of preparation quality during training (Table 3):

- amount of combinations performed without major errors (loss of apparatus, loss of balance, lack of achieving higher-level difficulty elements etc.), which can influence stability in the execution of competition routines (ASC);
- correlation between the total amount of major errors, which can influence the other gymnasts’ performance (and also the combination), and the amount of successful combinations (AE/AC);
• level of stability determined by correlating the amount of successful combinations and the total amount of combinations (ASC / AC).

Table 3. *Qualitative indicators of training*

<table>
<thead>
<tr>
<th>Periods / stages</th>
<th>Precompetitive stage</th>
<th>Competitive stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of successful combinations (ASC)</td>
<td>0.73±0.30</td>
<td>4.0±0.8</td>
</tr>
<tr>
<td>Amount of errors in combinations (AE)</td>
<td>54.7±12.0</td>
<td>40.4±11.0</td>
</tr>
<tr>
<td>Correlation between the amount of errors in combinations and the total amount of combinations (AE / AC)</td>
<td>3.52±0.74</td>
<td>2.10±0.6</td>
</tr>
<tr>
<td>Correlation between the amount of errors in achieving full exercises and the total amount of full executions (AE / AF)</td>
<td>4.28±0.32</td>
<td>2.0±0.1</td>
</tr>
<tr>
<td>Stability of the correlation (SC / AC)</td>
<td>0.03±0.03</td>
<td>0.2±0.03</td>
</tr>
</tbody>
</table>

**Results**

Interpretation and graphical representation of the computerized parameters:

• individual efficiency during a training lesson (Figure 1);
• average scores for group exercises during a training lesson (Figure 2);
• average scores for group exercises during a week (Figure 3);
• results in percentages for the execution of competition routines during a week, in the precompetitive and competitive stages (percentage of completed exercises, percentage of successful exercises and average score per training session (Figure 4);
• results for each gymnast (percentage of performed exercises, percentage of exercises performed with no failure or inaccuracy) (Figure 5).

![Figure 1. Individual efficiency during a training session in MSC 9 – precompetitive stage](image)

It can be seen from Figure 1 that all gymnasts achieve the best executions at the 10th and 11th full repetition of the competition routine. The same result was also achieved in the competitive period, which has led us to conclude that the gymnasts must perform 10 full repetitions before entering the competition.

If we make a correlation between Figures 1 and 2, we can note that the highest average score value (9.50 points) is recorded at the 11th full execution of the exercise.
Figure 2. Average scores for group exercises during a training lesson

Figure 3 shows inconsistency in the average scores for execution during a week. But this is explicable, given that the recorded data correspond to the first part of the precompetitive period, when the competition routines are not yet completely refined. The highest score was recorded on Wednesday (9.10 points), when only one training session per day was scheduled (in the precompetitive period).

Figure 3. Average scores for group exercises during a week (precompetitive stage)

Figure 4 highlights the results in percentages for the execution of competition routines during a week, in the precompetitive and competitive stages.

Figure 4. Percentage results for the execution of competition routines during a week, in the precompetitive and competitive stages
Figure 5 reveals that, in the precompetitive period no. 1, mesocycle 9, individual efficiency recorded during a week shows oscillations. The highest values are recorded at the end of the week, when competitions are also scheduled.

![Figure 5. Individual efficiency – day/week/exercise, “A” and “B” levels of difficulty](image)

The data provided by applying this system in order to assess the gymnasts’ efficiency during the training lessons represented objective benchmarks in establishing the team composition for the two competition events (the group with 2 hoops and 3 ribbons; the group with 5 balls). Thus, the gymnasts S.M., V.A., V.E. and T.R. were included in both groups, G.A. and H.G. participated in one event, and G.M. was not part of the representative team participating in the World Championships and European Championships.

**Conclusions**

This method allows for a clear and objective vision of training.

The computer program can be adapted to the needs of each coach.

Each female gymnast is tracked individually, her results being compared to those of the group, which allows the coach to save considerable time.

Graphical representation of the results facilitates the task of the entire technical staff and is highly significant in the psychological training of the group.

**References**


COMPARATIVE STUDY OF THE INFLUENCE OF SWIMMING ON THE GROWTH OF CHILDREN AGED 9-10 YEARS

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Abstract. In the century of speed, technology has penetrated very deeply into people’s lives, and exercising and the time they spend outside with and among friends have greatly diminished. Unfortunately, this trend also affects children who suffer very much from a lack of exercise, which draws attention to overweight problems, obesity, motor skills problems and so on, with direct effects on their appropriate development. The proper physical development is an important goal for children aged 9-10 years. Influencing it at a higher level can be intensified by practicing sport disciplines either as an extracurricular activity during their free time or as an activity within the vocational classes. In this study, we have tried to demonstrate that practicing a larger number of motor activities each week has a greater influence on some somatic parameters. And the more the required effort goes to the aerobic area, the more beneficial its influence is. For this purpose, we measured, from the anthropometric point of view, three different groups of children aged 9-10 attending a different number of practice sessions per week. The final results have demonstrated the importance of children’s participation in more motor activities every week.

Keywords: children, anthropometric measurements, physical education, swimming.

Introduction

In the century of speed, technology has penetrated very deeply into people’s lives, and exercising and the time they spend outside with and among friends have greatly diminished. Unfortunately, this trend also affects children who suffer very much from a lack of exercise, as observed by the World Health Organization (WHO, 2018), which draws attention to overweight problems, obesity, motor skill problems and so on, with direct effects on their appropriate development.

The proper physical development, combined with maintaining health, educating fitness components and enhancing basic motor, applicative-utilitarian skills specific to certain sport disciplines, are important goals of physical education and sports. Influencing them at a higher level can be intensified by practicing sport disciplines either as an extracurricular leisure activity or as an activity within the vocational classes. From this perspective, practicing a sport helps to improve the structures and functions of the body, the proper development of the personality and so on. Practiced with a certain frequency, it also becomes an essential factor of the proper physical development of the body (Predescu & Popescu, 2011, p. 7; Opstoel et al., 2015, p. 10).

Swimming is one of the alternative (seasonal) sport disciplines proposed by the school physical education curriculum (according to the school curriculum, MEN, 2014, p. 14) to be practiced during physical education classes. But, due to the required conditions and the lack of specific materials needed for this sport discipline, this branch is not among those frequently practiced during physical education classes.

This has not prevented this sport being practiced in schools/ high-schools that have chosen to have sports vocational classes – swimming. Thus, swimming is practiced during practical sports classes, and pupils in grades 1-4 attend both the physical education classes and the swimming practice (according to the school curriculum, 2014, p. 3). For the first 4 grades, the curriculum includes framework objectives that “express, at a high level of generality, the specific abilities and skills that have to be trained or developed during those years” (Stănescu, 2009, p. 16). The degree of achievement of the framework objectives is highlighted by the benchmarks that are required to be fulfilled at the end of the school years.

Within the vocational classes, the instructive-educational process in the sport of swimming is done in groups of various values - beginners, advanced and high performance, depending on the age, level of training and performance of each student. For each group of value, the curriculum (according to the school curriculum, MEN, 2014, p. 2) indicates specific competences and related content that can be used by the teacher in accordance with the actual means available and the characteristics of the group of students, the resources they have etc.

As an extra-curricular activity, swimming is one of the most beneficial means, with direct effects on the growth and development of children. One can swim for the whole year, but most opt to swim during the warm season. The content of the lessons “is to train depending on each one’s category (beginners or advanced)” (Tudor & Ciocă, 2010, p. 23). The groups have few students, the maximum duration being 50-60 minutes.
Purpose of the study

The influence of exercising on the body has been demonstrated both at national (Dragnea & Bota, 1999, p. 125-127, Predescu & Popescu, 2011, p. 10) and international (Baxter-Jones, 1995; Fogelholm et al., 1999; Opstool et al., 2015, pp. 10-14) levels. This study is not meant to highlight the differences that occur at the level of certain somatic parameters as a result of exercising. We have tried to demonstrate that the practicing of a greater number of motor activities per week has a greater influence on the somatic parameters. And the more the required effort goes to the aerobic area, the more beneficial is its influence.

Hypothesis

The participation in several practice sessions during each week helps children aged 9-10 years develop harmoniously and have somatic parameters higher than children of the same age who participate only in the physical education classes in the school curriculum. Also, the predominance of effort in the aerobic area emphasises these influences.

Methods

Participants

The study was conducted by comparing the anthropometric data of three groups of girls and boys aged 9-10 years. We have not distinguished between girls and boys because in the literature in the field it is mentioned that at this age there are still “no differences of great importance” (Predescu & Popescu, 2011, p. 13) between girls and boys in terms of the parameters tested by us.

The first study group consisted of children practicing high performance swimming, being students of a vocational class. They constantly participated in three weekly training sessions of two hours each, in addition to the two compulsory physical education classes foreseen in the school curriculum. Moreover, as they were students in a vocational class, they were practicing swimming for more than three years.

The second group consisted of 12 children (girls and boys) who practiced swimming as an extracurricular activity and who attended the swimming lessons offered by a private club. They practiced swimming two times per week. These subjects had been practicing swimming for various periods of time – between one and three years. All of them also participated in the physical education classes in the school curriculum.

The third group was made of students attending a state school, randomly selected, with only two physical education classes foreseen in the school curriculum. This group also included 12 children, girls and boys.

The measurements were made in March 2018 at the swimming pools used by the children of the first two groups and in the gym used by the third group.

To note that, during this study, we took into account the WMA Declaration of Helsinki (2013) on ethical principles to be followed in studies on human subjects.

Measurements

In order to assess the harmonious growth of children, specialists have set up a series of anthropometric measurements that provide detailed data on its evolution. In this paper we have only focused on the growth that evaluates the “increase in the size of organs, of body segments, of weight and of their volume” (Predescu & Popescu, 2011, p. 10). Growth is achieved through multiplication at cellular level and is subordinated to development (Predescu & Popescu, 2011, p. 10). The development, as a qualitative process of cellular differentiation, involves functional changes and qualitative improvements, which imply improvement and adjustment of the apparatuses and systems in the body, a complex evolution and “their coordinated integration into a unitary whole (structural diversifications and functional-adaptive changes”, Ionescu, 2013, p. 242). Because development involves more complex tests performed in specially designed spaces, in this paper, we have only focused on some somatic growth indices that are easy to measure both on the edge of the pool and in the gym. For this, we used:

- longitudinal dimensions: standing height – represents the distance from the vertex to the basis; it is measured with the stadiometer from a standard orthostatic position;
- transverse dimensions: arm span – is measured between the middle fingers on both hands. The subject is sitting with his/her arms raised at the level of shoulders, elbows extended and palms in an intermediate position (Cordun, 2009, p. 34);
circular dimensions: chest circumference in resting position – measured at the level of the chest, in apnea after normal expiration, with the help of the metric tape. The subject is in orthostatism, with his/her arms close to his/her body;

- circular dimensions: chest circumference during inspiration – is measured in the same position after a maximum inspiration, with the help of the metric tape;
- circular dimensions: chest circumference during expiration – is measured in the same position after a maximum expiration, with the help of the metric tape;
- the weight of the body is given by “the sum of relatively fixed elements (weight of skeleton, nervous system, skin and viscera) and of variable elements (muscle, fat and water in tissues)” (Crăciun & Tache, 2006) and is measured with the scales.

We have to add that the anthropometric measurements were made by us, but their accuracy depended greatly on the experience of each evaluator.

For the purpose of this study, we also used the bibliographic documentation method, the statistical-mathematical method (arithmetic mean, standard deviation, coefficient of variation) (Tüdös, 1980, pp. 20-36) and graphical representation.

Results

Analysis and processing of data

In order to facilitate the presentation of the data, we used the following abbreviations: EVI - for children in the vocational swimming classroom, EATL - for children practicing swimming as an extracurricular activity, and ESG - for children who only attended physical education classes in schools. Figures 1-6 show the data collected from each group.

![Figure 1. Standing height - expressed in centimetres](image)

From the analysis of Figure 1 we found that the children comprising the vocational swimming group are the highest, and their average was of 140.9 cm. Our data are comparable to those obtained by Fogelholm et al. (1999) which measured an average of 140 cm (both for girls and boys), but also by Opstoel et al. (2015, p. 7) who measured a height of 141.8 cm for subjects who swim. Children who practice swimming as a leisure activity have an average height of 136.5 cm, and those who participate only in the school physical education classes have an average height of 135.8 cm.

The smallest value calculated for the standard deviation was for the ESG group (2.97), and the highest was for the EATL group (7.30). The coefficient of variability indicated high homogeneity and small dispersion.
The analysis of Figure 2 indicated that the highest mean of arm span was found also in the EVI group (148.5 cm). Surprisingly, the EATL has an arm span average (133 cm) smaller than that of the ESG group (138 cm). The standard deviation value was close for the EVI and EATL groups (6.33 and 6.35 respectively), and for the ESG group, it was of 2.89. The coefficient of variability indicated high homogeneity for all groups.

Regarding the circumference in resting position, the lowest arithmetic mean was measured in the ESG group (64.5 cm), and the highest in the EVI group - 79.6 cm. The difference between the two groups was of 15.1 cm, which was due to the swimming-specific breathing exercises. The EATL group has a 3.2 cm average higher than the ESG group. The standard deviation calculated for the ESG group was of 8.59 and the coefficient of variability indicated moderate homogeneity.
The high level of the arithmetic mean of children in the EVI group is also maintained for size during inspiration. The arithmetic mean of this group was more than 11 cm higher compared to the EATL group and 16 cm higher than the ESG group.

The obvious difference is also maintained for size during expiration. It is over 10 cm between the EVI and EATL groups, and of 14 cm between the EVI and ESG groups.
Regarding weight, we found the lowest arithmetic mean in the EATL group (31 kg), which is below the values evaluated by Fogelholm et al. (1999, p. 1263) and by Opstoel et al. (2015, p. 7) on swimmers of the same age as our subjects (33.5 kg and 35.5 kg, respectively). The swimming children evaluated by us had an arithmetic mean of 41 kg, which is close to the upper limit indicated by Opstoel et al. (2015, p. 7). Children in the ESG group had the highest arithmetic mean (45.7 kg), although they were the smallest in height.

Conclusions

Parents’ attitude toward exercising, practicing a sport discipline has a great influence on children, as demonstrated by Fogelholm et al. (1999) or Crawford et al. (2010). If parents are active, children are also happy to participate in different sports activities. If parents are sedentary, children have the same trend without being aware of the risks they are facing.

The study confirmed the scenarios presented. A greater number of training sessions each week has a beneficial influence on the growth of children. The exercises focused on the aerobic exercise area are the most recommended, because they contribute to the development of somatic parameters, with direct impact on health (in this study, the development of the rib cage, with effects on breathing and circulation), but also on the education of aerobic resistance, with beneficial effects on the daily activities of the child.

Authors’ contributions

All authors contributed equally to this study and should be considered as main authors.

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COMPLEMENTARY TREATMENT WITH BEE VENOM IN INFANTILE CEREBRAL PARALYSIS

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Abstract. Bee venom is synthesised in the venom glands of queen and worker honey bees and stored in venom bags. Active components from bee venom can be very beneficial for people’s health. Bee venom contains 46.36% carbon, 7.56% hydrogen and 13.30 % nitrogen; it consists of proteins, enzymes, hormones, mineral salts, etheric oils and other volatile substances. According to research conducted in the last period, bee venom therapy can improve brain activity. This use of bee venom is part of apitherapy. Practiced since ancient times and more topical than ever, it is an alternative to classical therapies used to treat cerebral palsy. The treatment of this disease is performed during sessions that differ from one patient to another and according to the type of paralysis and its characteristics. It has been noticed that younger patients respond very quickly to the bee venom treatment. The better the patient’s condition, the faster his or her response to this therapy will be.

Keywords: bee venom, infantile cerebral paralysis, treatment.

Introduction

According to Cerebral Palsy Alliance (2017), a powerful research foundation from Australia, cerebral palsy is an umbrella term that refers to a group of disorders affecting a person’s ability to move. It is due to damage to the developing brain either during pregnancy or shortly after birth.

Cerebral palsy affects people in different ways and can impair body movement, muscle control, muscle coordination, muscle tone, reflex, posture and balance. Although cerebral palsy is a permanent life-long condition, some of its signs can improve or worsen over time. People with cerebral palsy may also have visual, learning, hearing, speech, epilepsy and intellectual impairments.

Bee venom is a compound with two main roles: bee defence and colony defence. It is synthesised in the venom glands of queen and worker bees and stored in venom bags. In the stinging process, venom is injected under the skin and deep into the tissues in a fluid form (Breed, Guzmán-Novoa, & Hunt, 2004).

Active components from bee venom can be very beneficial for people’s health if they are administrated in small amounts (equivalent to less than 100-300 bee stings for an adult) by specialised persons, in a customised way. If administrated improperly, ignorantly, bee venom may cause allergic reactions and irritations in certain people.

As Wesselius et al. (2015) notice, the treatment might induce pain and even result into death if the subject has an allergy to bee venom, which can produce anaphylactic shock. Because of this, before using it for therapeutic purposes, it is necessary to take all necessary protection measures for the subject (allergy testing, correct dosing) and work – the beekeeper therapist must be sure that this product is injected in complete safety.

According to Hegazi (2009), the most abundant active component of the venom is melittin, which has many useful properties, including powerful anti-inflammatory, anti-bacterial and anti-viral actions.

Topic addressed

Physical properties of bee venom (Marcus, 2014):

Bee venom is a transparent (colourless) dense liquid with a pungent smell and an acidic, bitter, astringent and burning taste, having the feature to crystallise within a short period of time.

- Appearance – homogenous powder mass;
- Colour – matte-white, greyish;
- Consistency – aerated powder;
- Smell – irritant, characteristic;
- Taste – pungent, bitter;
- Purity – without impurities.
Chemical composition of bee venom

Bee venom contains 46.36% carbon, 7.56% hydrogen and 13.30% nitrogen; it consists of proteins, enzymes, hormones, mineral salts, etheric oils and other volatile substances. Specific weight of venom is 1131 and its acid reaction has a pH between 4.5 and 5.5. It precipitates in alkaline environment. Bee venom has a complex composition, and its main component is formed by active protein substances, in a percentage up to 75% of the dried venom. In its turn, the active protein consists of 3 fractions: melittin, phospholipase and hyaluronidase. Out of the 8 existing albuminoid fractions, only two are important.

Melittin is the most important, being the most active. This fraction lyses red cells, releases histamine and serotonin, shortens even and striates muscle fibers, decreases blood pressure and respiratory rate, blocks peripheral and central nervous syncope etc. It is alkaline (pH 11) and contains 13 amino-acids: glycine, alanine, valine, leucine, isoleucine, serine, threonine, lysine, arginine, tryptophan, proline, aspartic acid and glutamic acid. It has a toxic action.

The second fraction consists of hyaluronidase and phospholipase A ferments. Its compounds are 18 amino-acids, namely those mentioned for the previous fraction, plus tyrosine, cystine, methionine, phenylalanine and histamine. Phospholipase A damages cell membranes, causes the sensation of pain and has toxic effects synergic with melittin. Hyaluronidase hydrolyses neighbourhood tissues and is denominated a diffusion factor, because it contributes to venom spreading in tissues and intensifies local reaction. This fraction does not have a toxic action.

Histamine from bee venom causes the sensation of rash and pain in the body, as well as the swelling of stung place. It acts with intensity on smooth muscles, the cardiovascular system and exocrine glands. Under its action, the smooth-muscle tone and peristalsis increase, resulting in intestinal spasms. Asthma crisis may occur and stimulate salivary, lacrimal, bronchial, pancreatic and gastric secretions. Phospholipase is involved in allergic reactions.

In the venom composition, there were also identified free amino-acids, nucleic acids, fats, volatile acids, the last ones being lost in the high part by drying (formic acid, hydrochloric acid and orthophosphoric acid). The third protein fraction represents 3% of the rough venom and is not active.

Bee venom also contains lipids, especially from stearin groups, hydrocarbons, acids (formic, hydrochloric, orthophosphoric) and bases. Of the mineral substances, venom contains calcium, magnesium, manganese, phosphorus (as organic compounds of phosphoric acid), sulphur (only as organic derivatives) and copper. The ash obtained from bee venom also contains magnesium (0.49%), phosphorus (0.42%), calcium (0.26%) and a large part of volatile oils and proteins that cause pain at the bee sting.

In contact with the air at room temperature, its volatile compounds solidify into white-grey crystals with a specific smell and an astringent taste. It is soluble in water, insoluble in ammonium sulphate and hardly soluble in 60° alcohol. It is soluble in acid solutions and partially soluble in the alkaline ones, the precipitate being dissolved in an acidic pH. The aqueous venom solution precipitates by heating at 90-100°, and proteins come back to the initial state in an acidic environment.

Human reactions to the bee venom drop are of three kinds: local, systemic and anaphylactic (Marcus, 2014).

In the first case of reaction, local sting expands in a few hours and the stung place may become red, hot and sensitive for 2 or 3 days.

A systemic reaction occurs within minutes after the sting and may cause general eruption, respiratory disorders, nausea, qualmishness, abdominal pain and syncope.

In the anaphylactic reaction, symptoms may occur within seconds after the sting and cause respiratory difficulties, mental confusion, qualmishness and a shock in blood pressure, which may lead to fainting and even death by respiratory and circulatory collapse.

Generally, a certain resistance to bee stings may arise, but the reactions to them may become unexpectedly, from one cause or another, very intense. People who are very sensitive may die from a single bee sting. On the other hand, there is a reported case of a man who received 2,243 stings and survived.

According to the latest research, bee venom has the can improve brain activity. According to Wesselius et al. (2015), a polypeptide extracted from bee venom, named apamin, is a neurotoxin that can inhibit certain channels of the central nervous system.

Apamin may cause a hyper-excitability of the brain leading to convulsions and respiratory paralysis, but may improve the ability to learn and remember. This helps researchers to better understand better how dopamine acts on brain activity; thus, they will be able to produce drugs with effects similar to apamin (Despre albine și miere, 2018).
Bee venom is used as lotion, as a biological complex. This has an effect on the whole body and increases its potential to recover from various diseases and cope with different types of external and internal aggressors.

Bee venom is a complex combination of enzymes, amino-acids and antioxidants. This colourless liquid is included into a class of drugs that contain more than 24 products based on bee venom. These products do not have the same effect as bee sting, although they are made from the same venom. Because of the processing way, some components with a role in influencing the sting healing are lost.

Venom is extracted and processed for drug products in different concentrations. It is used in the treatment of malaria, eye disease, joint disorders, facial nerve inflammation and cerebral paralysis. It is also used in the treatment of allergic and glycaemic disorders in children, as well as in the treatment of infantile cerebral paralysis.

In 1895, researchers discovered that bee venom had an effect 10 ten times more powerful than morphine (Kim et al., 2016). This was isolated in a product called Adolin, subsequently used in the treatment of cancer symptoms. In Japan, bee honey is used as a component against the growth of malignant tumours, because bee food destroys nucleic acids from tumour cells; the only inconvenient of this treatment is that it is slow. Besides its analgesic effects, it also has an effect on lowering fever, which is more powerful than that of aspirin.

The treatment for cerebral paralysis is performed during sessions that differ from one patient to another and according to the type of paralysis and its characteristics. It has been noticed that younger patients respond very quickly to the bee venom treatment. The better the patient’s condition, the faster the response to this treatment will be.

There is no fixed number of sessions that should be applied, because rapid effects are observed in some patients. According to medical reports, changes were noted after only 10 sessions, but, in other cases, there were necessary over 100 sessions. At the University of Cairo, a group of researchers in neurology (El-Menabbawy et al., 2014) monitored and described in detail the effect of bee venom on infantile cerebral paralysis. A group of 6 children were treated in this way, besides other methods, and the complementary treatment with bee venom was beneficial for all of them. Depending on the patient’s condition and the characteristics of the disease, bee venom will be injected between 3 and 5 times per week.

According to El-Menabbawy et al. (2014), there is another research, also performed in Cairo, on a group of 40 children with cerebral paralysis, with ages between 3 and 7 years. They were divided into two groups with 20 subjects each. The first 20 children were also applied the complementary treatment with bee venom, and the other 20 were applied usual therapy. For those in the first group, a better reaction to treatment was noted, in the sense that they managed to adopt the standing and sitting positions in a shorter time, and concerning their nutrition, an improvement was also observed. Therefore, it has been concluded that bee venom has a beneficial effect in the treatment of infantile cerebral paralysis.

Before using the bee venom therapy, it is always recommended to begin with a general detoxification method (Aloe Vera gel + medicinal herbs that stimulate toxin elimination through kidney, liver - gall bladder - small bowel - large bowel - lung and skin) (Căciulan, 2011).

It is important to improve the functioning of internal organs with herbal teas that specifically act on them.

Rebuild the body’s material structure using good nutrients (especially pollen, honey, royal jelly, propolis).

Always begin with the feeding and stimulation of adrenal glands.

Eat moderate condiments as mustard, coriander, caraway, onion, garlic, celery etc.

Masticate and swallow 3-4 grams of propolis per day.

Consume 200-1000 mg of royal jelly per day.

Consume enough Vitamin C (at least 1000 mg per day).

Eat enough seeds (sunflower, pumpkin, nuts etc.) every day.

Eat fresh green food that has enough enzymes.

Eat different type of food; each meal must contain a balanced combination of the following tastes: sour (the sour taste helps the liver, gall bladder, muscles, tendons and eyes), bitter (the bitter taste helps the nervous system, heart, blood vessels, blood circulation, small bowel and tongue), sweet (the sweet taste helps the conjunctive tissue, mouth, stomach, spleen and pancreas), spicý (the spicý taste helps the lungs, large bowel, skin, mucosae, nose, breathing and immune system) and salty (the salty taste helps the kidneys, adrenal glands, bladder, bones, joints and teeth).

Discussions and conclusions

Apitherapy has been used from ancient times to nowadays. Bee venom is part of it and, as previously shown, could be a solution in the cerebral palsy treatment. But, because bee venom therapy is not a classical one, it
requires some special preparation before, which will make it easier to be accepted by the subject and also to be more successful.

The stimulation of adrenal glands can be performed through massage, acupressure, acupuncture, apipuncture, Yoga etc., which must be focused on dorsal areas where the adrenal glands are located; the first puncture must always be applied there, in order to avoid a possible allergic reaction to the therapy with venom. Due to these methods, blood circulation (the blood is already cleaned and enriched with nutritive elements) is improved in the whole body.

We can say that only in this phase, after careful preparation, the therapy with bee venom can be started – the bioenergy should be flowing through the body with acupuncture, acupressure, Yoga, massage, gymnastics, Qigong etc.; the functioning of the nervous and endocrine systems (now well fed with clean blood, well oxygenated and high-quality energy) will be stimulated through mental exercises.

It could be concluded that bee venom therapy is not a curable therapy, but it can be used to minimise the effects of cerebral palsy. But, as shown before, it has to be used very carefully, because of adverse effects that may occur as a result of its inappropriate application.

References


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