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VALUES OF LEGS MUSCLE FORCE REALIZED AT DIFFERENT GONIOMETERS CONDITIONS OF MOVEMENT PERFORMANCE

UDK 796.012.11:611.98

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Abstract: In a sample of 24 healthy young male person, aged between 19 and 21 years, were analyzed leg muscle force values achieved at different goniometers conditions of movement performance. Comparison of average values of maximal leg muscle power manifested in isometric conditions and at different movement tasks, concluded that the different goniometers conditions differently affected the expression of maximum force. This research may confirm previous research which was experimentally proved that the natural conditions there are joint angle in which the muscles have the most favorable conditions for the mechanical action of force, and this angle is called the optimum joint angle. At the extension of lower leg, where foot represents the open end of the kinetic chain, effect m.quadriceps femorisa localizes only to the knee joint, at the same, power dependence of isolated muscle from its length has the form of concave parabola with a peak around the middle of the possible active reduced. At the closed kinetic chain as movement task squat leg muscles muscle maximum stress achieved at the end of the interval extensions.

Keywords: Isometric Force, Legs Muscles, Squat, Leg-extension

SUBJECT OF STUDY

Most of the movements and trends in the sport occur under the control of man. Movements and trends in the basis resulting from the properties of muscle under the influence of the nervous system generates a force which maintains the site, establishing a motion or influence to
change the movement and motion. Many situations in sports competition require from athletes to conflict outside resistance or to overcome external forces. In these cases, usually it says it is necessary to possess the myogens ability (force and power) as determinants of competitive success.

Force and power that man can express at performance of sports activities depend on many factors. One of the factors that largely determines the expression of muscle force is the position of the body. Change in joint position with changing muscle length, and arm muscle force in relation to the turning axis, and as a result changes torque forces. That means that for every joint in the mans body exists an optimal angle in which the muscles have the most favorable conditions for the mechanical action of force, and this angle is called the optimum joint angle. Analysis of position and movement of the locomotor apparatus, and optimization of mechanical conditions of muscle work in natural conditions is further complicated because the effects of multiple muscles in one movement and one joint angle does not need all of them to be optimal (Jaric 1997). Locomotor apparatus in mechanical terms of very complex system in which affected a large number of movable joints and halfmovable compounds that are adjacent to different parts of the body with viscous-elastic properties, but at the same time and turning centers biomechanical levers. In addition, more rigid segments (bones) are connected to different biomechanical lever systems (kinetic chain) - closed or open at one end of the two. The complexity of the locomotor apparatus produces a large number of kinematic and dynamic parameters, which are difficult to exactly measure out the laboratory conditions in which the sports movement and realistically take place. From dynamic values that describing the movement of the body most directly is measured muscle force. Isometric force (strength) is the maximum force that develops during maximal willing contractions with a constant angle in the joint corresponding extremities. Studies have shown that isometric dynamometric method has high reliability. Measuring the maximum muscle force greater number of researchers got a confidence coefficient in interval 0.85 to 0.99 (Wilson et al. 1996, Agre et al 1987). Today, as instruments for assessing the maximum isometric force, are used electric dynamometers (called sondes) that operate on the principle of strain-induced electric core of the instrument by pressing or dragging. The most accurate indicators of power get in laboratory conditions using a dynamometer (Peric 2009). The subject of this study represent the value of leg muscle force realized at different angles of the movement performance.
METHODOLOGY

This research was realized as a transversal study. The sample was comprised of 24 healthy young male person, aged between 19 and 21 years. All variables in this research can be conditionally divided into the anthropometric variables and variables for assessing myogens properties. Anthropometrics variables which were used in this study are: body height, body weight, percentage muscle, percentage of body fat and MFR-index (relationship between muscle and fat components of body composition). For the purposes of anthropometric measurements it is used anthropometar and physical Analyzer Tanita BC-418 (body composition analyzer). To estimate the forces targeted muscle groups were selected following movement tasks: leg extensions and squat.

Figure 1: Electronic dynamometer GLOBUS TESYS 1000

Isometric leg muscle force was measured with the help of electronic GLOBUS dynamometer (Figure1) and appropriate equipment in the gym. The maximum isometric force muscle legs extension in 3 positions was measured at movement tasks leg extensions and squat (Figure 2 and Figure 3) and to the angle of the knee joint of 80°, 110°, 140°. Subjects were made after an appropriate warm-up three maximum isometric muscle contraction for each leg previously defined angle in the knee joint in a position of leg extensions, as in the squat position. Subjects were given instructions to develop the maximum force for that short time, and that kept during 4 seconds. Signal of force development at the time it was possible to follow through the computer monitor. From the recorded curve the software is automatically calculated the maximum force. On Figure 3 and 4 is show the position that was occupied in measurements of maximum isometric muscle legs extension.
Figure 2: Measurement of maximal isometric muscle force manifested in the leg extensions at the angles in the knee joint 80°, 110°, 140°

Figure 3: Measurement of maximal isometric muscle force manifested in the squat at the angles in the knee joint 80°, 110°, 140°
RESULTS

Even a superficial analysis, it is easy to detect large differences in demonstrated force at different goniometers conditions. Significance differences definitely confirmed the results of ANOVA. Extension thigh is movement task in which is recorded a statistically significant difference between the average values of manifested force. In this movement task force is increased with increasing joint angle to 110 °, then the further increase in angle of joint force decline (Figure 4). F-value obtained using analysis of variance was very high, and the value realized level of significance (Sig.<.05) is below the theoretical defined conditions (Table 1).

Table 1: Values of force achieved at different goniometers conditions in leg extension

<table>
<thead>
<tr>
<th>Angle</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>K.var.</th>
</tr>
</thead>
<tbody>
<tr>
<td>80°</td>
<td>1047,79</td>
<td>115,16</td>
<td>816,00</td>
<td>1329,00</td>
<td>0,10</td>
</tr>
<tr>
<td>110°</td>
<td>1752,87</td>
<td>286,11</td>
<td>1214,0</td>
<td>2281,00</td>
<td>0,16</td>
</tr>
<tr>
<td>140°</td>
<td>1535,62</td>
<td>259,60</td>
<td>983,00</td>
<td>2002,00</td>
<td>0,16</td>
</tr>
</tbody>
</table>

Figure 4: Comparative show of force achieved at different goniometers conditions leg extension
Comparison of average values of maximum isometric force manifested in the conditions in squat position, it was determined that the different goniometers conditions differently affected on the expression of maximum force in the squat. With increasing angle of knee joint manifest force has grown (Figure 5). High F-values and a very low level of realized significance (Sig.) clearly showed that between groups there is a statistically significant difference (Table 2).

Table 2: Values of force achieved at different goniometers conditions in squat. Significance of difference between the average values was tested using analysis of variance

<table>
<thead>
<tr>
<th>Angle</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>K.var.</th>
</tr>
</thead>
<tbody>
<tr>
<td>80°</td>
<td>1290,46</td>
<td>303,56</td>
<td>954,00</td>
<td>1957,00</td>
<td>0,23</td>
</tr>
<tr>
<td>110°</td>
<td>1834,71</td>
<td>435,89</td>
<td>1217,00</td>
<td>2714,00</td>
<td>0,23</td>
</tr>
<tr>
<td>140°</td>
<td>2402,71</td>
<td>484,44</td>
<td>1690,00</td>
<td>3198,00</td>
<td>0,20</td>
</tr>
</tbody>
</table>

F-test = 43,091;  Sig. =.000

Figure 5 Comparative show of force achieved at different goniometers conditions in squat
Occurrence of a statistically significant difference between the average values of force required the application of Post Hoc Analysis by Tackey-Eve model, in order to determine the source of proven variability. When it comes to variable squat, it was found that all three values of each force can be seen as three groups between which there are statistically significant differences.

Expression of muscle force is often influenced by a number of disturbing factors, such as body composition, gender, level of physical activity or ability. As the above factors are specific to each of the respondents, inhomogeneity samples could significantly affect the validity of the obtained results. Therefore it is important to note that in this study was tested a relatively homogeneous sample, which consisted of active selected athletes from different sports branches. In Table 3 are shown the basic statistical indicators of anthropometric variables. Based on the average relationship of muscle-fatty component (MFR), which in this group of respondents was 4.14 may be noted that these are subjects that belong to the muscle-sport morphological type (Ugarković 1996).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Min.</th>
<th>Maks.</th>
<th>St.dev.</th>
<th>K.var.</th>
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<tr>
<td>Height (cm)</td>
<td>179,63</td>
<td>168,00</td>
<td>190,30</td>
<td>5,96</td>
<td>0,03</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>73,89</td>
<td>57,10</td>
<td>95,00</td>
<td>8,85</td>
<td>0,11</td>
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<tr>
<td>Fat mass (%)</td>
<td>13,28</td>
<td>5,40</td>
<td>21,40</td>
<td>3,74</td>
<td>0,28</td>
</tr>
<tr>
<td>Muscle mass (%)</td>
<td>49,69</td>
<td>45,30</td>
<td>52,40</td>
<td>1,67</td>
<td>0,03</td>
</tr>
<tr>
<td>MFR index(%)</td>
<td>4,14</td>
<td>2,22</td>
<td>9,25</td>
<td>1,63</td>
<td>0,39</td>
</tr>
</tbody>
</table>

DISCUSSION

In natural conditions, the muscle is active in the system of bone crank. In exercise movement in the joints, or by changing the joint angles change and mechanical conditions of muscle work. When the change joint angle, every muscle in a different way of changing your arm force, and therefore their own length and speed reduction, which are very important for mechanical analysis of muscle action. Due to the mechanical connection of parts of the locomotor apparatus, each basic movement necessarily affect on distant parts of the body and their basic movements. The influence of the mechanical nature manifests the powers that are transferred to the neighboring first and then further and further parts of the locomotor apparatus. There are very few movements
where the effect of muscle expressed only one running lever which is directly connected. Such movement is achieved that the overall effect of the training focuses on one muscle group, or more accurately stated in a muscle equivalent (Jaric 1997). In leg extension, where foot is open end of the kinetic chain, there is no significant transfer of force through the kinetic chain, and overall mechanical effect may be attributing a single equivalent muscle-m.quadriceps femoris. This research may confirm previous research which was experimentally proved that the force dependence of isolated muscle from its length has the form of concave parabola with a peak around the middle of the interval of the possible active reduction (Close 1964, Hof and Van den Berg 1981). Methods “in vivo” m.quadriceps femoris Thorstensson et all. (1976) and Gavrilovic and associates (1981) received a similar form of relations power - length of the muscle. It can be concluded that in natural conditions there are joint angle in which the muscles have the most favorable conditions for the mechanical action of force, and this angle is called the optimum joint angle. When it ideal lever the angle is 90°, while the real lever that determines the angle is difficult because of the complexity of the anatomic and mechanical conditions when performing the movement. Namely locomotor levers are curved, and muscles operate under different angles on the lever, so the joint angle changes in a specific way changing arm force. Thus, for example, the optimal joint angle for m.quadriceps femoris is about 112° (Gavrilovic et al 1981) or 105° (Marshall et al 1990) in the knee joint.

Analysis of position and movement of the locomotor apparatus, and optimization of mechanical conditions of muscle work in natural conditions is further complicated because the effects of multiple muscles in one movement and one joint angle does not need all of them to be optimal. An example of these statements is the effect m.quadriceps femorisa in raising weight from squat. Comparison of average values of maximum isometric force manifested in the conditions in squat position, it was determined that the different goniometers conditions differently affected the expression of maximum force in the squat. With increasing angle of knee joint manifested power has grown. Based on previous considerations it could be concluded that the optimal joint angle was about 110° because the force in muscle arms should be the biggest and it should be the easiest step to overcome the weight. However, in this system muscles exercised the greatest strain at the end of the interval extensions, and then can cope with the biggest weight. This seemingly paradoxical effect of extensors in the system of two levers that can be explained by the transmission coefficients. Mechanical effect of
extensors in the system of two levers in the letter spacing is characterized by increasing their heel transfer coefficients.

When getting up from the squat position shall be an extension of the knee joint and the joint angle increases with increasing joint angle increases and the transmission coefficient. At the corner of 165° in the knee joint transfer coefficient reaches a value of one \( k = 1 \), so that the leverage of speed exceeds the leverage of force, and consequent is that a large external force can be overcome only with a large hinged angles. (Jaric 1997). This is exactly the expression of force in the leg muscles in squat, is actually a sample of leg muscles power manifestation in a closed kinetic chain.

CONCLUSION

In a sample of 24 healthy young male person, aged between 19 and 21 years were analyzed leg muscle force values achieved at different goniometers conditions performance movement. Based on the obtained results it is possible to conclude the following:

- Comparison of average values of maximum force in isometric conditions, manifested in different movement tasks, it can be concluded that the different goniometers conditions differently affected on the expression of maximum force.

- In natural conditions there is a joint angle in which the muscles have the most favorable conditions for the mechanical action of force, and this angle is called the optimum joint angle. The leg extension, where foot presents the open end of the kinetic chain, effect m.quadriceps femorisa localizes only to the knee joint, at the same power dependence of isolated muscle from its length has the form of concave parabola with a peak around the middle of the possible active contraction. At the closed kinetic chain such as squat muscles achieve maximum strain at the end of the interval extensions.

- Mechanical effect of extensors in the system of two levers in the letter spacing of their heel characterized transfer coefficients increase to exceed the speed lever to force lever, and the consequence is that large external force can be overcome only with a large joint angles.
References


THE STRUCTURE OF SPORTS MOTIVATION AND THE PERCEPTION OF A COACH’S APPROACH TO ATHLETES COACHES

UDK 796.42.015.1

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Abstract: According to the self-determination theory, the experience of autonomy and self-determination is vital for optimal mental functioning and psychological development. Supporting autonomy rather than behavior control develops a sense of responsibility and intrinsic motivation in young athletes (Ryan & Deci, 2007). The aim of this research was to test the structure of the motivation of athletes and to determine to what extent they perceive their coach as autonomy supportive. It is presumed that the intrinsic aspects of sports motivation will be more dominant if there is a perception that the coach supports autonomy. It is also assumed that there will be a positive correlation between intrinsic motivation and the coach’s supportive approach. 108 athletes were tested, of both genders, aged between 14 and 23. The Sport Motivation Scale and the Sport Climate Questionnaire were applied. The research results show that in the tested young players of soccer, basketball, volleyball, as well as rowers, the intrinsic types of sports motivation dominate, as well as the existence of a positive correlation between the perception of the coach’s approach as supportive and intrinsic motivation.

Key words: intrinsic/extrinsic motivation, perception, autonomy, internalization

INTRODUCTION

Unlike the convictions of some prominent theoreticians of motivation such as for example Albert Bandura (Bandura, 1986 according to Deci & Ryan, 2000), who treats motivation as a unique construction and focuses research on establishing the differences between motivation and the state which is characterized by a lack of
every intention (amotivation), motivation, according to the theory of self-determination, is a continuum, which ranges from amotivation through various variants of extrinsic motivation and to intrinsic motivation (Deci & Ryan, 2000).

Children participate in a certain sport because they enjoy that sport, as the very fact of playing sports is interesting and represents a source of satisfaction and reward on its own. In order for that intrinsic interest in sport to be maintained, it is important for the coach to support the autonomy and sense of self-determination in young athletes. Supporting autonomy and the sense of inner causality contributes to a general psychological benefit and to developing a sense of responsibility regarding all those commitments linked with sports which do not necessarily have to be pleasant and interesting (Deci, 1996).

THEORETICAL PART

The structure of sports motivation – motivational continuum

The agents of socialization in the sports context, among which a coach secures the most significant place, very often have the inevitable duty of promoting behavior and activities which are not interesting and consequently it is necessary for them to become internalized, as well as to develop self-regulatory mechanisms which will regulate behavior in the long term. The process of internalization incites the external principles of behavior to be transformed into self-regulatory mechanisms. When important others and referential groups encourage an individual to participate in an activity which is fundamentally dull, that individual starts to internalize the activity which has previously been regulated externally (Deci & Ryan, 1987).

This is especially significant in sports, considering that for the optimal development of a young athlete’s personality, as well as for success in sports, is necessary to develop an inner locus of control, as well as autonomy of behavior and self-regulatory mechanisms which will in continually varying competitive situation enable the maintaining of self-confidence, emotional stability and a high level of achievement.

According to the proponents of the theory of self-determination (Ryan & Deci, 2007), internalization is interpreted as a continuum. The more a regula, or the value which is its essence, is entirely internalized the more it becomes a part of the integrated self and a basis of self-determined behavior. Extrinsically motivated behavior for which the
regulation are internalized in different degrees will also differ in relative autonomy.

At one end of the motivational continuum, there is a state of a complete lack of intention for action – amotivation. When lacking motivation, people either do nothing at all or carry out an activity passively and without any conscious intent. Intrinsic motivation is at the other end of the continuum, distinct from amotivation. Behavior which is intrinsically motivated represents a prototype of autonomous and self-determined behavior. When intrinsically motivated, people are involved in the activity due to interest for the activity itself and an inner satisfaction which ensues from participating in this activity.

Between amotivation and intrinsic motivation there are several types of external motivation. *External regulation* is the least autonomous type of external motivation and represents a classical example of motivation with rewards and punishments. The locus of behavioral control is completely external. External regulation is a type of extrinsic motivation dealt with in the operant conditioning theory (Skinner, 1973), which in earlier discussions on motivation contested intrinsic motivation.

*Introjected regulation* implies that the external regula is internalized, but is not accepted as its very own in a deeper sense. This is a type of external motivation which is partly internalized but has not become a part of the integrated self. Introjection as a form of internalization is considered largely controlling. By applying behavior based on introjection, individuals endeavor to avoid the feelings of guilt and shame or to achieve a contingent self-respect, i.e. self-evaluation which depends on certain results.

*Regulation by identification* is to a certain extent a more self-determined type of external motivation than the previous two. When this type of external motivation is present, there is a conscious evaluation of the aim of behavior or regulae and the acceptance of behavior as personally important. Identification is an important aspect of the process of transforming the external regula into a genuine self-regula. When the person is identified with an action or the value which this action represents, he or she accepts it at least on a conscious level and perceives a significant degree of autonomy, and thus the perceived locus of control is to a significant extent internal.

*Integrated regulation* represents the basis for the most autonomous form of behavior motivated by external factors. It occurs when the identification is evaluated and becomes coordinated with personal values, aims and needs which are already an integral part of the self. However, even though the forms of behavior which are managed by
the integrated regulation are carried out willingly, they continue to be guided and motivated by external factors, as they are carried out for the achieving of some personally important aim and not due to interest and pleasure in the activity itself. Such behavior is still instrumental.

Extrinsically motivated activities are not interesting in themselves and it is not very likely that people will be involved in such activities if they are not instrumental for the achieving of the desired results. Such activities mostly promote important others (Mead, 1934) by use of requests, offering rewards or demonstrating values which are at the basis of such behavior. The dynamics of adopting extrinsically motivated behavior as one’s own includes important other persons or groups, which indicates the relevance of the need for relatedness in the process of socialization and internalization. Nevertheless, the relatedness is not sufficient for a complete internalizing of extrinsic motivation. In order for a person to be able to accept responsibility for extrinsic behavior which is valued by important others, he or she must feel competent. If there is no feeling of competence, it is not very likely that the regulation of the desired behavior will be internalized, quite the contrary. The person will seek excuses why he or she is not behaving as demanded.

The feeling of autonomy is of a decisive significance for the process of internalization and integration. When there is relatedness and a sense of competence the internalization is only partial, as in the case of introjection, if there is no support for autonomy. When important others support autonomous behavior, the internalization is more complete, as in the case of integration. In order for some extrinsic regulation of behavior to be completely and efficiently internalized and integrated, the person must find his or her meaning and purpose of behavior in order for the regulation of this sort of behavior to be integrated into the self.

The coach’s approach

The need for autonomy is linked with the perceiving of the internal locus of control. When the locus of control is internal, the person has a subjective experience of “controlling the situation” and feels that his or her own activity is autonomous and self-determined. The support of an athlete’s autonomy is a prerequisite for the development of intrinsic motivation, personality integration and general psychological well-being.

There are coaches who have the attitude that the autonomy of those who are in some way in a subordinate position, such as in the case
of athletes, should be respected and valued. Such coaches for the most part show consideration for the feelings and inner states of athletes and support their autonomy in work. The second type of coach puts more value in the use of control and pays great attention to the opinion of authorities. This kind of “controlling” coach establishes the way of thinking and behaving and uses extrinsic rewards (Mageau & Vallerand, 2003).

Even though many empirical researches have shown that the style which supports autonomy stimulates intrinsic motivation and has a positive effect on the entire psychological development and mental health, the controlling style continues to dominate in sports (Ryan & Deci, 2007). A research carried out on the students of the Sports College of Belgrade has shown that upcoming sports coaches incline towards a certain dispositional orientation in the direction of supporting autonomy or controlling athletes’ behavior, but that a didactic impact on the developing of an approach which will support the autonomy and intrinsic motivation of young athletes is possible (Mladenović, 2009).

The aim of this research was to determine to what extent young athletes perceive that their coaches apply an approach which is supportive.

AIMS AND HYPOTHESES

The aim of the research

The main aim of the research was to determine whether there is a correlation between the domination of the intrinsic aspects of sports motivation and the perceiving of the coach’s approach as autonomy supportive. The objective was also to test the structure of sports motivation, as well as to determine to what extent athletes perceive that the coach’s approach supports their autonomy in the context of the sport they are participating in.

Hypotheses

The main hypothesis was that the approach supporting the autonomy of an athlete correlates positively with the intrinsic aspects of sports motivation. It has been presumed that with young athletes the intrinsic aspects of sports motivation will dominate as well.
METHOD

Variables

The independent variable in this research was the approach of sports coaches and it was operationalized as a subjective perceiving of the degree to which the coach supports the autonomy of his athletes. The dependent variable was the structure of sports motivation, operationalized through three aspects of intrinsic motivation (to know, to accomplish and to experience stimulation), three aspects of extrinsic motivation (identified, introjected, external regulation) and amotivation for sports.

Instruments

Two instruments were used in the research. The Sport Motivation Scale was used (according to Pelletier, Fortier, Vallerand, Brière, Tuson & Blais, 1995) to test the structure of sports motivation. The instrument consisted of 28 items divided into 7 subscales. Four items related to each of the seven motivational types: intrinsic motivation to know, intrinsic motivation to accomplish, intrinsic motivation to experience stimulation, extrinsic motivation identified, extrinsic motivation introjected, external regulation and amotivation for sports. The examinee assessed the accuracy of every item on a seven-point Likert scale. The scale of sports motivation was translated into the Serbian language, and the formulating of certain items was adapted to Serbian. The value of Cronbach’s alpha amounted to 0.88 which secures a reasonable reliability.

The Sport Climate Questionnaire was applied in order to test to what extent athletes perceive the coach’s approach as autonomy supportive. This instrument belongs to a battery of tests for testing the perception of the quality of the social context in different areas: at work, in education, health, and sports (Kasser & Ryan, 1999; Williams, Grow, Freedman, Ryan & Deci, 1996; Black & Deci, 2000; Williams & Deci, 1996). The questionnaire was also translated and adapted to the spirit of the Serbian language. It consisted of 15 items which the examinee assessed on a seven-point Likert scale. Each item describes one of the aspects of the coach’s approach which can be perceived as supportive to a different degree. The value of Cronbach’s alpha was 0.91.
Sample

The sample consisted of 108 young athletes. The largest number of those tested were young soccer players (74 or 67.8%), and the sample was supplemented by basketball players (15.3%), volleyball players (8.1%) and rowers (9%). The age range of the tested athletes was from 14 to 23, but two thirds of those examined were between 14 and 16 years of age (75.6%). The sample was to the largest percent made up of males (86.1%), while there were 14, i.e. 13.1% females.

RESULTS

The methods of descriptive statistics and intercorrelations were applied to test the structure of sports motivation. The application of the descriptive statistics method has shown that the most represented were the intrinsic types of sports motivation (Diagram 1). Largely represented was the intrinsic motivation to accomplish (M=5.53; SD=1.12). Very similar mean values were obtained for intrinsic motivation to know (M=5.48; SD=1.13) and to experience stimulation (M=5.47; SD=1.15), but also for extrinsic motivation introjected (M=5.46; SD=1.17). Extrinsic motivation identified (M=5.07; SD=1.25) and external regulation (M=4.21; SD=1.35) follow. The least represented are amotivation for sports (M=2.59; SD=0.95). t-test has shown that all the mean values are statistically significant. The obtained standard deviations from the mean values for every type of sports motivation point to the fact that there are the most potential individual differences in regards to extrinsic motivation identified and external regulation (Addendum 1).

Intercorrelations has shown that there is a significant link between the tested types of sports motivation. As it can be seen from Table 1, almost all the values of the correlation coefficient are statistically significant. The intrinsic types of sports motivation to the largest extent correlate between themselves (intrinsic motivation to know and to accomplish r=0.760; intrinsic motivation to know and to experience stimulation r=0.726; intrinsic motivation to accomplish and to experience stimulation r=0.723). All three types of intrinsic motivation significantly and positively correlate with extrinsic motivation types, while there is a significant and negative correlation with amotivation for sports (Table 1). The extrinsic motivation types are significantly correlated between themselves, even though extrinsic
motivation identified is to a larger extent linked with intrinsic motivation
to experience stimulation \((r=0.676)\), to know \((r=0.669)\) and to
accomplish \((r=0.598)\) than with the other two types of extrinsic
motivation – introjected \((r=0.595)\) and external regulation \((r=0.564)\).
Unlike the intrinsic types of sports motivation, it was shown that
extrinsic aspects of sports motivation are not significantly correlated
with amotivation for sports (Table 1).

![Diagram 1: The mean values for types of sports motivation: IMKNOW – intrinsic
motivation to know; IMACC – intrinsic motivation to accomplish; IMEXPST – intrinsic
motivation to experience stimulation; EMIDEN – extrinsic motivation identified;
EMINTJ – extrinsic motivation introjected; EMEXTREG – extrinsic motivation –
external regulation; AMOTIV – amotivation;](image)

<table>
<thead>
<tr>
<th>sports motivation</th>
<th>IM to know</th>
<th>IM to accomp.</th>
<th>IM to exper. Stim.</th>
<th>EM identified</th>
<th>EM introjected</th>
<th>EM ext. regula.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM to know</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM to accomplish</td>
<td>0.760**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM to experience stimulation</td>
<td>0.726**</td>
<td>0.723**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EM identified</td>
<td>0.669**</td>
<td>0.598**</td>
<td>0.676**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EM introjected</td>
<td>0.464**</td>
<td>0.530**</td>
<td>0.653**</td>
<td>0.595**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>EM external regulation</td>
<td>0.389**</td>
<td>0.516**</td>
<td>0.448**</td>
<td>0.564**</td>
<td>0.438**</td>
<td>-</td>
</tr>
<tr>
<td>Amotivation</td>
<td>-0.244**</td>
<td>-0.293**</td>
<td>-0.279**</td>
<td>0.050</td>
<td>-0.086</td>
<td>0.089</td>
</tr>
</tbody>
</table>

**IM** – intrinsic motivation; **EM** – extrinsic motivation; **p<0.01**
The mean value of the assessment of the coach’s approach amounts to 5.50 and is statistically significant ($t=57.856; p<0.001$). Any deviating from this value amounts to one standard deviation.

The correlations between the types of sports motivation and the perceptions of the coach’s approach has shown that all the values of the correlation coefficient are statistically significant. The degree of the support of autonomy of the athletes by their coach is not significantly linked only with amotivation for sports. As the hypothesis states, the perceiving of the coach’s approach as supportive largely correlates with the intrinsic types of sports motivation. The degree to which athletes perceive that the coach supports their autonomy is mostly linked with intrinsic motivation to accomplish ($r=0.436$), and then with intrinsic motivation to experience stimulation ($r=0.401$), and finally with intrinsic motivation to know ($r=0.376$). It is also statistically significant, though to a lesser degree, that the perception of the coach’s approach also correlates with the extrinsic types of sports motivation (Table 2).

<table>
<thead>
<tr>
<th>Sports motivation</th>
<th>Perception of coach’s approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic motivation to know</td>
<td>0.376**</td>
</tr>
<tr>
<td>Intrinsic motivation to accomplish</td>
<td>0.436**</td>
</tr>
<tr>
<td>Intrinsic motivation to experience stimulation</td>
<td>0.401**</td>
</tr>
<tr>
<td>Extrinsic motivation identified</td>
<td>0.348**</td>
</tr>
<tr>
<td>Extrinsic motivation introjected</td>
<td>0.373**</td>
</tr>
<tr>
<td>Extrinsic motivation - external regulation</td>
<td>0.342**</td>
</tr>
<tr>
<td>Amotivation</td>
<td>-0.118</td>
</tr>
</tbody>
</table>

** $p<0.01$

**DISCUSSION**

The testing of sports motivation structure has shown that with young players of soccer, basketball, volleyball, as well as rowers, intrinsic motivation dominates, which confirms one of the given hypotheses. Mostly represented is intrinsic motivation to accomplish something in sports. Even though the mean values for intrinsic motivation to experience stimulation and to know are almost equal, the
intrinsic motivation to experience stimulation has a certain advantage in regards to the motivation to spread wider knowledge within a chosen sport. Of the extrinsic types of motivation, represented the most is the motivation which rests on the mechanism of introjection, followed by identified motivation, and then external regulation. Amotivation for sports is the last in the structure of motivation of young athletes aged from 14 to 23.

Deci and Ryan (1987) suggest that a motivational continuum does not mean that every individual must successively run through all the types of motivation. Based on the obtained results, we can discuss the potential age specifics in sports motivation structure. The young athletes included in this research are largely motivated by the desire for accomplishment within a chosen sport. What follows is motivation by internal simulation, which means that mere participation in a certain sport represents inspiration and stimulus for further partaking in sports. Of the three tested types of intrinsic motivation, the desire to spread wider knowledge of the chosen sport is at the last place. Considering that two thirds of those tested were between 14 and 16 years of age, the question can be posed whether this order of intrinsic motivation types is conditioned by age? Is it a possibility that at the beginning of inclusion into some sport, the desire to spread knowledge of the favored sport dominates, yet which during years of training starts to become repressed by the desire to accomplish something within the desired sport, or is the structure of intrinsic stimuli of sports motivation unrelated to sports experience? Bearing in mind that the duration of participating in sports has not been taken into consideration during this research, certain longitudinal research can produce the response to the questions whether the internal stimuli to participating in sports interchange during the years, and also, what are mediator variables which condition their order in the structure of sports motivation.

A less significant place in the structure of the motivation of young athletes is taken up by extrinsic stimuli. The most represented is extrinsic motivation which rests on the mechanism of introjection. Introjection marks an incomplete process of the internalization of external rules and values. This means that the young athletes in this research for the most part carry out many dull but inevitable commitments linked with sport because this is the way “it should” or “must be”, and not because there is a complete understanding and acceptance of the necessity of a responsible approach to all sports commitments. Within the theory of self-determination, it is considered that extrinsic motivation which rests on the mechanism of introjection
favors optimal psychological functioning the least, but considering the age of the tested athletes in this research, we cannot say that this type of extrinsic motivation has a negative prefix, but rather, that it points to the specific nature of the developmental stage. Introjection as a part of internalization precedes in the developmental sense a complete internalization of external reasons which should become a part of self-regulatory mechanisms of behavior. Considering that the largest number of those tested are in the period of early adolescence (75.6%), it is to be expected that with the maturing of the personality, there will be a more complete internalization of reasons for more responsible behavior in general, as well as commitments linked with sports. There is evidence that the largest number of individual differences in the structure of sports motivation is in regards to extrinsic motivation by external regulation and identification. Motivation by external regulation is a standard motivation approach using rewards and punishment. There are the most individual differences in regards to the relevance of external rewards for young athletes. Such a fact points to individual differences in regards to the significant financial rewards and possibly depends on personal histories of rewarding and punishing. Individual differences in regards to extrinsic motivation which rests on the mechanism of identification indicates a different pace of internalizing the external regulation of behavior within individual regulatory mechanisms.

By testing the perceptions of the coach’s approach, it has been shown that young athletes to a certain extent perceive that their coach supports their autonomy. The mean value of the assessment of the coach’s approach amounted to 5.50, which indicates that the coach’s approach to the tested athletes is moderately supportive.

A coach’s approach thus perceived significantly correlates with all aspects of sports motivation. As the hypothesis states, the supporting of autonomy by the coach is mostly linked with the intrinsic types of the motivation of athletes. Such a discovery is in accordance with the theoretical suppositions of the self-determination theory.

The results of this research confirm the set hypotheses, but also set off a very important question: would a coach’s approach that is highly orientated towards supporting the autonomy of an athlete contribute to a quicker transpiring of the process of internalization of external regulation of behavior in self-regulatory mechanisms? The answer to this question could have practical implications in working with young athletes.
CONCLUSION

The self-determination theory points to the significance of internal stimuli of behavior and supporting the autonomy of athletes for optimal psychological functioning and for achievement and success in sports. Thus, this research has confirmed the hypotheses according to which the supporting approach of a coach is positively linked with the intrinsic aspects of sports motivation. Also confirmed is the presumption that internal sports motivation will dominate in young athletes. It remains an open issue whether the coach’s approach, which is largely orientated towards supporting the autonomy of an athlete, will contribute to a quicker internalizing of the introjected regulae of behavior within genuine self-regulatory mechanisms, or the process of internalization is determined by some dispositional variables. The internal regulation of behavior and the internal locus of control create conditions for the self-determination of behavior and for maintaining an intrinsic motivation for sports.

Addendum 1: The mean values and standard deviations for types of sports motivation (N=108)

<table>
<thead>
<tr>
<th>Type of sports motivation</th>
<th>M</th>
<th>SD</th>
<th>t-test</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic motivation to know</td>
<td>5.48</td>
<td>1.13</td>
<td>50.381**</td>
<td>107</td>
</tr>
<tr>
<td>Intrinsic motivation to accomplish</td>
<td>5.53</td>
<td>1.12</td>
<td>51.270**</td>
<td>107</td>
</tr>
<tr>
<td>Intrinsic motivation to experience</td>
<td>5.47</td>
<td>1.15</td>
<td>49.331**</td>
<td>107</td>
</tr>
<tr>
<td>stimulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extrinsic motivation identified</td>
<td>5.07</td>
<td>1.25</td>
<td>42.001**</td>
<td>107</td>
</tr>
<tr>
<td>Extrinsic motivation introjected</td>
<td>5.46</td>
<td>1.17</td>
<td>48.155**</td>
<td>107</td>
</tr>
<tr>
<td>Extrinsic mot. – external</td>
<td>4.21</td>
<td>1.35</td>
<td>32.197**</td>
<td>107</td>
</tr>
<tr>
<td>regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amotivation</td>
<td>2.59</td>
<td>0.95</td>
<td>28.201**</td>
<td>107</td>
</tr>
</tbody>
</table>

**p<0.01

References

THE EFFECTS OF SPECIFIC GAMES ON THE PREVENTION OF POSTURAL DISORDERS IN THE SAGITTAL PLANE IN PRE-SCHOOL CHILDREN

UDK 616.711-085.825-053.4

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Abstract: An experiment was conducted on a sample of 86 respondents from 5.5 to 6 years of age divided into two groups (54 in the experimental and 32 in the control group), with the aim to follow the effects of a specific exercise program directed towards the improving of the postural status in the sagittal plane. At the beginning and the end of the experiment, all the respondents were submitted to an assessment by six postural parameters: the degree of thoracic kyphosis, head protrusion, the position of the shoulders, the status of the shoulder blades or scapulae, the degree of lumbar lordosis and the pelvic slant. While the experimental group was submitted to systematic six-month exercises according to a specific program which was applied daily in pre-school institutions, the respondents from the control group took part in regular P.E. classes, within the standard curriculum of the pre-school. There was not a single significant difference between the postural status of the respondents in the experimental and control group in the initial assessment. However, significant differences between the experimental and control groups were established in the final assessment with all postural variables, occurring as consequences of different volumes and training intensity stimuli applied during the experiment. Significant changes in the initial to the final assessments were registered exclusively in the experimental, while completely lacking in the control group. The occurring differences between the experimental and control programs are primarily explained by the possibility to affect children’s motivation through preventive-correctional games. Except for the standard strength and stretching exercises, work on improving proprioception has also proven to be very efficient.

Key words: postural status, kyphosis, lordosis, head protrusion, scapulae alatae, games, pre-school P.E. classes
THE SUBJECT OF THE PAPER

The human apparatus of movement always adapts to conditions it is exposed to in the long term. Due to this mechanism, a continuing lack of movement leads to a weakening of the muscles, while increased physical activity leads to muscular hypertrophy. One of the consequences of contemporary life styles is that people of all ages are increasingly less physically active. One of the most common consequences of an ever-increasing hypokinesis is postural disorders, which in the last years has been especially noted in younger children (of preschool and young school age).

The body of a human succumbs to the laws of physics. Furthermore, it incessantly fights to resist the effect of the force of gravity in the endeavor to maintain the balance of force (in static conditions, primarily a balance between gravity and the force produced by the skeletal musculature). The active force of the muscles enables via the bones (biomechanical levers) a normal upright position of the body and the maintaining of physiological relations between the adjoining bones. With the weakening of the postural musculature, there occurs very quickly a disorder of these physiological relations which is firstly manifested as bad posture and which, if not treated in time with kinesitherapeutic exercises, is quickly converted into body deformities. This is especially valid for the spinal column where, due to a specific position and the reciprocal relations of the vertebrae, torques are formed very easily. The most prominent torques are those caused by the force of gravity in the sagittal plane, in which there are three physiological curvatures of the spinal column – cervical lordosis, thoracic kyphosis and lumbar lordosis. Especially sensitive to pathological enlargements are the thoracic and lumbar curvatures, especially in pre-school children, whose body mass increases at a fast rate, often significantly exceeding the spontaneous biological increase of force of the existing postural musculature. Thus, preventive exercising has a special role in the preschool age. The topic of this research is chiefly a specific program of preventive games whose effects are followed during an experiment with children in pre-school conditions.

A normal upright position is most often adopted when body height is at it greatest. It ensures the best biochemical conditions for starting movement and the most optimal position for the working of the organs in the chest and abdominal cavity. In a normal upright position, the center of gravity of the head is not located vertically above the center of the occipital joint, but is moved forward so that the line of action of
the force of gravity, drawn from the center of gravity of the head, falls in front of the revolving point (the occipital joint). This kind of correlation creates a torque in the occipital joint, and thus earth’s center of gravity attempts to force the head forward and downward. The dropping of the head is prevented by extensor muscles in the occipital joint by a constant static (isometric) contraction. The effort of these muscles is not, however, too considerable, considering that they are so strong they can also move the weight of the entire body.

The curvature of the thoracic spine (thoracic kyphosis) is also somewhat reduced in a normal upright position, and the shoulders are set back to a degree, raising the thorax and improving the position for inhaling air. The line of action of the force of gravity drawn from the joint body parts above the curvature of the thoracic spine passes in front of the spinal column. This helps to create a torque which attempts to enlarge the thoracic curvature. This tendency is confronted by the resistance of the back muscles, extensors in the thoracic part of the spinal column, with their static contractions. To maintain a physiological kyphosis, of significance is the strength of the deep back muscles, as well as the muscles from the ventral side of the body (thoracic and abdominal) which by contracting can also cause the curving of the thoracic spine forwards. This is why the prevention and correction of poor kyphotic posture is always based on the strengthening of the deep back muscles and a simultaneous stretching of the pectoral musculature.

The extent of lumbar lordosis in a normal upright position is such that the vertical line, lowered from the joint center of gravity of body parts above the groin curvature, passes over the vertebrae lumbalis, being the closest to the centers of the second and third vertebrae. Thus, a balance is established in the lumbar part of the vertebral column, so there is no need for more muscular effort, except for tonic contractions of the stomach muscles which maintain a balanced position of normal breathing and whose strengthening is considered to be an efficient means in the prevention of pathological lordosis. A much greater danger for the creating of deformities in the lumbar spine is the shortening of m. Iliopsoas - which, by contracting, can disrupt lumbar spine posture (Baum, 1974). Thus, the main means in the prevention and correction of lumbar lordosis, along with the strengthening of the abdominal muscles, is the stretching of the flexor muscles in the hip joint.

In a normal upright position, the pelvis takes up a standard position which implies a 60-degree angle slant. In that position, the muscle tone of the flexor and extensor muscles in the hip joint is almost the same.
The line of attack of the common center of gravity of the upper body parts is cut in half by the line which connects the center of both hip joints, which in turn prevents the appearance of a torque. In effect, in this segment of the apparatus of movement, a local balance is maintained, for whose sustaining a tonic (passive) contraction of the flexors and the extensors in the hip joint is sufficient.

Due to the weakening and contracting of the present postural musculature, there has lately been a significant increase of disorders of the spinal column in a sagittal plane noted in pre-school children. Except for the kyphotic and lordotic postures as basic pathological manifestations, also observed were similar postural status disorders: winged blades or scalpae (scapulae alatae), a loose belly, slanted pelvises and similar. Except for the fact that they impair esthetics, the mentioned disorders also imperil children's locomotion and prevent a proper functioning of the internal organs (primarily the lungs, the heart and the intestines due to a disruption of work in the thoracic and abdominal cavity).

Newer findings (Perić, 1989; Jovović, 2003; Erne, 2006; Obradović and Milošević, 2007) indicate that within the former Yugoslavia, a disturbingly large number of children have elements of bad posture which can very quickly turn into body deformities. With the aim to determine the efficiency of different models of preventive and corrective workouts, numerous studies have been carried out with children of a pre-school and younger school age (Nedvidek, 1975; Radisavljević, 1979; Perić, 1989; Ulić, 1995; Živković and Karaleić, 1996). Even though work methods with various degrees of efficiency were used, it can generally be concluded that in all cases, the increase of the engaging of postural musculature, in relation to the usual one, has regularly caused an improvement of the postural status. The intensifying of weakened and the stretching of contracted postural muscles were the basic activities, albeit not the only ones. Thus, in some research papers (Solarić, 1971; Perić and Cvetković, 2003), it is claimed that work on improving proprioception has proven to be very efficient, but only with children whose postural status has been disrupted to the point of bad posture. Proprioceptive exercises were carried out in the form of workshops, in which a large number of nerve impulses were sent to postural muscles by way of a considerable number of repetitions of specific movements.
WORK METHOD

This research was carried out as an experiment with parallel groups. The empirical procedure involved 86 respondents of both genders between 5.5 and 6 years of age (boys and girls attending preschool in the Belgrade municipality of Mladenovac). The sample was divided into two homogenous groups – experimental (54 respondents) and control (32 respondents), according to the criterion of postural status. In the experimental group, a specific program of preventive-correctional games accredited by the Institute for the Promotion of Education of the Republic of Serbia was applied on a daily basis, while the children from the control group were exposed to a standard program of P.E. classes as defined by the institute’s annual plan. The experimental program lasted six months, and was carried out by teachers who received training in a one-month seminar organized prior to the beginning of the experiment.

In the process of data collecting, the scaling technique was mostly used, with the application of standard physiatric protocols for the assessment of postural parameters on a sagittal plane. Two assessments were carried out for the needs of the research – the initial one before the start of the experiment and the final one after the end of the six-month experimental period. Both assessments were carried out by the same medical specialists, along with an application of identical physiatric assessment procedures.

The postural status was assessed by the application of the following variables: 1) thoracic kyphosis, 2) head protrusion in front of the vertical line, 3) the curving of the shoulders forwards, 4) the position of the scapula (presence of scapulae alatae), 5) lumbar lordosis and 6) the slant of the pelvis. The clinical picture for every variable was valued by a three-degree scale in which the following indicators were applied: BO – physiological (normal) posture, I – the first degree of bad posture and II – the second degree of bad posture.

Diagram 1: The somatoscopy procedure
During the assessment, two physiatric models were used: somatoscopy (visual observation) and the body posture test.

For a more precise somatoscopy, a special wooden frame was used, 1.5 meter x 1 meter (Diagram 1) onto which a square decimeter grid net was fixed. The respondents, wearing only their underwear, were asked to take up a normal upright position behind the frame, to spread their legs slightly, loosen their hands by their body and to look at a toy (a stuffed teddy bear) set at eye height, two meters away. With the aid of the framed grid, a line of gravity running from the center of the ear and the centers of the shoulder and hip joints was established. The respondents were assessed from both sides. The position of the shoulder blades or scapulae and the pelvis was also measured by somatoscopy, during which the position of the scapulae was viewed from the back. The body posture test was carried out in such a way that respondents with bad posture were asked to take up a proper upright position, during which a picture of a child with good posture was shown as a stimulus. If the respondent managed to achieve this position using the strength of his or her own muscles and to maintain this position for 30 or more seconds, he or she was classified in the first degree category of bad posture. The respondent who did not entirely manage to take up a normal position, or did so but not within the requested timeframe, was categorized in the second degree of bad posture (Diagram 2). All three modalities (BO, I, II) were expressed, on the level of a complete sample as well as subsample, separately for the initial and the complete final assessments.

The data gathered during the research was processed according to the descriptive and comparative statistics procedures. As the information used to quantify the postural variables was grouped in the
form of intervallic statistical series, the only determined descriptive parameter was the distribution of frequency, which during the comparative analysis requested the application of the $\chi^2$–test as an adequate non-parameter procedure. A complete statistical processing was carried out with the aid of the SPSS application program.

**RESULTS**

By way of a discriminative analysis, it was determined that there are no significant differences between the experimental and control groups regarding any indicators of the postural status (the degree of kyphosis, head protrusion in front of the vertical line, the curving of the shoulders forwards, the *scapulae alatae*, the degree of lordosis and the slant of the pelvis) during the initial assessment (Tables 1 to 6). This fact was exceptionally significant for the bringing of a final conclusion on the effects of the experimental program. Considering that no statistically significant differences were found in any contingency analysis carried out separately for each variable, the subsamples (in the experimental and control groups) were treated as maximally homogenous. This helped to create conditions which for the most part explain all the differences between the groups established in the final assessment with the impact of the applied model of preventive-correctional games.

The collected initial data indicated that the postural status was unsatisfactory. This is backed up by the large number of respondents lacking a normal status (BO). With all variables, the first degree of the postural status was dominant. The weakest clinical picture was noted with thoracic kyphosis which showed physiological values in as few as 19.8% respondents. Similar frequencies have been established also with parameters which in hitherto research were regular followers of a larger kyphosis – head protrusion, curved shoulders and *scapulae alatae*. This time as well it was proven that in pre-school children the second basic curvature of the spinal column in a sagittal plane – lordosis, is far less represented than kyphosis. Nearly half of the respondents (48.8%) had a normal lumbar spine.

**Table 1:** Incidence of kyphosis in the initial assessment

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>$\Sigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (absolute frequencies)</td>
<td>13</td>
<td>27</td>
<td>14</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>4</td>
<td>17</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>19.8%</td>
<td>51.2%</td>
<td>29.1%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 1.893; \quad \text{Sig.} = .388$
**Table 2: Incidence of head protrusion in front of the vertical line in the initial assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>∑</th>
</tr>
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<tbody>
<tr>
<td>Experimental (abs. frequencies)</td>
<td>25</td>
<td>24</td>
<td>5</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>11</td>
<td>15</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>41.9%</td>
<td>45.3%</td>
<td>12.8%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 2.123; \quad \text{Sig.} = .346$

**Table 3: Incidence of curved shoulders in the initial assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>∑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (abs. frequencies)</td>
<td>15</td>
<td>22</td>
<td>17</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>3</td>
<td>18</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>20.9%</td>
<td>46.5%</td>
<td>32.6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 4.342; \quad \text{Sig.} = .114$

**Table 4: Incidence of scapulae alatae in the initial assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>∑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (abs. frequencies)</td>
<td>15</td>
<td>26</td>
<td>13</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>3</td>
<td>22</td>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>20.9%</td>
<td>55.8%</td>
<td>23.3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 4.821; \quad \text{Sig.} = .090$

**Table 5: Incidence of lordosis in the initial assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>∑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (abs. frequencies)</td>
<td>29</td>
<td>11</td>
<td>14</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>13</td>
<td>10</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>48.8%</td>
<td>24.4%</td>
<td>26.7%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 1.714; \quad \text{Sig.} = .424$

**Table 6: Slanted pelvis in the initial assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
<th>∑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (abs. frequencies)</td>
<td>28</td>
<td>17</td>
<td>9</td>
<td>54</td>
</tr>
<tr>
<td>Control (absolute frequencies)</td>
<td>10</td>
<td>17</td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>Complete sample (relative freq.)</td>
<td>44.2%</td>
<td>39.5%</td>
<td>16.3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$\chi^2 = 4.324; \quad \text{Sig.} = .115$
By way of a discriminative analysis, it has been determined that, based on the initial assessment, the respondents from the experimental and control groups statistically significantly differ in all six variables of the postural status (Tables 7 to 12). The minimal values of the realized levels of significance (Sig.) indicated that during the experimental period there were significant changes in the postural status of the respondents.

The changes occurring in the control group, which used a standard pre-school P.E. program, mostly showed a positive tendency, but were far less in number than those in the experimental group. A contingency analysis showed that practically no empirical change, registered in the control group, was statistically significant and could not be interpreted as a consequence of a systematic effect of any kinesiological factor.

**Table 8: Incidence of kyphosis in the final assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>46 (85.2%)</td>
<td>8 (14.8%)</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>5 (15.6%)</td>
<td>20 (62.5%)</td>
<td>7 (21.9%)</td>
</tr>
</tbody>
</table>

$\chi^2 = 42.240^*$; Sig. = .000

**Table 9: Incidence of head protrusion in front of the vertical line in the final assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>54 (100%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>13 (40.6%)</td>
<td>15 (46.9%)</td>
<td>4 (12.5%)</td>
</tr>
</tbody>
</table>

$\chi^2 = 41.155^*$; Sig. = .000

**Table 10: Incidence of curved shoulders in the final assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>44 (81.5%)</td>
<td>10 (18.5%)</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>4 (12.5%)</td>
<td>19 (59.4%)</td>
<td>9 (28.1%)</td>
</tr>
</tbody>
</table>

$\chi^2 = 42.264^*$; Sig. = .000

**Table 11: Incidence of pectus excavatum in the final assessment**

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>51 (94.4%)</td>
<td>2 (3.7%)</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>Control</td>
<td>27 (84.4%)</td>
<td>3 (9.4%)</td>
<td>2 (6.3%)</td>
</tr>
</tbody>
</table>

$\chi^2 = 2.450$; Sig. = .294
Table 12: Incidence of scapulae alatae in the final assessment

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>44 (81.5%)</td>
<td>10 (18.5%)</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>5 (15.6%)</td>
<td>20 (62.5%)</td>
<td>7 (21.9%)</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 38.249*; \quad \text{Sig.} = .000 \]

Table 13: Incidence of lordosis in the final assessment

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>50 (92.6%)</td>
<td>4 (7.4%)</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>11 (34.4%)</td>
<td>11 (34.4%)</td>
<td>10 (31.3%)</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 34.854*; \quad \text{Sig.} = .000 \]

Table 14: Slanted pelvis in the final assessment

<table>
<thead>
<tr>
<th>Group</th>
<th>BO</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>48 (88.9%)</td>
<td>6 (11.1%)</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>9 (28.1%)</td>
<td>18 (56.3%)</td>
<td>5 (15.6%)</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 34.301*; \quad \text{Sig.} = .000 \]

The comparison of frequencies noted in the initial and final assessments of the relevant postural parameters (Diagrams 3 to 8) has indicated a growth of normal status (BO) on the behalf of the reduction of the first, and especially the second degree of the postural disorder.

The significant changes in the initial posture, therefore, are solely related to the experimental group, so it would be logical to conclude that the program of preventive-corrective games (“Walk straight – be healthy”) was far more efficient than the standard P.E. classes applied in the control group.

Diagram 3: Kyphosis of the experimental (E) and control (C) groups before and after the experiment
**Diagram 4**: Protrusion of the head in front of the vertical line in the experimental (E) and control (C) groups before and after the experiment.

**Diagram 5**: Position of the shoulders of the experimental (E) and control (C) groups before and after the experiment.

**Diagram 6**: Status of the scapulae of the experimental and control groups before and after the experiment.
**DISCUSSION**

In the initial assessment, not a single significant difference was determined between the postural variables of the experimental and control groups. In the final assessment, however, significant differences between the experimental and control groups were determined in all six variables of the postural status. This unequivocally points to the conclusion that the experiment has conditioned significant changes noted only in the experimental group. By quantifying the differences between empirical frequencies obtained in the initial and final assessments, it has been determined that in the experimental group there was a statistically significant improvement of results in all postural variables viewed in a sagittal plane. The deduction of positive effects of the experimental program of preventive-corrective games (“Walk straight – be healthy”) is also supported by the fact that in the control group, despite systematic work according to the standard P.E. program in pre-schools, there were
no statistically significant changes of the postural status after six months of P.E. classes. However, some improvements were noted nevertheless in the control group, primarily in the decrease of the number of children with bad kyphotic posture of the first degree. These empirical changes, in the statistical sense of the word are, however, insufficiently big to be considered a result of methodical physical exercising during a six-month period.

Especially significant for a proper interpretation of the obtained results is finding a logical explanation and reason why positive changes were so much more emphasized in the experimental group than in the control group. As the most prominent difference between the experimental and control programs, what comes to mind instantly is the amount and intensity of the applied exercise contents. While the program “Walk straight – be healthy” was applied on a daily basis, the control program adhered to a weekly plan of the pre-school’s activities, according to which there were one or two P.E. classes a week. It is a fact that in the control group the children worked out daily, but primarily in the form of morning P.E. classes during which a smaller number of low-intensity exercises lasting as little as 15-20 minutes were applied. Except for directed activities and morning workouts, recreational breaks whose duration and intensity were, seemingly, insufficient to cause more significant changes in the postural musculature were applied in the control group 2-3 times a week.

The experimental program, except that it was applied on a daily basis, consisted primarily of games and drama workshops whose duration was not limited beforehand. This apparently sent into the children’s apparatus of movement a far greater number of training stimuli which, it seems, were also of a high intensity. Considering that the applied experimental contents were dominantly focused on creating authentic motivation in children, it happened very often that some games were repeated in the family circle as well, that is, after the children left the pre-school. In addition to this, according to numerous feedback information by the teachers who carried out the experimental programs, the majority of the contents were also closely connected with other pre-school activities which brought about a high correlation between physical activities and, for example, the development of concepts of shapes, colors, space, mathematical concepts, et al. With the extended effects of training stimuli, there were significant proprioceptive effects realized. It seems that it is the application of the elements of proprioceptive training which is the basic advantage of the experimental over the control program. Thus, not only a larger number and activity
intensity, but also the inclusion of the affective elements of the children’s personalities, caused remarkably higher positive improvements in the changes of the postural status of the respondents.

CONCLUSION

Taking into consideration all the obtained findings, we can determine with certainty that the work model which is based on the application of specific preventive exercises and games is very efficient for the prevention of disorders of the spinal column in the sagittal plane of pre-school age children. It is important to say that, along with the mentioned exercises directed towards the strengthening and stretching of the postural musculature responsible for maintaining the physiological curvatures of the spinal column, exercises with a proprioceptive effect, that is age-adapted exercises for correcting the posture and the sitting position, were also carried out on a regular basis. They were realized via games, a basic methodological principle in pre-school education. Corroborating this are also the comments of the teachers who in their interviews with the researcher, stressed that all the contents were easy to apply, that the children managed to maintain high motivation, and that there was a great interest of the parents to apply the program at home as well. More than one third of the parents involved in the program for the prevention of postural disorders, stated that they often applied some of the contents out of school also. Along with this, the teachers stressed that the program was very appropriate and helped to link the P.E. classes with other pre-school activities, primarily in the development of spatial relations, mathematical concepts, physical exercises and notions of the self, as well as the development of speech.

References:

EVALUATION SYSTEM SERVICE SPORTS QUALITY IN MUNICIPALITY FITNESS CENTERS IN CITY OF THESSALONIKI

UDK 796.015.132 (495.622):005.6

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Abstract: This longitudinal study of the empirical nature which are, in a sample of 414 respondents of both sexes, with different social features (age, marital status, educational level, training experience), quantified views and opinions of service users fitness centers before and after gaining experience with certain center and specific programs. The data collection used a questionnaire consisting of 29 questions modeled after the seventh degree Likert scale. Items were divided into five groups so that the 5-6 claims covered by each of the five dimensions of quality Parasuraman and associates of the factor analysis procedure, defined as: 1) reliability, 2) assurance, 3) tangibles, 4) empathy and 5) responsiveness. Using t-test for independent samples was evaluated differences between the average scale of values established initially as expectations related to service quality, and then as a realistic assessment of services received during the three months of using the contents fitness centers. Differences between expectations and perceptions are interpreted as Gap's. It turned out that the dimensions around which were gathered questions for assessing the quality of trainers and program implementation, obtained positive changes. Therefore, Assurance and Empathy dimensions brought significant improvements in relation to expectations and were recorded positive Gap's. On the other hand, all the dimensions of the saturated-related issues for the assessment of material conditions, organizational and propaganda activities, such as Tangibles, Reliability and responsiveness, users rated poorer in comparison to their expectations. The biggest negative Gap was recorded in relation to the dimension Tangibles, which is a direct consequence of marketing messages to the real (sustainable) conditions in which the contents are realized. Gap's values, as a result of changes in attitudes and opinions of the respondents under the influence of experience, not depended on any one specific biosociological characteristics.

Key words: fitness, management, services, social structure
SUBJECT

Life of modern man in urban conditions is fulfilled many responsibilities that significantly reduce time. The race for jobs, the struggle for existence leaves very little free time. After satisfy their biological needs (to eat, sleep, relaxation and passive) modern man is confronted with the real struggle for space dedicated to creative leisure and recreation. In recent years more and more are searching for a quality fitness programs that would better meet the needs of urban people in the so-called free time. Fitness center programs should be designed to be as near as possible the needs of employed people and their programs as much as possible meet the needs and expectations.

Measuring the quality of service fitness centers in urban conditions is one of the most important tasks of modern sports management. It is methodologically very complex process that requires the researchers to more accurately determine the real needs of potential users, to objectively valorize the current market bid and to reliably quantify their mutual relations. In other words, practice is important to determine the relationship between the needs and expectations, with one, and offers a fitness center, on the other side. This paper deals with precisely those aspects of quality management in sports recreation. As a research model of users are taken and fitness centers from the territory of the City of Thessaloniki, but the results obtained are in good measure can be applied to similar urban areas. This especially applies to the application of specific research procedures and the use of analog research tools.

Examining the available bibliographic sources, as in the world and in Greece, there is a deficit of works related to this topic. One of the few studies of this issue was conducted by Gary Howat (1993 and 1996) from the University of South Australia. He tried to discover what search one who is engaged in recreational sports (the client at a time) from the gym, or to analyze the current problems in order to improve the whole system of service delivery and thereby increase customer satisfaction. Similar problems in Greece were investigated Aleksandriss and Paliaalia (1998 and 1999). They dealt with a large private fitness club chains in Greece, trying to discover what users require and what the gym may not give in order to increase the number of potential athlete.

Starting from these models, and the subject of this study were the relationships between the services provided by fitness centers in the city of Thessaloniki and (no) satisfaction that users feel for the services provided, as well as those services that are missing. Methodologically
speaking, the purpose of this study was to measure the so-called gap between expectations and what is received. As a methodological model used Parasuraman and associates model (1985), which measures the quality of service provision through multiple dimensions plan. Original Parasuraman formula identifies ten components of quality of service delivery: 1) reliability 2) responsiveness 3) Competence 4) access 5) courtesy 6) communication 7) credibility 8) security 9) Understanding / knowing the customer and 10) tangibles. The same authors of these ten elements, in a later study (Parasuraman and associates, 1988), by the method of factor analysis, reduced to five dimensions: 1) reliability, 2) assurance, 3) tangibles, 4) empathy and 5) responsiveness. The practical dimensions are called reliability, tangibles and responsiveness remained unchanged, while the other seven elements interpreted through two new complex dimensions: assurance and empathy.

METHOD OF WORK

This research was conducted in the form of an experiment with a group in which they tracked views and opinions of participants in recreational processes during a three-month period. In designing this research is managed by Parasuraman fifth dimensional model of service quality in sport. The data collection used a questionnaire consisting of 29 questions (Appendix 1). Questions are arranged so that each of the five theoretical dimensions to be covered with 5-6 items (questions). Questionnaire to measure expectations of the respondents were filled out before, a questionnaire measuring perceptions of three months after the use of fitness center services, such as the seventh degree Likert scale choose the type of assessment (from not true to true) that best reflects their attitude towards certain aspects of quality of sports services.

Appendix 1 The initial part of the instrument used in the evaluation of certain aspects of service quality in fitness centers

<table>
<thead>
<tr>
<th>N.</th>
<th>Claim</th>
<th>Not true</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Object and space for exercise are very attractive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Trainers look good and are well selected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The Center has modern equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The building has a satisfactory comfort</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hygiene facilities are in high level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Distance and size of parking are optimal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>All rooms in fitness center are well equipped</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The study included 414 subjects (recreational) from ten randomly selected fitness centers of the City of Thessaloniki, among which were represented in both sexes, different ages and different levels of education. Sample was very complex in relation to other social characteristics: the type of job, marital status, residential status and the type of fitness program in which they participated.

RESULTS

Completing the two questionnaires was obtained in a complex database with a total of 58 items (29 valued in the form of expectations, and as many as perception). The basic elements on which is based on statistical analysis presented as averages scale values which are evaluated individual items of the questionnaire. Comparison of the average scale of values, calculated for the expectations and perceptions, quantified the changes that the client incurred as a result of gaining experience in consuming fitness services, and estimated the attitudes of certain changes made under the influence of subjective perception.

As the comparison of two statistical series, formed in two time periods, required discriminate statistical analysis, as well as adequate procedures applied t-test for independent samples. At the same time with this, were calculated and specific cracks (GAP) formed between the average scale of values enshrined in the expectations and perceptions. Analysis of Gap's served as a supplement to the conclusions obtained after applying t-test.

Discriminate analysis showed that the Gap's appeared in all 29 items, but as their size was uneven (Table 1). It is possible to notice that the summary of average values also differed significantly, and summary gap (with a range between 6.09 and 5.88) could be interpreted as a significant negative deviation from the expected quality of services received (Figure 1). Logically, Gap's shares could be positive or negative, given the possibility that the attitudes of respondents changes for the better, but for the worse. The range between the largest and smallest GAP (width variation) ranged between 1.389 and -2.15. The biggest positive change (1.389) was found for the 25-item and that users rated the attention of trainers during exercise, and the largest negative changes (lowest value GAP) for the 19-item which is checked as the sports centers appreciate suggestions of users. This practically means that users have had positive experience with the attention that the trainer give in relation to what they expected, while their experience with
respect, or rather neglecting, their proposals were disappointing and that they influenced perceptions significantly reduce the level of expectations. By the same analogy can be interpreted and all other items.

Table 1: Results of a comparative analysis of the respondents expressed views on the expectations and perceptions of the situation in fitness clubs. (Marked with an asterisk are items which is determined statistically significant difference between expectations and perceptions, and the minus mark in front of the Gap values indicated the direction of the negative changes)

<table>
<thead>
<tr>
<th>N.</th>
<th>Item</th>
<th>Expectation</th>
<th>Perceptions</th>
<th>Gap</th>
<th>t-test</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The appeal of the facilities</td>
<td>5.62</td>
<td>4.53</td>
<td>-1.092</td>
<td>12.000</td>
<td>.000*</td>
</tr>
<tr>
<td>2.</td>
<td>Appearance trainer</td>
<td>5.50</td>
<td>6.40</td>
<td>0.897</td>
<td>-9.628</td>
<td>.000*</td>
</tr>
<tr>
<td>3.</td>
<td>Contemporary equipment</td>
<td>6.36</td>
<td>4.75</td>
<td>-1.609</td>
<td>21.805</td>
<td>.000*</td>
</tr>
<tr>
<td>4.</td>
<td>Comfort facilities</td>
<td>6.31</td>
<td>4.49</td>
<td>-1.823</td>
<td>20.891</td>
<td>.000*</td>
</tr>
<tr>
<td>5.</td>
<td>Hygiene facilities</td>
<td>6.12</td>
<td>4.88</td>
<td>-1.241</td>
<td>11.613</td>
<td>.000*</td>
</tr>
<tr>
<td>6.</td>
<td>Close to parking</td>
<td>4.60</td>
<td>3.94</td>
<td>-0.664</td>
<td>4.682</td>
<td>.000*</td>
</tr>
<tr>
<td>7.</td>
<td>Equipment space</td>
<td>6.34</td>
<td>5.62</td>
<td>-0.713</td>
<td>7.981</td>
<td>.000*</td>
</tr>
<tr>
<td>8.</td>
<td>Time Accuracy</td>
<td>6.16</td>
<td>6.64</td>
<td>0.487</td>
<td>-9.628</td>
<td>.000*</td>
</tr>
<tr>
<td>9.</td>
<td>Quality of information</td>
<td>6.20</td>
<td>6.19</td>
<td>-0.007</td>
<td>0.093</td>
<td>.926</td>
</tr>
<tr>
<td>10.</td>
<td>Keep the promise</td>
<td>6.34</td>
<td>5.53</td>
<td>-0.804</td>
<td>8.968</td>
<td>.000*</td>
</tr>
<tr>
<td>11.</td>
<td>Advice from the trainer</td>
<td>6.55</td>
<td>6.50</td>
<td>-0.049</td>
<td>0.791</td>
<td>.429</td>
</tr>
<tr>
<td>12.</td>
<td>Quality Control</td>
<td>5.75</td>
<td>4.28</td>
<td>-1.470</td>
<td>12.226</td>
<td>.000*</td>
</tr>
<tr>
<td>13.</td>
<td>Value for money</td>
<td>6.13</td>
<td>6.12</td>
<td>-0.012</td>
<td>0.160</td>
<td>.873</td>
</tr>
<tr>
<td>14.</td>
<td>Advertising of new programs</td>
<td>5.87</td>
<td>5.59</td>
<td>-0.284</td>
<td>2.693</td>
<td>.007*</td>
</tr>
<tr>
<td>15.</td>
<td>Always support from the trainer</td>
<td>6.60</td>
<td>6.80</td>
<td>0.198</td>
<td>-4.306</td>
<td>.000*</td>
</tr>
<tr>
<td>16.</td>
<td>Close the trainer to the athlete</td>
<td>6.46</td>
<td>6.71</td>
<td>0.249</td>
<td>-4.737</td>
<td>.000*</td>
</tr>
<tr>
<td>17.</td>
<td>Courtesy trainer</td>
<td>6.19</td>
<td>e6.37</td>
<td>0.176</td>
<td>-2.059</td>
<td>.040*</td>
</tr>
<tr>
<td>18.</td>
<td>Quick solving the problem</td>
<td>6.33</td>
<td>4.71</td>
<td>-1.626</td>
<td>15.087</td>
<td>.000*</td>
</tr>
<tr>
<td>19.</td>
<td>Suggestions users</td>
<td>5.88</td>
<td>3.73</td>
<td>-2.150</td>
<td>16.992</td>
<td>.000*</td>
</tr>
<tr>
<td>20.</td>
<td>Civility trainer</td>
<td>6.59</td>
<td>6.95</td>
<td>0.362</td>
<td>-8.406</td>
<td>.000*</td>
</tr>
<tr>
<td>21.</td>
<td>Trust in trainer</td>
<td>6.56</td>
<td>6.88</td>
<td>0.319</td>
<td>-7.613</td>
<td>.000*</td>
</tr>
<tr>
<td>22.</td>
<td>Education of the trainer</td>
<td>6.32</td>
<td>6.86</td>
<td>0.548</td>
<td>-9.087</td>
<td>.000*</td>
</tr>
<tr>
<td>23.</td>
<td>Interest trainer</td>
<td>6.33</td>
<td>6.84</td>
<td>0.509</td>
<td>-7.797</td>
<td>.000*</td>
</tr>
<tr>
<td>24.</td>
<td>Experience of the trainer</td>
<td>6.25</td>
<td>6.85</td>
<td>0.606</td>
<td>-9.310</td>
<td>.000*</td>
</tr>
<tr>
<td>25.</td>
<td>Attention of the trainer</td>
<td>5.22</td>
<td>6.61</td>
<td>1.389</td>
<td>-14.045</td>
<td>.000*</td>
</tr>
<tr>
<td>26.</td>
<td>Empathy of the trainer</td>
<td>5.85</td>
<td>6.40</td>
<td>0.542</td>
<td>-6.330</td>
<td>.000*</td>
</tr>
<tr>
<td>27.</td>
<td>The timing of the program</td>
<td>6.17</td>
<td>6.50</td>
<td>0.337</td>
<td>-4.568</td>
<td>.000*</td>
</tr>
<tr>
<td>28.</td>
<td>Distance facilities</td>
<td>5.97</td>
<td>6.33</td>
<td>0.364</td>
<td>-4.405</td>
<td>.000*</td>
</tr>
<tr>
<td>29.</td>
<td>Friendly relations with trainer</td>
<td>6.24</td>
<td>6.87</td>
<td>0.626</td>
<td>-8.427</td>
<td>.000*</td>
</tr>
</tbody>
</table>

Cumulative averages 6.09 5.88 -0.214 6.152 .000*
Figure 1: Relationship between the average scale values of certain collectively for all items related to expectations and perception

Table 2: Results of a comparative analysis of service quality dimensions obtained by comparing expectations and perceptions of objective conditions in fitness clubs

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Expectation</th>
<th>Perceptions</th>
<th>Gap</th>
<th>t-test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibles</td>
<td>5.838</td>
<td>4.943</td>
<td>-0.895</td>
<td>17.321</td>
<td>.000*</td>
</tr>
<tr>
<td>Reliability</td>
<td>6.138</td>
<td>5.833</td>
<td>-0.305</td>
<td>6.286</td>
<td>.000*</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>6.292</td>
<td>5.662</td>
<td>-0.630</td>
<td>11.791</td>
<td>.000*</td>
</tr>
<tr>
<td>Assurance</td>
<td>6.402</td>
<td>6.879</td>
<td>0.477</td>
<td>-14.244</td>
<td>.000*</td>
</tr>
<tr>
<td>Empathy</td>
<td>5.892</td>
<td>6.541</td>
<td>0.649</td>
<td>-12.821</td>
<td>.000*</td>
</tr>
</tbody>
</table>

Figure 2: Ratio of average scale values obtained by analyzing the responses gathered around five theoretical dimensions of service quality

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In order to get a clear picture of the structure and quality of sports services, implemented Parasurman-analysis of these five theoretical dimensions of quality (Table and Figure 2). The results are fully correspondent with those relating to the individual questions from the questionnaire.

**DISCUSSION**

Answers to all 29 questions from the questionnaire, related to expectations, were very homogeneous. Low average scalar value (4.6) was recorded at the questions that concerned the proximity of the parking lot, which shows that the expectations to a minimum essential prerequisite for assessing the overall quality. On the other hand, the highest average scalar values (all grades through 6) were calculated for the questions that were related to characteristics of the trainer, and only then for the supply of space and quality equipment, and for professional accountability and quality of the organization. It is interesting that the courts are related to the aesthetic component viewed through the attraction of the facility and look under the trainer were scalar values 6th. The largest representation of high expectations related to the trainers and lower scores related to the aesthetic details have pointed to the high world of sports services that customers obviously expect most of those who directly implemented programs (trainers and instructors) and the quality of their "tools" (devices and equipment), and that their aesthetic effects in the background. The highest average scalar value (6.402), with the expectations established for the dimension of Assurance, and also responsiveness to high scalar average of 6.292. The lowest level of expectations (5.838) service users are expressed in relation to the dimension of Tangibles.

Answers to most questions related to the perception of users were also very homogeneous. The largest number of average scale values of responses exceeded the central value of 4 which is considered the border between positive and negative end of the applied numerical scale. Only answers to questions about parking near the appreciation and suggestions of users had lower average scale values of 4. The highest average scores are established for issues related to quality and characteristics of staff trainers, as well as to the accuracy and diligence in the implementation of the program. Even 18 of total 29 items had average scalar value greater than 6, with trainer features (trust, education, interest, experience and friendly relations) were the highest
rated on the basis of perceptions of users. The highest average scalar value (6.879) was found for dimension Assurance as well as during assessment of expectations, but which is now calculated using the arithmetic mean was something bigger. Besides it, the average scalar value greater than 6 had a dimension of Empathy. The lowest rated dimension of quality was Tangibles, the only scalar which was lower than the average of 5. Around it were group issues related to external effects, and the aesthetic component of comfort, which is expected to be rated as less important.

From the 29 items analyzed, only three were significant differences between the marks obtained on the basis of expectations and what are the real subjects received. Important gaps missing only from item number 9 (the quality of information), 11 (related to advice from the trainer) and 13 (Value for money). Therefore, the three-month experimental period left significant traces in the minds of respondents about the level of quality of some of sports services. Most important information from the number of changes was their direction.

Among the 29 items, many changes were positive character, while a large number of cases arising as an expression of unfulfilled expectations. Regarding the relationship of positive and negative changes, their distribution was almost symmetrical. Determined in 15 negative and 14 positive values of Gap. When, however, calculated the arithmetic mean of all the common average Gap's, identified a negative sum value of -0.214. Based on the realistic conclusion is that the majority of users of sports services, under the influence of experience, is generally performed negative changes, which the expectations generally were slightly higher in comparison to what was perceived before the acquisition of direct experience. Using t-test found that this difference was statistically significant and, given that the realized level of significance (Sig.) was far below the theoretical limit of 0.05.

Almost all the statistically significant positive changes referred to the questions which evaluated the main features of the coach (diligence, civility, provenance, the level of knowledge, confidence, courtesy, time accuracy, interest, attention, empathy, friendly relationship, etc.).This points to the fact that expectations when it comes to quality of trainers was lower than the perception empirical experience. Trainers have proven the most important factor of forming a positive opinion about the level of quality sports services.

On the other hand, all the parameters that are in the area of responsibility of the management of sports centers were faced with some disappointment the user, or with significantly lower grade formed the
basis of perception. In other words, everything in propaganda activities offered to users, did not fulfill their expectations. That is a statistically significant negative difference between expectations and perceptions of established parameters such as: attraction, comfort and hygiene facilities, contemporary accessories, equipment, proximity to parking, quality control, and introduction of new (advertised) program, the speed of problem solving, accepting the proposal Users. All this can be expressed as unrealized promises, which is the explicit content of the tenth issue which was obtained by a negative Gap 0.804.

Based on interpreted Gap's shares, calculated for each individual item questionnaire on quality of services, we can say that the coaches (instructors) the main carriers of the quality and the only one that their work can compensate and objective financial and organizational deficiencies. This are, respondents were cost of money invested (value for money), despite the statistically confirmed unfulfilled overall expectations, the positive rate. For the money they get quality programs and qualified implementers (coach) and dissatisfaction with the unfulfilled promises by the management are happy to compensate you felt during the exercise.

The results obtained by the analysis of quantitative indicators that are calculated for the five theoretical Parasuraman's dimensions (Tangibles, Reliability, responsiveness, Assurance and Empathy) were fully correspondent with those relating to the individual questions from the questionnaire. This proved that the dimensions of which are gathered around the issues of assessing the quality of trainers and program implementation, obtained positive changes. Therefore, Assurance and Empathy dimensions brought significant improvements in relation to the expectations, to them recorded positive Gap's. On the other hand, all the dimensions of saturated issues for evaluation of material conditions, organizational and propaganda activities, such as Tangibles, Reliability and responsiveness, users rated poorer in comparison to their expectations. The biggest negative Gap was recorded in relation to the dimension Tangibles, which is a direct consequence of marketing messages to the real (sustainable) conditions which are realized sports and recreational facilities.

Realistically it was assumed that the nature and size of the established differences (especially seen through the Gap's) not the same for all categories of respondents, and may depend on some biological and social specifics such as: gender, age, marital status, education level, type of employment, preferent program and length of participation in it. Therefore, analysis of variance tested differences between expectations
and perceptions in relation to the above hypothetical predictors (gender, age, marital status, education level, type of job training and internship program preferred). Based on the collected data it was possible to notice that the aforementioned bio-sociological predictors have caused one significant difference between the attitudes of respondents. From a total of 203 realized level of significance, obtained by applying discriminate calculation procedures, only two were lower than the theoretical limit (Sig. ≤ .05) and indicated statistically significant differences between the averages Gap's. It was a too small number to any hypothetical bio-sociological element could mark significant for the prediction of attitudes and opinions of respondents about the quality of services.

CONCLUSION

Comparison of the average scalar value calculated for the expectations and perceptions, the quantitative changes that occur in customer service after gaining experience. Gap's appeared in all items, but as their size and direction were uneven. The biggest positive change was found for the item that users rated the attention of coaches during exercise, and the largest negative changes for the one which is checked how many users appreciate the suggestions.

As the number of positive and negative changes, their distribution was almost symmetrical. Gap's size proved to be statistically significant even in the 26 items. All statistically positive changes referred to the questions which evaluated the main features of the coach (diligence, civility, provenance, the level of knowledge, confidence, courtesy, time accuracy, interest, attention, empathy, friendly relationship). This points to the fact that expectations when it comes to quality of trainers was lower than perceive experiential experience. Trainers have proven the most important factors for forming a positive opinion about the level of quality sports services. On the other hand, all the parameters that are in the area of responsibility of the management of sports centers were faced with some disappointment the user, or with significantly lower grade formed the basis of perception.

On the basis of all noted, it can be concluded between the segments of education direct sports professionals and those who organize and manage the operation of sports centers (owner managers) there is still obvious discrepancy. Although it is shown that the waist forming the foundation of quality, it is still insufficiently represented in practice, and engagement of experts is still in the background in relation to capital which, apparently, still manage enough qualified managers.
References


THE IMPACT OF ANTHROPOMETRIC DIMENSIONS ON THE RESULTS OF SWIMMERS

UDK 797.21:572.087

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Abstract: One of the more important factors for assessing the possibility of progress and for the selection of a top swimmer is his/her morphological status. The topic of this paper is the researching of the anthropometric dimensions of 132 male swimmers from four Belgrade clubs within three age categories (pioneers, cadets, juniors), with the aim to determine their impact on the speed of swimming the 25-meter event, the 50-meter event and the number of strokes during a 50-meter swim event, using various swimming techniques. To assess the morphological traits, 27 anthropometric variables were applied, according to the procedure determined by the International Biological Program (IBP) and generally. The results obtained in this research have given a basic insight into the significance of anthropometric dimensions and their correlation with criteria variables for assessing the success of young swimmers. A statistically relevant link of multiple tested variables with criteria variables was confirmed, giving swimming experts the possibility to carry out an adequate selection of young swimmers according to swimming techniques, to follow the physical development of their competitors, as well as to realize predictions in creating better results in relation to certain anthropometric sizes.

Key words: Anthropometrics, swimmers’ age, results, selection

TOPIC

Sports achievements show a constant improvement of results in all age categories of athletes and on all levels of competitions, imposing the following question: what are the limits of a human’s motor abilities? This constant progression in sports results is also conditioned by the
progress of scientific research, as well as new scientific findings in various areas, and the popularizing of sports and sports competitions with young people and their participation in systematic training processes.

Success in all sports events, including swimming, depends on a series of linked factors such as biomotoric abilities, cognitive and connative functions, motivational structures, the pedagogic process of training, optimal and long-term training, and appropriate anthropometric dimensions, that is, morphological structure and build. Many other factors, whose effect is present albeit not easily quantified, affect success in swimming, along with the impact of specific weight, the arrangement of the centers of gravity and thrust, and anthropometric sizes (height, length of extremities, joint mobility, the dispersal of muscle mass), and also vital capacity. The factors which impact the results of a swimmer could be the following: swimming technique, the current functional condition of the swimmer - preparedness, the morphological build of the swimmer, motivation, external competitive conditions, the method of measuring time, etc. The mentioned criteria impact results in various ways, depending on the individual (psycho-physical) abilities of the swimmer. Considering that all these problems are not easy to solve, what would in fact be necessary would be a larger team of experts from various areas, as well as long-term testing, but we will dedicate ourselves here to researching only certain segments of morphological traits.

In the process of selecting talented athletes, we can discern between two groups of indicators (Zaciorski, 1974). One of these are the so-called “conservative” indicators, the second being the “non-conservative”. The names point to the fact that it is very hard to change stable indicators that have an impact on improving the training process. Among the stable indicators, we have anthropometric parameters, followed by the reaction speed of the arms and legs, where the coefficient of succession is 0.714-0.857, which means that the reaction time is greatly impacted by succession. The morphological status of the athlete is a significant component which impacts functional abilities and affects the predisposition of the organism for certain sports activities. Swimmers, perhaps even more than other athletes, are extremely conditioned by their morphological build, in which anthropological traits come to the fore in a special way. The floatage of a swimmer mostly depends on anthropological sizes such as height, weight, the center of balance and thrust, the vital aptitude. The ratio of muscle mass and its quality, the length of the extremities and joint flexibility, help to categorize swimmers according to swimming techniques. The functional, motor and
psychological components impact the duration of work. In principle, selection should be oriented towards stable indicators and in the most part should be based on them. It is relatively easy to improve the variable indicators as they develop under the impact of the environment, mostly from the moment when young athletes enter the systematic training process. For achieving top sports results in swimming, what is needed is long-term, demanding and systematic training. Furthermore, it can take from 8 to 10 years for a beginner to become a top swimmer (Česnokov, 1973). Considering that the development trend of swimming record results from year to year shows an evident tendency of achievements in younger categories, including young people into the training process is what is happening in today's world. The above mentioned author suggests that the right age for children to start to train swimming is between 7 and 9. A poll carried out in the former Soviet Union shows that the majority of coaches (43%) prefer to start systematic training sessions with children ages 7-8. Counsilman (1968) takes into consideration ages 5-6, which is verified by Australian experts. The first successes are expected with young girls aged around 12-15, and boys from 14-17, while the time for optimal possibilities with girls is ages 16-20, and boys from 18-22, and the time for top achievements with girls is ages 21-23 and boys ages 23-25 (Ozolin, 1970).

The achieving of top swimming results depends directly on sports experience and thus the problem of active inclusion should be researched in more detail, regardless of large distinctive differences in an individual.

In researching the morphological status of younger athletes, Russian coaches incline to choose swimmers who are tall (91% of coaches), lean (68% of coaches), have a lesser body weight (55% of coaches), have long limb muscles (31.8%), etc. Other coaches are also orientated towards similar criteria of morphological indicators. Kapus (1982), while researching young Slovenian swimmers via a canonical analysis, attained the model of a constitutional type of swimmer aged 10-12, who is tall, with narrower legs, arms and feet, a large torso and lung capacity, with larger upper arms and thighs, broad shoulders and well-toned muscles, especially of the arms and the shoulder area, and with a small amount of subcutaneous fat tissue and a proportional body mass.

In crawl swimmers, there are significant differences in sprinters and long distance swimmers in height, weight, and trunk size, and with other techniques there are also conspicuous differences, so that backstroke swimmers belong to the group with the greatest longitudinal
measures. They are relatively light with a large torso, and thus also with a large absolute body surface area. Breaststroke swimmers are comparatively short and heavy (Tables 1 and 2).

**TABLE 1: Height, weight, trunk size and the absolute body surface area of top male swimmers (Bulgakova, 1985)**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Body height (cm)</th>
<th>Body weight (kg)</th>
<th>Trunk size (cm)</th>
<th>Abs. body s.a. (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100m crawl</td>
<td>170.0 ± 3.3</td>
<td>75.0 ± 2.0</td>
<td>100.0 ± 3.5</td>
<td>1.99 ± 0.14</td>
</tr>
<tr>
<td>400 m crawl</td>
<td>177.5 ± 2.3</td>
<td>68.5 ± 1.7</td>
<td>98.0 ± 1.8</td>
<td>1.91 ± 0.22</td>
</tr>
<tr>
<td>1500 m crawl</td>
<td>175.0 ± 3.5</td>
<td>66.5 ± 1.6</td>
<td>97.0 ± 2.4</td>
<td>1.90 ± 0.14</td>
</tr>
<tr>
<td>Backstroke</td>
<td>183.0 ± 2.0</td>
<td>69.0 ± 1.1</td>
<td>100.0 ± 2.4</td>
<td>2.01 ± 0.24</td>
</tr>
<tr>
<td>Dolphin style</td>
<td>175.3 ± 1.5</td>
<td>72.0 ± 0.8</td>
<td>98.5 ± 3.0</td>
<td>1.91 ± 0.09</td>
</tr>
<tr>
<td>Breaststroke</td>
<td>175.0 ± 1.3</td>
<td>76.5 ± 1.4</td>
<td>97.5 ± 3.0</td>
<td>1.90 ± 0.17</td>
</tr>
</tbody>
</table>

**TABLE 2: Height, weight, trunk and absolute body surface area of top female swimmers (Bulgakova, 1986)**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Body height (cm)</th>
<th>Body weight (kg)</th>
<th>Trunk size (cm)</th>
<th>Abs. Body s.a. (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100m crawl</td>
<td>169.0 ± 4.7</td>
<td>61.3 ± 3.2</td>
<td>91.5 ± 3.2</td>
<td>1.7 ± 0.09</td>
</tr>
<tr>
<td>400 m crawl</td>
<td>166.9 ± 4.8</td>
<td>59.0 ± 5.4</td>
<td>90.3 ± 3.1</td>
<td>1.6 ± 0.01</td>
</tr>
<tr>
<td>1500 m crawl</td>
<td>165.0 ± 4.2</td>
<td>58.2 ± 5.9</td>
<td>90.3 ± 3.9</td>
<td>1.6 ± 0.09</td>
</tr>
<tr>
<td>Backstroke</td>
<td>169.1 ± 4.6</td>
<td>60.0 ± 3.4</td>
<td>90.6 ± 4.0</td>
<td>1.6 ± 0.01</td>
</tr>
<tr>
<td>Dolphin style</td>
<td>164.1 ± 5.6</td>
<td>59.1 ± 5.9</td>
<td>91.6 ± 3.4</td>
<td>1.6 ± 0.08</td>
</tr>
<tr>
<td>Breaststroke</td>
<td>166.6 ± 4.6</td>
<td>59.3 ± 4.3</td>
<td>89.7 ± 3.0</td>
<td>1.6 ± 0.01</td>
</tr>
</tbody>
</table>

The age of the athlete and specialization in swimming according to technique directly depends on morphological dimensions, especially body height and weight. In older and stronger swimmers who specialize in the 100-meter crawl, the breaststroke and the dolphin technique, there is a small difference between the height and weight and a lesser floatage. Younger swimmers who opt for the middle-distance in the crawl and backstroke techniques have the largest indicators of height and weight. Based on this, it can be concluded that the preparation and training of backstroke swimmers and long-distance crawl swimmers should start earlier than that of sprinters.

For the forecasting of sports abilities and researching the stability of indicators, Bulgakova and Voroncov (1976) use the following as anthropometric parameters: body height, body weight, the length of the arms and legs and width of the shoulders.

Research in the sport of swimming allows the option of concluding that slower sexual maturing is an optimal factor in achieving top results (Česnokov (1973), Counsilman (1968)).
A controlled dosing of loads and an increase of sport quality, as well as the rate of biological maturing, impact the dynamics of improvement in swimming. The topic of this paper is the researching of anthropometric dimensions in 132 male swimmers from four Belgrade clubs, within three age categories (pioneers, cadets, juniors) and their impact on the speed of swimming the 25-meter and 50-meter events and the number of strokes in the 50-meter race, using various swimming techniques.

Based on the results of this research, the issue of the impact of morphological traits on criteria variables will be resolved, without taking into consideration the other factors which impact the results.

One of the important scientific issues is the determining of dominant traits which condition top sports achievements in competitive sports and carry out the analysis of the dynamics of changes of these traits in young athletes. The largest and the most prominent changes in the organism take place in the first two decades of life. At the end of this stage, the majority of traits of physical development reaches the largest values, which after a certain lingering on a high level, start gradually to decline.

The previous papers from the area of sports have focused on two aspects which affect each other and which determine the traits of physical development. These are endogenous and exogenous factors, of which endogenous factors have the most impact on the development of morphological traits, above all on innate (genetic) traits. These factors belong to stable indicators, which are very hard to change, i.e. to have an impact on improving the training process.

Exogenous factors, or multiple socio-economic factors, also have an impact on physical development. Planned and long-term sports training, coordinated with the age traits of athletes, appropriately impacts morphological traits, even though for some anthropometric measures the scope of improvement can be relatively small, that is, it can be limited by genetics. A very important problem in top sports is related to the significance of the body constitution in achieving success in competitive events. It is without doubt that for top sports results in certain sports branches, body constitution and certain traits of the morphological status have a first-rate significance. In the researching of anthropometric indicators carried out so far, it has been concluded that athletes within one event mostly belong to a similar “biotype”. Morphological analyses indicate that swimmers differ according to anthropometric dimensions depending on the swimming technique they use. Those who specialize in the crawl technique vary according to their chosen events by height, weight, and torso size.
Diagram 1: Skeletal (longitudinal) measures of female swimmers (1. length of foot parts, 2. length of upper arms, 3. length of lower arms, 4. length of fingers, 5. length of trunk, 6. length of thighs, 7. length of calf, 8. length of foot) (Bulgakova, 1979)

Diagram 2: Body contours and the cross section are in top swimmers (Bulgakova, Vajcehovski, Milanova, 1977)
Body weight is in correlation with strength, which is needed for speed-strength locomotion for a 100-meter swim. Long-distance swimmers have obviously lower morphological parameters, as a significant place in their results is taken up by functional abilities. Middle-distance swimmers are, according to morphology, somewhere in between sprinters and long-distance swimmers. Backstroke swimmers are taller than others as this is for them a significant predisposition for success, and they have large torsos, like crawl sprinters, while their weight in relation to height is the lowest. Specialists in the breaststroke and dolphin techniques have approximately the same values in the so-called total proportions, which indicate that these parameters are not decisive for the two techniques. However, breaststroke swimmers are to some degree heavier. Crawl, breaststroke and backstroke swimmers have long legs, while swimmers using the dolphin technique have exceptionally short legs. Crawl and backstroke swimmers have relatively long arms, while breaststroke and dolphin style swimmers have shorter arms. Crawl swimmers (sprinters) and dolphin style swimmers have the broadest shoulders (Diagram 1 and 2).

WORK METHOD

Sample of respondents

The sample of respondents covered by this research was made up of 132 males, swimmers aged from 10 to 18, who swim actively and are registered in certain swimming clubs.

The following Belgrade swimming clubs volunteered swimmers for the sample of respondents: SC Partizan, SC Vračar, SC 11 April, SC Beograd.

The sample of variables

Two groups of variables are covered by this research: anthropometric – for defining the morphological status of the respondents and criteria variables – relating to the speed of swimming, and the stroke number of the respondents.

Taking the topic and aim of the research as the starting point, a sample of 27 anthropometric variables and three criteria variables in each swimming technique have been determined.
For the assessment of morphological traits, 27 anthropometric variables were applied, according to the procedure determined by the International Biological Program (IBP) and generally, such as the following:

1. The longitudinal dimensionality of the skeleton;
2. The transversal dimensionality of the skeleton;
3. Volume and body mass and
4. Subcutaneous fatty tissue.

*Anthropometric variables:*

A) **Longitudinal dimensionality:**

1. body height - ABOH
2. leg length - ALEL
3. arm length - AARL
4. foot length - AFOL
5. hand length - AHAL

B) **Transversal dimensionality:**

6. shoulder width - ASHW
7. width of pelvis - AWIP
8. diameter of wrist - ADIW
9. diameter of elbow - ADIE
10. diameter of knee - ADIK
11. diameter of foot - ADIF
12. foot width - AFOF

C) **Volume and body mass:**

14. body mass - ABOM
15. medium volume of torso - AMIT
16. upper arm volume - AUAV
17. forearm volume - AFV
18. calf volume - ACAV
19. thigh volume - ATHV

D) **Subcutaneous fatty tissue (skinfold thickness):**

20. upper arm skinfold (two variants) - AUAS
22. forearm skinfold - AFS
23. back skinfold - ABAS
24. belly skinfold - ABES
25. chest skinfold - ACHS
26. calf skinfold - ACAS
27. upper arm skinfold - AUAS
Criteria variables:

1. swimming time for 25 meters using all swimming techniques,
2. swimming time for 50 meters using all swimming techniques and
3. the number of strokes in the 50-meter race using all swimming techniques.

The research was carried out throughout the competitive season, during the 2006 Belgrade League. The results from this competition held in Belgrade in the Vračar sports center swimming pool (semi-Olympic) were taken as criteria variables, and all the measurements in anthropometrics were carried out in the center’s clinic. The team of examiners for measuring anthropometric variables was made up of three experts.

The measuring was carried out during the morning hours, with instruments of a standard make, every time calibrated before the measuring sessions. The data obtained in the way described above was processed in procedures of descriptive and comparative statistics, via the SPSS 10 computer program.

Within the framework of descriptive statistics for all variables of different groups (according to swimming techniques and age), obtained were the following: the arithmetic mean, standard deviations and the coefficient of the variable.

Within the framework of comparative statistics, a correlational analysis was applied, describing the relations between anthropometric and criteria variables in different groups.

RESULTS

Based on the set subject and the aim of the investigation, a statistical analysis of data was applied in the following way:

1. The values of the basic descriptive statistical parameters of the researched anthropometric variables according to techniques in the total sample were shown in tables and diagrams (Table 3).

2. Thus, the results interpretation includes a correlational analysis of anthropometric and criteria variables according to techniques as well as the degree of connectedness of these parameters (Table 4). The degree of significance of the parameters was determined on the 0.01 and 0.05 levels of significance.
3. Based on the obtained relations, the degree of connectedness is shown in a diagram (from 1-4) of the anthropometric groups, in each technique, in the total ages of the swimmers (Diagram 1).

### Table 3: The total sample of swimmers (N=132)*

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Crawl</th>
<th>Backstroke</th>
<th>Breaststroke</th>
<th>Dolphin</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>S</td>
<td>V</td>
<td>M</td>
<td>S</td>
</tr>
<tr>
<td>BM</td>
<td>0.57</td>
<td>0.03</td>
<td>0.51</td>
<td>0.22</td>
</tr>
<tr>
<td>BM</td>
<td>0.57</td>
<td>0.03</td>
<td>0.51</td>
<td>0.22</td>
</tr>
<tr>
<td>LL</td>
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<td>0.04</td>
<td>0.55</td>
<td>0.07</td>
</tr>
<tr>
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<td>0.04</td>
<td>0.55</td>
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<tr>
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</tr>
<tr>
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<tr>
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<tr>
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<td>0.58</td>
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</tr>
<tr>
<td>HW</td>
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<td>0.01</td>
<td>0.63</td>
<td>0.03</td>
</tr>
<tr>
<td>TY</td>
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<td>0.02</td>
<td>0.56</td>
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<tr>
<td>UV</td>
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<td>0.26</td>
<td>0.11</td>
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<td>0.17</td>
<td>0.31</td>
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<tr>
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</tr>
<tr>
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<td>0.52</td>
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<td>FW</td>
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<td>FL</td>
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</tr>
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<td>0.26</td>
<td>0.03</td>
</tr>
<tr>
<td>EX</td>
<td>0.64</td>
<td>0.01</td>
<td>0.64</td>
<td>0.03</td>
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</tbody>
</table>

*Table 3: The total sample of swimmers (N=132)*

### Table 4: The correlation of parameters with the total sample of swimmers

<table>
<thead>
<tr>
<th>Var.</th>
<th>CRW</th>
<th>BACKSTROKE</th>
<th>BREASTSTROKE</th>
<th>DOLPHIN</th>
</tr>
</thead>
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<tr>
<td></td>
<td>25m</td>
<td>50m</td>
<td>100m</td>
<td>25m</td>
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<tr>
<td>BM</td>
<td>-0.785**</td>
<td>-0.762**</td>
<td>-0.802</td>
<td>-0.739</td>
</tr>
<tr>
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<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>LL</td>
<td>-0.738**</td>
<td>-0.715**</td>
<td>-0.797</td>
<td>-0.734</td>
</tr>
<tr>
<td></td>
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<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>SW</td>
<td>-0.766**</td>
<td>-0.734**</td>
<td>-0.784</td>
<td>-0.776</td>
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<td>0.000</td>
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</tr>
<tr>
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<td>-0.762**</td>
<td>-0.786</td>
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</tr>
<tr>
<td>ED</td>
<td>-0.668**</td>
<td>-0.672**</td>
<td>-0.748</td>
<td>-0.668</td>
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<tr>
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<td>-0.878**</td>
<td>-0.897</td>
<td>-0.820</td>
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<tr>
<td>HL</td>
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<td>-0.697**</td>
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</tr>
<tr>
<td>HW</td>
<td>-0.692**</td>
<td>-0.676**</td>
<td>-0.655</td>
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The impact of anthropometric dimensions on the results of swimmers

Diagram 1: The value of connectedness of anthropometric groups with criteria variables in all four swimming techniques

- **Correlation is significant at the 0.05 level**  
- **Correlation is significant at the 0.01 level**
DISCUSSION

Crawl swimmers have a good connectedness of criteria and anthropometric variables (Diagram 1). With longitudinal variables, the largest connections of TV are with: 25 meters -0.786 (0.00); 50 meters -0.769 (0.00) and the number of strokes during the 50-meter event -0.802 (0.00). The negative prefix indicates that the connection of variables is inverse. Thus, the largest connection is with the number of strokes during the 50-meter event which, due to the largest longitudinal measures of crawl swimmers, is logical. There is also a large connection between the number of strokes and the length of the legs -0.754 (0.00), and AL -0.775 (0.00) which is also very much connected with the 50-meter swim 0.974 (0.00). Also noted was a connection between FL and swimming the 50-meter event -0.708 (0.00), which shows that with the growth of the foot there is a greater speed of swimming (a better result). “The length of the hand impacts a better result of the swimmer,” says Kramljeva (1976) in her research paper. These comparisons indicate that the number of strokes certainly depends inversely on the length of the extremity. “Body height and the length of the arms have a proportionally biomechanical impact on the demands of technique on the results of sprinters” (via the increasing of efficiency and a smaller number of strokes) - Grimson, Hay; Kremiljeva 1976; Bulgarova 1977. Crawl swimmers also have the greatest LL, AL, BH, FL so that the correlation with criteria parameters is the most prominent with this technique. “Lean and light feet impact success in swimming” – it is confirmed by a group of authors from the 30s, 50s, 70s, while Kremiljeva (1976) states that longer legs are more efficient for shorter distances.

With transversal variables, a large connection with criteria variables has been noted in the following: in SW with the number of strokes -0.784 (0.00), which indicates that a larger shoulder width reduces the number of strokes; PW with swimming the 25-meter race -0.788 (0.00), which indicates that the value of PW is inverse with results for 25 meters; ED and results for 25 meters -0.754 (0.00); AD with stroke number -0.679 (0.00); HW correlates the most with swimming the 25-meter event -0.692 (0.00) and the 50-meter event -776 (0.00) and FW the most with results for 25 meters -0.649 (0.00) and the number of strokes for 50 meters -0.668 (0.00). These results show that FD and KD correlate the most with the number of strokes, that FW and HW impact the speed of swimming and the number of strokes inversely and that this results from the greatest average values of HW and FW. “Wide palms impact success in swimming,” according to a group of authors from the 70s.
These variables are very significant for crawl swimmers and also for the propulsion of arms and legs. The results of crawl swimmers also depend inversely on the body mass, even more so than height, which is confirmed by a high coefficient of correlation (-0.802) with the number of strokes (-0.786) with results for 25 meters and -0.769 with results for 50 meters. The volumes also correlate with the results for 25 and 50 meters and TV for 25 meters -0.777 (hypoxia), ONL for 50 meters 0.742, ThV for 25 meters -0.653 (0.00), (which shows that the m. triceps suri is important in sprint swimming with crawl swimmers) and CV with 25 meters -0.653 (0.00). A greater strength of the m. quadriceps speeds up the leg propulsion which in a crawl swimmer's sprint is very important. A larger leg mass helps a better leg propulsion in the sprint, according to Kremljeva (1976). FV correlates the most with the number of strokes for 50 meters -0.785 (0.00), so that a greater strength of the arm strokes decreases the total number of strokes.

There are many different links between criteria variables and the skinfold thickness. Thus, FST (0.450), ThST (0.422) and CST (0.401) correlate significantly with the speed of swimming the 25-meter event, which is understandable, as efficiency of the leg propulsion (which has a slightly larger impact than the arms propulsion on the results of 25 to 50-meter events) and a greater strength of the lower arm muscles results in a stronger arms stroke which in turn significantly impacts the speed of swimming the 25-meter event. SST (-0.474), BiST (0.424), TrST (0.430) and ThST (0.417) are significantly linked with the 50-meter results, and these correlations confirm the significance of m. biceps, m. triceps brachia and m. latissimus dorsia in a stronger arms stroke and m. quadriceps in a larger propulsion which together significantly impact the speed of swimming the 50-meter crawl. With a crawl swimmer, the link with criteria variables is the largest, as they have the smallest values of the average BST and ThST. There is a weak link of results for 25 meters and BST (0.297), TST (0.346), TrST (0.341), as well as results for 50 meters and CST (0.337), FST (0.372) and experience (-0.352), which shows that the results for 25 and 50-meter events do not greatly depend on these parameters.

The values of BiST (0.297), FST (0.369), CST (0.305), TrST(0.297) do not correlate significantly with the number of strokes. In variables TST and TrST with results at 50 meters, BiST at 25 meters and TST, TrST and SST, there are no correlations with the number of strokes.

With backstroke swimmers as well as with crawl swimmers, the link with criteria variables is the largest with the longitudinal measures
of the body, with results at 25 meters: BH (-0.734), LL (0.710), HL (-0.708), FL (-0.774), AL (-0.679). These correlations indicate that the speed of swimming increases with the growth of these parameters, except with LL, which is consistent, as the length of the arms, legs, hands and feet significantly impact the efficiency of the propulsion of backstroke swimmers. Of the transversal measures, the results for 25 meters correlate the most with the following: SW (-0.776); ED (-0.688); AD (-0.720); HW (-0.645); KD (-0.692); FD (-0.677); and FW (-0.733). The value of these parameters is inverse and significantly impacts the speed of swimming the 25-meter event. The ED, AD, HW, FW parameters also significantly impact inversely the number of strokes at 50 meters.

Body mass correlates inversely with criteria variables and the most with the speed of swimming the 25-meter event (-0.739). The volumes of backstroke swimmers correlate significantly with the speed of swimming the 25-meter event, namely: TV (-0.791), UAV (-0.601), FV (-0.726), ThV (-0.653) and CV (-0.472 (0.13)). This means that the speed of swimming the 25-meter event increases with the increase of these volumes. The correlation with the 50-meter results is smaller than with 25-meter results. The only weak link is CV with the number of strokes at 50 meters (-0.384).

A link between the speed of backstroke swimmers and ST is weak or non-existent. The only more significant link can be seen between the number of strokes and ThST (0.426), and CST (0.440). There is a weak impact on the results of 25 meters of ThST (0.406) and CST (0.394), as well as 50 meters ThST (0.360) and CST (0.356). From these links, we can see that the only correlation ST and criteria variables have are with ThST and CST and in an inverse manner. Backstroke swimmers also have the highest CST and ThST volumes, which confirms that smaller volumes of both ST, ThST and CST of backstroke swimmers impact the larger speed of swimming and a smaller number of strokes.

The results for 50 meters have no link with BiST, TST, BST, TrST variables, and this is also valid with BiST and TST at 25 meters. With breaststroke swimmers, the longitudinal dimensionalities of the skeleton are also well linked with criteria variables, and mostly with the results for 50 meters: BH (-0.757), LL (-0.715), HL (-0.727), FT (-0.706) and AL (-0.737). The values of these parameters show an inverse link with the speed of swimming the 25-meter and 50-meter events and the number of strokes at 50 meters.
This is explained by the fact that the length of the extremities impacts the acceleration of speed and a lesser number of strokes. With transversal measures, there is a greatest link with 50-meter results, namely: HW (-0.675), AD (-0.713), HW (0.727), FT (-0.654) and FW (-0.675). The correlation is inverse, except with HW, which means that with the increase of the width of transversal measures, the 50-meter results are better. The only weak link is KD with 25-meter results (-0.471), AD with the number of strokes (-0.471) and ED with the 50-meter swim (-0.685 with 0.685 sec). This shows that the width of these joints is less significant for swimming speed and the number of strokes for breaststroke swimmers swimming the 50-meter event. BM and the volumes correlate the most with 50-meter results, namely: BM (-0.690), TV (-0.773), UAV (-0.672), FV (-0.700), CV (-0.553) and TV (-0.593).

These results show that the transversal measures of the body correlate significantly with 50-meter results and less so with 25-meter results and the number of strokes, and inversely. Thus, with the increase of the volume and body weight, the result improves (this relates to the development of the muscles and the increase of muscle mass). With the ST variables, the only significant link is with swimming at 25 meters with BiST (0.315) and FST (0.369) and the number of strokes with BiST (0.315). This means that with the increase of the skinfold thickness of these parameters, the 25-meter results also increase. This is confirmed by the claim that breaststroke swimmers must have a larger arms muscle mass, as this increases the efficiency of propulsion. Furthermore, the parameters of TST, ThST, CST, TrST are weakly linked with all the criteria variables. This means that the values of these parameters have a weak impact on the results and number of strokes, while TrST and the SST have no correlation with criteria variables. From these links, it can be seen that the result of a breaststroke swimmer has a weak or no dependence on the amount of fatty tissue in certain muscles.

We can see the greatest difference in the correlations of anthropometric and criteria variables with swimmers of the dolphin style. Longitudinal variables show the greatest correlations with the 25-meter results, namely: BH (-0.571), LL (-0.545), HL (-0.574), FL (-0.505) and AL (-0.567). These values show that longitudinal measures of the body inversely correlate with 25-meters results and prove the claim that the speed of swimming at 25 meters dolphin style depends on their longitudinal measures. Of the transversal measures, a satisfactory correlation with all criteria variables is shown by -HW, -KD and -FD. HW correlates satisfactorily with 25-meters results (-0.501) and 50 m (-0.449) while there is a weak correlation with the number of strokes.
A weaker correlation is also noticeable with SW, PW, AD, ED with all the criteria variables.

TM does not have a significant correlation with criteria variables, so that the corpulence of dolphin style swimmers can vary for achieving good results. TV and FV have a significant correlation with all criteria variables and in an inverse manner, which is proved by the largest, compared to all the other techniques, average values of these parameters. There is a weaker link of criteria variables with UAV, TV, CV, which indicates that the results do not depend on these parameters, i.e. they have a weak connectedness.

As with other techniques, ST correlates less strongly with criteria variables than other dimensions of a skeleton (Diagram 4). More significant correlations have been noticed with FST and experience with all the criteria variables. TST correlates with 25-meter results (0.431), with 50-meter results (0.475) and SST with 50-meter results (0.443). Which means that with an increase of 25 meters, there is also an increase of TST and the results and with an increase of experience, there is a decrease. With short-distance swimmers, there is a larger muscle mass with less fat, and with long-distance swimmers, the opposite - Kremljeva (1976).

The other skinfold thickness parameters - BiST, BST, TST, CST, SST weakly or not at all correlate with criteria variables, so it can be concluded with breastroke swimmers as well that the quality of the results do not depend on the amount of fatty tissue.

CONCLUSIONS

The research was carried out with the aim to determine the degree of connectedness between the speed of swimming and the number of strokes, on one hand, and relevant anthropometric dimensions, of the other. Tested were 132 male swimmers in three age categories, members of four Belgrade clubs. In the total sample group, the respondents were separated according to technique.

Taking also into consideration the limitations conditioned by the sample size, the swimming techniques and errors which appear in this kind of testing, we can conclude the following:

- The obtained results of descriptive statistics can serve in the selection of swimmers according to techniques of a certain age.
• In the total swimmer sample, a greater physical development in crawl and dolphin style swimmers in relation to other techniques can be seen (Table 3).

• In the total sample, there is a largest link with anthropometric and criteria variables, of both longitudinal and transversal dimensionality, and the volume and body mass of swimmers. These groups of crawl, backstroke and breaststroke swimmers correlate well with the results and number of strokes, inversely (Table 4).

• A greater significance of the degree of connectedness of the total sample of swimmers of a diverse age is that age has a smaller impact on the relation of anthropometric and criteria variables.

• The connection of results with anthropometric groups varies according to swimming techniques. It correlates the most with the crawl style and the least with the dolphin technique (Diagram 1).

• A statistically significant link of many tested variables with criteria variables has been proven. There is a better link of anthropometric groups with results than with the number of strokes, which means that anthropometric variables have a greater impact on the results, while other factors (mostly training) are evidently more significant for the number of strokes.

• The results obtained in this testing have given a basic insight into the significance of anthropometric dimensions and their link with criteria variables for the assessment of the success of young competing swimmers. At the same time, the level of reciprocal connectedness of all these dimensions with criteria variables ranges from insignificant to very significant in relation to various tested techniques. This means that anthropometrics is not the decisive factor in determining the quality of a swimmer and that there are more factors which impact the result, but it can be considered as a good means in the initial selection and the choice of talented swimmers.

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Marković, V.: The impact of anthropometric dimensions on the results of swimmers


STRESS OF THE ANTICIPATION IN SPORT

UDK 791.01:159.9

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Abstract: According to the Canadian psychologist Hans Selye stress is an unspecific response of the organism to some request. Factors causing stress are defined as stressors and can have different results. Sports events in its own right represent stressors especially when some crucial competitions are expected or in case of some match which has important influence on the following events, on the destiny of the team or the athlete himself or herself. Athletes always come to start or to a match with some degree of anxiety. Too much of the anxiety has inhibitory influence. According to Calagnin motives referring to a fear of failure are in high correlation with the intensity of stress reactions before the match. Research and solutions to the problem connected with the resistance of athletes to stress has wider theoretical and practical significance for the resolving of the consequences of the stress.

Key words: Stress, Sport, Anticipation, Anxiousness

INTRODUCTION

Research on stress is usually connected with Hans Selye (1974, 1976), Canadian physiologists, one of the founding fathers of stress research and a leading authority in this area worldwide. According to Selye stress is an unspecific response of the organism to a demand put on him. Factors causing stress are called stressors and can have different effects but they all have one thing in common- they stir the organism to
establish adaptive function and restate the normal status. It is not
important whether the person is experiencing stresses as favourable or
unpleasant ones, only the intensity of the demand put on the organism is
what counts.

Sporting events themselves represent stresses but they can not be
viewed out of the milie of some socio-cultural environment, athletes’
personalities characteristics, motivation and his or her psychophys-
iological state immediately prior to competition which all can influence
the intensity of the body reaction to the oncoming competition. Some
authors cite other factors that can make a competition more stressful
such as unknown opponent, unknown terrain, the importance of the
competition, a feeling of responsibility for the entire team, etc.

From the above mentioned one can conclude that a competition
often induces stress in an athlete and even the anticipation of the
competition in psychological terms represents a stressful situation. One
could divide factors forming the response to stresses in athletes into two
groups: internal relating to the individual traits of the athlete and the
external relating to the importance and the level of competitions,
audience, visiting or home playing, etc. Considerations about stress
should include several aspect such as physiological, psychological and
psychosomatic. research of the psychological aspect of the stress demand
especially complex approach. Intensity of the athletes reactions to the
oncoming sporting event as a stressor can be controlled through
physiological parameters (most often researched and applied procedure)
and the unification of other external conditions which is hard to achieve
just prior and during the competition.

This paper will give theoretical frames on stress research and
mention some research that give better insight into the understanding of
stress anticipation in athletes.

Stress in one of the most used term in medicine, physiology and
psychology. It is used in different contexts and implies different
meanings which gives rise to a problem of clear definition of this term.
In a dictionary of psychological and psychoanalytical terms of H.
English and A. english stress is defined as a force applied on a system
strong enough to cause strenuousness or distortion or if strong enough to
change the system into a new form.

The dictionary further says term stress can encompass physical
forces and physical systems but also psychological and psychological
systems. Golderson (according to Kapor, G. Social Psychiatry, 1978
Zagreb) defines stress as a state or a situation internal or external that put
demands on the body to adapt. This is adaptive activity of the body
which is a key word when talking about stress mechanism. He also says that stress can be biological or social or psychological or the mixture of all. Biological stress causes primary physical defending mechanism while psychological stress invokes the Ego defending mechanisms.

Predecessor of the stress theories a French physiologist Clod Bernard had introduced in the second half of the 19th century a term interior environment. For the body to survive interior environment should have continuity, i.e. homeostasis. Homeostasis is a term implying stability of the chemical composition and physical-chemical attributes of the interior environment.

The first works of Hans Selye, endocrinologist from Montreal, published in 1936 who was a forrunner in the theories on general adaptation syndrom contained basics on stress. According to these hypotheses a reaction to the external influences of a living body is formation of unspecific altertness manifested in functional and morphological changes in the internal organs especially in endocrine glands controlled by the hypophisis. the author thought these changes were protective and their function was to mobilise all body’s potentials to fight the harmful agent. Launching stress theories and general adaptation syndrom as a reaction on harmful agent Selye distinguished three stadia in the development of this syndrome: alarm reaction, resistance and exhaustion. First Sale’s assumptions on general adaptation syndrom caused a lot of comotion in scientific circles. Ensuing critiques were first of all about underestmating the role of nervous system in the development of stress. So as to compensate his theory on stress Selye in 1956 and in 1975 wrote that to define more precisely the notion of stress it is necessary to emphasiz what stress is not.

Referring to this he writes Stress is not identical to the emotional arousal or nervous tension... stress in not always a specific consequence of the aggression of damage. Since pleasant or unpleasant quality of stress is immaterial any type of normal activity... can cause substantial stress without causing harmful effects. Damaging stress is called distress. Stress is not something to avoid. According to a definition it cannot be avoided since each situation enhances some need that sustains life energy. Complete relief from stress is death. Contrary to general opinion the aim of the man is not to avoid stress but to master it and enjoy it..... .

Thus Selye’s theory claims that stress does not have to be pathological phenomenon but it can be a normal adaptive reaction and a preparation for the defense of the body. Stress becomes a pathological phenomenon only when neurohumoral mechanisms fail to function and when the strength or intensity of stressors overcomes immune capacities.
of the body. Contemporary notions of stress have long ago outgrown Selye’s theory because up-to-date solutions to this problem include psychosocial aspects that can largely determine human behavior, their relationships, their adaptation capabilities, etc.

Unlike considerations of stress in the realms of physiology where the focus is placed on different biophysiological factors analysis and interpretation of stress in psychology is mainly directed on the phenomena connected to stress on psychological basis such as conflicts, frustrations, anxiousness and defense mechanisms of personality. Special attention of the researchers in psychology is directed on the study of individual characteristics of defense from strongly expressed embarrassing emotional tension. In this sense specially emphasized are so called stresses of the environment which are connected to conflicts of motives and frustrations.

It is also known fact that a term emotional stress is often used. The use of this term means that emotions play certain role in stress i.e. in formation of syndrome emotional components are involved or emotions can cause stressful.

In publications considering problem of stress on a social level stressful situations are those social situations or events in the life of the individual either on a macro or micro level that call for adaptation changes or some efforts on the part of the individual aimed at adaptation to the changes.

Modern life gives rise to the confirmation of the above mentioned assumptions because social changes and the tempo of changes is such that more and more efforts are demanded so that an individual can adept and are direct cause of the symptoms mostly defined as adaptive stress syndrome.

In the light of the above said one can conclude that theories of stress in physiology, psychology and sociology do not coincide. Therefore it is suggested to consider stress as a general term referring to overall variation of the process and not as rigorously differentiated notion referring to the specific response to the stress.

**SOURCES OF STRESS**

Processes of biological and social maturation set all types of demands on the individual. Sources of stress are manifold and man is always exposed to stress but the sensitivity to the same intensity of stress is different in some phases of psychophysical development of the individual. It could be said that with the prolonged lyfe expectancy the
period of the exposition to stressful situations is increased. Working conditions are also stressful factors (Dimitrijevic, 1975). Literature says that stress is caused almost always when deviation from the optimum state can not easily be overcome. Namely man is so made to function optimally when moderate demands are put. Any deviation from the optimum whether in positive (too severe demands) or in negative sense (too unchallenging demands) becomes a potential source of stress.

Relation of motivation and stress is a complex and not well defined one. When regarding it one takes into account basic principles of the motivation theory that claims reinforcement of action in order to improve conditions worse than optimal ones. In regard to this point one can assume that action can be inspired not only by real distancing from the optimum but also in just hints of this distancing. Action is thus possible even before the stress comes which is denoted as anticipation action functioning so as to lessen the effect of stress when it really takes place. This fact shows that stress does not have to happen suddenly when stressor triggers this action but it is in most cases a continuous variable and grows gradually to the level of maximum capacity of the individual.

In nowadays working conditions the part of physical stressors influencing man is increasing. These factors imply numerous social ecological life and working conditions such as interpersonal relationships, work organization, management style, micro and macro climate conditions, etc. These are usually related to motivation and working efficiency in industry.

Social stress implies the influence of other people as a potential stressor. They influence individuals as stimulus that raise the alertness level (arousal) that can any time cross the border of the optimum level. Generally small society (or smaller number of people) can arouse low level of alertness to the optimum and larger number of people (for example the audience) can arouse this level above the optimum one. In such situations and in order to reduce the overload people can react twofold: they put more effort to eliminate overload or they give up the task altogether. These reactions are known as reactions of fight or flight as Canon used to designate them (acc. to Selye, 1975). If neither of them is possible the individual becomes auto or heteroagressive or secludes into loneliness depending on the personality traits type.

Principally it can be said that any stimulus can be stressful because of its special meaning for a particular person. However, there are such stimuli that cause problems in large majority of people. Some authors this fact designate as a continuum of stimuli that are different in meanings and consequences they can cause in different individuals. On
one end of the continuum there are such stimuli that are symbolic and add certain meaning to a particular individual and to a layman can seem harmless, insignificant and usual ones. On the other end of this continuum there are stimuli that depending on their intensity and danger for vital functions of persons can mean overload for most defense mechanism of each person. Whether one stimulus will mean a threat for homeostatic functioning of the organism and realization of the persons aims depend on its intensity, on the adaptation abilities of the organism and previous forms of learning that the person has undergone. In the end one can say that final effect of the stressor influence depends largely on individual personal traits that stressor affects.

**TYPES OF STRESS AND ITS MECHANISMS**

In biology and physiology stress is used to denote factors of environment such as coldness or heat that can more or less affect the individuals and to denote the state of the organism whose balance is dysfunctional under the influence of some outer factor.

In psychology and sociology stress describes psychological relations or social situations demanding from the person to exert efforts to adapt to them which in turn brings changes in the organism of the individual. Consistent with this phenomenon psychology and sociology use the term stressful situation denoting an objective state inducing stress and the term stress is used to denote subjective reaction of the person to the objective situations. It is to emphasize that subjective stressful reaction (psycho-physiological, psychosomatic reaction) that mostly induces stress must be observed as inevitable consequence of the stressful situation called stressor.

From the psychological point of view referring to an estimation of individual meaning of the stressful situations the emotional misbalance is mostly caused by the following situations:

1. Situations demanding reaching of responsible decisions in the absence of evident physical activity
2. Situations where responsibility is connected with physical action
3. Situations where persons are helpless observers of dangerous situations
4. Situations where persons act for someone else
5. Situations where persons abilities are proven

According to Selye mechanism of stress is nonspecific one that is organism undergoes the same physiological changes no matter what is
the stressor. Most significant reactions are reactions of hypothesis and kidney glands. These release large quantities of corticosteroids under the influence of hypothesis i.e. its adrenocorticotrope hormone. Physiological changes are brought about as a consequence of neurohormonal activation are increased heart and breathing function, bigger blood sugar level, release of fat acids, etc. Some medical studies show that certain psychological states are often followed by changes in adrenalin and noradrenalin excretion. For example active aggression is connected to increased excretion of noradrenalin in the urine while anxiousness is connected to bigger release of adrenalin. Following these guidelines there are differences between the athletes more or less active during the game. For example, a goalkeeper is less active but is more psychologically active and tense in relation to other team players.

Although some author claim that each psychological stress is accompanied with physiological reactions while physiological stress can go without psychological effect one should note that in most cases physiological stresses (hunger, infections) transcend into psychological ones causing anxiousness, aggression and other unwanted reactions. In this sense Selye says that a difference should be made between a primary and secondary shock. This is important because primary shock is induced by neuron stimuli while secondary shock is caused by intoxication.

**CONSEQUENCES OF STRESS**

Intensive sociological development has influenced changes in life styles in all aspects so that human psychopathology has assumed new forms and new structures in large number of its manifestations.

Competition in social relations causes real of fictional rivalry between people. As a result a diffuse emotional tension is created in each person. Phobias, decreased self respect and inner conflicts compose individual feeling of isolation. Life full of unresolved conflicts causes dissipation of energy and lesser efficiency. Within psychopathological manifestations as a consequence of exposure to stress most often we mention anxiousness and psychosomatic diseases.

**ANXIOUSNESS**

There is a discrepancy in a definition of this term mostly defined as a differentiation from fear. Fear is mostly defined as intensive short
embarrassing feeling of great tension followed by vegetative signs caused by strong external and internal stress.

Anxiousness is a fundamental state of man, one of the reactions representing life manifestations essential to the biological side of man. It originates in a German word Angst and in psychology refers to inductive feeling of a fuzzy anticipation of fearful future, that is a state described as terrible and unpleasant expectation and anticipation, worry and uncertainty. It lasts longer than fear and stems in the feeling of endangered code of values essential to a person. Although fear and anxiousness are closely related terms lots of authors make difference because fear has consciously perceived object which is intimidating and anxiousness is the manifestation of the anticipation of oncoming danger, so it is a function of future. Tiele (according to Milovanovic, 1978) claims that fear is psycho physiological and anxiousness is a psychopathological phenomenon. Anxiousness is manifested through psychopathological, psychomotor and neurovegetative symptoms. Motor dysfunctions vary from excitedness to real stupor. They are followed by expressive mimics. Neurovegetative symptoms are pale face, sweating phases, dryness of mouth, tachycardia, anorexia, decrease of libido and sexual functions, higher blood pressure and glicemia. In theory we differ between normal and abnormal anxiousness. We take into account first of all stressor factor while the reaction itself can be adequate or inadequate. Some authors claim that essential difference between these two is not the quality of the affective state or the stressor but directly depends on the psychological structure of the person. Stress therefore must be observed in relation to the person affected by it.

PSYCHOSOMATIC DYSFUNCTIONS

Stressful situations are without any doubt significant factors of anxiousness and frequent or prolonged state of the emotional tense is in time transformed into psychological and bodily symptoms. Anxiousness and stress are followed by numerous vegetative and endocrine changes that if lasting longer can bring about a host of psychosomatic dysfunctions.

Taking into account multifactor etiology in medicine psychosomatic dysfunctions or psychosomatic disease is proclaimed only when psychological cause is the main etiological factor. More precisely psychosomatic dysfunctions are emotional dysfunctions with bodily manifestations. There are mostly expressed in a misbalanced function of
the organs and if subjected longer to stress in morphological damage of the given organ.

Most psychosomatic dysfunctions are high blood pressure, cardiovascular diseases, heart failures, colitis, ulcers, diabetes and the like. No matter the unique ethimological factor each psychosomatic dysfunctions has its specific mechanism of development determined by the persons trait composition and the reaction mechanisms. More thorough considerations of psychosomatic dysfunctions belongs to medical field and is not to be detailed more here.

PRIOR START STRESS

Emotions in athletes and other psychological manifestations are created during sports activities and represent important component of the dynamics and formation of sports results. Although muscle activity is a basic component, psychological engagement especially in elite athletes is indispensable in all sporting activities.

While considering the influence of stress on athletes one should emphasize that sporting events are not the only stressors but a host of others that are not measurable and controllable. Sporting events must be viewed in the frame of wider socio-cultural and educational influences. Bearing in mind that sport is just a temporary activity that calls for the engagements of the whole personality especially in the elite and professional sport existential problems such as profession, job finding, marriage can be stressors in the athletes lives.

Among numerous motives of the young to take up sports a desire for success is a factor that largely increases tension before the competition and brings athlete into a state of stress mostly defined as an anticipation stress. In such a situation an opponent is experienced as a frustration because a defeat caused by him can diminish the feeling of self evaluation. As an additional stressors one can mention referees and the audience as arbitraries. The audience can exert special influence because even in cheering up it can pressurize athletes wanting the win at any cost.

Even more stressors on the eve of a match are unknown opponent teams, unknown terrain, responsibility for the team, a reward or sanction in case of reached or failure to obtain good results. Athletes are physically endangered because of falls, kicks or punches of the opponents, injuries) which all calls for solid physical preparation. Fatigue is also important factor because it brings about dysfunction of normal activities and it is known that fatigue decreases resistance to stress.
Numerous authors claim that competition is a stress for the athletes but there is no unanimous opinion about the factors causing intensity of stress and helping it.

Pavlov talks about muscle joy meaning muscle work bringing pleasure to the whole of body and creating psychological joy which in turn contributes to mans pleasure and health. However the price for mans pleasure and health in sport that athletes and especially elite ones have to pay is bigger than it seems. Some European psychologists cite the estimates on increased incidence of homicide in athletes after big competitions. (Vanek, Cratti, 1974). This contributes to the fact that athletes are exposed to stress before, during and after the competitions regardless of the type of stress.

Most authors dealt with the analysis of the anticipation stress experienced before the math that is seen as a stressor and can contribute to the final scores. Almost all athletes come to a start or to a match with a dose of stress and tension (moderate level of arousal can be positive for athletes) but too much of tension can act inhibitory. An athlete comes with a desire to show his abilities, wants a success, or to win or his team to win, but the same goes for his opponent making any effort to do so. In such a situation both partners feel frustration of their wishes and their integrities as well, for the failure can diminish self respect. They fear all other direct or indirect loosing consequences. In any case competition represents a difficult exam because the referee and the audience examine each move. Intensity of the anticipation stress is multiplied before the important competitions such as state, world and the Olympic competitions where one win or loss can determine ones destiny. So they have unfavorable conditions to execute their tasks. As to Vanek, 1974 more stress resistant athletes who in higher excitation conditions keep their values and capabilities to perform the tasks have better chances to win. Biological base is considered essential for the development of the complete higher nervous activity type as a response to stress. But there are also some relations and correlations between some genetically defined traits that define the tolerance to the anticipation stress. One should mention typology of Crechmere and Sheldon that correlates persons traits and body composition especially the type of somatotonic type with high emotional resistance and expressed tolerance to stress, with athletic build, love for physical exercising and games. This is typical classical example of sport prone personality and is to be found in sport more often than in other spheres of life and human activity.

Soviet authors Ilin and Scariadin (1976) have concluded that inevitable conquer of a dangerous situation can gradually bring to ada-
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...tion but not to changes in persons traits, although Sale claims that it is not possible to totally adapt to stress. The previous authors also think that one should pay attention to a ratio of fearfulness and aggression in athletes. Aggression in sports (as a contrast to definition of a psychiatric definition of aggression) correlates with courage and risk disposition. Fearness usually forms tendency to excitement, fear and apprehension. In a harmonious composition of a personality there is a certain level of traits but if high level of fearfulness is a constant trait it is easily transformed into state of excitedness and fear, questioning of ones abilities to intensively and emotionally react in stressful situations and thus diminishing the efficiency in playing. Soviet author Lisenko has proved that higher level of fear in gymnasts was compensated successfully in the stressful situations when aggression overcome fear.

One of the special indicator of emotional resistance is relatively stable level of motivation that does not undergo changes under the influences of success and failure. Kalinin (1976) has shown that motives connected to fear of failure highly correlate with the intensity of stressful reactions. Important role in overcoming the emotional stress have defending mechanisms.

While investigating emotional sphere in stress we should take into account the fact that intellect is not to be separated from the creation and the control of emotions and that good control of the intellect over emotions plays a vital role within the host of factors causing tolerance to stress.

Dragicević (1966) researched the sample of 102 Yugoslav athletes and measured a degree of general neurotic methods of the personality inventory. Results had shown that majority of athletes show apparent reactions of anxious tendencies. Kolomicjev and Hudadov (1976) had shown that it is important to take into account when dealing with the resistance to stress in athletes social climate in sports group and solidarity factors.

Stranski and Svoboda (according to Puni, 1976) devised even more complete approach to this problem of taking up sports as one of the more specific activities according to which one can make a selection of people and who people on the other side select. In theory there are claims that only certain types of people can bear the burden of social and physical tension of taking part in sporting events and if continue to be in sports are subject to negative and positive changes of personality as well. (Vanec and Krati 1974).

Milojević at al. (2001) have analysed on a sample of 120 soccer players relations between their personal structure and level of their
intellectual abilities and their psycho-physiological reactions immediately before the start of the match. Immediately before the start of the match blood pressure, and heart rate were measured and body temperature. On the basis of the statistical data processing it can be concluded that the best parameter competition stress is body temperature. It seems that blood pressure and heart rate are measures that point out to adaptation to a competition stress in soccer players.

When examining emotional reactions in stressful situations we should emphasize that lack of one completely satisfactory theory of personality and good formulation of parameters it is difficult to mutually understand and cooperate on the part of different schools representatives in psychology and the use of results that they have reached.

Solving of different problems connected to the emotional resistance of the athletes to stress goes way out of the domain of the sports activities. This problem has a wider context and meaning in psychology and the research on sports stress or the model of stress in wider prospects.

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FITNESS CENTERS’ QUALITY MANAGEMENT SYSTEMS ACCORDING TO THE EDITION OF INTERNATIONAL STANDARD ISO 9001:2008

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Abstract: This work presents the importance of ISO 9000 standards suit for the employed in sports and recreation area, primarily for those in the area of fitness. The work gives terms and definitions explanations (according to ISO 9000), ISO 9001 requirements as well as the review of differences between ISO 9001:2008 edition and ISO 9001:2000 edition (the third edition was published on Dec. 15, 2000 and the forth on Nov. 15, 2008). Some of the author’s findings related to her MSc thesis entitled “Quality management in fitness” and 20 fitness centers survey in Belgrade are also included in the work. Additionally, the possible system implementation issues and certificate gaining procedure for the interested fitness centers and other sports organizations are presented in the work.

Keywords: management quality, fitness, standardization, ISO 9001, control, work organizing, sport recreation, sport recreational centers

1. INTRODUCTION

1.1 ISO and international standardization

ISO is one of the three leading international standardization organizations. The word ISO stems from the Greek word *isos* meaning: equal or the same. According to January 2009 data, ISO includes 158 member bodies from different regions all around the world. Actually, the members are the national standardization institutes of specific countries. ISO develops voluntary technical standards related to all kinds of business activities. The work of preparing international standards is
carried out through ISO technical committees (e.g. construction, traffic, sports, agriculture, management etc.). Each ISO member body, interested in a subject-matter of any of the technical committees, has the right to delegate its own representatives into the committee in question. All the ISO member bodies wanting so, take part in international standard development through their institutes and decide either to take the status of active members or the status of observers. Active member bodies prepare international standards and vote, whereas observers receive working materials but are not obliged to vote. In order for an international standard to be introduced, it is necessary for that standard to be approved by the votes of at least 75% of active member bodies.

ISO international standards contribute to establishing the necessary minimum for good business practice. They support development, production and supply of more efficient, safer and cleaner products and services. However, they are subject to political influence of those countries introducing them (since these countries protect their own industries and concepts). For that reason it is very important for a country to be the active ISO member. Standards make international trade and business cooperation within countries easier.

ISO develops only those standards for which there is realistic need on the market. This work is done by experts. These experts can be assisted by others with relevant knowledge, such as government agencies representatives, consumer organization representatives, academies representatives and research laboratories representatives. ISO standards are published with the label of international standard and represent international consensus. Each and every country can accept an international standard in its original form and introduce it as a national standard. It can also modify the standard or even completely change it for its own interest.

According to January 2009 data, ISO has introduced more than 17800 standards and related documents. This particular article deals with quality management standards and their application in fitness centers.

1.2. Family of quality management and quality assurance standards (ISO/TC 176)

Nowadays, when the role of management is obvious in all areas and when managers are produced from almost all faculties, it is necessary to use the knowledge integrated in ISO international quality management standards. ISO technical committee ISO/TC 176 has jurisdiction over the standards of ISO 9000 family, namely the quality
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management and quality assurance standards. According to data from the year 2009, there are 81 national bodies of delegates who participate in the work and there are 21 observer countries. ISO 9000 family of international quality management standards and instructions has received a global reputation of being the basis for establishing effective and efficient quality management systems.

ISO 9001 standard comprises principles and forms the basic standard of this family. It specifies the basic principles for quality management system (QMS) that a fitness centre or any other organization must fulfill in order to show its ability to deliver the products consistently (in this case the products being fitness services) along with increasing the satisfaction of customers. At the same time the organization shows the ability to fulfill the requirements of legal regulations. Taking this standard into concern, the evaluation of the interested fitness centre or organization is performed, i.e. it is checked whether the requirements are fulfilled. If the evaluation is positive, the fitness centre or any other organization receives ISO 9001 certificate.

Nevertheless, upon introducing ISO 9001 quality management system it is recommended that the whole family of standards is used in an integrated way.

ISO 9000 standard is a vocabulary and it is used to acquire proficiency in basic concepts and the professional language.

ISO 9004 standard comprises instructions for performance improving, it describes practice and can be used in order to make the quality management system more effective and efficient in achieving the established trends and goals. ISO 9001 and ISO 9004 standards are written in a way that enables their correlation with other management systems (e.g. environmental protection) as well as with specific requirements of certain industries or areas. These standards also help to gain recognition through national or regional programmes.

1.3. Terminology of standards

In all ISO standards the terminology that is used is very precise. The standard introducers are trying to formulate the definitions so that the wrong interpretations are prevented as much as possible. Once the standard is introduced the reactions of users are monitored all over the world. If any misunderstandings or misinterpretations are identified within introducing national standards in pursuance of international ones, the new versions of standards are altered. For the above mentioned reasons it is highly recommendable to use the terminology of ISO
standards, namely the terminology of ISO 9000 standards for the management area, because it prevents misunderstandings among different authors.

One of the morals to draw from the way of defining terms in standards is that everything we want to be acquired clearly in a business system must be defined precisely. On a practical example, ISO shows that experts in the same or different areas from different countries can discuss, vote and introduce a definition that will be used globally – which largely helps mutual understanding. Implications are not good in business since they easily lead to misunderstandings, one business or communication party implying one thing whereas the other implying something completely different. For the above mentioned reasons we will give here a few ISO 9001 standard definitions as examples.

**def: Management** are coordinated activities to direct and control an organization.

Note: In English, the term “management” sometimes refers to people, i.e. a person or group of people with authority and responsibility for the conduct and control of an organization. In order to avoid confusion with the above mentioned term, the term “Top management” should be used referring to people.

**def: Quality management** are coordinated activities to direct and control an organization with regard to quality.

Note: Direction and control with regard to quality generally includes establishment of the quality policy and quality objectives, quality planning, quality control, quality assurance and quality improvement.

**def: Quality** is degree to which a set of inherent characteristics fulfills requirements.

Note 1: The term “quality” can be used with adjectives such as poor, good or excellent.

Note 2: “Inherent”, as opposed to “assigned”, means existing in something, especially as a permanent characteristic.

**def: Characteristic** is a distinguishing feature.

Note 1: A characteristic can be inherent or assigned.

Note 2: A characteristic can be qualitative or quantitative.

Note 3: There are various classes of characteristic, such as the following:
- physical (e.g. mechanical, electrical, chemical or biological characteristics);
- sensory (e.g. related to smell, touch, taste, sight, hearing);
- behavioral (e.g. courtesy, honesty, veracity);
- temporal (e.g. punctuality, reliability, availability);
- ergonomic (e.g. physiological characteristic, or related to human safety);
- functional (e.g. maximum speed of an aircraft).

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2 SRPS ISO 9000:2007 - def. quality management 3.2.8
3 SRPS ISO 9000:2007 - def. quality 3.1.1
4 SRPS ISO 9000:2007 - def. characteristic 3.5.1
**def:** Requirement⁵ is a need or expectation that is stated, generally implied or obligatory.

Note 1: “Generally implied” means that it is custom or common practice for the organization, its customers and other interested parties, that the need or expectation under consideration is implied.

Note 2: A qualifier can be used to denote a specific type of requirement, e.g. product requirement, quality management requirement, customer requirement.

Note 3: A specified requirement is one that is stated, for example in a document.

Note 4: Requirements can be generated by different interested parties.

**def:** Customer satisfaction⁶ - customer's perception of the degree to which the customer's requirements have been fulfilled.

Note 1: Customer complaints are a common indicator of low customer satisfaction but their absence does not necessarily imply high customer satisfaction.

Note 2: Even when customer requirements have been agreed with the customer and fulfilled, this does not necessarily ensure high customer satisfaction.

### 1.4. Quality standards development up to the latest standards' edition ISO 9001:2008

The first official standard was published in 1971 by the American National Standards Institute (ANSI) and it was entitled “Specifications of General Requirements for a Quality Program”. Similar regulations were later published by Great Britain, Germany and France. The first international quality standard was published in 1987 by ISO (first edition of vocabulary, ISO 8402 and requirements, ISO 9001).

Regulation of quality management systems according to international standards increasingly develops in the second half of 1980’s. All around the world numerous manufacturing and service organizations, both small and large ones, gain certificates of alignment with ISO 9001, ISO 9002 or ISO 9003 standards (the first and the second editions). In this way these organizations demonstrate their orientation towards quality in order to achieve consignees’ or customers’ satisfaction as well as the satisfaction of other interested parties (owners, employees, suppliers, bankers, trade unions, partners or societies). Generic character of these standards means that they do not refer to any specific product, service or industrial sector, but operation in numerous areas starts from the same requirements of ISO 9000 standards series.

There was a considerable difference between ISO 9000:2000 standards series and the previous editions so the period of redirecting to the new version of standards was called transition. The third edition of

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⁵ SRPS ISO 9000:2007 - def. requirement 3.1.2
⁶ SRPS ISO 9000:2007 - def. customer satisfaction 3.1.4
standards was characterized by consolidation of ISO 9001, 9002 and 9003 standards’ requirements into one standard ISO 9001 as well as redirecting to process approach. Process approach, i.e. paying attention to the whole production system and its internal processes instead of only to product characteristics, is a new trend within management system. It is realized that process approach can prevent numerous mistakes (i.e. discrepancies) that can exist on a product or service.

The latest revision of ISO 9001 standard from 2008 does not include significant differences in relation to the 2000 version. ISO 9001:2008 standard was developed in order to include specific clarifications of requirements that also existed in ISO 9001:2000 version but that proved to be problematic or misinterpreted during their application. ISO 9001:2008 standard was also developed in order to improve compatibility with ISO 14001:2004. However, ISO 9001:2008 neither introduces any additional requirements nor changes the purpose of ISO 9001:2000 standards. This new version is only the outcome of the continual process of improvement and communication with customers.

ISO 9001:2008 certification is not considered to be so the organizations that have already been certified according to ISO 9001:2000 will have the same status of their certificates as the ones certified according to ISO 9001:2008 standard.

According to the official ISO internet site, the identified gains in the new ISO 9001:2008 edition are included in the following categories:

- clarification
- higher compatibility with ISO 14001
- maintaining consistency within ISO 9000 standards family
- enabling easier translation

Since the year 2000, ISO 9000 standards have made difference in requests concerning quality management systems and the ones concerning products.

All the achievements within the area of sports and recreation; and thereby fitness; such as codes, regulations etc. have made this human activity largely prepared and ready for accepting the subtleties brought in by ISO 9000 implementation. But ISO 9001 standards themselves are useless without their connection with the complex mechanisms of specific branches. For this reason it is necessary for the sports, recreation and fitness experts and especially management experts from the mentioned branches to be aware of the significance of ISO 9000 standards family implementation.
1.5. Management principles according to ISO 9004

According to ISO 9004\(^7\), the eight basic management principles are:

1. **Customer focus**
   Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

2. **Leadership**
   Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

3. **Involvement of people**
   People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

4. **Process approach**
   A desired result is achieved more efficiently when activities and related resources are managed as a process.

5. **System approach to management**
   Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

6. **Continual improvement**
   Continual improvement of the organization's overall performance should be a permanent objective of the organization.

7. **Factual approach to decision making**
   Effective decisions are based on the analysis of data and information.

8. **Mutual beneficial supplier relationships**
   An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

    These principles are a form of management knowledge sublimate and are stated in numerous management publications, usually not in this systematic way but specifically organized in groups or as discussion topics. Every book on management includes parts that can be subsumed under one or more of these principles. However, sometimes

\(^7\) SRPS ISO 9004:2001 – item 4.3 Quality management principles application
some of these principles are left out. These eight management principles are incorporated into the content and requests of ISO 9001 international standard.

2. SOURCES AND METHODS

This work is based on bibliographic method in order to familiarize fitness experts with ISO standards topic. In addition to this, the results of transverse non-experimental structural study research of management organization system in twenty fitness centres were used. These results were obtained from monitoring, interviewing, polling and scaling in the twenty fitness centres from October 2007 to December 2008.

3. RESULTS AND DISCUSSION

Based on the research conducted in twenty fitness centres in Belgrade, it is concluded that the level of management system development is very low. Owners and managers are mostly not even familiar with the existence of ISO 9001 standard that could help them in system organizing.

The overall data and average scores indicate that the level of documentation evidence is very low. QMS (quality management system) implementation is performed through verification of the three basic elements:

1. Documentation evidence of the system,
2. Alignment of documentation and 9001 standards requests,
3. System implementation.

If the first element is missing, the further verification is prevented. It is inevitable to mention that the missing documentation evidence does not necessarily indicate that the service lacks quality, but by all means it indicates that the quality is not verifiable or sustainable through a longer period of time. Every serious management system, even if it is not related to ISO 9001 requests, includes documentation evidence because quality is not accidental. The Chart 1 demonstrates average scores of documentation evidence in fitness centres.

The average score of documentation evidence includes the following: the level of mission, vision and quality policy development; the way of subject-matter documentation; the level of structuring and documentation evidence of activity process; the existence of documentation according to the standard requirements; documentation evidence of
employees’ characteristics, rights and obligations; the level of employees’ training and awareness increasing actions. The scores were graded from 1 to 5.

![Chart 1. Average scores of documentation evidence in fitness centres](chart)

Based on comparison of average scores of spatial planning (3.62) and average scores of documentation evidence (2.85); which presents the precondition for implementation and verification of quality management system; the conclusion is that in fitness centres it is invested much more into spatial furnishing and equipping than into quality management system development. This situation puts the currently existing fitness centres in Serbia into danger of competition with foreign fitness centre chains. These chains have not only invested large material resources but also bring fully developed quality management systems. The potential quality of services in Serbian fitness centres is based on separate quality and effort of individual employees. Customers may be satisfied with individual fitness instructors but it is interesting to mention the fact that from 138 employees in these 20 fitness centres only 10 of them have permanent jobs. This fact indicates that people who introduce quality into fitness centres are not attached to their specific place of employment but will readily follow the better offer and management and transfer to another fitness centre. In such occasions those fitness centres that lack the implemented quality management...
system and that were abandoned by well-trained instructors are doomed to failure. On the other hand, those fitness centres that have implemented quality management systems are resistant to such occasions because, besides everything else, their system includes the regulated procedures of employees’ training and work control so the employees are easily replaceable.

3.1. The importance of ISO 9000 standards family implementation in fitness centres

The importance of ISO 9000 standard is stated below as a bulleted list:
- Instructions for management and better product
- Order and control implementation
- Better understanding with other organizations
- Marketing value
- Country interest
- Economic importance
- Importance for PE structure
- Importance for customers
- Quality circle: better organization – better service – higher demand – higher income – better working conditions – higher expert interest – branch development – better organization...

3.2. The way of implementing quality management system in fitness centres and other sports organizations according to ISO 9001

After a thorough research in fitness centres the data has been reached on the current condition of these centres and the suggestion has been made on how to implement QMS in fitness centres. The way of implementing QMS is as follows:
- Introducing fitness centre owners and managers to the importance of QMS for their fitness centre business
- Interest and orientation of fitness centre owners, directors and highest management
- Choice of adequate consultant
- Documentation production
- Practical application
- Internal control and review
Corrective measures
Application to an accredited certification body for evaluation
Evaluation conduct
Formal ceremony of certificate presentation
System life
Periodical additional audits

In order for a fitness centre management to decide upon such a step, it is important to know for example what ISO 9001 standard requires from a fitness centre. The following list gives a few examples:

- Determining the kind of sports and recreation product (i.e. service) it offers
- Determining the customers and their needs
- Defining quality
- Recognizing, defining and documenting its own processes
- Determining and applying the ways of process control and review
- Producing written procedures
- Determining quality policy, mission, vision and aims
- Determining rights and obligations of employees
- Being customer oriented
- Managing its own resources
- Measuring, analyzing, improving and managing uncoordinated products

4. CONCLUSION

ISO 9001 standard requirements are not essentially considerable but they certainly introduce order and business quality maintenance in fitness centres. The practice of these standards implementation has proved that the results are certain. In this context, it is important to emphasize that it is not necessary to perform certification so that the management knowledge from international ISO 9000 standard family is applied. Quality is not accidental and, in order to secure it and maintain it, it is inevitable to obey the approved regulations within QMS.

References:


www.eoq.org - European Organization for Quality
www.ansi.org - American National Standards Institute
www.asq.org - American Society for Quality
www.bsi.org.uk - British Standards Institution
www.cenorm.be - European Committee for Standardization
www.efqm.org - The European Foundation for Quality Management
www.esqh.net - European Society for Quality Healthcare
www.iqa.org - Institute of Quality Assurance
www.iso.org - International Organization for Standardization
www.ats.org.rs – Accreditation body of Serbia
www.jus.org.rs - Serbian Standardization Institute
INSTRUCTIONS FOR THE AUTHORS

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The initial page (which is not numbered) contains THE TITLE OF THE PAPER, the first and last names of each author, their academic titles, the institution in which they work, the year of birth, address, telephone number and e-mail address.

The second page

The second page (a separate unnumbered page) contains an ABSTRACT, 150 to 200 words long. The abstract must include a precisely defined subject and the aim of the paper, a brief description of the research procedure and the most relevant results obtained. The key words are given underneath the abstract. There must be no more than 5 key words.
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The text of the paper should start on a new page. All the pages (from 1 to a maximum of 15) are enumerated.

The original scientific papers must contain the following elements: the subject of the paper, the method, research results, discussion, conclusion and references.

* How to write the INTRODUCTION
- Precisely define the research subject and link it with a wider scientific framework in relation to the current relevance and application of the problem.
- Give a short review of the most important hitherto research which is directly or indirectly linked with the research problem. List the mentioned bibliographic sources in the list of references.
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* * *

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- The tables must be simple and easy to follow.
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