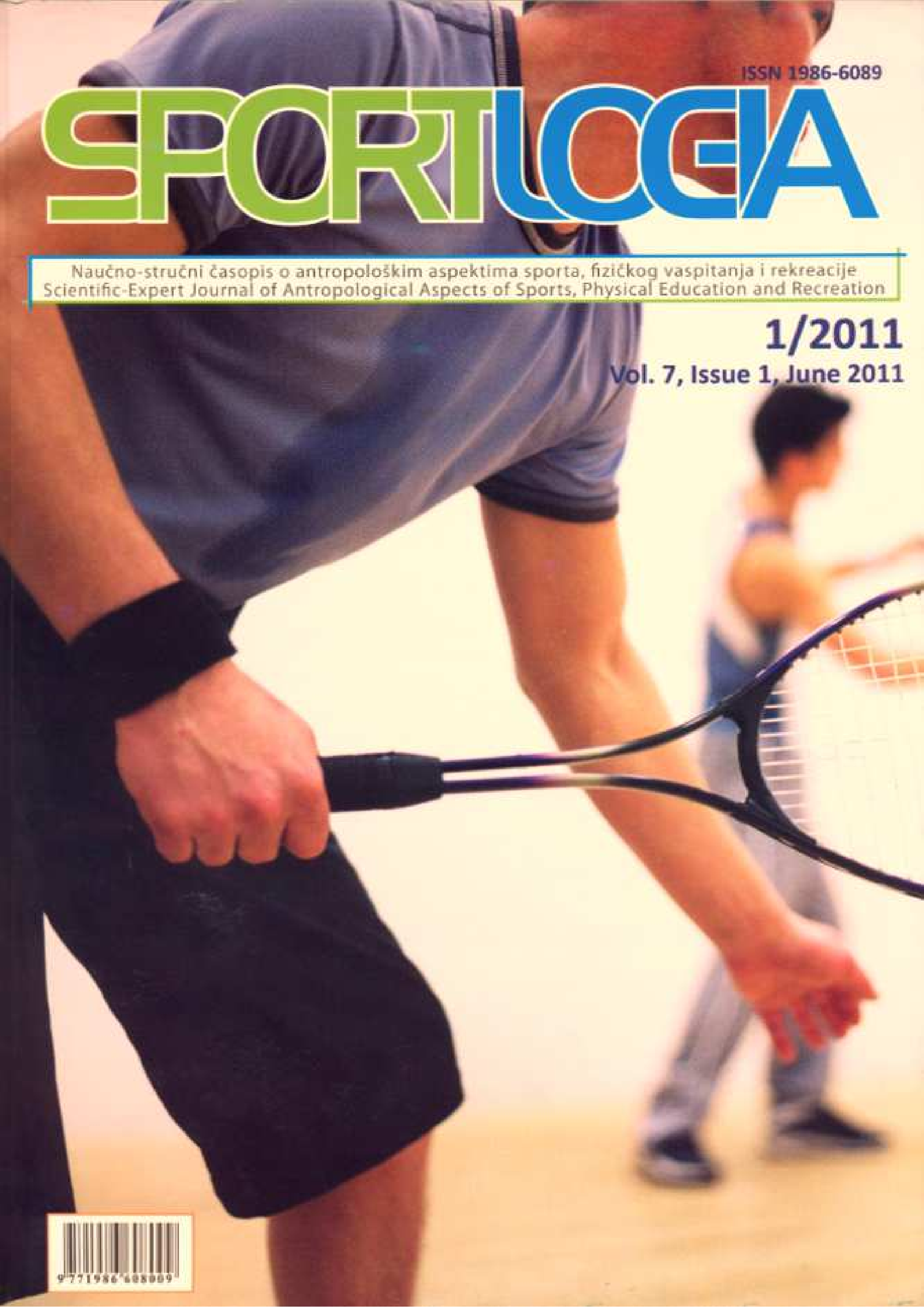
ISSN 1986-6089

SPORTLOGIA

Naučno-stručni časopis o antropološkim aspektima sporta, fizičkog vaspitanja i rekreacije
Scientific-Expert Journal of Antropological Aspects of Sports, Physical Education and Recreation

1/2011
Vol. 7, Issue 1, June 2011



Izdavač/Publisher:

Fakultet fizičkog vaspitanja i sporta, Univerzitet u Banja Luci
Faculty of Physical Education and Sports, University Banja Luka

Štampa / Printed by

Grafid, *Banja Luka, Bosnia and Herzegovina*

Tiraž / Copies

400

Adresa Uredništva / Editorial Office

Fakultet fizičkog vaspitanja i sporta
Univerzitet u Banja Luci
Bulevar Vojvode Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina
Phone/Fax: 00387 (0)51 31 22 80
E-mail: ffvis@blic.net
Web site: http://sportlogia.com (full text available free of charge)

Apstraktovano ili indeksirano u / Abstract or Indexed-in:

EBSCO SPORTDiskus with Fulltext, EBSCOhost Research Databases, Index Copernicus, Academic Search Premier, Fulltext Sources Online, Open J-gate, DOAJ, WorldCat

Katagolizirano pri / Catalogued in:

Wittenberg University, University of Washington, Journal Finder (Everest University Tampa Library, Brescia University Library), German Sport University Cologne, Electronic Journals Library - Regensburg, University Library Hamburg, Technical University Berlin, Wissenschaftszentrum Berlin für socialforschung, Geneva foundation for medical education and research, COBISS.ba

SportLogia journal (print ISSN 1986-6089, e-ISSN 1986-6119, CD-ROM ISSN 1986-6097) is published two times in one volumen per year (every June and December) by Faculty of Physical Education end Sports, University of Banja Luka, Bulevar Vojvode Petra Bojovića 1A, 78000 Banja Luka, Bosnia and Herzegovina. Subscriptions are available on a calendar year basis for 25 euros, one issue 15 euros + post-office delivery costs. Printed in Bosnia and Herzegovina.

SportLogia

CONTENT *Vol.7, issue 1, june 2011.*

THE SOCIO-PROFESSIONAL STATUS OF PHYSICAL EDUCATION TEACHERS IN PORTUGAL - A QUALITATIVE APPROACH

António Gomes Ferreira[1] **and José António Moreira**[2]

[1]Faculty of Psychology and Educational Sciences, Coimbra, Portugal
[2]Department of Education and Distance Learning, Porto, Portugal

ORIGINAL SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.001G COBISS.BH-ID: 2100504 UDC: 371.124:796(469)

SUMMARY

Despite some worth mentioning initiatives, Physical Education teaching in Portugal was only unveiled and recognised at a later stage by others than the ones directly involved in it. In fact, during most of the 20th century, both the subject and the teachers were clearly considered to have a peripheral status, particularly when compared to their professional peers. Considering the changes in the last decades, we found it pertinent to analyse how these teachers perceive the status that is assigned to them by teachers of other subjects, and also by their students. For the purpose of this analysis, we used a qualitative methodology in our study focused on a group of fifteen teachers with varied degrees in Physical Education, and graduated from some of the most distinguished schools in Portugal since the 1940s until the end of the 20th century. We concluded that there could be made a definition to a certain extent, regarding what the other teachers think about the status of Physical Education teachers. Some of the teachers, namely those graduated from institutes, ISEF (College of Physical Education), realise that their fellow teachers do not recognise their true value and treat them as the "poor relatives" of education. Nevertheless, there are those who perceive and recognise their value and treat them as equals. More consensual, however, seem to be their perceptions about the opinion of students and staff, as our study tends to show that Physical Education teachers feel that they assign them an identical status to that of teachers of other subjects.

Key Words: physical education; teachers, socio-professional status.

INTRODUCTION

We can say with some certainty that the process of professionalisation of Physical Education teachers and professional awareness only really began in 1940 with the creation of the National Institute of Physical Education (INEF - Portuguese acronym for Instituto Nacional de Educação Física). Indeed, important changes operated within the INEF decisively contributed to the creation of an organisation and professional identity in the field of Physical Education. Since then, there has been uniformity in the profession, through the unification of recruitment, certification and unique training model, and the systematization of knowledge by trying to integrate the different training components (scientific, pedagogical and pedagogical-didactic) into the three year course. And, more importantly, there were teachers whose sole mission and profession were the teaching of the Physical Education, because until then the post was mainly for doctors or army officers, who saw this as an ancillary profession (Gomes, 1991).

However, despite the creation of this professional *organisation*, these professionals were poorly evaluated in the forties, fifties and sixties, bearing in mind the type of training they had and the inequalities they were subject to compared to the teachers of other studies. For a long time, a number of professionals defended that Physical Education teachers should be equivalent to other secondary education teachers, considering not only their higher education qualifications as well as their responsibilities in terms of providing educational

training to young students. In the INEF newsletter, referring to the Physical Education teachers, João de Barros noted that their fees were "about half of the salary of colleagues from other subject groups", and, in his opinion, about 50% of what these teachers would need to live on (1959, p. 32), an unfair situation because there was "no educational or scientific reason that could ever justify the lower status of physical education and music, and its teachers, in the national school organisation" (ibidem, p. 33).

In the early sixties, this inferiority was still was a reality, as teachers of Physical Education were barred from being hired as employees and, at best, they were contracted workers in the framework of Physical Education. Thus, the difference was not only in terms of wages but also in the type of labour relations that these teachers had. In fact the only reason invoked to justify the different treatment of teachers of the so called "noble" subjects and those of Physical Education resided in the non-university degree status of Physical Education.

However, the attempt to expand the number of teaching staff of Physical Education was made through the creation of Schools of Physical Education Instructors (at the EIEF - Portuguese acronym for Escolas de Instrutores de Educação Física). These shorter courses had been contested by many professionals of the field because, in their opinion, they represented a setback in the training process that had been outlined since the early forties. Considered as teachers "made under pressure", trained in only two years, these shorter courses incorporated certain individuals of more modest social origin and more women, threatened the requalification of Physical Education, created instability and a image of easiness that shook *the spirit of professional organization*, forming a division within the profession and giving rise to conflict around the issues of hierarchy (Crespo, 1976).

The situation of inferiority of Physical Education professionals compared to colleagues of other areas persisted for many years, and the government felt there was no need to do justice to a class that had proved, more than enough, its competence (Rosário, 1996). Indeed, in the first half of the seventies, this inferiority was still quite evident, and Physical Education was unable to assert itself as an important subject among other teachers and among the Portuguese in general. Since 1974, the situation has improved with the integration of training in Physical Education in university higher education and the publication of a series of diplomas that valued the importance of teaching Physical Education (Brás, 1996) in the education system. Although the government recognised this, the Physical Education teachers, according to some authors, continued to be underestimated by a relatively large bracket of "national intelligence", even if, based on its training and specific tasks, it could be included in this bracket (Bento, 1986; Crespo, 1992). In fact, although it was not dubbed as an ancillary discipline, Physical Education was kept out of the core humanistic, scientific, aesthetic and modern values (Carvalho, 2002), which hindered the recognition of its importance. Thus, although in the early years of the eighties the qualified Physical Education teachers "relished" the university status assigned to their training, they had not yet been given the desired widespread social recognition (Moreira & Ferreira, 2011).

At the end of the decade, a number of situations emerged that contributed to the differentiation of the professional status and to the complex situation of Physical Education as a school subject and as an area of knowledge. Real or perceived, this crisis was observed at a time when there were several courses in the field of Physical Education and Sports, some lacking the desired quality, bringing with them a certain conceptual, methodological and ethical division and disorientation (Januário, 1995). In fact, the emergence of new courses and new institutions for training teachers of Physical Education, some belonging to the subsystem of public higher university education and others to the polytechnic institutes, and others to private institutions gave rise to tensions and conflicts resulting from different backgrounds of knowledge and prestige. Although those with degrees from public universities and those with degrees from other institutions were all teachers of Physical Education, their status and legitimacy were different, contributing to the decline of the profession. It was, therefore, based on this context that we sought to develop a study to examine how the Physical Education teachers perceive the importance that teachers of other subject groups and students assign to them.

METHODS

In this study, we intend to basically analyse how a group of Physical Education teachers in Portuguese primary education (7th, 8th and 9th year of schooling) and secondary education schools (10th, 11th and 12th year of schooling) views the importance that teachers of other subject groups and school students assign to them. The nature of this research led us to consider a qualitative study where the direct speech submits to an interpretative logic, that in framing and explaining the position of the interviewed teachers, intends to describe how Physical Education teachers relate within their subject group in the current Portuguese school context. Situating ourselves, therefore, within the framework of a non-positivist and interpretative paradigm of phenomenological and ideographic nature (Cohen & Manion, 1990) we resort, in this research, to a methodology of qualitative nature that places the emphasis on upgrading the "person" as a subject of knowledge capable of reflecting, rationalising, communicating and interacting (Pujadas Munoz, 1992; Silverman, 2000). Aiming to stimulate the emergence of study data, we resorted to the use of semi- directed interviews, and to analyse the data from this interview we used a research technique that encodes the apparently disordered statements: the analysis of contents (Bardin, 1977; Ferrarotti, 1986; Krippendorf, 1980; Vala, 1986).

This technique consists in the systematic analysis of a text (Ferrarotti, 1986) allowing us to identify the most repeated subjects as well as the mental associations that gave rise to it. To achieve the analysis of contents, we adopted the methodology and the procedures defined by Bardin (1995) and Vala (1986): the organisation of the analysis, the coding focused on the content guided by the identification of subjects, the grouping, the inference and the interpretation.

We began this analysis with a drifted reading of all the interviews, aiming to line up the common subjects and detect particularities according to the specific respondent. Later, we began the coding process, which involved the identification of the subjects or definition of the categories of analysis of the units, favouring enumeration or choice of the counting rules, classification and aggregation, meaning, the choice of the categories. After defining the categories and organising "clippings" and "gluing", we moved on to systematising the emergent groups, aiming to respect the exhaustive rule defended by Bardin (1995), which considers all the elements of the corpus.

Considering all the interviews of the group and comparing the contents, we separated all the records of the corpus into paragraphs and sequentially numbered them according to the alignment of the interviews.

In order to organise the information into a perceivable structure, we opted to codify the data using only three letters (without repeating codes to avoid problems of indexation in computer processing), ie. the initials, the three first letters of the word, or a set of three significant letters.

Finally, based on the representation of the records, we analysed the inference and interpretation of the data in the interviews. In this respect, the results are nothing more than a systematisation of the descriptions, the sense of which we hope to understand by organising them into categories of analysis chosen by us, having as main objective their interpretation.

TABLE 1
Study sample

Codes of interview	Institutions of Initial Formation
E2, E13, E14	Instituto Nacional de Educação Física (INEF)
E10, E12	Escola Instrutores de Educação Física (EIEF)
E1, E4, E7, E8, E10, E11	Institutio Superior de Educação Física (ISEF)
E3, E5, E6, E9, E15	Faculdades de Desporto de Educação Física (FAC)

Our sample consisted of a group of fifteen interviews to teachers (Table 1) with different initial training in Physical Education, taken at well known institutions of our country during the twentieth century: the National Institute of Physical Education (INEF - Portuguese acronym for Instituto

Nacional de Educação Física), created in 1940; the Schools of Physical Education Instructors; the Higher Institutes of Physical Education in Lisbon and Porto; and the Faculties of Science, Sports and Physical Education, created in the early nineties.

After deciding to study this group of professionals, we selected it in a non-random way without looking for a "representative" sample, given the qualitative nature of the methodology. This selection sought to ensure the greatest possible diversity of experience and personal characteristics and was based on initial training courses (training institutions). With this procedure, we wanted our sample to be made up of teachers who had different training courses in different time periods, with different lengths of service and career positions, in order to come close to the concept of maximum variation sample.

RESULTS AND DISCUSION

As mentioned above, we do intend to consider in our analysis pertaining to the recognition of the status of Physical Education teachers the diversity of initial training of the individuals who made up this teaching group in the first decade of the 21st century. The central idea of this study is that the perception of the status of Physical Education teachers is to some extent linked to their initial training and to the way in which these teachers relate their projections from this training with other colleagues in the same area and with teachers of others subjects as well as with students.

In this sense, we tried to find out how Physical Education teachers coming from different schools of training perceive the importance that teachers of other groups and students assign to them. To this end, we will present the information from the interviews in tables, in order to illustrate the relevance of some of their opinions. We think that choosing this organisation model of information that allows us to study the representations of teachers in a systematic and analytical way will allow a more adequate view of the general representation of their perceptions. The records pertaining to this dimension were marked with the expressions of Full Approval (+), Full Fail (-) and Balanced (+/-).

By induction, based on the responses from teachers, it was possible to fit in this dimension, seventy eight records, the categories of Teachers from Other Subject Groups (PGD - Portuguese acronym for *Professores de outros Grupos Disciplinares*), meaning how teachers perceive the importance that teachers of other subject groups assign to them; Students (ALU - Portuguese acronym for *Alunos*), meaning how teachers perceive the importance that students assign to them.

For the first category, teachers from other subject groups and with respect to the classification of the records, we found that out of the twenty five records, eleven have a positive sign, three show some indecision and eleven have a negative sign, revealing a balance of opinion that these teachers have about this recognition from fellow students. While some perceive that other teachers do not recognise their value, treating them as "poor relatives" of teaching, as belonging to a "second line" of educators, others perceive that there is already recognition of their value and equal treatment.

In effect, several studies (Armour & Jones, 1998; Hendry, 1975; Templin & Schempp, 1990) prove the "peripheral" situation of Physical Education teachers, which are disadvantaged in terms of rewards and support to their work, or in terms of perception that other teachers have; so these perceptions underline usually the non-academic, anti-intellectual and peripheral nature of the subject they teach (Williams, 1981).

With regard to the opinions of teachers with degrees from INEF and EIEF, we found four records in this subcategory, all with a positive sign, which reveals the existence of a perception of equal status, although some teachers do admit that some of the older colleagues still find it difficult to treat them in the same way.

Respondent -E13- (Table 2), as we can see in the record shown, feels that although the situation is much better than thirty years ago, there are still teachers who look at Physical Education in a different way, thinking that these teachers are professional entertainers.

Respondent -E2- also refers that from the moment when "*[...] teachers of other areas realised that Physical Education teachers also had university training, they began to show different behaviour*" (UR 8).

It seems clear that the issue of initial training is important. Respondent -E14- has no doubt that this was a problem that affected the recognition of the status of the Physical Education group, saying that: "*[...] the lack of training of some Physical Education teachers made people look at the subject with some disdain [...] But now I find that things are much better, and there*

are fewer teachers with this negative view [...]" (UR 69). In fact, this teacher alerts us to an important issue at the professional status level, related to the lack of training of some teachers who taught in schools until the eighties of the 20th century. At that time, the number of Physical Education teachers increased to address the lack of teachers due to the expansion of schools then underway. People were recruited without having proper training or with very short training; this was the case of the Physical Education instructors. This situation eventually threatened the qualification system of Physical Education in schools and brought about instability to the possible construction of interests common to the Physical Education teachers (Carvalho, 2002). In fact, the work developed by the teachers with degrees from the INEF and later from its successor university institutions was hindered by teachers without proper training who could hardly understand and keep up with the effort of valuing and dignifying Physical Education in Portuguese schools.

TABLE 2
Teachers of other subject groups (INEF/EIEF)

S	UR	Marking	Record
E13	65	+	Now I find that things are much better, but there are still some teachers, especially the older ones, that look at Physical Education a little differently, thinking that we are still professional entertainers. They think that we do not prepare the lessons and that they do not follow any structure. It's just running and jumping [...]

Legend: **S** − Codes of interview; **UR** − Unit of register; **+** − Full Approval.

In fact, the perceptions of teachers trained at the ISEFs seem to be different from those trained at INEF/EIEF. Of the eleven existing records in this subcategory, seven of them are negative, three show some indecision and only one is positive, which shows that these teachers have the perception that they are still seen as the "poor relatives" of teaching and there are still many teachers of other subjects do not assign equal importance to the efforts of Physical Education teachers. To prove this, we have the testimony of respondent -E4- who states, as we can see in Table 3 (first record), that the treatment given by the school board confirms this inferiority.

Respondent -E1- also emphasises that Physical Education teachers and the subject itself lack recognition, and tries to find an explanation for this: "*I do not know if maybe we, as teachers of Physical Education, are guilty, but my idea is that to some extent we are guilty, because maybe we should be more careful in the way we manage our pedagogical activity [...]*" (UR 2). That is, in the 21st century, teachers trained at ISEFs understand that Physical Education teachers are not only less valued in relation to teachers of other subjects, but this can also be the result of poor pedagogical awareness of the physical education teachers themselves.

Respondents -E7- and -E11- show the same position. While the latter states that they are still regarded as "second line" teachers, the former reinforces the opinion of -E4- with regard to the issue of assessment of the subject, pointing out that "*teachers in formal and informal conversations say that Physical Education is important, but when Physical Education teachers try to be consistent and give fair grades according to student performance, they are often 'forced' to change the grades allegedly because this area is not so important and they can only spoil the students' grade averages*" (UR 36). This position, shown by some teachers of other areas at review meetings and described by respondent -E7-, shows that there is still some prejudice from the late sixties that the subject itself is not of an academic background. At that time, and despite the changes taking place within the subject, the status of Physical Education and its teachers and the traditional noble subjects and their teachers was not entirely equivalent. But, so it seems, at the end of the first decade of the 21st century the subject is still seen as inferior. The position of respondent -E10- reflects this reality a bit, when he says: "*Physical Education is an important subject, because it contributes to well-being and improves the physical condition of children, but then again it is not assigned the same importance as the one assigned to History, Mathematics, etc [...]*" (UR 54). The only record with a clearly posi-

tive trend is that of respondent -E8-, shown in Table 3, indicating that he has an identical status to that of other teachers, because of his quality training and good practices. But it is not clear that this kind of recognition can be generalised within the majority of the teachers of his field of expertise. It may well be that the others consider him as an equal in that school, but this may not be the feeling of teachers of other subjects about the groups of teachers of Physical Education in the country or even in a specific region.

With regard to the perceptions of teachers graduating more recently, we found eight records in this subcategory, six positive ones and only two negative ones, which seems to reveal, contrary to the position of those that received training at the ISEFs, that nowadays they feel that their status is identical to the ones of other teachers, although some still differentiate the subjects of *academic* and of *non-academic* background, dubbing the Physical Education teacher as "gym" teacher.

This is the observation of respondent -E6- who states, as we can see in the first record in Table 4, that fortunately those conservative teachers who said that "gym teachers were great for teaching tumbles and jumps" are not that many anymore.

Some of the teachers interviewed said they felt downgraded when they were called gym teachers. Influenced precisely by the expression "gym teacher", respondent -E9- feels the same as the previous respondent, saying that: "*[...] nowadays, the status is the same, but it was not always so. Until about ten or fifteen years ago, we were dubbed gym teachers*" (UR 45).

Finally, respondent -E5- feels he is a privileged teacher, justifying the parity treatment with the fact that "*in addition to being a Physical Education teacher*", he coordinates the department, the School Sports and is a class director, and so he believes this is why "*the other teachers recognise my performance as I am constantly working at school*" (UR 24). But like all other teachers interviewed, he is aware that some still "*[...] do not consider Physical Education and its teachers as having an identical status*" (UR 26).

TABLE 3
Teachers of other subject groups (ISEF)

S	UR	Marking	Record
E4	18	-	Some teachers still look at us as if we were the poor relatives. And what I'm about to tell you confirms it. The Chairman of the Executive Board told us one day: "You can change the evaluation criteria, but they will not be accepted in the Teaching Standards Committee, because I do not have a classroom to give you for the tests".
E8	40	+	Yes! It seems to me that from the moment my colleagues realised that we also have a higher education degree and that our practices are not what they used to be, they changed their attitude a bit. But there are always exceptions [...]

Legend: **S** − Codes of interview; **UR** − Unit of register; **+** − Full Approval; **-** − Full Reprobation.

TABLE 4
Teachers of other subject groups (FCDEF)

S	UR	Marking	Record
E6	31	+	The mentality of teachers from other areas is already changing. We used to be the gym teacher who told students to do a few tumbles and jumps; now we are the teachers of Physical Education. But there are still some, especially the older ones, who still think we're the gym teacher.
E3	14	-	I'm treated differently by some teachers, and it's funny because this treatment has changed over the years; the idea of the gym teacher has changed, but still there are those who tell jokes, but because their words don't matter, I usually do not comment.

Legend: **S** − Codes of interview; **UR** − Unit of register; **+** − Full Approval; **-** − Full Reprobation.

From the opinions of the teachers interviewed from the Higher Institutes or from the Faculties of Sports Sciences and Physical Education, it is clear that, despite changes in recent decades, there are still some teachers from other subject areas that do not assign the same importance to Physical Education and its teachers as they do to other more intellectual subjects.

Regarding the category of *Students* and the classification of records, we found that out of the fifteen records, eleven are positive, one shows some indecision, and only three are negative, which reveals that students have the same perception of an identical status for Physical Education teachers and for teachers of other subjects. However, the majority of records show that the students in our study slightly confuse the issue of status with the issue of liking the subject.

On the other hand, looking at the opinions of the teachers trained at INEF and EIEF, we found in this category four records, three of which are positive and one shows some uncertainty regarding the above mentioned aspect, which seems to account for the notion of having an identical status. As respondent -E2- states, in the record in Table 5, since the weight of the subject began to influence the students' assessment, they have begun to pay some attention to it.

Other respondents trained at INEF, -E13- and -E14-, although not discussing this in great detail, are under impression that students recognise that the status of the Physical Education teacher is identical to the one of teachers of others subjects. In turn, the teacher trained at EIEF, having doubts in this respect, states that "*students like the subject, but she doesn't know if they understand whether it has the same status*" (UR 63).

TABLE 5
Students (INEF/ EIEF)

S	UR	Marking	Record
E2	10	+	Since this subject influences the grade average, students no longer skip so many classes and are beginning to pay a little more attention to it. This also was a struggle of the INEF, who always fought to bring all the subjects on a par. In fact, there is evidence that physical education is very beneficial not only from the physical point of view, but also from the psychological point of view, and can help increase academic performance.

Legend: **S** − Codes of interview; **UR** − Unit of register; **+** − Full Approval.

One of the statements made by this teacher takes us to the focal point of the interpretation of the recorded responses. She is almost certain that students enjoy Physical Education, but doubts that they place it at the same level as the other subjects.

Regarding the opinion of the teachers trained at ISEF, the results are more balanced. Of the six existing records in this subcategory, four are positive and two are negative, but if we are to look closer at these records, we will see that these teachers find it difficult to distinguish if the feeling for this subject is the same. In fact, we believe that enjoying Physical Education and liking the teacher does not necessarily mean recognising that the teacher has the same professional status.

In any case, there is also a perception among Physical Education teachers that students do not always assign great importance to their efforts. Respondent -E11- mentions, as we can see in the second record in Table 6, that some students do not assign any importance to the subject or to Physical Education teachers. In this regard, respondent -E1-, seems to have a clear-sighted view, because he has the feeling that although his students like him and his subject, they do not assign as much importance to him and the subject as they do to other subjects and their teachers.

As far as the perceptions of teachers trained more recently are concerned, we found in this category five records, four of which are positive and only one is negative. These records are quite identical to the records of teachers from the ISEFs, and also reveal some misunderstandings on the issue of status and liking the subject. The statement of respondent -E6- is quite clear on this, as we can see in the first record in Table 7. The opinions of respondents -E3- and -E5- point in the same direction. Some of the interviews are more obvious.

Respondent -E15-, as we can see in the second record, in the same table, shows that although students like the subject, they do not assign it the same importance.

TABLE 6
Students (ISEF)

S	UR	Marking	Record
E7	37	+	Students even enjoy Physical Education and find their teachers "very cool".
E11	58	-	I have had students telling it "to my face" that I could grade them as I please, because it did not count at all. So, when they say this, it means that they feel the same about its importance.

Legend: **S** − Codes of interview; UR − Unit of register; **+** − Full Approval; **-** − Full Reprobation.

TABLE 7
Students (FCDEF)

S	UR	Marking	Record
E6	33	+	Students recognise our work because normally this is the class they enjoy the most.
E15	74	-	The students, I don't think so, although, generally speaking, they like the subject.

Legend: **S** – Codes of interview; **UR** – Unit of register; **+** − Full Approval; **-** − Full Reprobation.

Sometimes, too, these respondents tend not to distinguish between importance, difficulty, evaluation and status. The statement of respondent -E9-, saying that "*students begin to be aware of its importance, because they experience its strictness 'first-hand'*" (UR 596), seems to reflect this vague concept. Without ignoring the fact that the issue of power is relevant in this sense of status, we believe it should not be interpreted only in terms of greater "*strictness*" of Physical Education teachers.

CONCLUSION

The teaching of Physical Education in Portugal took a long time to be integrated in public schools and become credible compared to other school subjects. In fact, Physical Education and its teachers were less valued than other subjects and teachers of other areas in the school system, for almost the entire 20th century. In fact, only with the training provided by INEF was there more uniformity in the profession, with a single training model, at least until the creation of Schools of Physical Education Instructors. However, we must always bear in mind that the changes were slow. Therefore, until the mid-seventies of the 20th century, the professional status of Physical Education teachers is characterised by not being on a par with the teachers of the more intellectual subjects.

From the analysis of the interviews, summarised in the previous pages, we can see that there are some aspects that involve more consensus or more attention than others. One of the more consensual aspects relates to the fact that most Physical Education teachers believe that their students recognise their value as teachers of this subject. However, the analysis of these results must be made with some reserve, because it seems that the respondents in our study sometimes confuse the professional status with the mere fact of liking the subject. The fact that Physical Education teachers have the perception that students enjoy and value the subject they teach is not the same as assigning the same importance to those of more intellectual bias.

Less consensual are the results referring to the importance that the Physical Education teachers believe are assigned to them by the teachers of other subject groups. Indeed, in the first case, while some teachers, especially those with ISEF degrees, have the perception that professional colleagues do not recognise their value and treat them as "*the poor relatives*"of teaching or as if they belong to a "*second*

line" of educators, there are others who perceive that their value is recognised and demonstrate parity treatment. Note that these results are consistent with recent studies developed by Martins (2010) and Cortesão (2010), pointing in the same direction. Martins, for example, found that 42% of the teachers from other subject groups considered it less harmful to miss a Physical Education class than miss a class in another subject. This means that the teaching of Physical Education is not considered as important as the more classical and intellectual subjects, so then it is normal that its teachers sometimes feel that they are not always as reputed as others that teach other subjects. In any case, much has changed in the last few decades of the 20th century and the first decade of the 21st century. Today, Physical Education teachers are part of a legal framework and have responsibilities as any another teacher of any another professional group. Some even occupy higher ranks in school organisation. But this study also reveals that changing the legal framework is not enough to change the perception of a professional group. Some of the teachers interviewed were well aware of this and did not overlooked the fact that some of their peers still nourish an idea of inferiority of Physical Education and its teachers.

REFERENCES

Armour, K., & Jones, R. (1998). *Physical Education Teacher's Lives and Carreers*. London: Farmer Press.

Bardin, L. (1995). *Análise de Conteúdo* (Content Analysis). Lisboa: Edições 70.

Barros, J. (1959). Da Situação do Professor de Educação Física (The Situation of the Physical Education Teacher). *Boletim INEF*, *1(XX)*, 32−33.

Bento, J. (1986). Acerca do papel do professor de Educação Física (About the Role of the Physical Education Teacher). *Horizonte*, *13*, 3−7.

Barás, J. (1996). Metamorfoses na formação de professores de Educação Física (Metamorphosis in the Training of Physical Education Teachers). *Boletim SPEF*, *14*, 47−54.

Carvalho, L. (2002). Sobre o status da disciplina da Educação Física na década de sessenta: fragmentos de um estudo histórico-organizacional (On the status of the physical education subject in the sixties: fragments of an historical-organizational study). *Boletim SPEF*, *21/22*, 55−85.

Cohen, L., & Manion, L. (1990). *Métodos de Investigation Educativa* (Methods of Educational Research). Madrid: La Muralla.

Cortesão, M. (2010). *Clima Escolar, Participação Docente e Relação entre os Professores de Educação Física e a Comunidade Educativa (*School Environment, Teacher Participation and Relation between Physical Education Teachers and the Educational Community). Unpublished master thesis. University of Coimbra, Faculty of Psychology and Education Sciences.

Crespo, J. (1976). A formação de professores de Educação Física. Alguns dados históricos (Physical Education Teacher Training. Some historical data). *Ludens*, *1(1)*, 29−36.

Crespo, J. (1992). A Educação Física. A Reestruturação de uma identidade (Physical Education. Restructuring an identity). *Horizonte*, *48*, 217−222.

Ferrarotti, F. (1986). *Sociologia* (Sociology). Lisboa: Editorial Teorema.

Gomes, R. (1991). Poder e Saber sobre o Corpo – A Educação Física no Estado Novo (1936-1945) (Power and Knowledge about the Body - Physical Education during the »Estado Novo«). *Boletim SPEF*, *2/3*, 109−138.

Hendry, L. (1975). Survival in a marginal role: the professional identity of the physical education teacher. *British Journal of Sociology*, *26(4)*, 465−476.

Januário, C. (1995). Um conceito para a Educação Física (A concept for Physical Education). *Horizonte*, *66*, 203−207.

Krippendorf, K. (1980). *Content analysis*. London: Sage.

Martins, I. (2010). *Clima de Escola, Participação e Identidade- Um olhar sobre a disciplina e o professor de Educação Física. Dissertação de Mestrado* (School Environment, Participation and Identity - A glance at the physical education subject and teacher). Unpublished master thesis. University of Coimbra, Faculty of Psychology and Education Sciences.

Moreira, J., & Ferreira, A. (2011). The self-esteem of the teachers of Physical Education in Portugal. Online Proceedings European Society for the Systemic Innovation of Education,

Towards Systemic Innovation of Education. Leuven: ESSIE Annual Assembly, 55-59.

Pujadas Munoz, J. (1992). *El método biográfico: el uso de las histórias de vida en ciências sociales* (The biographical method: the use of life stories in social sciences). Madrid: CIS.

Rosário, A. (1996). *O Desporto em Portugal. Reflexo e Projecto de uma Cultura* (Sports in Portugal. Reflection and Project of a Culture). Lisboa: Instituto Piaget.

Silverman, D. (2000). *Doing Qualitative Research*. London: Sage.

Templin, T., & Schempp, P. (1990). The problematic nature of a career in a marginal subject. *Journal of Education for Teaching*, *16*, 3−28.

Vala, J. (1986). A análise de conteúdo (Methodology of Social Sciences). Content Analysis in A. Silva and J. Pinto (eds.), *Metodologia das Ciências Sociais*. Porto: Edições afrontamento.

Williams, E. (1981). The Physical Education Specialist – problem of definition. *Bulletin Physical Education*, 63(3).

Received: May 10, 2011
Accepted: Juny 7, 2011

Correspodence to:
António Gomes Ferreira, PhD
Rua do Colégio Novo
Apartado 6153
3001-802 Coimbra
Portugal
Phone: 00351 23 98 51 450
Fax: 00351 23 98 51 465
E-mail: antonio@fpce.uc.pt

PREDICTING THE FINAL TIME IN SLALOM BASED ON THE TIME OF THE FIRST AND SECOND RACE

Mihajlo Mijanović[1] **and Bojan Matković**[2]

[1]Faculty of Phisical Education and Sport, Banja Luka, Bosnia and Herzegovina
[2]Faculty of Kinesiology, Zagreb, Croatia

ORIGINAL SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.011M COBISS.BH-ID: 2100760 UDC: 796.926

SUMMARY

Prediction of final race time in slalom based on the time achieved in first and second race is a paper with a purpose and a primary goal to address the attention to relevant factors that determine final result in alpine skiing, and all that based on exact indicators gained under exact and strictly controlled rules of FIS. The mentioned example is about slalom discipline. Due to the fact that the result is a primary goal, the asked question is: Does the final result depend more on time achieved in first or in second race?

Precise and direct answer is given in the conclusion of the paper. The conclusion is formed on the basis of precise results gained in the World Cup race. The race took place in Zagreb, Sljeme, 2010. Gained results indicate a conclusion that a total time in slalom is in a high positive correlation with achieved time in first race. Multiple correlation coefficient and multiple determination coefficient of first and second race compared to total time is high and statistically significant in example $R = .67$, $R^2 = .45$, $p \leq .001$. Standardized predictive values of Beta in Table 7 give the right to conclude that achieved time in first race is more significant, or have more influence on the final result comparing to the time achieved in second race, in example $Beta_1 = .55$, and $Beta_2 = .40$. Assuming that general conditions of competitions are approximately same, the reasons of bigger influence of first than the second race should be looked for in tactics of coaches and competitors. The reasons for changing of tactics for the first and for the second race are determined by the FIS rules. Among other things, rules state that right for participating in second race have only first 30 participants from the first race. The natural conclusion is that the first race, or ride, is without any calculations and by principle "all or nothing". The tactic of second race is significantly different. The race must successfully end, even with risk of insignificant improve, or even failure. Of course, the weather can influence on better or worse result. In accordance with the law of possibility the influence of weather is evened, or annulled.

Key words: alpine skiing, slalom, prediction, correlation, discrimination.

INTRODUCTION

Alpine skiing is a sport that is a special event, pleasure and satisfaction of the audience and the general public. The moment of achieved victory or a good sport performance is a great satisfaction and pleasure for the competitors, parents, coaches, and coaching staff. Surely, that in any competitive sport, including skiing, sport performance highlights in the foreground. So the eternal question is: How to win and achieve a better sport performance? The coaches, parents and the other professional or partly professional persons related to alpine skiing are thinking in this way.

For these reasons, and especially including of professionalism in sport, more often there are various algorithms, equations and formulas specifications of success in sport (Bilić & Mijanović, 2008; Mijanović, 2004). No matter that it is at present impossible to achieve great success without the involvement of science, it remains to empirical science and a lot of unclear and inexplicable, or partially clear and explained: What are the reasons and the factors that impeccably determine sport performance? Surely it is unrealistic

to expect that someone will find a formula without error, how to get the exact sport's result, but it will be found by using empirical formula and science with a small error is quite obvious. One of the main reasons for the eternal mistake of predicting sports results is evidently present a virtual number of factors and the factors are being changed in time and space. Some formulas that were valuable ten years ago, or even less, are no longer valid, or they are, but under different circumstances, factors and coefficients of prediction are substantially changed. It is good in some way. Well, if it is not the case, sport and sport's resultes would turn to the scientific laboratory, the coaches would become trainers, sportsman would become guinea pigs, and chemists and laboratory technicians would write prescriptions how to get to sports results. It can be assumed how the athletes, coaches, parents, public and other entities would react on it.

Experiment usually goes ahead of science, experiment inspires the scientists, the study confirms and improves the Empire, gives her guidance regarding to improving of quantity and quality. The moment when that experiment i.e. the practice, does not confirm the formula, that moment, the formula stop to be valid.

The subject of this study is alpine skiing, slalom disciplines. The problem is the attempt of exact visualization of influence of achieved time in first and the second race on the final result. The aim of study is in logical causality with the problem and the subject, which was to measure the correlation and prediction ot the results of the first and second race with the final result.

Based on past experience, ie. empirical, the hypotheses could be that the results of the first and second race have a positive correlation and prediction of the final result in slalom. At the same time cannot be assumed that the intercorrelation and individual prediction of the first and second race time is at the same time total i.e. the final result.

Those who are directly in competition skiing, i.e. athletes and coaches, feel the problem rather curious that the final results of the slalom is more dependent on one or two races. This was an issue or problem has already been explicated as the primary goal of this paper.

For an accurate and scientifically acceptable answer to the above question racing in the slalom World Cup was used. For those who are less familiar with this it should be said that the World Cup is only for the best competitors from all over the world, regardless of ethnic belonging, as opposed to the Olympics and World Championships, where the best competitors do not take part, but the best in the country, or nation. For this reason the race for the World Cup are generally higher quality than racing at the World Championships and Olympics.

In this case it is about three variables related to the time achieved in the first race, second race and the final time is the sum of both achieved times. To notice, that is the case of a composite variable consisting of the sum of the results of two races. (Official Bulletin of Men's Slalom 06/01/2010, 2010)

The meaning that this is the biggest range of competition, implying that they meet the strictest criteria and valid proposition of FIS alpine skiing. So those are some precise and strict rules that must be met, i.e. by the organizer. It is known that even a small deviation from the established criteria, can postpone the competition, or if held, can be undone at the individual, or general level. The mentioned race was held and verified by the officials from the International Ski Federation FIS.

In order to better monitor the results basic features of track where the race was held should be emphasized.[1]

RESULT AND DISCUSION

Rules of the FIS include electronic and manual measurement of the maximum guarantee validity, reliability, discrimination and objectivity. At the gained results the error does not exist or if does, it is negligible.

After examining the basic statistics, the average in the first race was much better than the average in the second race (Table 1). It should be noted that the length of the course, attitude and number of gate was the same. If we looked at general conditions, i.e. quality of paths and trails or difficulty, it could be said that they have been even better in second race. A huge difference in the average time should be attributed to the competition rules. Eligible to take part in second race were only 30 first competitors from the first race. Also the standard deviation as a measure of variation is also significantly higher in the second race. On the basis of measures of dispersion and coefficient of normal distribution to be noted that after the second race two sub-groups were formed. A group of competitors who fought to retain the leadership position

[1] Place and time of the race held in Croatia, Zagreb-Sljeme, on February 2010. Start 982 meters, 762 meters target, altitude 220 m, the number of gates 68/67). The number of competitors in the first race was 75, and 30 other winners from the first race. Total number of athletes who have successfully completed both races was 27. Start of the first race was at 15.15. The second race starts at 18.30 hours. The quality of tracks and other facilities were in compliance with all FIS rules that apply to race in the World Cup.

of the existing loans and a group of those who found themselves in position for the first time has a place in the World Cup. Tactic of second group is significantly different from the tactic of the first group. Priority for competitors from second group is that they must successfully complete the race, that provides a place in the World Cup, and includes safe and slow driving.

TABLE 1
Descriptive statistics

Racing	*N*	*MIN*	*MAX*	*M*	*SD*
First race	27	53.91	55.98	55.1304	.52627
Second race	27	55.18	62.25	59.4052	1.46978
Total score	27	1:53.31	1:57.55	1:54.9067	1.11427
Valid N (listwise)	27	—	—	—	—

Legend: ***N*** – number of observed slalom participants; ***MIN*** – the best time (minimum value); ***MAX*** – the worst time (maximum value); ***M*** – mean; ***SD*** – standard deviation.

The results in Table 2 confirm the results from Table 1. As to be seen from the correlation matrix, correlation linear coefficient between the first and second race was -.030 which confirms this background statement on the large-present calculation and the different tactics. From statistical point of view the correlation is insignificant and very low, or zero. At the same time and the expected correlation between the first race, or final, score is quite high at .0539 which is certainly statistically significant at the level of error $p \leq .01$. Certain that second race should be associated with the final result, but the connection is as shown substantially lower than the first, in the case of correlation coefficient is .0383. The probability of error was $p \leq .05$.

TABLE 2
Correlation matrix

	First race	Second race	Total score
First race	1.000	-.030	**.539**[2]
Second race	-.030	1.000	**.383**[1]
Total score	**.539**[2]	**.383**[1]	1.000

[1] Correlation is significant at the .05 level (two-tailed)
[2] Correlation is significant at the .01 level (two-tailed)

Overall picture of the final results complement and confirm the results in Table 3. Kolmogorov-Smirnov test and related statistical indicators already seen in Table 1 unambiguously clear and precisely show that correlation asymptote and empirical function is very high at .968. Namelly it is the distribution that is consistent with normal or Laplas-Gauss function. This statement does not apply to the results achieved in the second race. Lack of normality in the distribution of total time variable was because of the result, or time from second race.

The difference of means between the first and second race is shown in Table 4. The difference over 4 seconds between the arithmetic mean is very high, not only with the Sport and competition standpoint, but also statisticaly. For comparison, the worst result placed person in the first race in the second race was 55.98 seconds, and the best score in the second run was 55.18 seconds. Among other indicators confirm the fact that the second race was "peaceful" so overall strategy was to be finished, or that placement must be achieved.

The results of regression analysis are shown in Tables: 5, 6, and 7. It is a multiple regression analysis where the criterion variable have been represented by the total time of the first and second race. Predictor of variables was the time of first and second race. Tables 5, and 6 show and confirm that the joint prediction of time of the first and second race was statistically significant with an error probability $p \leq .001$.

TABLE 3

One-Sample Kolmogorov-Smirnov Test

		Racing		
		First race	Second race	Total
N		27	27	27
Normal Parameters[a,b]	*M*	55.1304	59.4052	154.9067
	SD	.52627	1.46978	1.11427
Most Extreme Differences	Absolute	.095	.187	.177
	Positive	.063	.142	.177
	Negative	-.095	-.187	-.081
Kolmogorov-Smirnov Z		.493	.927	.922
Asymp. *p* (2-tailed)		.968	.301	.363
Exact *p* (2-tailed)		.949	.266	.324
Point Probability		.000	.000	.000

[a.] Test distribution is Normal.
[b.] Calculated from data.

Legend: ***N*** – number of observed slalom participants; ***M*** – mean; ***SD*** – standard deviation; ***p*** – statistical significance.

TABLE 4

T-test for dependent sample

Racing	*t*	*df*	*p* (2-tailed)	Mean Differneces	Lower	Upper
First	544.355	26	**.000**	55.13037	54.9222	55.3386
Second	210.017	26	**.000**	59.40519	58.8238	59.9866

Legend: ***t*** – *t*-value; ***df*** – degrees of freedom; ***p*** – statistical significance.

TABLE 5

General regression parameters

Model	R	R^2	R_c^2	Std. Error
1	.671[a]	.450	.404	.86017

[a.] Predictors: (Constant), first race, second race

Legend: ***R*** – multiple correlation coefficient; R^2 – determinantion coefficient; R_c^2 – corrected determination coefficient; ***Std. Error*** – standarda error of estimate;.

TABLE 6

Analysis of variance - ANOVA

	Model	Sum of Squares	*df*	Mean Square	*F*	*p*
1	Regression	14.524	2	7.262	9.815	**.001**[a]
	Residual	17.757	24	.740		
	Total	32.282	26			

[a.] Predictors: (Constant), first race, second race
[b.] Dependent Variable: total score

Legenda: ***df*** – degrees of freedom; ***F*** – *F*-ratio; ***p*** – statistical significance.

The results and times achieved in the first race have had larger and statistically significant prediction on total time as it already observed based on correlation matrix. Predictive value of non-standardized and standardized regression coefficients and their statistical significance is shown in Table 7.

TABLE 7
Standardized and non-standardized regression coefficients

	Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
		B	Std. Error	Beta		
1	(Constant)	72.599	19.139		3.793	**.001**
	First race	1.167	.321	.551	3.639	**.001**
	Second race	.303	.115	.399	2.535	**.015**

Legend: **B** – beta coefficient; ***t*** – *t*-value; ***p*** – statistical significance.

CONCLUSION

The obtained results indicate that the total time in slalom is in a positive and high correlation with those achieved in the first race. Achieved time during the second race is not correlated with the total time. The coefficients of multiple correlation and coefficient of multiple determination of first and second race with the time were quite high and statistically significant in this example: $R = .67$, $R^2 = .45$, $p \leq .001$. Individual standardized regression coefficients of Beta, or predictive value of time in the first and second run are high and statistically significant with a probability error of less than 1%.

Practice shows that the sports results cannot be viewed unilaterally, particularly cannot be predicted on the basis of the statistics no matter how appropriate and exact. The conclusion implies that a serious scientific generalization is possible, but with a certain possibility for error.

Surely, that the practice and experience in competitions are confirmation of received statistics, and statistics is the confirmation of practices and events on the ground. This paper stirs up the thinking and opens up a host of other important issues when it comes to competition in alpine skiing. It is known that two or three lap times are measured. The question is which lap time mostly affects the final result. Whether the predictive value of first and second race lap time is the same or similar? Finally, is it optimal to have two races in slalom, or is it sufficient just one, or whether it would be reasonable to make a third one, were top 15 based on the results of the first two races would be eligible to take part. Informal goal and the assumption is that this paper will be useful and interesting for primarily coaches and competitors who experience the best alpine skiing problems. Experienced coaches and athletes on the basis of empiri perceive the importance, influence and connections of first and second race with the final result and without statistics. Statistics cofirmes or rejects the validity of thinking of coaches, athletes and coaching staff. Statistical indicators, as they are, are obtained based on precise measurements and as such are not questionable. Different conclusions are possible because the coaches and athletes observe, see, comprehend and evaluate on their way not only statistics, but also achievements in skiing.

REFERENCES

Bilic, Ž., & Mijanovic, M. (2008). The influence of transit time to the total time in the slalom. *Acta Kinesologica*, *2(1)*, 52–56.

Mijanović, M. (2004). The structure of the relevant factors in alšine skiing. *Ski magazin*, *11*, 60–63.

Official Bulletin Men's Slalom 06/01/2010. (2010). Zagreb/Sljeme: Audi FIS Sky World Cup "Vip Snow Queen Trophy" 2010.

Received: May 12, 2011
Accepted: Jun 16, 2011

Correspodence to:
Mihajlo Mijanović, PhD
Faculty of Physical Education and Sport
Bul. Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina
Phone: 00387 65 86 25 75
E-mail: mihajlom@ac.me

EVALUATION OF ADAPTIVE PROCESSES OF KINEMATIC AND DYNAMIC PERFORMANCES OF RUNNING AT MAXIMUM SPEED IN TRAINING WITH ADDITIONAL INERTIAL LOAD APPLICATION

Zoran B. Pajić[1]

[1]Faculty of Sports and Physicial Education, Belgrade, Serbia

ORIGINAL SCIENTIFIC PAPER

DOI: 10.5550/sgia.110701.en.017P COBISS.BH-ID: 2101528 UDC: 796.422.015

SUMMARY

The subject of this study was to investigate the effects of additional inertial load in the training of maximum running speed. The objective of this research was to produce changes in kinematic and dynamic performances of maximum running speed in training with additional inertial loads application, as well as to determine the adaptive processes that were supposed to significantly influence the maximum running speed in the observed variables. An experiment with parallel groups was carried out during which the effect of experimental factors (inertial load) was on two levels. The first, control group (C), had no additional load. Second, experimental group (EA), ran with load attached to arms, and another group (EL), with load attached to legs. The research included initial and final measurements of variables in the phase of maximum speed (25m-50m). The change of kinematic variables recorded by non-contact telemetry measurement (two-dimensional system) of a cycle of strides during sprint step in the phase of maximum running speed was analyzed. The obtained results indicate that the applied experimental factor within the specific six week period caused statistically significant changes in experimental (EA) and (EL) groups. It is obvious that the different location of inertial load in experimental groups affected the changes in the observed variables differently, as well as that the applied additional load selectively affected the change in the observed variables. The results of this study open up new dilemmas such as the adequacy of the same load for both arms and legs, normalization of the absolute value of the load according to actual mass of each locomotive apparatus of athletes, the length of the experimental treatment, the quality of training periods in the experiment, inhomogeneity of the sample, as well as a criterion for the sample equaling according to the initial motor potential and the like.

Key Words: velocity of running, moment of inertia, moment of momentum.

INTRODUCTION

The application of external load of participants during maximum speed running has already been suggested as a potential method of training (Bosco, Rusco, & Hirvonen, 1986; Pajić, 2000; Ropret, Kukolj, Ugarković, Matavulj, & Jarić, 1998). Such a training of running at maximum speed with additional load should be effective in order to enable the conversion of the increased muscle strength into muscle power (Delecluse, Van Coppenolle, Willems, Leemputte, Diels, & Gories, 1995; Ropret et al., 1998). The efficiency of muscle contraction in cases of additional load application, i.e. the ability to overcome the additional resistance by muscle contraction, depends on many factors. These are, in addition to other, *higher muscle strength* (based on the number of activated motor units, warming up, muscle structure, present fatigue, etc.); *longer lever* arm action of muscles (more convenient than a short, but specified by anatomical characteristics and cannot be changed); *more convenient angle of muscle action on the lever* (any moving away from the right angle by its expansion or reduction, reduces the efficiency of muscle contraction due to fewer number of contacts and myofilament surface area contacts and the like); *smaller force (mass) of the additional load* which opposes the muscle contraction; shorter arm

through which the additional load force acts, *a less favorable angle of action of the additional load force* (further from approximately the most efficient angle of (900), thus reducing the efficiency of the additional load resistant force and facilitates muscle to overcome, i.e. control the additional load force). Previous statements can be condensed into the general rule that *everything that acts on the increase of the muscle contraction torque force and/or the reduction of resistance forces torque contributes to the muscle contraction efficiency,* i.e. the ability to overcome the additional load force (resistance) with smaller/lower strength. Different results have been obtained for the fact that the kinematic and dynamic variables of running at maximum speed change under the influence of additional load depending on its weight and location of its fixing, and they are probably the consequence of different methodologies applied in researches. The experiments that were carried out have implied the use of various load size, places of their fixing and running at different speeds. However, measurements while running at a moderate speed and on the treadmill were conducted in most studies, with the exception of some in which the change of kinematic variables in conditions of maximum speed and acceleration with the additional load was analyzed (Majdell & Alexander, 1991; Ropret et al., 1998). In some studies the results showed no change in stride length and frequency (Catlin & Dressendorfen, 1979; Cavanagh & Kram, 1989; Martin & Cavanagh, 1990). The results indicating increased frequency and reduced stride length were obtained in most papers (Cooke, McDonaght, Nevill, & Davies, 1991; Rusko & Bosco, 1987; etc.). The opposite results, when the frequency was reduced and stride length increased, have been reported in the researches (Martin, 1985; Stegman, 1981; Winter, 1983; etc.). The result when the increased arm load and leg load in particular caused a reduction in running speed, while the stride length remained unchanged and frequency reduced, was obtained (Ropret et al., 1998). Majdell and Alexander (1991) verified the change of the kinematics of 40 m running at a maximum speed, under the influence of training with the additional load. Six-week training with the additional load (10 pounds, 4.5 kg) was applied in the experiment. The treatment influenced the maximum speed of running to be statistically significantly increased (from 5.16 m/s^{-1} to 5:26), to shorten the contact phase (from 0.13 to 0.11sec), to statistically significantly reduce the upper leg angle of the take off leg in a moment of take-off (from 4.27 to 4.12 degrees), as well as and to increase the maximum angle of the lower leg flexion (from 2.62 to 3.28 degrees). The variables stride frequency and stride length significantly correlate with the morphological characteristics, and the additional load affects the decline of their relationship with morphological characteristics (Pajić, Preljević, & Kostovski, 2010). It is not completely clear whether the experimental factor caused the loss of correlation relationships, or the reason for that was inhomogeneity of the sample (morphological and/or motor mismatch) or both.

The objective of this research was to analyze the effects of additional inertial load in the training process on the maximum running speed. The applied experimental factor should cause changes in kinematic and dynamic performances of maximum running speed in order to determine the adaptive processes in the observed variables. Such a training of running at maximum speed with the additional load should be effective to facilitate the conversion of increased muscle strength into muscle power. (Delecluse et al., 1995; Ropret et al., 1998).

Thus, the goal of this study was, after their identification, to evaluate the adaptive processes that result from training with additional inertial load application in kinematic and dynamic performances of maximum speed running, which is assumed to significantly affect the maximum running speed.

METHODS

Sample of participants

The sample of participants in this study consisted of students of Faculty of Sport and Physical Education in Belgrade. From the current popula-tion a sample of students was defined (n = 21), aged 20.8 ± 1.8. Due to the initial sprint time the participants were classified into three groups depending on the running speed. The groups were formed in attempt to make on equal abilities distribution among them.

Measurement conditions and variables (Instruments)

The system of three pairs of solar cells was applied for *time parameters* measurement – measurement system (Brower timing system).

The following variables were measured:

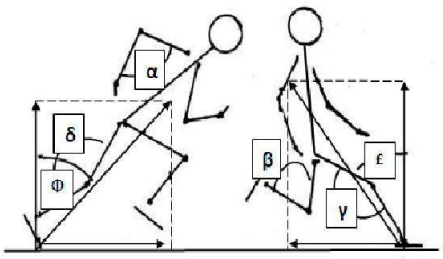
Variables	Sign	Meas. Unit
Running speed in the maximum speed phase	VR	m/s
The average stride length in the maximum speed phase	SL	m
Stride frequency in the maximum speed phase	SF	Hz

For the *number of strides* (NS) measurement, the system of three video cameras was used, one of which recorded the distance of 25-50m in order to determine the number of strides between the first and the last contact, while the first and the last contact were identified by the other two cameras. *The average stride length* (SL) was calculated by dividing the distance between the first and the last foot contact with a number of strides. *Stride frequency* (SF) was calculated by dividing the speed of running with the length of strides. Based on the time for which the distance was run, *the maximum speed of running* was calculated (VR). For kinematic parameters measurement Mac Reflex 3.2 Measurement System Software with the Macintosh version 3.0 (for 2D and 3D system) was applied. The measurement procedure with this system provides a non-contact (telemetric) movement measurement. The basic principle of the system is recording the position of a number of well-defined points in space. The measured points are marked with reflective markers, and their movements are registered by a special video camera.

Variables	Sign	Meas. Unit
Angle in the knee joint centre at take-off time	AKTT	°
Angle in the knee joint centre at the time of contact	AKTC	°
Angle of maximum flexion of the lower leg during the back swing	AMFL	°
Angle of maximum flexion of the forearm during the back swing	AMFA	°

The kinematic variables measured on the track in conditions of maximum running speed (Figure 1):

FIGURE 1
Kinematick variables



Legend: **(δ)** - angle in the knee joint center at take-off time (AKTT); **(α)** - angle of maximum flexion of the forearm during the back swing (AMFA); **(β)** angle of maximum flexion of the lower leg during the back swing (AMFL); **(γ)** - angle in the knee joint center at the time of contact (AKTC); **(Φ)** - critical angle of the body at take-off time; **(£)** - critical angle of the body at the time of contact.

Based on the previous measurements and software data acquisition with the applied software Mac Reflex 3D.V.3.1B2 and Microsoft Excel software adaptable, the values for variables (AKTT, AMFL, AMFA and AKTC) were determined.

The experiment protocol

The experiment with parallel groups was carried out during which the effect of the experimental factor (inertial load) was on two levels. The first control group (C) realized the sprint training without additional load application. The second experimental group (EA) ran with the additional load attached to the arms. The third experimental group (EL) ran with the additional load attached to the legs.

Experimental factor

In order to increase the moment of the arms and legs inertia in the training procedure the addi-tional load was applied in the form of bands with plates, fixed to the ankle and wrist. In line with previous researches and results (Catlin & Dressendorfen, 1979; Cavanagh & Kram, 1989; Martin, 1985; Ropret et al., 1998; Stegemann, 1981) a load of 1.8kg was applied, for which it was calculated that it changed the average torque inertia for about 50%.

Testing procedure

The research included initial and final measurements of all variables. Both measurements were realized in two days, the initial measurement (pretest) one day prior to the beginning of training procedures application, and the final one two days after the end of the training procedure. The measurement of dynamic and kinematic variables was realized in running at maximum speed on the track from the 25th to 50th meter. Each participant ran two times, and for the final processing, the better result was used. Measuring devices (photocells - Brower Timing System) were set at the start, to register the stand position start (0.5m), at 25m and at the end of 50m. The values were measured with an accuracy of .01s.

Training procedures

Every athlete warmed up before the active speed training. Warm-up consisted of a number of sprint exercise (dog run, high lift your knees, scooping up, skip-semi-skip running etc.), and stretching all the muscles involved in sprinting. They then performed a series of acceleration and change of pace running. After this warm-up the respondents were marshaled into their respective groups to carry out specific procedures for trainers. During the six week training the exercise was performed three times a week; it was progressively more difficult, because the volume of work increased after every two weeks. In the first two weeks, each subject was performing a series of five repetitions of his specific training regime. During the third and fourth week of training the load is increased to two sets of five repetitions of their specific training. Last two weeks, the intensity was increased to three sets of five repetitions for each group. One series consisted of five repetitions, and ran a top speed of 50 meters from semi-high start with 2-3 minutes rest between each run, with 8-10 minutes recovery between each set.

Training method

- First, the control group (C) included a run at maximum speed at 50m, from semi-high start, with a 2-3min. recovery between reps and 8-10min. rest between sets.
- Second, the experimental group (EA), included the same training program that the control group implements, with the provision that the two hands bore the additional load.
- Third, the experimental group (EL), included the same training program that the control group implements, with both feet carrying an additional burden.

Acquisition of experimental results

Out of the descriptive statistical indicators, the measures of central tendency (arithmetic mean – M) as well as measures of dispersion (standard deviation - SD) were applied. Out of the qualitative methods of statistical analysis, the *t*-test for dependent samples was applied. The level of significance ($p < .05$) was applied to determine the significance of differences between pretest and post test for each group. Statistical analysis was performed in the statistical program SPSS 16.

RESULTS AND DISCUSION

The results of the descriptive statistics for all three groups at the initial and the final measurement are displayed in Table 1.

The results of *t*-test for dependent samples at the initial and the final measurement are shown in the Table 2.

From the shown results it can be concluded that the applied training procedure in the maximum speed phase did not cause significant changes in the running speed (RS) in either group. The comparison of results from the initial and final measurements showed that there were no statistically significant changes in the observed variables in the control group (C).

From the above it is evident that the participants of the group (EL) reduced the running speed, but not within the range of statistical significance. Similar to these findings, (Ropret et al., 1998) stated that the effect of leg load on speed was statistically significant in both sprint stages (speed decline of 7.8% and 12.8%). The reasons for speed decline in the experimental group (EL) might be found in the assumption that the applied load caused a technique and movement coordination disruption respectively, i.e. an inadequate adaptation of the nervous system in movement control. Another reason could be a deficit in the speed (reactive) force that is needed in the new modified conditions of overcoming the gravitational forces, ground reaction force and the lower extremities inertia. Shortening of the contact phase, one of the key factors in increasing the running speed is largely the ability to express force for the shortest possible time (*F-t*), greater exhibited force and displacement to the right (*F-v*) relationship. If in such a study a significant shift (*F-v*) curve to the right was determined, it would clearly demonstrate that exercise with additional load modified the mechanical work of leg muscles in ex-

perimental group athletes, i.e. it increased the speed (reactive) power. In the experimental groups there are statistically significant differences in variables for the average stride length (SL) as follows – on average the participants had a lower score on the initial measurement (EA - $p < .022$) and (EL - $p < .003$) and the stride frequency variable (SF) – the participants on average had higher scores on the initial measurement (EA - $p < .002$) and (EL - $p < .000$). Therefore, there was an extension of strides and the reduction of their frequency.

TABLE 1

Descriptive statistics at the initial and the final measurement for the control group (C), experimental (EA) and experimental (EL) groups.

Variables	Measurement	Control (C)		Experimental (EA)		Experimental (EL)	
		M	*SD*	*M*	*SD*	*M*	*SD*
VR	final	8.11	.45	8.45	.27	8.29	.30
	initial	8.10	.35	8.45	.35	8.33	.37
SL	final	2.01	.12	2.16	.14	1.98	.23
	initial	1.96	.20	2.08	.14	1.88	.24
SF	final	4.02	.20	3.92	.24	4.22	.46
	initial	4.19	.27	4.07	.29	4.47	.47
AKTT	final	160.83	4.66	166.16	1.16	161.00	1.41
	initial	160.66	4.63	160.33	1.03	162.66	1.03
AKTC	final	158.33	3.50	164.00	2.09	155.33	1.75
	initial	156.83	4.87	157.00	2.28	159.00	1.09
AMFL	final	38.83	2.85	43.00	3.63	45.66	3.72
	initial	39.66	2.33	42.16	4.87	42.50	4.08
AMFA	final	104.83	3.48	97.50	3.78	113.16	4.21
	initial	106.33	3.72	106.33	4.50	106.00	6.09

Legend: **VR** - running speed in the maximum speed phase; **SL** - the average stride length in the maximum speed phase; **SF** - stride frequency in the maximum speed phase; **AKTT** - angle in the knee joint center at take-off time; **AMFA** - angle of maximum flexion of the forearm during the back swing; **AMFL** - angle of maximum flexion of the lower leg during the back swing; **AKTC** - angle in the knee joint center at the time of contact.

When wearing the additional load, the moment of inertia is increased, resulting in a lower frequency of the leg which acts as a pendulum (Stegman, 1981). This increases swing length phase, while the reduced speed of leg during swing can be a limiting factor to a further running speed increase (Bobbert, Mackay, Schinkelshoek, & Huijing, 1986; Martin, 1985). Thus, under the assumption that motion speed is unchanged, stride frequency reduction is followed by stride length increase. In accordance with the results of this study on stride length, there were also findings in which the increase in stride length was observed when the effect of adding 2 kg on each foot during walking was taken into account (Inman, Ralston, & Todd, 1981). Russsel and Belding (1964) reported that the stride frequency is inversely proportional to the weight of footwear worn during walking at speed of 3.5 miles/h. It is evident that the arms load caused smaller decrease in stride frequency rather than the *legs load*, although the decline in stride frequency was statistically significant in both groups. The same results that the stride frequency decreased less in the group (EA) in both phases (1.6% and 1.5%) were reported by Ropret et al. (1998). The explanation for this could be the fact that *the arm adjustments to the changed conditions* of moment of inertia, and therefore the gravitational forces, are *much higher compared to the legs*. They happen because of the tendency to maintain the movement intensity, so there is a reduction in the upper arm-forearm angle, to eliminate the forces acting on the longer arm, i.e. torque reduction, which causes the frequency increase. The increased arm frequency opposed to legs cause the increased level of neural activity (reciprocal inhibition) and thus positively influences the leg kinematics. Bearing in mind that the amplitude reduction of the swing is more possible in

the elbow than in the knee and hip joint (Majdell & Alexander, 1991), it can be assumed that such adaptive processes, as a result of the arm load, may influence the change in leg kinematics. These claims can be linked to the findings (Cook et al., 1991) that the additional load of 5% of the total body mass, *worn as a belt on the trunk*, is much higher than in this study, *caused an increase stride frequency*. It may be concluded that the higher load caused an increased nerve pulsing to the periphery, in order to maintain the movement intensity, resulted in stride reduction, thereby increasing the stride frequency. The adaptation of the body in mentioned circumstances is of *neurogenic and myogenic nature* (Bosco, Zanon, Rusko, Dalmonte, Bellotti, Latteri et al., 1984; Milner-Brown et al., 1975; Moritan & De Vries, 1979; Thornton & Rummel, 1974; according to Bosco et al., 1986;[1] Russo & Bosco, 1987) and it is carried out by a relatively quick adaptation of neural factors by increasing the number of recruited motor units, the increased level of discharge and their better mutual work synchronization. However, the second phase (of myogenic adaptation), is characterized by the increase of their glycolytic potential and lasts for several months (McDonagh & Davies, 1984; according to Bosco et al., 1984), which justly points to the need of a special study of experimental treatment duration and possibly leads to doubt regarding the length of the treatment applied in this study given the different plasticity of some tested variables.

[1]First three papers were cited in the article Bosco et al, 1986, and that is why they are not in the list of references

TABLE 2

Descriptive statistics at the initial and the final measurement for the control group (C), experimental (EA) and experimental (EL) groups.

Variables	Control (C)			Experimental (EA)			Experimental (EL)		
	t	*df*	*Sig.* (2-tailed)	*t*	*df*	*Sig.* (2-tailed)	*t*	*df*	*Sig.* (2-tailed)
VR	-.874	5	.422	-.015	5	.988	-.626	5	.559
SL	1.270	5	.260	3.272	5	**.022**	5.423	5	**.003**
SF	-1.572	5	.177	-5.890	5	**.002**	-7.998	5	**.000**
AKTT	.415	5	.695	10.750	5	**.000**	-2.712	5	**.042**
AKTC	1.307	5	.248	8.573	5	**.000**	-8.696	5	**.000**
AMFL	-1.746	5	.141	1.185	5	.289	10.304	5	**.000**
AMFA	-2.423	5	.060	-22.007	5	**.000**	3.909	5	**.011**

Legend: **VR** - running speed in the maximum speed phase; **SL** - the average stride length in the maximum speed phase; **SF** - stride frequency in the maximum speed phase; **AKTT** - angle in the knee joint center at take-off time; **AMFA** - angle of maximum flexion of the forearm during the back swing; **AMFL** - angle of maximum flexion of the lower leg during the back swing; **AKTC** - angle in the knee joint center at the time of contact.

The results of this study indicate that the experimental factor significantly influenced the changes in elbow and knee joint angles while realizing the maximum running speed, and thus its efficiency, given the importance of these variables for success at maximum speed running. It is obvious that the different location of inertial load in experimental groups affected the changes in the observed variables differently, as well as that the applied additional load selectively affected the change in the observed variables. The applied training procedures in the phase of maximum speed in the experimental groups (EA) and (EL) caused a statistically significant change of the knee joint centre angle at the time of take-off variable (AKTT) – in average, the participants in the initial measurement had lower scores (EA - $p < .000$) and higher scores (EL - $p < .042$). For higher running speed realization it is important to regulate the critical angle of body inclination, minimizing the vertical centre of body displacement and neutralization of the negative impact of ground reaction force components. The obtained results indicate that the increase in angle (EA) had a positive impact, while the reduction in (EL) negatively affected the running speed. Group (EA) at the moment of take-off had a higher knee joint angle at the time of take-off (AKTT) i.e. higher critical body angle. By this a stronger stretching at the time of take-off was achieved, which re-

sulted in a more positive impact of horizontal component of the ground reaction force on the speed of running in the ventral direction.

The applied training procedure of the experimental groups (EA) and (EL) caused a statistically significant change in the variable the centre of the knee joint angle at the time of contact (AKTC) – the participants on average had a lower score in (EA) - $p < .000$) and higher score in the initial (EL) - $p < .000$). The results indicate that the increase in angle in (EA) had a positive impact, while the reduction in (EL) negatively affected the running speed. So, there was an increase in knee flexion, which negatively affects the maximum running speed. In order to achieve a higher running speed at the time of contact with the ground a lower critical angle of the body on contact, or greater angle in the knee during contact (AKTC) are required i.e. lower flection, because it reduces the negative impact of the horizontal component of ground force reaction on the running speed in dorsal direction.

From the aforementioned results it is noted that the participants in the experimental group (EL) increased the average angle of maximum flexion of the lower leg during the last swing (AMFL) within the statistical significance – the participants on average had a lower score on the initial (EL - $p < .000$). This change has a negative effect on running speed since the moment of leg inertia is increased; the angular velocity and thus leg frequency are both reduced. The maximum forearm angle flexion during the back swing (AMFA) changed significantly – the participants on average had higher scores in the initial measurement (EA - $p < .000$) and lower scores (EL - $p < .011$). The monitoring of arm kinematics during running with the additional load would make it possible to prove the assumption that the above changes are the result of adjustments in the mechanics of arm movements, since the participants performed the elbow joint flexion by which the moment of inertia is reduced, and thus the overall impact of the additional load. Since the smaller angle reduces the hand inertia moment, therefore its higher speed and shorter duration of arm swing are achieved.

This results in frequency increase of the body segments movements, i.e. the positive influence of the higher running speed. The explanation for this could be the fact that *the arm adjustment to the changing conditions of moment of inertia is much higher compared to legs*. They happen, as it has already been explained, because of the tendency to maintain the intensity of movement, which leads to reduction of the upper arm-forearm angle, in order to eliminate the forces acting on the longer arm, i.e. to reduce the torque, which causes an increase in frequency.

For the evaluation of the obtained results of (AMFL and AMFA) variables the following facts may serve. Human movements are not made by individual segments, but by kinetic chains that comprise larger number of joints, among which there has to be good coordination. It helps developing a force against the external load, the accuracy of the movement, which is especially important; it ensures that the ends of the kinetic chains develop much faster than those achieved by a single segment. This movement coordination results in more speed concordance of adjacent joints of the kinetic chain in the same direction for high speed of a certain segment of kinetic chain. When running at maximum speed, the arm speed is the result of the sum of upper arm, forearm and the hand speeds. Thus, as the result of time coordination achieved in the joints of long half-kinetic chains, the maximum speed of skeletal muscles shortening (which is less than 1 m/s), transforms into a higher distal segment speed (hand speed during swing is about 15 m/s, and foot speed of the swing leg is over 20 m/s). At sprint running, it is the chain of the foot resting on the ground, through the pelvis, to the feet of swing leg, while in the second case from the same foot, over the trunk and arms, to the hand. At these activities the open successive schemes are realized because the movement is transferred from a closed to an open end of the kinetic chain. A sprinter cannot change the mass of his kinetic chains and segments, but can affect the momentum of quantity of his motion (the product of moment of inertia and angular velocity changes). This is achieved in a way that by the rotational motion in the shoulder, hip and ankle the change of moment of inertia of his kinetic chains happens. So, at the same angular momentum, by reducing the moment of inertia of the kinetic chain, or of an active body segment, its angular velocity can be increased or by increasing the moment of these segments inertia the radial velocity can be reduced. So, by changing the moment of segments inertia, a sprinter controls its angular velocity. A leg and/or an arm rotate around the frontal axis in the swing phase, which passes through the centre of the hip or shoulder. In order to make this movement for the shortest possible time the respondents acted with the maximum moment of force of the current muscles. Since this moment of muscle action is limited, *the respondent reduces moment of segments inertia. By knee (AMFL) or elbow flexion (AMFA) he approaches the centres of gravity of the lower leg and foot to the axis of rotation, i.e. hip joint, or the centres of gravity of forearms and*

hands to shoulder joint. Thus the moment of inertia of the kinetic chains is reduced by about two times, according to *Newton's second law* (the total moment of force acting on a body fixed to the axis around which can rotate, is equal to the product of its moment of inertia and its angular acceleration), angular acceleration of the swing leg or arm is increased for the same amount. By this their higher speed and shorter duration of the swing phase are achieved. This results in increasing the frequency of the body segments movements and higher running speed.

It is interesting that, despite the foregoing, the experimental group (EL) significantly increased the maximum knee flexion angle (AMFL). It could be expected that the respondents would adapt to the changed inertia conditions and make adequate knee flexion and reduce the angle. But this did not happen. According to Newton's first law, objects stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force. Every body resists the action of an external force by its own inertia proportionally to its own weight (body which changes its motion under the force of another body, due to inertia affects another body by force of inertia). Thus, the swing leg exerts a force of inertia to other segments of the body in the opposite direction of its motion (acceleration). Hence, this force is directly dependent on the mass segment and the size of its acceleration. In this experiment, the segment mass is increased by the additional load, which caused the increase of the inertia forces with all the subsequent consequences. Inertia forces in sprint running during the continuous leg swings act constantly, *causing a larger quantity of muscle work to be spent on overcoming this force than all the others* (work against gravitational force, air resistance, ground friction force, and the like). So, the reason for the increase in the maximum knee flexion angle (AMFL) could be the assumption that for the newly altered inertial conditions there were no adequate changes in the power and strength or that training period in the experiment did not provide enough time for proper motor adaptation in the mentioned variables of force and power. It is possible that the reason for an inadequate adaptation may be sample motor inhomogeneity (in the power and strength), given that the sample is balanced solely by the results in sprint at the required distance. Thus, perhaps, excessive heterogeneity of individual results affected negatively the overall variance (the dispersion of results). It is possible that, by adding the above factors, the conditions which determine the speed decrease in this experimental group were created.

However, an especially interesting finding is that in the group (EL) there was a significant increase in the elbow joint angle (AMFA) even though the hand was not additionally loaded. It could be expected that the respondents would adapt to the changed inertia conditions and make adequate elbow joint flexion and reduce the angle and the moment of inertia. This finding could be evaluated by the following facts. According to *Steiner's theorem* (mr^2), the moment of inertia of the current segment or any of the kinetic chains, equals the sum of *its own* (equal to the moment of inertia which a segment would have if the axis of rotation moved into its centre of gravity) and *positional* (equal to the product of mass segments or the whole kinetic chain and the square of the distance of its centre of gravity from the axis of rotation) moment of inertia. The more the segment is moved away from the axis of its rotation, the greater its moment of inertia is. This means that during moving the segment from the axis of rotation, its own moment of inertia does not change, but the positional increases by the square of this distance. Since there was a statistically significant increase in knee angle (AMFL), there was an increase in positional moment i.e. the increase of force of inertia of a given segment. The swing leg exerts a force of inertia to other segments of the body in the opposite direction of its acceleration. Thus, when running at maximum speed, there is a constant acceleration and deceleration of segments (kinetic chain of limbs), especially of their open ends – hands and feet, during which great forces of inertia of the additional loads must be compensated by muscle forces. *Synchronized movement of contralateral limbs* is one of the main characteristics of fundamental motions, and the ipsilateral limbs are always in the opposite movement phase. Therefore the opposite movement is always done in the hip joint and shoulder of the same side of the body in the sagittal plane (ventrally - dorsal). This synchronization of movements of the upper and lower limbs affects the hip to follow the movements of legs in ventral and dorsal direction (leading to pelvis rotation in the transverse plane), and makes the shoulder joint follow the movement of arms. The consequence of this is that the pelvis and shoulder axis in the transverse plane always rotate in opposite directions. Since, in the ventral direction, the hip of the leg in the swing phase and the shoulder joint of contralateral hand move at the same time, it implies that the rotation of the spine is always in the direction of the swing leg. This could lead to the conclusion that *the increase in positional moment of arm inertia is an attempt to compensate for the increased inertia forces of a leg moving in the opposite direction*. There-

fore it could affect a better synchronization of contralateral segments' movements, with the purpose of more stable overall movement of the lever system of the entire body.

CONCLUSION

The obtained results indicate that the applied experimental factor within the specific six week period caused statistically significant changes in experimental (EA) and (EL) groups. The obtained results indicate that the applied experimental factor in the specific six week period caused statistically significant changes in experimental (EA) and (EL) groups. The applied load significantly influenced the kinematic variables which influence on the factors that favour and those that interfere with the efficiency of performance of maximal running speed is obvious (angular momentum, moment of inertia, ground reaction forces, gravitational forces, monoarticular and biarticular muscle action, matching movements, activities of the kinetic chain). We can assume that the variables (AKTT, AKTC, AMFL and AMFA) are predictable for the maximum running speed and that there is their significant connection with running at maximum speed.

The results of this study face a new dilemma. It is not clear whether the same load for arms and legs is adequate, since the arm adjustment to the changed conditions of moment of inertia and therefore the gravitational forces is much higher compared to the leg adjustment, as well as whether different time is needed for full adaptation of both arms and legs. In this research an attempt to increase the momentum by changing the inertia conditions is significant. The introduction of the absolute value of the load, without calculating the actual mass of each locomotive apparatus individually, raises doubts because the moment of inertia increases by mr^2, i.e. the value of the applied load is squared, even if it is only one gram. The results of this study reasonably indicate the need for special study of experimental treatment duration and eventually doubt the length of the applied treatment in this study, given the different plasticity of some tested variables. So, there were no adequate changes in the power and strength or the training period in the experiment did not provide enough time for proper motor adaptation in the mentioned variables of force and power. It is possible that the reason for an inadequate adaptation can be motor (in the power and strength) sample inhomogeneity, given that the sample is balanced solely by the results in a sprint at the required distance. It can be assumed that, together with the prolonged duration of training factor influence, there would be a correction in speed power expression, and consequently an easier correction of altered inertial conditions for loaded body segments, and thus the relative increase of movement frequency. This would probably increase the running speed. Given the finding that it is not clear whether the experimental factor caused the loss of correlation links between the dynamic variables and morphological characteristics (Pajić et al., 2010), or the reason for it is inhomogeneity of the sample (morphological and/or motor mismatch) or both, it may be interesting to examine the predictability and the impact of morphological characteristics in training with the additional load application.

REFERENCES

Bobbert, M. Y., Mackay, M., Schinkelshoek, D., & Huiijing, P. A. (1986). Biomechanical analysis of drop and countermovement jumps. *Eur. J. Appl. Physiol.*, *54*, 566−573.

Bosco, C., Zanon, S., Rusko, H., Dalmonte, A., Bellotti, P., Latteri, F., et al (1984). The influence of extra load on mechanical behavior of skeletal muscle. *Eur. J. Appl. Physiol.*, *53*, 149−154.

Bosco, C., Rusko, H., & Hirvonen, J. (1986). The effects of extra - load conditioning on muscle performance in athletes. *Med. Sci. Sports Exerc.*, *18(4)*, 415−419.

Catlin, M. J., & Dressendrfer, R. H. (1979). Effects of shoe weight on the energy of running. *Med. Sci. Sports*, *11*, 80.

Cavanagh, P. R., & Kram, R. (1989). Stride length in distance running: velocity, body dimensons, and added mass effects. *Med. Sci. Sport Exerc*, *21(4)*, 467−479.

Cooke, C. B., McDonagh, M. J. N., Nevill, A. M., & Davies, T. C. M. (1991). Effects of load on oxygen intake in trained boys and men during treadmill running. *J. Appl. Physiol.*, *71(4)*, 1237−1244.

Delecluse, C., Van Coppenolle, H., Willems, E., Leemputte, M., Diels, R., & Goris, M. (1995). Influence of high-resistance and high-velocity training on sprint performance. *Med Sci Sport Exerc*, *27*, 1203−1209.

Inman, V. T., Ralston, H. J., & Todd, B. (1981). *Human walking*. Baltimore: Williams and Wilkins,.

Majdell, R., & Alexander, M. J. (1991). The effect of overspeed training on kinematic variables in sprinting. *J. Human Mov. Studies.*, *21*, 19−39.

Martin, P. E. (1985). Mechanical and physiological responses to lower extremity loading during running. *Med. Sci. Sports Exerc.*, *17(4)*, 427−433.

Martin, P. E., & Cavanagh, P. R. (1990). Segmental interactions within the swing leg during unlosded and loaded running. *J. Biomechanics*, *23(6)*, 529−536.

Pajić, Z. (2000). The influence on inertial load on adaption processes during running at various speeds. *Fizička kultura*, *54(1/4)*, 46−55.

Pajić, Z., Preljević, A., & Kostovski, Z. (2010). Effects of the application of inertial loads on the morphological performances in the stage of running development at maximaum speed. *International Scientific Journal of Kinesiology*, *7(2)*, 47−53.

Ropret, R., Kukolj, M., Ugarković, D., Matavulj, D., & Jarić, S. (1998). Effects of arm and leg loading on sprint performance. *Eur J Appl Physiol.*, *77*, 547−550.

Rusko, H., & Bosco, C. (1987). Metabolic response of endurance athletes to training with added load. *Eur. J. Appl. Physiol.*, *56*, 412−418.

Russell, H. D., & Belding, H. S. (1964). *Metabolic cost of wearing various types of footwear. National Academy of Sciences Committee on Quartermaster Problems Report*. Cambridge, MA; Harward Fatique Laboratory.

Stegman, J. (1981). *Exercise physiology: Physical bases of work and sport. J.S. Skinner (Trans. and Ed.)*. Chicago: Year book medical publishers.

Winter, D. A. (1983). Biomechanical motor patterns in normal walking. *J. Mot. Behav.*, *15*, 302−330.

Received: February 6, 2011
Accepted: April 26, 2011

Correspondence to:
Zoran Pajić, PhD
Faculty of Sports and Physical Education
Blagoja Parovića 156
11030 Belgrade
Serbia
Phone: 00381 63 23 49 15
E-mail: zoran.pajic@dif.bg.ac.rs

DIFFERENCES IN THE ANTHROPOLOGICAL PROFILE OF THE BASKETBALL REFEREES WITH REGARDS TO THEIR CHRONOLOGICAL AGE

Tomislav Rupčić[1], **Bojan Matković**[1], **Damir Knjaz**[1], **Saša Baščevan**[2], **and Saša Rodić**[3]

[1]Faculty of Kinesiology, Zagreb, Croatia
[2]Polyclinic "Petand", Zagreb, Croatia
[3]High School Jastrebarsko, Zagreb, Croatia

ORIGINAL SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.027R COBISS.BH-ID: 2102040 UDC: 796.323.072.4

SUMMARY

The aim of our research was to determine differences in the anthropological profile of best Croatian basketball referees with regard to their chronological age. The study included 31 referees from the A referee list in the competitive season 2008/2009. In order to determine the statistical differences they were divided into two age groups; young (n = 16) including referees age 26-32 and older group (n = 15) including referees aged 33-46. Participants were tested on different variables for the assessment of motor and functional abilities and morphological characteristics. Also, in this research were included two variables called Quality of officiating and Experience. Data analysis was performed using the software package STATISTICA for Windows, 8th version. For each variable basic descriptive statistical parameter was calculated. Analysis of statistical differences in the anthropological profile with regard to the chronological age of basketball referees was performed using t-test for independent samples. According to our results basketball referees differ only in the variables for the assessment of motor abilities, while there were no statistically significant differences in the tested morphological characteristics and functional abilities regarding referees' age. To conclude, investigated basketball referees were all well physically prepared, meeting high standards of physical conditioning-motor preparation needed for the basketball games of the highest national level.

Key Words: basketball, referees, chronological age, anthropological profile, experience.

INTRODUCTION

Basketball is a very complex and dynamic sporting activity characterized by rapid and frequent changes of offensive and defensive actions. Generally, basketball falls into a group of complex sports that are composed of simple and complex motion in terms of cooperation between teammates during the game. Modern basketball is characterized by high intensity activity during all forty minutes of the game, which requires a players' excellent fitness – motor preparation (Matković & Matković, 2010).

As well as players, basketball referees are also an integral part of basketball, and their role in the final outcome is very important, sometimes even crucial. Especially, having in mind the statistics that show how 90% of basketball games on any competing level end with one to three points more or less in favor of one or the other team.

Quality fitness – motor preparation of the referees allows them better tracking of players dynamic movement during the game, which results in better quality of officiating and positively reflects on regularity of basketball competitions, which in the end affects on positive development of basketball as a sports game.

METHODS

Sample of respondents

The sample of respondents consisted of 31 basketball referees from the A referee list for the season 2008/2009. The list of referees was determined by The Croatian Basketball Referees Association, and is compiled every year according to officiating performance of the referees in the previous season.

For the purpose of determining differences in anthropological profile of basketball referees according to their chronological age, the sample of respon-

dents was combined into two subsamples. One subsample (*Young*; $n = 16$) was combined of the referees aged 26 to 32 years (29.62 ± 1.85 years), and the other (*Older*; $n = 15$) included referees from 33 to 46 years of age (37.33 ± 4.56 years).

Variable sample

Variable sample was composed of morphological characteristics, tests for evaluating motor and functional abilities and two variables called Quality of officiating and Experience. Measured morphological characteristics were: height, body mass and fat percentage (bioelectric impedance) and body mass index was also calculated. Motor tests – eight with bending (MAGOSM), 4x5 meters (MAG4x5), side steps (MAGKUS), and 93639 with a turn (MAG9OK), were used to estimate agility, while a test – 20 meter run with lap time at 5 and 10 meters (MES20M, MESP05 i MESP10), was used to estimate explosive power sprint type. All motor tests used in the research are well known and have quality metric characteristics (Jukić, Vučetić, Aračić, Bok, Dizdar, Sporiš et al., 2008; Metikoš, Prot, Horvat, Kuleš, & Hoffman, 1982). With the use of maximal ergometry test on the treadmill, maximum oxygen intake was measured and ventilatory threshold was determined. Measuring instruments (Cosmed - Quark b² "breath by breath" spiroegometer, a Technogym - Runrace Competition HC1200 treadmill and a telemetry heart rate monitor - Polar Electro OY CE 0537) that were used, provide direct, "on-line" monitoring and the analysis of ventilation metabolic parameters, while the high reliability of measured data is increased by the constant microclimatic conditions in the lab.

First variable – *quality of officiating* – tells us about successful officiating of a certain referee in the previous season. It makes a grade point average obtained by controllers of officiating during basketball games. Second variable – *experience* – tells us about the number of competitive seasons which a certain referee has officiated in the highest national ranking competition.

Data processing methods

Data processing was conducted with the use of a software package STATISTICA for Windows, version 8. For each variable the following parameters were calculated: mean (*M*), standard deviation (*SD*), minimum value (*MIN*), maximum value (*MAX*), range of scores (*RAN*), kurtosis (*KURT*), and skeweness (*SKEW*). The testing of statistical differences in anthropological profile considering the chronological age of the basketball referees was done with the use of *t*-test on independent samples.

TABLE 1

Descriptive statistical parameters of referees' morphological characteristics

$n = 31$	*M*	*SD*	*MIN*	*MAX*	*max D*	*K-S p*
Height (cm)	186.34	5.40	176.40	198.50	.083	.984
Mass (kg)	88.04	7.47	74.80	107.00	.104	.891
%fat (%)	15.99	3.37	8.20	23.40	.095	.945
BMI (kg/m²)	25.32	1.60	21.80	29.20	.095	.945

Legend: ***M*** – mean; *SD* – standard deviation; *MIN* – minimum value; ***MAX*** – maximum value; *max D* - maximum distance between the theoretical cumulative relative frequency (normal) and the relative cumulative empirical frequency (obtained by measurement); ***K-S p*** – error of statistical inference; Height (cm) – body height; **Mass (kg)** – body weight; **%fat** – body fat percentage; **BMI (kg/m²)** – body mass index.

RESULTS AND DISCUSSION

Table 1 shows descriptive statistical parameters of morphological characteristics of the basketball referees. Based on the results it can be concluded that with their height, the basketball referees significantly exceed the average population of adult men in Croatia (Mišigoj-Duraković, Heimer, & Matković, 1998; Ružić, Heimer, Mišigoj-Duraković, & Matković, 2003). Surely, it is related to the selection that is done in the youngest age in basketball, where height has an important role in selection of beginner boys. Since most of the referees had their first experience with the game of basketball as players, and only afterwards choose officiating as a form of participation in this interesting and demanding sport, it isn't surprising

that they are tall on average. Body mass is consistent with height. One thing that is probably more interesting and is related to morphological characteristics, and has probably more influence on game officiating efficiency, is body composition which was determined in two ways: by measuring the amount of body fat with bioelectrical impedance procedure and calculating the body mass index. According to the classification of the World Health Organization (Lewis, McTigue, Burke, Poirier, Eckel, Howard et al., 2009) which helps us determine nutrition degree, and with the obtained average body mass index (25.32 ± 1.60 kg/m²), it can be concluded that the referees belong to the group of people with slightly increased body mass (from 25.00 to 29.92 kg/ m²). From the total number of respondents, 14 referees fall into the group with normal body mass index, while even 17 of them have the BMI between 25.0 and 29.9 kg/m², which means that these values put them into the group of people with excessive body weight.

However, the obtained average amount of body fat, expressed in percentage (15.99 ± 3.37%), tells us that the referees belong to a group of people with optimal body composition (Wilmore, Costill, & Kenney, 2008). Reason for such different interpretation regarding determination of body composition, should be sought in the manner of calculating the body mass index. BMI is calculated as the ratio between body weight (kg) and the square of body height (m²), and based on its value, a body composition can´t actually be determined with certainty. Also, very often happens that two people with the same body weight and height have a different body composition or a different proportion of body fat and lean body mass.

Table 2 shows that "younger" referees (26-32 years) have the average height of 187.63 cm, and body weight of 88.03 kg. The percentage of body fat is 15.63%, and the body mass index is 25.03 kg/m². Basketball referees who, by their chronological age, fall into the sample of "older" respondents (33-46 years), have the average height of 184.98 cm, and body weight of 88.06 kg. The percentage of their body fat is 16.37%, and the body mass index is 25.63 kg/m².

The results of the *t*-test for independent samples between the two subsamples of respondents show that statistically significant differences in morphological characteristics between younger and older basketball referees do not exist. Based on the value of body fat percentage, it can be concluded that both younger and older referees fall into a group of people with optimal body composition (Wilmore et al., 2008).

Previous studies conducted on basketball referees weren't able to establish which of the motor abilities are responsible for successful monitoring and efficient movement of the referees during the game.

Knowing the dynamic of the game, type of rotation of the referees during the game (three – person mechanics of officiating), and the need to find the ideal angle of observation of a certain situation on the court, it can be assumed that explosive power sprint type and agility have the greatest predictive value of motor abilities for successful officiating (Rupčić, Matković, & Knjaz, 2010).

For this reason, for the purposes of this research were selected tests of valid metric characteristics to estimate agility – motor ability which is largely responsible for conducting quick changes of direction and explosive power sprint type.

TABLE 2

T-test on independent samples - morphological characteristics

Variables	*M* (26-32) Younger	*M* (33-46) Older	*t*-value	*df*	*p*	*F*-ratio
Height (cm)	187.63	184.98	-1.38500	29	.176	1.140386
Mass (kg)	88.03	88.06	.01052	29	.991	2.088158
%fat (%)	15.63	16.37	.60013	29	.553	1.517649
BMI (kg/m²)	25.03	25.63	1.03193	29	.310	1.071882

Legend: **Height (cm)** – body height; **Mass (kg)** – body weight; **%fat** – body fat percentage; **BMI (kg/m²)** – body mass index; ***M*** – mean; ***df*** – degrees of freedom; ***p*** – statistical significance.

In the test *Side steps* (MAGKUS), used to estimate lateral agility movements, the basketball referees reached an average value of 8.19 ± 0.82 seconds, with the range of scores from 6.54 to 9.90 seconds, which is slightly worse in comparison to the results in the same test of the professional basketball players

(Matković & Matković, 2010). However, considering a few best results achieved on the test, it can be seen that some of the referees have achieved better values than the players' average.

Comparing the obtained results in the test *20 meter run with lap time at 5 and 10 meters* (MESP05: 1.54 ± 0.15 seconds, MESP10: 2.37 ± 0.18 seconds and MES20M: 3.78±0.24 seconds) with achieved results of the professional players (MESP05: 1.31 ± 0.17 seconds, MESP10: 2.05 ± 0.22 seconds and MES20M: 3.33 ± 0.26 seconds, SDC Faculty of Kinesiology University of Zagreb), and also the values obtained by extensive research on a sample of a professional army of The Republic of Croatia (MESP05: 1.62 ± 0.12 seconds, MESP10: 2.43 ± 0.14 seconds and MES20M: 3.83 ± 0.23 seconds, Jukić et al., 2008), it can be seen that the referees are slightly slower than the players, but are faster than professional soldiers.

Based on the analysis of the obtained results in motor tests for evaluating agility and explosive power of sprint type, it can be concluded that the referees have adequately developed area of motor abilities which is necessary for effective game monitoring (officiating) – Table 3.

Given the use of representative sample of respondents in this research, the obtained results may even use as model parameters for the purpose of better control of the fitness – motor preparation of the referees.

TABLE 3

Descriptive statistical parameters of motoric tests

Variables	*M*	*MIN*	*MAX*	*SD*	*SKEW*	*KURT*
MAG9OK (s)	8.40	7.24	9.76	.55	-.15	.19
MAGKUS (s)	8.19	6.54	9.90	.82	.23	-.19
MAGOSM (s)	16.76	14.53	21.09	.23	1.38	3.91
MAG4X5 (s)	5.62	4.93	6.74	.39	.77	1.07
MESP05 (s)	1.54	1.28	1.86	.15	-.13	-.89
MESP10 (s)	2.37	2.05	2.70	.18	-.10	-.97
MES20M (s)	3.78	3.37	4.21	.24	-.13	-1.10

Legend: ***M*** – mean; ***SD*** – standard deviation; ***MIN*** – minimum value; ***MAX*** – maximum value; **MAG9OK** – 93639 with a turn; **MAGKUS** – Side steps; **MAGOSM** – Eight with bending; **MAG4X5** – 4 x 5 meters; **MESP05** – Passage at 5 meters; **MESP10** – Passage at 10 meters; **MES20M** – 20 meters run; (s) – seconds.

TABLE 4

T-test on independent samples – motoric tests

Variables	*M* (26-32) Younger	*M* (33-46) Older	*t*-value	*df*	*p*	*F*-ratio
MAG9OK (s)	8.09	8.73	3.89	29	**.000**	1.610
MAGKUS (s)	7.68	8.73	4.58	29	**.000**	1.251
MAGOSM (s)	15.98	17.59	4.73	29	**.000**	3.499
MAG4X5 (s)	5.44	5.83	3.17	29	**.003**	1.414
MESP05 (s)	1.47	1.62	3.14	29	**.003**	1.114
MESP10 (s)	2.27	2.48	3.83	29	**.000**	1.295
MES20M (s)	3.63	3.95	4.42	29	**.000**	1.899

Legend: **MAG9OK** – 93639 with a turn; **MAGKUS** – Side steps; **MAGOSM** – Eight with bending; **MAG4X5** – 4 x 5 meters; **MESP05** – Passage at 5 meters; **MESP10** – Passage at 10 meters; **MES20M** – 20 meters run; **(s)** – secunds; ***M*** – mean; ***df*** – degrees of freedom; ***p*** – statistical significance.

Based on the results in Table 4 it is evident that there are statistically significant differences in all tests for assessing the observed motor abilities between the two subsamples of respondents, or between the sample consisted of "younger" referees (26-32 years), and the other consisted of "older" referees (33-46 years). The results confirm the scientific fact that men's motor abilities gradually decrease with chronological age.

Determination of functional abilities of the referees was performed with a spiroergometry method using progressive load on a treadmill with a constant inclination of 1.5%.

Based on comparison of the obtained results of absolute and relative maximal oxygen intake of the professional Croatian basketball players (Matković & Matković, 2010) and the basketball referees, it can be concluded that the referees have lower values than the players' average.

Comparing the referees and the untrained population in Croatia, it is evident that their results are significantly better in average, and that the referees mostly fall into categories of very good or excellent aerobic capacities (Heimer et al., 2004).

The obtained values of heart rate and oxygen intake on anaerobic threshold with ventilation – metabolic indicators, correspond to the values characteristic to sports activities dominated by aerobic energy processes, because the respondents were crossing the anaerobic ventilatory threshold at very high intensity load (Rupčić, 2010).

The average results of absolute (4.59 ± 0.48) and relative maximal oxygen intake (52.49 ± 5.80), the fact that the referees have crossed anaerobic ventilatory threshold in average at the value of 86.19 ± 4.35% of maximal oxygen intake, or at the value of 90.97 ± 3.07% of maximal heart rate, tell us about their well – developed aerobic endurance (Table 5).

TABLE 5

Descriptive statistical parameters of functional abilities

Variables	*M*	*SD*	*MIN*	*MAX*	*maxD*	*K-S p*
VO2max (l/min)	4.59	.48	3.77	5.60	.0871	.973
VO2max rel (ml/kg/min)	52.49	5.80	43.15	65.56	.1217	.748
relVO2ANP (ml/kg/min)	45.22	5.36	35.35	56.76	.1191	.771
%VO2max ANP (%)	86.19	4.35	75.43	94.84	.1405	.573
MVDmax (l/min)	158.48	19.75	119.70	198.50	.0912	.959
VeEq (l/min)	33.96	3.85	22.00	41.00	.1685	.342
VO2/HR (ml/beep)	25.28	3.50	20.10	38.10	.1418	.561
V_max (km/h)	15.41	1.08	13.50	17.00	.1661	.359
V_ANP (km/h)	11.88	1.08	9.00	14.00	.1365	.610
Fsmax (bpm)	187.12	8.75	169.00	204.00	.0853	.978
FSANP (bpm)	170.16	8.75	152.00	184.00	.1205	.759
%FSmaxANP (%)	90.97	3.07	84.10	95.78	.1435	.545

Legend: ***M*** – mean; ***SD*** – standard deviation; ***MIN*** – minimum value; ***MAX*** – maximum value; ***max D*** – maximum distance between the theoretical cumulative relative frequency (normal) and the relative cumulative empirical frequency (obtained by measurement); ***K-S p*** – error of statistical inference; **VO2max (l/min)** – maximum oxygen intake; **VO2max rel (ml/kg/min)** – relative maximum oxygen intake; **relVO2ANP (ml/kg/min)** – relative oxygen intake at anaerobic threshold; **%VO2max ANP (%)** – oxygen intake at anaerobic threshold expressed as a percentage of maximal oxygen intake; **MVDmax (l/min)** – maximal minute ventilation; **VeEq (l/min)** – ventilatory equivalent; **VO2/HR (ml/beep)** – maximal oxygen pulse; **V_max (km/h)** – maximal speed of treadmill; **V_ANP (km/h)** – speed of treadmill at anaerobic threshold; **FSmax (bpm)** – maximal heart rate; **FSANP (bpm)** – heart rate at anaerobic threshold; **%FmaxANP (%)** – heart rate at anaerobic threshold expressed as a percentage of maximal heart rate.

Based on the results it can be concluded that the referees have a good developed aerobic capacity, similar to the professional basketball players (Castagna, Chaouachi, Rampinini, Chamari, & Impellizzeri, 2009) as well as to the referees from other team sports (Casajus & Castagna, 2007; Castagna & D'Ottavio, 2001; Krustup & Bangsbo, 2001).

Table 6 shows the results of *t*-test for independent samples between "younger" (26-32 years) and "older" (33-46 years) basketball referees in basic variables for estimating functional abilities (maximal oxygen intake; relative maximal oxygen intake, relative maximal oxygen intake at anaerobic threshold). Based on these results it is concluded that there is no statistically significant difference in the level of functional abilities of the basketball referees according to their chronological age.

Table 7 shows the results of *t*-test for independent samples between the two noted samples of respondents in variables: *Quality of Officiating and Experience.*

The results showed how the referees are statistically different in both variables. Based on the evaluation grades of controllers of officiating it is evident that "older" referees get a better average score (4.16) in the *quality of officiating* compared to "younger" basketball referees (3.95). Also, "older" referees have much more experience (10.60) in the officiating the highest level of competition in relation to "younger" referees (4.18).

CONCLUSION

Regarding the anthropological status, the basketball referees differ considering their chronological age only in variables (tests) for motor abilities evaluation, while there are no statistically significant differences in variables of morphological characteristics and functional abilities.

Therefore, it can be concluded that the basketball referees, who made this sample of respondents, have an optimal body composition, and well – developed aerobic capacity, and also the referees regardless of their older chronological age retain a high level of listed abilities.

The question is: *Why do the basketball referees with weaker motor abilities, have better grades in average regarding the quality of officiating?*

TABLE 6

T-test on independent samples – functional abilities

Variables	*M* (26-32) Younger	*M* (33-46) Older	*t*-value	*df*	*p*	*F*-ratio
VO2max (l/min)	4.73	4.45	-1.68	29	.102	1.428
VO2max rel(ml/kg/min)	54.04	50.84	-1.56	29	.127	1.521
relVO2ANP (ml/kg/min)	46.54	43.82	-1.43	29	.163	2.106

Legend: **M** – mean; ***df*** – degrees of freedom; ***p*** – statistical significance.

TABLE 7

T-test on independent samples – Quality of Officiating and Experience

Variables	*M* (26-32) Younger	*M* (33-46) Older	*t*-value	*df*	*p*	*F*-ratio
Quality of Officiating (1-5)	3.95	4.16	2.05	29	.049	1.413
Experinece (years)	4.18	10.60	4.51	29	.000	4.803

Legend: ***M*** – mean; ***df*** – degrees of freedom; ***p*** – statistical significance.

The answer is simple: the obtained results indicate the extreme complexity of the game of basketball which is directly related to complexity of the rules of basketball itself. All the referees who made the sample of respondents are physically well prepared and have met the high criteria of needed theoretical knowledge in the rules of basketball for officiating the highest national rank. However, in the end the experience in applying the gained knowledge makes them different in quality of officiating.

Once again it was showed that experience is an indispensable factor for successful officiating of the

game of basketball. The results obtained confirmed the assumption how experienced referees, with the necessary theoretical knowledge "enriched" by the keen sense for the game, achieve better results in officiating a game, under the condition of good physical fitness. It is natural that the motor abilities of chronologically older basketball referees gradually decrease, but considering the complexity of the game, they make up for this deficiency with their gained officiating experience.

REFERENCES

Casajus, J. A., & Castagna, C. (2007). Aerobic fitness and field test performance in elite Spanish soccer of referees different ages. *Journal of Science and Medicine in Sport*, *10(6)*, 382–389.

Castagna, C., & D'Ottavio, S. (2001). Effect of maximal aerobic power on match performance in elite soccer referees. J*ournal of Strength and Conditioning Research*, *15(4)*, 420–425.

Castagna, C., Chaouachi, A., Rampinini, E., Chamari, K., & Impellizzeri, F. (2009). Aerobic and explosive power performance of elite Italian regional-level basketball players. *Journal of Strength and Conditioning Research*, *23(7)*, 1982–1987.

Heimer, S., Mišigoj-Duraković, M., Ružić, L., Matković, B., Prskalo, I., Beri, S., et al. (2004). Fitness level of adult economically active population in the republic of Croatia estimated by EUROFIT system. *Collegium Antropologicum*, *28(1)*, 223–233.

Jukić, I., Vučetić, V., Aračić, M., Bok, D., Dizdar, D., Sporiš, G., et al. (2008). *Dijagnostika kondicijske pripreme vojnika* (Diagnostics of physical fitness of soldiers). Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu, Institut za istraživanje i razvoj obrambenih sustava.

Krustrup, P., & Bangsbo, J. (2001). Physiological demands of top-class soccer refereeing in relation to physical capacity: effect of intense intermittent exercise training. *Journal of Sports Sciences*, *19*, 881–891.

Lewis, C. E., McTigue, K. M., Burke, L. E., Poirier, P., Eckel, R. H., Howard, B. V., et al. (2009). Mortality, health outcomes, and Body Mass Index in the overweight range. A science advisory from the American Heart Association. *Circulation*, *119(25)*, 3263–3271.

Matković, Br., & Matković, B. (2010). Funkcionalne i motoričke karakteristike košarkaša i košarkašica (Functional and motor characteristics of basketball players). In B. Matković (Ed.) *Antropološka analiza košarkaške igre* (pp. 107–121). Zagreb: Kineziološki fakultet, Hrvatski košarkaški savez.

Metikoš, D., Prot, F., Horvat, V., Kuleš, B., & Hoffman, E. (1982). Bazične motoričke sposobnosti ispitanika natprosječnog motoričkog statusa (Basic motor skills of the above-motor status respondents). *Kineziologija*, *14(5)*, 21–62.

Mišigoj-Duraković, M., Heimer, S., & Matković, Br. (1998). Morfološke i funkcionalne karakteristike studentske populacije Zagrebačkog sveučilišta (Morphological and functional characteristics of the student population of Zagreb University). *Kineziologija*, *30(2)*, 31–37.

Rupčić, T. (2010). Fiziološko opterećenje sudaca tijekom košarkaške utakmice (Physiological load of basketball referees during a game). Unpoblished doctoral dissertations, Sveučilište u Zagrebu, Kineziološki fakultet.

Rupčić, T., Matković, B., & Knjaz, D. (2010). Antropološki profil košarkaških sudaca (Anthropological profile of basketball referees). *Hrvatski Športskomedicinski Vjesnik*, *25*, 16–22.

Ružić, L., Heimer, S., Mišigoj-Duraković, M., & Matković Br. (2003). Increased occupational physical activity does not improve physical fitness. *Occupational & Environmental Medicine*, *60(12)*, 983–988.

Wilmore, J. H., Costill, D. L., & Kenney, W. L. (2008). Body composition in sport. In J. Wilmore i D.L. Costill (Eds.), *Physiology of Sport and Exercise* (4th ed., pp. 318–327). Champaign, IL.: Human Kinetics.

Received: October 18, 2010
Accepted: March 17, 2011

Correspondence to:
Tomislav Rupčić, PhD
Kineziološki fakultet
Horvaćanski zavoj 15
10000 Zagreb
Croatia
Phone: 00385 95 91 25 151
E-mail: tomislav.rupcic@kif.hr

STUDENTS MOTIVATION FOR SPORTS AND THEIR EVALUATION OF SCHOOL

Nenad Suzić [1]

[1]Faculty of Philosophy, Banja Luka, Bosnia and Herzegovina

ORGINALNI NAUČNI ČLANAK

DOI: 10.5550/sgia.110701.en.035S COBISS.BH-ID: 2102296 UDC: 371.3::796]:159.947.5

SUMMARY

In this survey a sample of 312 students of primary school aged 8 – 14 years was used to test the hypothesis if the motivational profile predetermines sport activities and a success in Physical Education (PE) classes. After a factorisation and crossing of the components of external and internal motivation, the author extracted three motivational profiles of actors in sports activities: internal motivated, joint motivated and external motivated. It turned out that these profiles significantly determine if the kids will play sports, but yet not significantly on their success in PE. These findings are not in favour of PE and they show the need for teachers to try to reduce external, and support the internal student's motivation. Significant finding of this survey is also the fact that as older they get the positive evaluation and experience of school is dropping down. This is especially important if we have in mind that by factorization is determined that for the students the first by its importance in PE is the enjoyment and self-improvement, and that two negative motivational factors are right after them. Besides significant findings, this survey offers some new dilemmas for further research and study.

Key words: motivational profile, internal (internal) motivation, external motivation, amotivation, evaluation of school.

INTRODUCTION

Playing sports is a part of healthy and happy life of every human being of today. We are living in a time of technology, and a part that is still left to a man is to manage the machines, and to spend the most of his life over a computer or a control desk, better said, passive. This state of body can be compensated by playing sports, and the need for that is growing together with the progression and improvement of machines. But, playing sports is not obligatory, so the motivation has the leading role for that. The research has showed that motivation significantly contributes to student's achievement in Physical Education (PE) and their sports involvement (Good & Brophy, 2000). The experience teaches us, and the self-determination theory (SDT – Self-Determination Theory; Deci & Ryan, 1985) confirms that in the basis of motivation for PE are not identical motives as the ones that affect sports involvement. Besides, the research has also showed that people defer by their motivation for playing sports (Vallerand, 1997). Guided by those findings I dedicated this research to finding of motivational profiles of our primary school students, as also the students of early and mid – adolescence.

For proper understanding of this phenomenon, and for the finding of *motivational profiles*, it is necessary to start from the thesis that there are some different types of motivation. First of all, it is undeniable that several authors agree about external (external) and internal (internal) motivation (Brière, Vallerand, Blais, & Pelletier, 1995; Vallerand, 1997). Second, we have to have in mind that the same motivation is not valid for both PE and playing sports (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008). Third, we should differentiate the individual motives of students for PE and playing sports in cognitive, emotional and behavioural plan. Fourth, we should consider the Paul Pintrich's thesis about continuum of motivation (Pintrich, 2003) that says that somebody's external motive is at the same time somebody else's internal one. When we have all these assumptions, it is clear that we will be able to look at the motives of our students for PE and sports involvement much easier and more complex.

The fact is that a small number of people do sports, and the fact is also that all of them have PE. Is there

any collision, and if yes, what is it all about? This is a question I intend to indirectly affect in this paper with the assumption that there will be more problems for further research and scientific review, more than this paper is going to give. We know that sometimes opening a new phenomenon for new research can be almost as valuable as the research itself, and that sometimes asked question can be a trigger for powerful changes. In example, when we ask a question why the school contributes so little to a student's involvement in sports, we address the problem to the praxis of today's schools, and that can be a motive for the management and the professional service of some school to explore and compare the curriculum and the number of PE classes in practice. So, these types of questions directly affect the education praxis and contribute to their progressive development.

Motivation in sports

Motivation in sports has its own specificity. For example, in math classes children are active only in some cognitive aspects, and in PE classes both cognitive and physical. So, at the very beginning PE has some motivational advantage. One of the special advantages of this kind of education is that it activates both sides of students' cortex. We are familiar with the fact that schools are primarily focused on the left side of the brain (Hannaford, 2007; Vitale, 2005), or better said they stimulate and rely on that left side. When we stimulate both sides of brain in our teaching, students show unhidden pleasure that is notable by their laughter and their moves (Hannaford, 2007). PE classes have a way to often stimulate both parts of students' brain. For example, there are some games based on motor skills, coordination, as also sports that equally engage left and right hand, like swimming and so. That is an extraordinary motivational advantage of PE, which is, unfortunately, insufficiently used by our teachers.

Other set of motivational variables of PE lies in the nature of motivational continuum. Throughout research Vallerand and his associates found three key motivators: 1) feeling of pleasure, 2) will for learning and discovering new things, and 3) self-improvement (Vallerand, Blais, Brière, & Pelletier, 1989). Not in one single subject self-improvement is obvious and measurable as in PE, and by that comes also feeling of pleasure and continuous learning and discovering of new things. So, all three of mentioned motives are present in PE.

Third brick of motivation in PE we can find in gregarious motives of youngsters. That is especially when it comes to team and collective sports. Through working together, achieving group goal, in team sports young people accomplish their mi-identity that is severely threatened by atomized way of living in modern civilization. Even Aristotle pointed out that human being is "animal sociale", and Aldelfer developed that thesis in "gregarious motives" of people (Aldelfer – see in: Hellriege, Jackson, & Slocum, 2002), where he sees three needs as a gregarious motives: need to develop, need to connect and existential needs. Research has showed that social goals play important role in student's life (Suzić, 2001), and one other research discovered that students will remember even some absurd and insignificant details because of the good teaching interaction and satisfying of gregarious motives (Suzić, 2008a). Team achievement can be a greater motive for an individual than the one accomplished by himself, and that kind of motives are typical for a lot of sports.

Self-determination in sports

Theory of self-determination (SDT – Self-Determination Theory; Deci & Ryan, 1985) should be explained because we can expect that students who play sports are not at the same time the best ones in PE, and even do not valuate school with higher attributes than their fellow students. Teaching has its own rules and goes by some fixed curriculum. There are a lot of things students are not glad to learn. Besides, for someone to be great in PE, he must have a substantial dose of versatility: to be good in athletics, gymnastics, sports with ball, in coordination and rhythmic, to manage and overcome certain theoretical knowledge and so. If one student is, for example, talented for basketball, he can be regular at trainings, and also do basketball in his free time, but at the same time avoid PE classes. To be clear, that is, indeed, very rear case, but that student just has no chance to win high mark in PE. Most of physical culture teachers try to accept and even reword students who actively play some sports.

Other basis for evaluation of SDT in this paper is the need of students to determine their activities on their own, to make decisions and perform certain activities on their own as well. That kind of independence adolescents will accomplish a lot easier and much better through some individual or group sports, inside some club or team. The motivation here ranges from external or externally instructed, through introjected that implies that person has »internalized formal external source of motivation, but has not yet really accepted the given behaviour« (Boiché et al., 2008, p. 689), to intrinsic or internal motivation. According to SDT, every person tends to really decide

about their activities, to involve activities because of the real enjoyment, because she founds it worth doing, is able to give some personal contribution and appreciates it. The lowest level of self-determination is amotivation. Research has shown that people with high level of amotivation have a low level of control, because they find themselves not able to achieve desired goal (Deci & Ryan, 2000). These findings have determined me to, beside internal and external motivation, I also measure amotivation as well on taken sample of primary school students, and to offer data about number of amotivated participants in this sample. This is very significant for teachers, because they will be able to perceive better some performances of children amotivated for sports, and by that make some necessary measures to help their students.

Motivational profile compared to evaluation of school and sports

In the sense of value, sports have a high quota for some people, and yet for the others it has no special meaning and value. Besides, we should have in mind the fact that one number of people gives a high position but is oriented to passive experience and a role of spectator, unlike the ones that rather participate in sports activities. We should take all mentioned when we try to see motivational aspects of students. Namely, students will behave towards the school and PE in accordance with their values and their orientation. That means that motivational profile will significantly determine evaluation of school and sports.

What are the motivational profiles of students and how to recognize them? In this survey professor Nikos Ntoumanis from Athens discovered three motivational profiles on one English sample: 1) high level of self-determination and a low level of external regulation, 2) low score of self-determination, middle score on introjected motivation, and a high score of external regulation and amotivation, and 3) average score in all forms of regulation (Ntoumanis, 2002). This classification some authors take as motivational profiles, but do not deny it (Boiché et al., 2008, p. 690). To derivate his classification Ntoumanis used a Cluster analysis as adequate methodological procedure. Following his findings I used analysis of variance to derivate three motivational profiles that are valid for our primary school students. It showed that these profiles are an excellent reflection of student motives and that they may be related to their evaluation of sports and PE.

Evaluation of school and sports is very little discussed in contemporary pedagogical literature. One survey showed that students accredit more negative than positive attributes to school (Suzić, 2009). Other survey has shown that students in their learning put their own performativ goals on first place, what means that the first thing they want to do is to be better than the others (Suzić, 2008b). These findings are not in favour of today's schools because we can notice that students in those samples were more likely to external (external) regulation and competing with others than to high level of self-determination, or, the most desirable pedagogical profile came second. The question here is how to change motivational profiles of students, or, how to reduce the influence of unfavourable negative profiles, and intensify the influence of positive ones. This is a problem that should be researched throughout experimental teaching and school design, what I address to new researchers, pedagogical starters. In the mean time, we should expect from this research to identify motivational profiles of students and methodological crossing of those profiles with significant parameters like: playing sports, the mark in PE, priority motives of students for playing sports, age and evaluation of school.

RESEARCH

Hypothesis

Basic hypothesis in this research is: motivational profiles of students significantly determine their playing of sports, but also not the mark in PE. Proofing of this hypothesis involves finding of evidence for several significant questions. To be concrete, it is necessary to establish motivational profiles of students, to connect these motives with marks and establish which one of them are the priority ones for engaging in sport activities. Regarding school mark, it is necessary to compare it with evaluation of school, with student's age and some parameters that represent involvement in sports. Besides, it is also necessary to determine the primary motives for doing sports and PE and the connection between motivational profiles and student's marks in PE classes.

Instruments

Two instruments and one protocol for gathering data were used in this survey. Instruments are: *SMS – Sports motivational scale* (EMS – Echele de Motivations dans les Sports; Boiché et al., 2008) and CTE – *Consistence of Teaching Evaluation* (Suzić, 2009). I will show these two instruments by their basic properties.

SMS – Sports motivational scale (EMS – Echele de Motivations dans les Sports; Boiché et al., 2008) has 18 points divided in six subtests, with three points per each. The examinees respond to questions that

determine what stimulates them to participate in PE classes. For example, one of these statements is: *I participate in PE classes because I find sports amusing*. The examinees responded by Lickert scale from 1 = *I strongly disagree* to 7 = *I strongly agree*. Second subtest was dedicated to intrinsic motivation, and measures the students' perception of knowledge and skills as a base for self-improvement. One item says: *I participate in PE classes because of the joy I feel when I have the experience of improving some sport ability*. Next subtest measures the quantity of identified regulation. One of three items says: *I participate in PE classes because I will have a great use of what I learn there later in life*. Next subtest measures introjected regulation. One of three statements is: I participate in PE classes because *I would feel guilty for possible failure in PE*. Fifth subtest measures external regulation: One statement says: *I participate in PE classes because that is something I need to do*. The last subtest of SMS – scale has three articles and measures amotivation. One of them says: *I do not see the use of PE classes*. Kronbah – alpha coefficients for internal consistence for these subtests are given in Table 1.

CTE – *Consistence of Teaching Evaluation* (Suzić, 2009) has two subtests: negative and positive evaluation of school. It's made of two subtests, with ten statements or attributes per each, that students reply using Lickert scale: 1 = *I do not agree at all* to 5 = *I totally agree*. For example, for negative statements were questions like: *Too many classes are boring, they are all alike*. In opposite, students were asked the same question, only in positive context: *Classes in this school are mostly very interesting*. The students answered by Lickert scale, the numbers were added up and divided by number of statements, so at the end was gained average scale of value or student's decisions for negative or positive evaluation of school. To get the index of school evaluation consistence, it was necessary to reverse the statements of negative evaluation of school subtest, and then calculate the average value of those differences. The highest levels of consistence are the results congruent or very near zero, and the highest levels of inconsistence are the results away from zero. Internal consistence was measured by Kronbah – alpha coefficient given in Table 2.

Sample

The sample contains 312 students from two primary schools in the territory of Banja Luka: "Desanka Maksimović" school with 190 students and "Borisav Stanković" school with 122 students. The age of students is from eight to fourteen years old, with 161 male and 151 female involved and $\chi^2 = .32$ what indicates that this difference is not statistically significant ($p = .57$).

TABLE 1
Internal consistence of Sports motivational scale (SMS)

Subtest	Kronbah-alfa (α)
Intrinsic motivation: Stimulation	.68
Intrinsic motivation: Knowledge and skill	.74
Identified regulation	.83
Introjected regulation	.81
External regulation	.85
Amotivation	.85

TABLE 2
Data about calibration of CTE – scale

Subtest, variable	Kronbah-alpha (α) in earlier survey (Suzić, 2009)	Kronbah-alpha (α) in this survey
Negative evaluation of school	α = .86	α = .87
Positive evaluation of school	α = .81	α = .77

The way of doing this survey

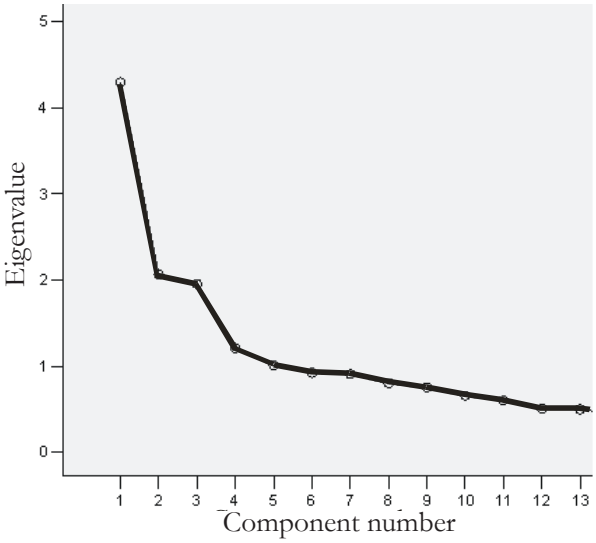
The research was implemented in February 2011, by giving the students sheets for answering and writing the level of their agreement/disagreement with the red statement. On the same sheet they filled some data about them: birth year, school success and so. Students were asked to answer sincerely, and if they have any doubt, to raise their hand and stop the testing person. In this way by the dynamics of reading we have secured the honesty of answers and removed potential indistinctness in case when students read the questions on their own. All data were processed by SPSS 13 Statistica programme for Windows.

RESULTS OF RESEARCH

Before answering the main problem set in the hypothesis, it is necessary to turn to some questions that significantly contribute to the review of facts relevant to more complex seeing and proofing of hypothesis. Such question is: What are the priority motives of students in evaluation of sports and PE. I looked for the answer by factorizing the *SMS – Sports motivational scale* (EMS – Echele de Motivations dans les Sports; Boiché et al., 2008). After factorizing this instrument several factors were abstracted. It was necessary to decide how many of them to keep. The best thing to do was the Katell method of landslide (Scree plot; see also: Suzić, 2007, p. 210). Figure 1 clearly shows that we can stop at five factors.

FIGURE 1

Number of factors by Katell method of landslide



After Oblimin rotation, *enjoy in PE and self-improvement is extracted* as first factor (Table 3). This is a promising finding, because it shows that our students care about the self-improvement in PE and enjoy it. The research has showed that high evaluation of some activity intensifies the thrill, effort, interest, and achievement (Wagner, Kegan, Lahey, Lemons, Garnier, Helsing et al., 2006). The structure of first factor in Table 3 is composed of three items where dominates self-improvement, pleasure, and evaluation of sports for personal life. In accordance with findings of Wagner et al, we can state that the priority of our students is pedagogically and psychologically preferable. Pedagogues of physical culture can use this finding to motivate students, because it is quite clear what the students most want. Besides, in working with those students who do not take these variables as the most important ones, teacher can use interaction, coeducation, and group work to pass positive motives from one student to another.

The second in the range of motivation is *amotivation* (Table 3). This is not really the result to hope for, because pedagogically seen, more adequate would be if this factor was somewhere in the fifth place or lower – but not to be second in student priorities. The points inside this factor refer to statements that PE is a waste of time, that students do not know why they attend PE classes and that they do not see the use of PE. Research of Robert Vallerand showed that amotivation is followed by high level of external regulation and low level of other forms of motivation (Vallerand & Fortier, 1998). Beside the fact that in our sample amotivation comes second, it is clear that we have a lot of students who do not like sports and PE and do not see the point of that. It is very clear what teachers should do: throughout constructive interaction and cooperative discussion with students it is necessary to permanently think-out activities in PE teaching and use sports as their activities as also provide possibility for active playing of sports in school.

Third factor is *PE as a commitment and responsibility*. This also isn't very encouraging result. This factor is formed by four points: feeling of responsibility, feeling of guilt, fulfilling the expectations of some significant persons and personal consequences. For the first appearance, it is clear that two kinds of motives are involved, identified and introjected regulation. To simplify, it is about behaviour regulated by external motives. By that kind of motivation behaviour is predetermined by outside regulations, norms, and authorities, but is still not a part of personal value code (Boiché et al., 2008, p. 689). When we look at teaching of all subjects in general, we can state that it is basically based on teachers' authority, norm plans

and programs, sanctions for the ones who do not listen, and like. All of that encourages external motives of students like identified and introjected regulation, but just a little the internal ones like self-improvement. This should worry us in particular when we know that self-improvement, together with enjoy in sports as the first motive of our students, is here identified as a first or priority factor (Table 3). Here we could use some new research about the types of motivation that dominates in our modern teaching of PE and other subjects.

TABLE 3

Primary motives of students for playing sports and for PE classes

Factor	Components after rotation				
	1	2	3	4	5
Enjoyment in PE and self-improvement	.75 .59 .56				
Amotivation		.82 .75 .71			
PE as obligation and responsibility			.79 .77 .76 .69		
Positive emotions and belief in value of PE				.74 .71 .55	
Importance of PE in life and the excitement					–.67 –.65 –.59 –.54 –.54

Extraction method: Analysis of principle components; Rotation method: Oblimin with Kajzer normalization; 24 iteration rotation.

The fourth in a role are *positive emotions and belief in values of PE*, and is constructed of three particles: fun in these classes, positive emotions, and PE and sports as a need. This factor belongs to stimulation as an intrinsic motive. Together with the first one, this factor presents an internal motive and second and third one the external motives. When we take the fact that external and internal motivation are orthogonal and that researches showed that external regulation does not depend on intrinsic motivation (Fairchild, Horst, Finnes, & Barron, 2005), it is clear that amotivation and external regulation must be changed in favour of strengthening of positive emotions and assure students in values of sports.

The fifth factor is negatively oriented towards the other four. It is *importance of PE in life and the excitement that comes with it*. It has five particles, which of two refer to flow experience that follows motives in sports activities and three on feeling brought by PE. So, here we deal with intrinsic and introjected motives, with combined motivational profiles.

When we know that there are students with combined motivation, our interest is to see if those students are more or less successful in PE than the others. True response to that question is in Table 4, where $\chi^2 = 12.41$ (is not statistically significant; $p = .13$) show that students with combined motivation do not defer from students with other motivational profiles. We could use some new research that would show, in experimental design, is it possible to change external in favour of internal motives of students, and under what circumstances is most effective to make those changes.

Motivational profiles in sports

In the search for motivational profiles of students I was oriented by classification of Nikos Ntoumanis, where he differs: mostly self-regulated, amotivated and external motivated, and the ones who combine these two options (Ntoumanis, 2002). This classification is too wide and too combined to present the profiles, as other authors noticed (Boiché et al., 2008,

p. 690). Besides, Cluster analysis is not the safest methodological procedure for classifying profiles, because each of these constructs needs to be orthogonal in compare to the other two. That was the reason for me to apply different methodology to abstract three student's motivational profiles for playing sports. I have summed and divided with their number all items that measure internal motivation in *SMS – Sports motivational scale* (EMS – Echele de Motivations dans les Sports; Boiché et al., 2008). Then I subtracted the average of amotivation and external regulation from the gained average. Now I have the ones that have high positive values, and those are the students with strong internal motivation, the ones with expressively negative values, those are the students with prevailed amotivation and external regulation, and all of those in a range of plus/minus one standard deviation would be the ones with combined motivation. I called the first ones internal motivated, or self-determined, the second ones external motivated, and the third ones are the students with combined motivation. This could be a good classification because we have two opposites, positive and negative, and all others are in between or moderately motivated. We could use a check of these constructs by a new instrument specially designed for measuring of these profiles where would be shown the existence of orthogonal between them, because this classification is made by an instrument that is not made for that kind of measuring. Still, following the researches of other authors (Boiché et al., 2008) we can use this to see the motivational orientations of students. It showed that this classification gave some very useful data (Table 5).

TABLE 4

Motivational profile of students and PE mark

Motivational profile	PE mark					Total	χ^2	*p*
	1	2	3	4	5			
Self-determined	0	0	5	11	31	47		
External motivated	1	3	5	52	159	220		
Combined motivation	0	2	2	14	27	45		
Total	1	5	12	77	217	312	12.41	.13

TABLE 5

Motivational profiles to sports playing indicators

Variable		Motivacioni profili			Total	$\chi^2_{(2)}$	*p*
		IM	CM	OM			
Trainings	Yes	32	131	16	179		
	No	15	89	29	133		
	Total	47	220	45	312	11.39	**.003**
Club membership	Yes	25	107	11	143		
	No	22	113	34	169		
	Total	47	220	45	312	10.01	**.007**
Has some sport device	Yes	35	140	19	194		
	No	12	80	26	118		
	Total	47	220	45	312	10.84	**.004**

Legend: **IM** - Internal motivated; **CM** - Combined motivation**; OM** - External motivated

Data in Table 5 clearly show that internal motivated students are significantly more active in doing sports comparing to the external motivated ones. There are more internal motivated who train (32) than the ones who do not train (15), while this ratio is opposite for the external motivated students (Table 5). The difference in favour of internal motivated is significant for all three indicators of active playing of

sports: for active training $\chi^2_{(2)}$ = 11.39 (level of significance .003), for club membership $\chi^2_{(2)}$ = 10.01 (level of significance .007) and for owning of sport device $\chi^2_{(2)}$ = 10.84 (level of significance .004). This agrees with the research of Luc Pelletier et al, and that research showed that internal motivated student do sports more for their soul than the external motivated ones (Pelletier, Fortier, Vallerand, & Brière, 2001). When we have in mind the results and the indicators I got in this survey, then comes the question why the ones who actively play sports are not at the same time the most successful in PE (Table 4), or how much does the PE contributes to student's active playing of sports and what other factors influence the efficiency of PE teaching and playing sports. Here should be expected some new survey as well, because resolving this question is of crucial importance for active playing of sports and getting the youngsters to do that.

Evaluation of school and sports

Its shown that positive evaluation of school goes down with students ageing ($F_{(6)}$ = 41.22; level of significance .001; Table 6). This is the finding that agrees with one research made before (Suzić, 2009), but it would be good to check it again with one longitudinal research. Either way, results show that positive evaluation of school goes down with student's age. Other controversial finding is that students who have high level of external motivation for sports together with the ones with combined motivation have higher score for positive evaluation of school than the internal motivated students ($F_{(2)}$ = 8,62; level of significance .001; Table 6).

That proofs that motivational profiles of students significantly predetermines their playing of sports, but not the marks in PE, what is the main hypothesis in this survey. This actually proofs the main hypothesis.

DISCUSION

The main hypothesis of this survey was set contradictory. On one side is the statement that motivational profiles predetermine playing sports, and on the other hand, statement that those profiles do not influence the school mark in PE. If some students love sports, why wouldn't they have higher marks in PE? Seen on the lay way, every man of practice will say that that is not correct, but this research showed that it is. This is a completely new and un-researched topic, and that is why I gave strong and methodologically assuring basis so this survey would be easily renewed and able to prove or dismiss data given in this paper.

TABLE 6
Analysis of variance (ANOVA) for the ratio of positive evaluation of school, age and motivational profile

Variable	Age	*N*	*M*	*SD*	*F*	*p*
Positive evaluation of school	8 years	23	3.26	.52		
	9 years	62	3.49	1.12		
	10 years	54	2.65	.88		
	11 years	23	2.65	.56		
	12 years	50	2.41	.78		
	13 years	74	1.55	.85		
	14 years	26	1.30	.51		
	Total	312	2.45	1.13	41.22	**.000**
Motivational profile	IM	47	1.83	1.14		
	CM	220	2.55	1.11		
	OM	45	2.62	1.15		
	Total	312	2.45	1.13	8.62	**.000**

Legend: **IM** - Internal motivated; **CM** - Combined motivation**; OM** - External motivated

First we needed to extract motivational profiles. Even though Cluster analysis is known as a good methodological base for grouping of data, I didn't take the approach of Nikos Ntoumanis (Ntoumanis, 2002) for granted, what seems to come from some other authors in a certain way (Boiché et al., 2008, p. 690). I rather chose to make my own categorization of motivational profiles. I gained three profiles: internal, combined and external motivated. This kind of classification or categorization is more similar with other findings of researches dedicated to this phenomenon (Biddle & Wang, 2003; Boiché et al, 2008; Wang, Chatzisarantis, Spray, & Biddle 2002). After statistical crossing of these profiles with accomplishment of students in PE classes, it seems that none of these profiles is followed with differences in PE marks (Table 4), but they significantly influence if students will play sports or not (Table 5) as also how students will evaluate school (Table 6). Especially indicated data is that external motivated students have the highest scale value in evaluation of school. The reason for that is probably the fact that our schools mostly support and reword external motivation. Those students who do not see school as a place where they will accomplish their sports activities, they do not see it as a place where they can fulfil their need for training, playing sports and enjoying in it, at the same time they do not valuate school with highest values on Lickert-tipe scale (Table 6, Table 4). This is pedagogically alarming result because indicates the need for changing of these values and attitudes of students. This change will not happen throughout just talking, reassuring and persuasion, but throughout concrete action as well. It is necessary to ensure children to train in school, to follow changes on their body, to follow the increasing of capabilities and endurance, and to feel personal gain from sports and school support.

Especially significant finding of this research is the divination about what are the priorities in evaluation of sports and school PE to our students. Factorization showed that those are enjoyment in PE and self-improvement (Table 3). This is an encouraging finding, but at the same time disappointing when we know that schools give so little of this to students. Second and third factor by its importance are amotivation and PE as obligation and responsibility (Table 3). Both of these factors have negative influence on real motivation, on internal motivation for playing sports and PE. We should look for positive teaching models that will encourage reduction of these factors, and in the first line bring self-regulation and internal motivation.

Interesting and valuable finding is also the knowledge that students reduce their positive evaluation of school in accordance to years spent in school. Namely, older students valuate school more negatively than the younger ones (Table 6). When school would be the place for enjoying, place where children would feel joy of divination and self-improvement, it is shore that with years, positive evaluation of school would also become higher. Finding of this research as also the one before this (Suzić, 2009) show that that is not the case. We should ask ourselves is it possible to organize the school where children would love to go in, where they will enjoy in learning, sports and art, school they will simply love. We do not need a lot of persuading to give a positive answer to this question because our practice already knows some of that kind of classes, and besides, the number of teachers who manage to get children to start to love learning, to do their teaching obligations with pleasure is growing.

In general, the main hypothesis of this research is proven, and that is that motivational profiles of students significantly predetermine their playing of sports, but not the school success in PE. This finding shows that teaching of PE should be approximated to internal motives of students, and to especially work on reduction of external motivation that treat sports as obligation and responsibility, or rewards obedience and submissiveness of students. Besides this general finding, this survey also left a number of new research topics, and I hope that those topics will prompt some other researchers, future master and doctoral studies students, to go on in that direction.

REFERENCES

Biddle, S. J. H., & Wang, J. C. K. (2003). Motivation and self-perception profiles and links with physical activity in adolescent girls. *Journal of Adolescence*, *26*, 687–701.

Boiché, J. C. S., Sarrazin, P. G., Grouzet, F. M. E., Pelletier, L. G., & Chanal, J. P. (2008). Students' motivational profiles and achievement outcomes in physical education: A self-determination perspective. *Journal of Educational Psychology*, *100*, 688–701.

Brière, N. M., Vallerand, R. J., Blais, M. R., & Pelletier, L. G. (1995). Development and validation of a measure of intrinsic, extrinsic and amotivation in the sport context: The Échelle de Motivation dans les Sports (ÉMS). I*nternational Journal of Sport Psychology*, *26*, 465–489.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The „what" and „why" of goal pursuits: Human needs and the self-determination theory. *Psychological Inquiry*, *11*, 227–268.

Fairchild, A. J., Horst, S. J., Finnes, S. J., & Barron, K. E. (2005). Evaluating existing and new validity eviedence for the Academic Motivation Scale. *Contemporary Educational Psychology*, *30*, 331–358.

Good, T. L., & Brophy, J. E. (2000). *Looking into classrooms* (5th ed.). New York: Longman.

Hannaford, C. (2007). *Pametni pokreti*. Buševec, HR: Ostvarenje.

Hellriegel, D., Jackson, S. E., & Slocum, J. W. (2002). *Management: A competency-based approach*. Thompson, CA: South-Western Thompson Learning.

Ntoumanis, N. (2002). Motivational clusters in a sample of British physical education classes. *Psychology of Sport and Exercise*, *3*, 177–194.

Pelletier, L., Fortier, M., Vallerand, R., & Brière, N. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, *25*, 279–306.

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching context. *Journal of Educational Psychology*, *95*, 667–686.

Suzić, N. (2001). Atribucija ciljeva studenata (Attribution of student's goals). *Vaspitanje i obrazovanje – časopis za pedagošku teoriju i praksu*, *br. 4/2001*, str. 51–69.

Suzić, N. (2007). *Primijenjena pedagoška metodologija* (Applied educational methodology). Banja Luka: XBS.

Suzić, N. (2008a). Can we motivate students to memorize sensless contents. In Book: A. Kozlowska, R. Kahn, B. Kožuh, A. Kingston, J. Mažgon (Eds.), *The role of theory and research in educational practice* (pp. 113–133). Grand Foks: University of North Dakota.

Suzić, N. (2008b). Šta učenici žele postići školskom ocjenom (What do students want to achieve with school mark). *Obrazovna tehnologija*, *br. 2/2008*, str. 1–18.

Suzić, N. (2009). Kako učenici vrednuju školu i kako uče (How students valuate school and how they learn). In Proccesings: *Monografija međunarodnog znanstvenog skupa »Škola po mjeri«* (pp. 221–236). Pula: Sveučilište Jurja Dobrile u Puli.

Vallerand, R. J. (1997). Toward a hierarhical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (pp. 271–360). New York: Academic Press.

Vallerand, R. J., Blais, M., Brière, N. M., & Pelletier, L. G. (1989). Construction et validation de l'échelle de motivation en éducation (EME) [Construction and validation of the Educational Motivation Scale (EMS)]. *Revue Canadianne des Sciences du Comportement*, *21*, 323–349.

Vallerand, R. J., & Fortier, M. N. (1998). Measures of intrinsic and extrinsic motivation in sport and physical activity: A review and critique. In J. L. Duda (Ed.), Advances in *Sport and Exercise Psychology Measurement* (pp. 81–101). Morgantown, WV: Fitness Information Technology.

Vitale, B. M. (2005). *Jednorozi su stvarni: Pristup učenju desnom hemisferom mozga*. Lekenik, HR: Ostvarenje.

Wagner, T., Kegan, R., Lahey, L., Lemons, R. W., Garnier, J., Helsing, D., et al. (2006). *Change leadership: A practical guide to transforming our schools*. San Francisco, CA: Jossey-Bass.

Wang, J. C. K., Chatzisarantis, N. L. D., Spray, C. M., & Biddle, S. J. H. (2002). Achievement goal profiles in school physical education: Differeneces in self-determination, sport ability beliefs, and physical activity. *British Journal of Educational Psychology*, *72*, 433–445.

Received: February 27, 2011
Accepted: April 15, 2011

Correspodence to:
Nenad Suzić, PhD
Faculty of Philosophy
Bulevar Vojvode Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina
Phone: 00385 65 53 85 00
E-mail: nenad_szc@yahoo.com

BASKETBALL IN THE TERRITORY OF FORMER YUGOSLAVIA FROM 1ST OF JANUARY 1942 UNTIL THE 9TH OF MAY 1945

Petar Pavlović[1], **Slobodan Simović**[1], **Kristina Pantelić**[1], **and Zrinko Grgić**[2]

[1]Faculty of Physical Education and Sports, Banja Luka, Bosnia and Herzegovina
[2]Croatia Sports Museum, Zagreb, Croatia

SCIENTIFIC WORK REVIEW

DOI: 10.5550/sgia.110701.en.045P COBISS.BH-ID: 210255 UDC: 796.323.072"1942/1945"

SUMMARY

Development of basketball in the territory of former Yugoslavia in the time of II World War remained quite un-researched. Even though it was truly played, with almost same intensity as before the War, for a long time people were silent and wrote very little about it. During the period (1942 – 1945) several sport clubs existed in Belgrade: Sk. 1913, Bask, Bsk, Btk, Bob, Obilić, Sask, Bankarac, Izbeglice (Refugees), Vladan Matics' club and others who cherished basketball in newly-formed teams. Besides many games, they organised championships and did their best to promote basketball among school youth. Beside Belgrade, basketball was played in other places too: Novi Sad, Subotica, Petrovgrad, Šabac, Kragujevac, Niš, Prizren, Split, Zadar, Dubrovnik, Šibenik, Kotor and other, with different intensity. Most of the games and championships happened during 1942 and 1943. During writing historical method was used (finding of primary historical sources, their analysis, as also finding and analysis of secondary historical sources). Numerous sources made in that time were reviewed and consulted (magazines, newspapers, papers, records, reports, overwrites, etc.) in: archives, libraries, institutes, private archives and museums of sports of former Yugoslavia, as also the sources made afterword.

Ključne riječi: Basketball, WW II, competitions, "Novo vreme" ("New times").

INTRODUCTION

Development of basketball in the territory of former Yugoslavia in the time of II World War remained quite un-researched so far. There are a few papers about basketball development from that particular period and from that area. Pavlovich names one of the reasons for that:

> People here treat historical part of physical culture with a lot of negligence, better said historical sciences have been passive towards this area of human culture for quite some time, what brought a significant lack of methods and attention towards keeping and studying of those materials. From those reasons a very small number of primary historical documents were saved as same as other archive materials about physical culture during the war. That is also one of the reasons why in historiography literature, a part from relatively rich memoir materials and popular affairs, we can rarely find scientific papers talking about the areas of physical culture (Pavlović, 1989, p. 3).

Meaning and the role of sports in culture in our country and also around the world, simply cannot be out of the attention of science, and by that out of the history science, and that is why more and more attention is given to the research of sports history and also history of basketball.

We could think that, in those troubled times and all the hardness of the II W.W. on the territory of Yugoslavia at the time, people did not pay any attention to sport activities. But that was not the case. Researches have shown that people, even in those difficult times, did pay attention, among other things, to diversity of sports activities where was also basketball.

Even though it was truly played during the War, for a long time people were silent and wrote very

little about it. In Belgrade the intensity of basketball was almost the same as before the occupation. It was played not only by pre–war players, but also by other athletes and school youth.

During 1941, several sport clubs existed in Belgrade: Sk. Jugoslavija, Bask, Bsk, Btk, Obilic, Bob, Sask, Vladan Matics' club and others who cherished basketball in new-formed teams. Besides playing in teams they also played games, organised championship of Belgrade and did their best for promoting basketball among school youth. Most games were on Kalemegdan court (playground of Bob) and Tašmajdan (playground Btk). First Belgrade championship was held on 27th and 28th September 1941. (Simović, Pavlović, Pantelić, & Grgić, 2010)

Besides Belgrade basketball was played in other places of former Yugoslavia: Novi Sad, Petrovgrad, Subotica, Šabac, Kragujevac, Niš, Prizren, Split, Zadar, Dubrovnik, Šibenik, Kotor and other, with different intensity. In the next "war-years" (42 – 45) basketball activities continue.

This issue was very little written about, because of just a few scientific papers about this topic, and due to the fact that mentioned period of basketball development (42 – 45) remained un-researched so far, our goal throughout this paper is to research, analyze, highlight and bring out of oblivion that same period. We hope to stir up sport historians and readers of all sorts, especially basketball fans, to indulge themselves into further research.

METHOD

During writing, the historical method was used (finding of primary historical sources, their analysis, as also finding and analysis of secondary historical sources). Numerous sources made in that time were reviewed and consulted (magazines, newspapers, papers, records, reports, overwrites, etc.) in: archives, libraries, institutes, private archives and museums of sports of former Yugoslavia, as also the sources made afterword.

RESULTS AND DISCUSSION

Work of the Serbian Basketball Association

In the first half of September 1941 Serbian Basketball and Volleyball Association was founded. Svetislav Vulović was elected for the first President. Technician was Boro Jovanović. Beside spreading basketball in Belgrade and all Serbia, beside competitions, new clubs and sections, association also worked on their own rules, rules of basketball as also on the improvement and organisation of referees.

Nenadović in "Novo vreme" magazine from 2nd March 1943 writes about the work of the Association:

> After a longer brake, which started along with the winter days, and still stands, basketball and volleyball are being re-woken. Serbian Basketball and Volleyball Association used that period to make their own rules, as also the rules for basketball and volleyball, so that in the future everything goes on normally. Future games will be attended by more referees, because they gave their best to train and make a few of them, which will attend basketball and volleyball games and earn the confidence of both players and audience (cited in Paunić, 2007, p. 181).

Association in a little over a year, has achieved notable success: more than three hundred registered players in Association, 23 registered clubs, all participate in the competition, they organized the Championship of Serbia, the first national team game, and created basketball rules, a good referee staff and so on.

The Steering Committee of the Association has decided to hold the First regular annual Conference on the 6th of July 1943. Text of Nenadić in "Novo vreme" magazine from that same date is the best way to describe the work of the Association until that period:

> That day will be historically and undeniably the most important date for this sport. Basketball and volleyball for little over a year of organized promotion have interested a lot of athletes, in the first place, because today there are over 300 verified players in the Association, as also the whole sports public. It is considered that a total of over 15.000 viewers attended a so – far basketball and volleyball games. Association managed to organize its first championship and gain its first champion for 1942, as also to organize one very beautiful game between representations of Belgrade and National Guard. Only that kind of addicted work could attract 23 clubs to sign and actively participate in the championships of the Association. Yet, the Association had one big lack. Because of the preoccupation about the many games going on, Technical Board

had no time to make the rules. They worked by the combination of several rules, which had their differences, and none of them were accepted as official ones. That is why referees could not be synchronized. Fortunately for the Association and all players, Aksentijević, Popović and Dimić, great fans of this game, managed to do that. It was probably a great practice and a dedicated work that gave these young men the opportunity to end this work. Boro Jovanović, a technical referent of the Association for basketball and the first member of the Commission for the acceptance of the rules, gave his opinion and a good word for them (cited in Paunić, 2007, pp. 181–182).

Mirko (Bata) Aksentijević, Nebojša Popović and Ivan Dimić even out and wrote the rules, and a Commission for the acceptance of the rules, whose first member was Boro Jovanović, commanded them and gave their positive opinion. About them "Novo vreme" no. 52 in its Sports department from 27 July 1943 says:

It is not necessary to emphasise the meaning of the creation and the publication of these rules for the development of our basketball. Because it should be considered that even before the foundation of the Association, basketball already existed here (before 1941), and clubs had their "wild" development even then, and every one of them had their own rules. Now this sport will gain its uniformity which is cooperated with the basketball around the globe. By doing that, Serbian Basketball and Volleyball Association, a long with the three mentioned players – the writers of the rules, filled a huge emptiness which has stemmed the progress of this young sport in our environment (cited in Paunić, 2007, p. 182).

Association formed a referee team with: Boro Jovanović, Selimir (Sele) Radovanović, Zvonimir Neferović, Mileta Tešin, Mirko (Bata) Aksentijević, Miodrag (Mija) Stefanović, Vaso Stojković, Slobodan Vukanović and others.

It starts with two – referees – per – game practise (older, more experienced referee and the beginner), what seemed to be very good. It was just like the old saying says "More eyes see well."

To improve the work of the referee crew for basketball, as also to answer to all other questions that involve refereeing, on the 14th December 1943 was formed Assembly of the basketball and volleyball referee association. Constituent Assembly was held in the premises of the Sk. Mitić, starting at 6 p.m. The Assembly was announced in "Novo Vreme": "In the premises of the SK 'Mitić' (entrance from the st. Uskočka) today, 6 p.m. sharp, will be held a Constituent Assembly of Basketball and Volleyball Referee Association" ("Constituent Assembly of Referee Association today", 1943, p. 5).

Basketball becomes more and more popular, more interesting for the viewers, games are more visited (at BSK's and SK 1913's game attended some 1.500 viewers), and other athletes go in for it.

Basketball and volleyball constantly embrace better positions in our sport lives. There are more and more soccer players among competitors and viewers. Basketball and volleyball attract them, by not only their beauty and dynamics, but also by its practical value. They know that there is no better and more complete training than this sport, because in the game all parts of the body are equally active (cited in Paunić, 2007, p. 172).

Basketball activities in Belgrade in 1942

During 1942 basketball continues, and even more intensive than before. A lot of games go on between existing clubs, a lot of tournaments happen, new clubs are founded (National guards), first representative games of the Association are being played.

FIGURE 1
Sk. 1913 team from 1942.
(Source: Stojković, 2005, p. 22)

"Novo vreme" from 1st April 1942 writes that on the first day of Easter, on Btk's playground in Tašmajdan, starting at 10.30 a.m., two basketball games between A – teams of Sk. 1913 and Obilić, and B – teams of Sk. 1913 and Sask took place.

The same source states the teams for the upcoming games:

> A-team of SK 1913: Nikolić, Aksentijević, Mađeruh, Neferović, Tešin, Stefanović, Dimić, Galović and Savić. B-team of SK 1913: Petrović, Petković, Ostojić, Mihajlović, Nenadović, Ronac, Kosovac, Denić, Oljača and Vujičić. Obilić: Gajić, Trajković, Sokolović, Kašanin, Aleksić, Jovanović, Golubović, Severin and Bijelić. Sask: Kenig, Kostić, Obradović, Đupanović, Vulović, Dinić, Marković and Novaković ("They play on the first day of Easter", 1942, p. 5).

Planed and announced games took place on Easter, Sunday, 5th April 1942, starting at 10.30 a.m. on Btk playground in Tašmajdan.

On Sunday, 12th April 1942, on Btk playground in Tašmajdan were played two basketball games between Sk. 1913 and Bsk, and A and B women teams of Sk. 1913.

Before the games, in "Novo Vreme" magazine, no. from 12th Aprila of the same year, was announces text as follows:

> Today at 15.30 p.m. on BTK playground in Tašmajdan the first game between BTK and SK 1913 will be played. Because of the great interest for the mentioned game, the organizer, SK 1913, has taken all the necessary for everything to be in order […]
> By this game BSK and SK 1913 start a new friendly relations in this type of sports. […] When BSK manages to gather its best team just then we could say something about prestige of these two soccer rivals, but in this type of sports ("First BSK – S. k. 1913 game", 1942, p. 5).

"Kolo", in no. from 18th April 1942 writes:

> Last week BSK and SK 1913 have met. Around one thousand and five hundred spectators came! Is there really anyone else to claim that our sport audience is not interested in some other sports as well ("Near 1500 spectators in basketball game", 1942, p. 27).

On Sunday, 10th May 1042, on BTK playground starting at 10 a.m. three basketball games were played: B team of Obilić and Btk (first one), Bask and Bsk (second) and A team of Obilić and Sk. 1913 (third). About the third game, in which Obilić won by 30 : 17 (10 : 13), Nenadović (1942a) writes:

> Obilić wanted a rehab against SK 1913 because of the defeat from before. He made it. He attacked hard the basket of its opponent and came to advantage […] The second part of the game is totally under the play of Obilić which gain 20 goals. Obilić totally broke down the Sk 1913 and gave a great game […] There was no weak place in their game yesterday. They all played great and deserved to win. The only thing that could be said is for the rough play of Trajković, because of what referee had to exclude him (p. 5).

FIGURE 2

Article in "Novo vreme" journal from April 14, 1942 (Source: Nenadović, 1942b, p. 5)


Кошарка се свиђа нашој спортској публици

"Novo vreme" in no. from 16 May 1942 announced that Serbian Basketball and Volleyball Association, on Sunday 31 May of the same year will organize the competition in basketball and volleyball for the BTK (Belgrade Tennis Club) Cup. They have also announced that all clubs from Belgrade would participate in competition: Bsk, Bask, Sk 1913, Obilić, BTK, Bob, Mitić and Bankarac. The end of the statement says: "Serbian Basketball and Volleyball Association call all member clubs to file a report about the exact number of active basketball and volleyball players" ("Basketball and volleyball tournament for the BTK Cup", 1942, p. 5).

Seven teams took place at the competition, not eight, as it was announced by "Novo vreme". Namely, the "Bankarac" team didn't show up. Following teams have participated: Sk. 1913, Obilić, Bsk, Btk, Bask, Mitić and Bob. They had six games each. First

place won Sk. 1913 team, with 12 scored points, beating all other teams, with total of 238 : 95; second place Obilić, 10 points, 5 victories, total of 151 : 100; third Bsk, 8 points, 4 victories, total of 147 : 127; fourth Btk, 6 points, 3 victories, total of 127 : 133; fifth Bask, 4 points, 2 victories, total of 95 : 132; sixth Mitić, 2 points, one victory, total of 66 : 163 and seventh, last place, Bob, 0 points, no victories, total of 92 : 166.

Sports Board of "National Guard"

In the first half of the 1942 a Sports Board of the National Guard was founded, with Rafael Ban as a head of the team. He was famous sports expert, whose main goal was to promote and spread basketball in the National Guard. Along with his assistants Ban achieved admirable success, not only in Belgrade, but in other parts of Serbia too.

"Novo vreme", edition from 14th August 1942 writes: "Considering the so-far work in Belgrade, Valjevo, Skela, Slepčević and Štitar near Šabac Sports Board of the National Guard had a notable success" (Nenadović, 1942c, p. 8).

On Sunday, 16th August 1942, on Btk playground in Tašmajdan the first representative basketball game among National Guard and representation of Belgrade organized by Serbian Basketball and Volleyball Association was played. National Guard team won by 31 : 20 (13 : 8). Nenadović (1942d), among other things, writes:

> Nice and fair game quickly wormed up the spectators, so they chirred-up for their representation from the beginning. In fast actions of both teams goals just came along, but the National Guard team had more luck and managed to end the first half-time to their advantage with 13 : 8. In the following part National Guard demonstrated a great play and won against Belgrade with 31 : 20 (13 : 8) (p. 5).

Basketball activities in Belgrade in 1943

Basketball activities in Belgrade continue in 1943.

On Easter, 25th April 1943, on Btk playground in Tašmajdan two games were played, and those two games, according to Novo vreme journal, were the first ones in that year ("Interesting games happen on Easter", 1943).

Organized by Serbian Basketball and Volleyball Association, on Btk playground in Tašmajdan, from 15 – 24 May 1943 competitions were held in basketball and volleyball. Six clubs with seven teams participated in competition, three women teams: Sk. Mitić, Sk. 1913 and Bob, and four men teams: Bask, Btk, Sk. 1913 and Obilić. This is the way it is written in "Novo vreme": "There is lot of interest about this tournament, and that is why we expect a lot of spectators and fans of participating clubs" ("Today starts the tournament of the Basketball Association", 1943, p. 4).

On Saturday, 10th July 1943, somewhere in the afternoon, as a part of sports competition on Btk playground there was a basketball game between men teams of Sk. 1913 and Btk ("Gentleman's fight between SK 1913 – BTK", 1943).

Basketball competition for the Bob Cup took place in the period 17 – 20 July 1943 on Bob playground in Kalemegdan. Participated: Bask, Sk. 1913, Obilić and Bob.

Games started on Saturday 17th July of the same year in 4.30 p.m. The game between Bask and Sk. 1913 started at 8.00 p.m. Begović left us an interesting description of the game between the teams of Bask and Sk. 1913.

FIGURE 3

Bob women team from 1942 - Mirković, Petrović, Mladenović, Jančković and Komljenović (Source: Paunić, 1981, p. 626)

> Something is wrong in Seismological Bureau. Probably Jelenko's seismographs become senseless. Because, one earthquake that happened on Saturday 17th of July 1943 at 8 p. m. sharp, with the epicentre in one of the Kalemegdan's caves remained un-registred. The walls of the Old Town, which every day are talking to the passers-by about a huge and tumultuous history, have once again trembled and shook. This time the reason was un-remembered delirium among the spectators during the BASK and SK 1913 game. The calm and quiet visitors of Kalemegdans's park, who were resting in the evening sun after a long working day, were shocked "Is it a

> thunder or the earth is shaking?" and led by curiosity they flew to the BOB's playground where "something that Belgrade has never seen before" took place (cited in Stojanović, 2005, p. 24).

Competitions ended on Tuesday 20th July of the mentioned year. First place and BOB Cup won Bask team.

On Saturday, 11th September 1943, starting at 4.00 p.m. basketball competition with six men teams took place. Participated: Bob, Sk. 1913, Mitić, Obilić, Bask and Sk. Srbija. Three games happened between: Obilić and Mitić, Bob and Sk. 1913 and Bask and Sk. Srbija ("Basketball players also play for the Red Cross", 1943).

The last game of that day was the one between Bask and Sk. Srbija. Bask won with a huge difference, 58 : 1. According to Jevtić:

> With one excellent and compact play, where you couldn't say this is better than that, BASK succeeded to break the team of Serbia in that way that its players were simply "swimming on the court". We can say that there was a shot after every forty seconds. And so it kept on in both half-times until Munćan reached 34, and the whole team of BASK a total of 58 – 1. Shooters for BASK: Munćan 34, Šaper II and Dinić both 12. For SK Srbija: Vasiljević 1 (cited in Paunić, 2007, p. 183).

Basketball activities in Belgrade in 1944

During 1944 there was a little bit less basketball than in the years before.

When Slava Stojković asked Nebojša Popović: "With War coming to an end it seems that basketball plays less than before?" he answers:

> Yes, especially when Srem Front happened. Because, first of all the liberation of Belgrade happened in 1944 and after that Srem Front. They recruited a lot of people. I volunteered. First they denied my application because of a knee operation I had few months before, but I ran away and went there (Stojković, 2000, p. 18).

There are just a few data about basketball activities in Belgrade in 1944.

According to "Novo vreme" from 26th august 1944 on Saturday 26th and Monday 28th August 1944 in Belgrade were played two basketball games between representatives of Kragujevac and Belgrade. We didn't find any data about that game. (Paunić, 2007)

According to Stanislav Paunić: "That was the end of the Basketball in those hard times [...] the basketball that was also played in other towns across Yugoslavia" (ibidem, p. 365).

Basketball activities in Belgrade in 1945 – Founding of basketball section as a part of the Phys-culture society Red Star

The group of sports-workers from Belgrade: Zoran Žujović, Slobodan Ćosić, Ljubiša Sekulić, Nebojša Popović, Svetozar Gligorić, Dušan Bogdanović, Mira Petrović, M. Ćirić and others during February 1945 started the initiative to found new sports, or how it was called at that time, new Phys-culture Club in Belgrade.

On the fourth of March 1945 a Phys-culture society "Red Star" was founded in the premises of Sokol society Belgrade – Matica in Deligradska no. 27 (DIF from 1946).

On the Assembly there was a hard discussion about how to name that new sports club, and at the end they decided to call it the "Red Star". Zoran Zujovic, in conversation with Petar Pavlović on March 1979 in "Politika" building in Belgrade says:

> A hard discussion was led about the name of the new sports club. There were many suggestions. At the end, I think, Slobodan Ćosić said: "To name our society the Star" and I spontaneously added: "Excellent, only, if it is a Star, let it be Red". All present agreed with this suggestion. And so, that is how Star got its name. I have members' card no. 1 (Pavlović, 1989, p. 555).

It was composed mainly from the rest of the SK "Jugoslavija", they inherited their stadium, the other objects, players, and red – white colours.

Among others, a basketball section was also formed. For the head of the man and woman section was named Mira Petrović. About that Nebojša Popović says:

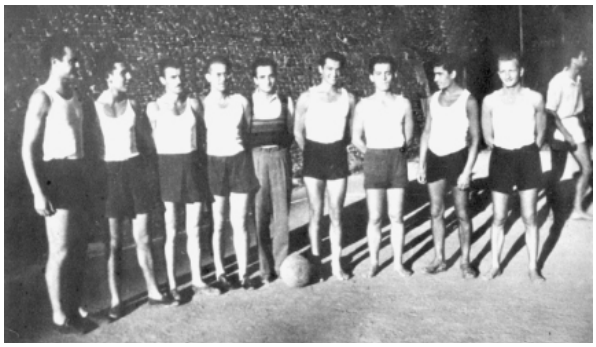
> I was hardly walking on that 4th March 1945 – there was still shooting on Srem Front – when we founded the Red Star. Actually, when I came back from the front and the medical treatment I was active again, that is how it was called in those days. In the House of the youth (Dom omladine) Vračar, in villa Srškovića (his son played basketball with me

in SK 1913) it was decided to start with the sports activities […] in the building of DIF, whose windows were broken from the bombing, we founded the Star. You should remember this: the head of the basketball section was Mira Petrović, she was the first "mom" of basketball, because she led both man and woman. She became the best women basketball player of Yugoslavia and she married also the player of Star, famous otolaryngologist dr Borko Jovanović (cited in Stojković, 2000, p. 18).

How they got their right to use the playground and managed to persuade Russian soldiers to give them one room, how they stole the land from the tennis court of Bob, how they broke the wall to spread the playground and what other kind of problems they ran into Popović says:

FIGURE 4

Kalemegdan, Belgrade, April 1945, team that played first game after the liberation of Belgrade - Alagić, Stojanov, Maderuh, Neferović, Aksentijević, unknown, unknown, unknown and Lahman (Source: Paunić, 1981, p. 629)



The basketball club Star was born on Little Kalemegdan, were before the War was a tennis court. The club was called BOB (I don't know what it means) and his biggest opponent was BTK from Tašmajdan, Belgrade tennis club. When they played, sometimes a several thousands of fans came. However, in those rooms on Kalemegdan Russian soldiers were. Somehow we managed to persuade them – a little bit with schnapps, a little with cigarettes – to give us one little room and the right to use the playground. And so it started. We, literary, stole the ground from tennis players and the first basketball playground made from black slag was now red from tennis ground. We had to break down the outer wall and we got in a lot of trouble because of it. The writer Milorad Panić – Surep, who didn't care about the historical and cultural legacy, he sued us, there was a legal procedure, and I was one of those who defended the Star, with the explanation that we didn't break down the fortress as a historical monument, but only the outer wall, between the fortress and that wall was a water, as around all surrounded cities. And somehow we managed to pass by (ibidem, p. 27).

Mirko Aksentijević says about that:

That tennis playground was between the walls [...] almost the same size as the courts [...] and then we got an idea to put the stands in one of these walls [...] and than through work action [...] there was no money at the time and everything was on the volunteer bases [...] and we started to break down that wall [...] alone, without any engineer [...] and after few days they stopped us and asked what we are doing [...] that is a historical monument [...] and then I was called to see Surep Panić who was responsible for Belgrade culture [...] and he gave me a hard reprehend [...] he says [...] that is a historical monument [...] what are you doing [...] but I answered him with quite a certainty [...] listen [...] one thing [...] no one sees that cultural monument [...] and we will make that thousands of people come there [...] and connect even more with that monument and culture [...] ant that past [...] we are not doing anything wrong [...] he looked at me [...] and he was surprised [...] he says all right, but [...] I don't want you to go to the end [...] finish what you have started [...] and don't go any further [...] all right [...] a word is a word [...] we made it that way [...] and it stands even today [...] so we kind of connected eternally basketball with that cultural monument [...] it was empty than [...] there was no tennis [...] BOB was there before [...] we took it (cited in Paunić, 2007, p. 195).

Milorad Sokolović wrote as follows:

You could still hear the enemy cannons in Belgrade, the enemy who was retreating over the Srem plain. A group of young man sat the baskets on abandoned tennis courts of BOB inside the walls of the ancient Kalemegdan fortress. The Red Star was born there, the school and the "garden" of the future bas-

ketball players. On their own, brick by brick, and step by step they were taking over the tennis courts [...] Bata Aksentijević, Nebojša Popović, Vasa Stojković, Ivan Dimić, Miodrag Stefanović, Borislav Stanković, Aleksandar Gec, Srđa Kalember, Rade Jovanović and Relja Meštrović were the first basketball players in Red Star uniforms. Later on they were joined by Aleksandar Nikolić and Strahinja Alagić from KNOJ team, Sokolović from "Metalac" from Belgrade, Vladislav Demšar from "Edjšga" from Novi Sad and Tulio Roklicer from "Zadar". The most famous among women basketball players were: Sonja Mladenović, Ružica Radovanović, Ljiljana Petrović, Mira Petrović, Mirka Janačković, Pelagija Aksentijević, Anica Filipon, Nena Šešlija, Angelina Gavrilović, Aleksandra Dakić, Vera Sretenović, Mima Stefanović, Branka Cipruš, Milica Gruičić, Milca Vulović, Cica Ognjenović, Vera Blagojević and others. The initiator of all actions in Kalemegdan was Nebojša Popović, active player, the coach of women and men team, organizer, manager [...] In loved with basketball he didn't mind about what needs to be done, as long as the Red Star, and first of all basketball, starts its way to the stars (Sokolović, 1975, p. 27).

Phys-culture course

In Belgrade, from 26th to 31st March 1945, in the office of the Sokol society Beograd – Matica in Deligradska no. 27 was held the first phys-culture course, for phys-culture heads, organized by School for physical education. As a part of the course there were some basketball classes. Bora Jovanović held the lecture.

In "Dnevnik" of School for physical education, among other things, says:

26th March 1945, Monday: 3rd class Basketball: Short explanation of the game. Leading and catching the ball technique. Bor. Jovanović [...]
28th March 1945, Wednesday: 3rd class Basketball: Leading and catching the ball technique. Shoot from one place in several different ways. Bor. Jovanović…
29th March 1945, Thursday: 5th class Basketball: Leading and passing the ball on the go. Shooting the basket on the go and catching the rebounded balls. Bor. Jovanović (cited in Paunić, 2007, p. 191).

Besides Belgrade basketball was greatly played in other places (Novi Sad, Petrovgrad, Subotica, Šabac, Kragujevac, Niš, Prizren, Split, Zadar, Dubrovnik, Šibenik, Kotor) on the territory of former Yugoslavia too, with different intensity.

In some places occupation army, besides playing basketball, founded clubs, brought the game into schools, promoted and spread it among youth and other population, first of all because of the political and ideological influence, and all in the purpose of changing the nationality of the occupied people. For example in Novi Sad, Petrovgrad and Subotica that was the job of Hungarians, and in: Prizren, Split, Zadar and Kotor of Italian occupation authority.

Novi Sad

During 1941 basketball was mostly played among school youth. In the school year of 1941/42 the first city school championship was held with six teams participating. From 1942, besides halls, basketball starts to play on open courts too.

Playgrounds were built in school yards, but the baskets were still without the panel. Only the new UAC playground, today's soccer stadium of Vojvodina – (north part), had a playground with exact dimensions and proper baskets with panel. In "Odeon" cinema (today's JNA house) were posted panels and most of the high school championship games for the 1942/43 year were played there. On the same year was formed the basketball section in Novi Sad – UVAK (Ujvidéki vasutas atletikai club), with mostly high school students playing (Miklović, 1972, p. 13).

The coach was Gerdov Janoš.

High school basketball championship of the so-called South Hungary was held in Subotica on 21st February 1943. For Novi Sad performed the team of Technical high school (IKY) with: Mišković, Dević, Kiš, Horvat and Gerdov. They won the second place right after the Segedin Gymnasium.

Miklović writes that in 1943 the first women basketball team – UAC in Novi Sad was also formed. "The head of the section was Čorba, and for the team performed Lenc Gizela, Mate Julija, Kirila Irena, Mamutović Spomenka i Biro Ilona" (ibidem, p. 14).

Novi Sad men teams, UVAK and UAC, competed in so-called South Hungary League where also participated teams from Sombor, Subotica and Segedin. In UAC team played: Ištvan Glambož, Tibor Lehel, Jene Feldi, Laslo Pap, Lajoš Sokolaji, Janoš Gal and

Ferenc Nađ, and in UVAK: Janković, Dević, Čizmar, Gerdov, Til, Bičkej, Šudar, Majšaji, Kiš and Berko.

According to Sokolović (1975), in the end of April 1945 in Sports society Radnički from Novi Sad was founded the basketball section, both for man and women. It was founded by players: Oskar Bozo, Jožef Čizmar and Jožef Danijel. In women team played: Pajić, Dorovoić, Ranković, Dević and Seleši, and in men's: Balog, Kiš, Vicko, Pap and Dezidar.

Petrovgrad

Among school youngsters basketball started to play during 1943, in the time of arrival of teacher of physical education from Hungary, Ištvan Kamaraš, to Hungarian Gymnasium in Petrovgrad. Directly from Hungary was brought a basket construction set in the yard of the Hungarian Gymnasium. On the same year Ištvan "formed a school team and trained with them and at the same time with all others interested for that game" (Balog, 1956, p. 5). Although it was continuously trained "yet there was no official game, but the effort was to pick up some basic technical and tactical skills. In this period we only had inner-school competitions with all higher classes of Gymnasium and High school participating" (ibidem). Ištvan Kamaraš says as follows:

> [...] when I came to school [...] to so-called Mesinger [...] it's that higher Hungarian Gymnasium [...] now I can say something more [...] because I am one of the participants from that generation (the conversation is translated by Tibor Dudiambrozi, professor from Zrenjanin), former pupil of that Gymnasium where professor Kamarač taught (remark S. P.) [...] and practiced under his guidance [...] he said [...] that one of the things children loved [...] was [...] that he sat the basketball court [...] that the constructions for basketball court were found [...] one portable structure for the hall [...] regardless to the small size of the hall [...] he started some serious trainings [...] like in Pešta [...] and when children saw that there is some serious work there [...] and that there is some improvement [...] so many of them came that he just couldn't find enough time to follow [...] those generations [...] and pupils [...] and the ones who already [...] played in former Sokol system [...] but they [...] Putnik Mile and Tešin Mileta [...] all the ones who already new basketball they learned in that Sokol system [...] he accepted them [...] and Serbian youngsters [...] and who trained along with Hungarian youngsters too [...] and along with us trained in that Hungarian Gymnasium [...] in one occupied country [...] where was quite risky to accept other generation to come to your school [...] I have to say that [...] I also found strange to have some trainings behind closed doors [...] and he explained right away [...] that he was strictly ordered by Rajscomand [...] because every school had to be secured [...] that no one can accept Serbian youngsters in school [...] only their own [...] no other [...] he accepted that generation of players [...] better-said Serbian youth wanted and knew something about basketball [...] and that is why those trainings were in closed halls [...] I remember [...] and I didn't know why the doors were closed (Kamaraš, 1979; as cited in Paunić, 2007, pp. 185–186).

According to Tot in Petrograd basketball among school youth started to play in 1942. Tot, in conversation with Stanislav Paunić on 12th February 1979 in Zrenjanin, about the mentioned says:

> [...] 1942 came to high schools [...] Economics High School and Gymnasium [...] professor Kami brought the portable baskets [...] Kamaraš Ištvan [...] stayed until the end of the occupation [...] right before the liberation [...] all professors from Hungary came back [...] than I saw basketball for the first time (Tot, 1979; as cited in Paunić, 2007, p. 185).

Subotica

There are just a few data about basketball in Subotica during the War. Marjanović says:

> [...] I was born In Subotica, and went to school there and [...] during the occupation [...] I saw basketball for the first time when Hungarians who's basketball at the time was [...] like [...] very developed [...] they played a game in Subotica [...] and we had a very ambitious teacher of physical education [...] Actually at the time he even was a basketball representative of Hungary [...] and he started to gather us with a lot of ambition [...] especially the tall ones [...] his name was Sitner [...] I was around 190cm at the time [...] around 42 [...] 43 [...] year [...] than, as a Gymnasium team, we used to travel and play basketball almost every week [...] they loved it that much [...] all expenses were covered [...] we travelled from

one place to another [...] And we had quite some team [...] Pera Šarčević [...] also played with us [...] that bowler [...] Yugoslav record-holder [...] the trainings were very serious [...] already in 1944 we had one very good game with their school for physical education [...] we lost [...] I even remember with 33 – 30 [...] Sitner gave a lot more to basketball than anything else" (Marjanović, 1980; as cited in Paunić, 2007, p. 186).

On 21st February 1943 a high school championship of so-called South Hungary was held in Subotica. The team of Segedin Gymnasium won first place, second Technical high school from Novi Sad, third Subotica Gymnasium and fourth Subotica Trading School.

Šabac

In "Novo vreme" from 16th May 1942 is written that basketball started to play and that there are new formed clubs, not only in Belgrade, but in other parts of Serbia too. It also says that Šabac already has a basketball team. "Basketball started to develop inside the country too. In Niš and Šabac already existed some basketball teams" ("Basketball and Volleyball tournament for the BTK Cup", 1942, p. 5).

FIGURE 5
Slijepčević, Kitog, Mačva (near Šabac), 1942, National Guard of Serbia, Basketball course, participants with diplomas. (Source: Paunić, 1981, p. 620)

In Šabac two basketball teams were formed, Sk. 1913 Šabac and a team of Third group of members of National Guard. Some real games started soon.

On Sunday 2nd August 1942 on "Mihajlo Lac" athlete track in Šabac, somewhere in the afternoon, a basketball and volleyball competitions between Sk 1913 from Šabac and a team of Third group of members of National Guard from Štitar and Sljepčević village were held ("Basketball and volleyball in Šabac", 1942, p. 5).

About basketball in Šabac, Mišković says, in his interview given to Stanislav Paunić on 17th May 1980 in Šabac:

Basketball had just arrived to Šabac [...] during the occupation [...] in 42 [...] my friend [...] I used to know [...] I met him by Dragutin Lazarević [...] he was a triple Serbian record-holder in middle and long tracks [...] Galović Ljubiša [...] he went from Belgrade because of Germans [...] and we together founded a basketball club [...] first game was with Belgrade [...] on the tracks [...] they sat the baskets themselves [...] we took some wooden fence [...] and we made baskets from that [...] we made hoops in Mala [...] the stands were crowded [...] because we wrote [...] there will be a friendly game in Basketball [...] as when they come to see horse races [...] (Mišković, 1980; as cited in Paunić, 2007, p. 184).

Kragujevac

In the time of War basketball occasionally occurred in Kragujevac. According to Mišković Miodrag Stefanović brought basketball in Kragujevac during 1943. They played it in school yard of women Gymnasium. There also was one game between representation of Kragujevac and "Working Guard". Kragujevac lost. About that, R. Mišić, in interview given to Stanislav Paunić on 18th February 1979 in Rijeka says:

Mija Stefanović brought basketball to Kragujevac in 1943 [...] one group came to work [...] Mija and Aksentijević [...] together we sat some wooden baskets in school yard of Women Gymnasium [...] demonstration game [...] some "Working Guard" – representation of Kragujevac [...] "Working Guard" won 17 – 14 [...] first equipment and first rules came from Mija (Mišić, 1979; as cited in Paunić, 2007, p. 184).

Petrović writes that Pavle Kostić and Mirko Aksentijević brought basketball ball to Kragujevac in 1942, that they formed basketball sections in sports societies "Trgovački" and "Šumadija", and that there were games between them.

The first basketball ball was brought from Belgrade. Paja Kostić and Bata Aksentijević brought it in 1942. They were sent by the occupation army to create an image of good order under German occupation. In sport societies "Trgovački" and "Šumadija" they

> formed basketball groups. In the time of War players of "Šumadija" and "Trgovački" played games among themselves, but there are no written data about that. I relied on oral narratives of Stevan Žilović and Živorad Vasiljević (Petrović, 1969, p. 12).

Basketball representation of Kragujevac had a game with representation of Belgrade on 13th August 1944 in Kragujevac. Kragujevac won. 10 : 9. On Saturday 26th and Monday 28th August of the same year in Belgrade Kragujevac team had two games with representation of Belgrade. The results, as also some other details about those games, so-far remain unknown to us.

Niš

In "Novo vreme" from 16th May 1942 writes that in Niš and Šabac already exist some basketball teams and that very soon Niš will organize basketball championship.

"Basketball started to develop inside the country too. Basketball teams already exist in Niš and Šabac. Soon will be one tournament in Niš" ("Basketball and Volleyball tournament for the BTK Cup", 1942, p. 5).

So-far we do not know if that competition was indeed held.

Prizren

Italian solders occasionally played basketball and organized championships in Prizred during the occupation. In the beginning of May 1942 they founded their society named "Federata" where they played basketball as well. They acquired some balls, jerseys, sneakers; they set first baskets in Gymnasium playground in September. They had their basketball-teachers. A. Morina writes:

> These teachers were mostly Italian and had the task to, as well as practical, give also some theoretical classes. In those theoretical classes they have trained people for military-political purpose, bringing some fascist spirit into them. First public game was played on October 1942 between town team and Italian army (Morina, 1968, p. 21).

Paunić says: "Italians will also play some basketball here during the occupation, but not because they really want to spread the game, but mostly as one way of fascist propaganda" (Paunić, 2007, p. 243).

Prizren youngsters were not fascinated by that game, and they didn't show any great interest in it, even though Italian solders tried to attract as many youth as they could, first of all because of the political influence. S. Đikanović writes about that:

> An area, like this one is, which had lived in tradition of hard patriarchy for centuries, was not really friendly to some new kinds of sports and fun, so it was, kind of normal, to take every news about that with such a scepticism [...] how much time it takes to forget this sport or that kind of entertainment in other places [...] It is interesting to note that the Italians, the invading soldiers, brought some of unusual game in those time and in that territory (volleyball and basketball), which the villagers watched without any special thrill, so there was no higher response, although the Italians tried to influence the political organizing of youth and younger children (Đikanović, 1972, p. 8).

Split

Basketball started in Split in 1941. During the next few years (42 – 45) basketball activities continued.

In March 1942 one game between representations of Zadar and Split took place. We didn't find any other information about it beside a single photography, so a lot about that game so-far stays un-known to us.

On May of 1943 players of Split took part in the final championship of G.I.L. of all Italy in Rome. In reviewed documents we didn't find the names of Split players, with whom they played, the results and other. The only thing that is written is that the Split players took part at the final competition in Rome on May 23rd 1943 against Zadar for the 7th place. They won the 7th place by beating Zadar 22 : 17. Perić writes about that:

> First affirmation and special phenomena of sports in Split was seen in Rome in 1943 at the final tournament of Italian G.I.L. championship. Before this a lot of smaller, local championships happened, were we could see 150 - 200 teams performing. On the final tournament in Rome, 23rd May 1943, in a game for 7th place, Split defeated Zadar by 22 : 17, even though basketball existed in Zadar for over 15 years, with, of course, regular high school championships (Petrić, 2000a, n.p.).

According to Marović: "With Italian capitulation in September 1943, Split had no basketball until the liberation" (Marović, 1982, p. 329).

According to same author it starts to play again in February 1945 in new-formed Split Phys-culture Board (FOSK). In May of that same year a women basketball section was formed and existed as a part of FD Hajduk. The initiator of that idea was Marko Lete, who also was a head of the mentioned society at the beginning.

FIGURE 6

Basketblal game as a prat of newspaper report, took place in Split between Zadar and Split, March 1942 (Source: Košarkaška nostalgija, n.p.)

Spalato, marzo 1942 **– Una fase della partita fra le rappresentative di Zara e di Spalato.**

> Since than a true basketball development starts in our town, says Marović, and exactly in May 1945 when a women section was formed on the initiative of United Association of Yugoslav Youth (USAOH) for Dalmatia, with the idea of spreading phys-culture movement among women. A taught about that came from the youth leaders, better said from the engineer Marko Leta, who led the section for a while. It existed as a part of FD Hajduk, as a sport game section, and had around 15 players: Dragana Kovačić, Sonja i Teny Gizdavčić, Elvira Carbonini, Valerija Zavagni, Mirjana Lučić and others. In the mid 1945 the coach of this group was Uroš Tominić Paja, pre-war basketball player (ibidem, pp. 329–330).

Zadar

In Zadar, during the War, basketball existed in schools, in games against Split and on the official competitions with Italian clubs.

Đuro Vujanić, one of the initiators and founders of basketball section in Zadar in April 1945, in a letter to Stanislav Paunić, from 23 May 1979, among other, says:

> During the War I wasn't active in basketball, but I was a regular visitor of trainings and games for both, men and women. A simplifying situation was that you could clearly see everything from the town park, right above the playground. There was a very good man and woman basketball. But, unfortunately, because of the War, such a beautiful activity was kind of dropped down. In the time of the occupation people from Zadar spread basketball to Šibenik and Split. But it all came back to Zadar. I already said that there was a quite good quality man and woman basketball there, so many of players were the main leaders of the game and the standing pillars of after-war basketball in Zadar. I will mention their names because they deserve it. Man: Ermano Vazzalev, Guido Pittoni, Umberto Nadoveza, Tullio Rochlitzer, Antonio Zerauchek, Augustin Zane, Guierrino Alluni and some others too. For representation of Yugoslavia participated: Pittoni, Zerauchek and Rochlitzer. Women: Madera Kalmeta, Uccija Cirkovich, Bijanca Kalmeta etc. For representation of Yugoslavia participated Madera Kalmeta (Vujanić, 1979; see in Paunić, 2007, p. 185).

On May of 1943 players of Zadar took part in the final championship of G.I.L. of all Italy in Rome. In reviewed documents we found a data that the Zadar players took part at the final competition in Rome on

May 23rd 1943 against Split for the 7th place. They didn't take the 7th place because Split won by 22 : 17.

On April 1945 a phys-culture society was found in Zadar, and a basketball section as a part of it. Paleka writes:

FIGURE 7
Women players of Zadar on game in Split 1942. Standing: Loli Svirčić, Lia Orlić, Lučana Uča Ćirković, Maria Sala. Down: Madera Kalmeta, Amella Varisco and Sonja Svirčić. (Source: Marić, 1996, p. 16)

> The initiators of that society were Đuro Vujanić, Tullio Rochlitzer and Berto Nadoveza. The first one was a famous referee and in one time also a coach, and after even a office-bearer, Rochlitzer and Nadoveza were the players of "Zadar" (Paleka, 1976, p. 27).

Kotor

During the War basketball started in Kotor in 1941, right after the occupation of Boka Kotorska by the Italian army. Basketball activities continue through the following years.

The game between representation of Kotor and the team of Italian army, that was stationed there, took place in May of 1942. That same game remained in the memory of people who were the actual actors of it. Italians won. The result remained unrecorded. For Kotor played: Petar Lubarda, Vjekoslav Pezenti (or Prezenti), Vladimir Šević, Ante Savić, Veljko Tujković, Branko Proročić and Aco Ivanović.

In the beginning of January 1943 players of Kotor G.I.L. played a game with the players of the same name from Split who have lost by 14 : 34.

After the capitulation of Italy in September 1943, basketball in Kotor stopped. After the end of War basketball activities continue.

Ljubljana

There are some data which show that during the WW II basketball existed in Ljubljana as well. About mentioned Pavlin (2005) writes:

> Basketball didn't totally disappear in the time of the WW II because the interest for Slovenian sports, and so basketball as well, during the Ljubljana occupation, was taken over by CONI (Comitato Olimpico Nazionale Italiano) who engaged Slovenian sport organizations with some kind of autonomy. Sokol was recessed, and all of his property and role took over the fascist organization G.I.L.L. (Gioventu Italiana Littorio di Lubiana) (p. 120).

In 1941 G.I.L.L., among other things, have organized a youth sports games for students 13 – 18 years old including athletics, volleyball, basketball, skating and skiing (Kokalj – Kovačević, 2003).

Zagreb

In reviewed sources we didn't find data about basketball in Zagreb in that mentioned period. But, when we are taking about published materials about basketball, the situation is quite different.

In Zagreb in 1942 a book was published by an unnamed author "Sport games. Basketball", edition of Administrative Command of ustash Youth, Department for physical education, with 112 pages and 102 drawings, printed by printing office "Gaj" from Zagreb.

The cover page says: Professional book, Department for physical education, Sport games, Book I, Basketball, with 102 drawings, Zagreb 1942, Administrative Command of ustash Youth.

In the book: Jajčević Z. (1987). Sport affairs in Croatia. Addition to history of sport affairs. Zagreb: Libraries of Zagreb, in chapter: Material for bibliographic-monographic and periodical publications in sports, edited by Tatjana Nebesny and Jablanka Sršen, states:

> Review of monographic publication. Index of author, organizer, editor and translator, page 141, no. 583, author Milan Kobali. Sport games / by Milan Kobali – Zagreb, 1942. 2 SV (professional book of the Department for physical education) SV 1: Basketball – 112 pages, SV 2: Handball – 100 pages (p. 141).

On the basis of the already mentioned we can state that the author of the book Basketball, published

in Zagreb in 1942, was Milan Kobali. It stays unknown for now why the book doesn't have his name, even though he is the author.

The book "Basketball – rules in words and pictures", by Milan Kobali was published in Zagreb 1938/39, printed on the printing machine, hard binding (Kobali, 1986).

It still remains unknown to us if that Kobali's book was printed and published in 1942 without the name of the author.

The book from 1942 is divided in three parts (chapters): Technique of the game, Game practise and Rules of the game. In introduction, among other things, says that basketball develops all muscles and organs of the human body together, that it is a very useful game and it can be used as a basic method of physical education, that it can:

> [...] be of great use as a winter practice for athletes [...] Basketball is an inexhaustible well of different actions and moves, because it contains a variety of possibilities for both team and individuals [...] As a team game, basketball develops a sense of a whole and friendship. One of the main characteristics of basketball is that it excludes all kind of rudeness, because every single one is severely punished ("Sports games I volume. Basketball", 1942, p. 5).

FIGURE 8
Book Basketball printed in Zagreb 1942

In the first part (Technique of the game), page 26 says about catching and passing the ball, play-through, one-leg turn, feinting, shooting, free throw and stopping. All actions are illustrated by 37 drawings. At the end of the chapter, in one page, there are thirty short instructions for playing basketball.

In second part (Game practice), in 32 pages of text and 29 illustrations were presented the exercises: without ball and basket, only with the ball, only with basket, with ball and one basket, with ball and both baskets, practice game with one and with two baskets. At the end of the chapter in one page were given 10 advices for basketball teachers. Advice no. 9 says:

"Be a role model to your players in everything. With kind word, act and example impress your players to gladly love and listen to you. You cannot suppress something if you do it yourself" (ibidem, p. 60).

In the third part (Rules of the game) in 45 pages and 32 illustrations were given 13 rules:

Playground plot; boards, baskets and ball; leaders of the game and their duties; players and substitutions; terms; rules of the game; points, winner, additional time and forced interruptions; outside; počinak i "vrijeme odbiti", held ball; free throw; violation of the rules and sanctions; faults and sanctions (technical faults of players, technical faults of opponents and personal faults).

At the end of the book, before the content, in two and a half pages of text and two pages of drawings instructions are given for construction of basketball devices.

According to research of Pavlović (1989) Sarajevo, as also other places in the territory of today's Bosnia and Herzegovina, had no basketball activities in the time of the World War II.

REFERENCE

Balog, A. (1956). *Razvoj košarkaškog sporta sa osvrtom na NR Srbiju u vremenu od 1945-1955. godine* (Development of basketball with emphasis on PR Serbia in the period from 1945-1955). Beograd: Institut fizičke kulture.

Basketball and volleyball in Šabac. (1942, Avgust 6). *Novo vreme*, p. 5

Basketball and volleyball tournament for BTK Cup. (1942, May 16). *Novo vreme*, p. 5.

Basketball players also play for the Red Cross. (1943, Septembr 11). *Novo vreme*, p. 4.

Costituent Assembly of Referee Assosciation today. (1943, December 14). *Novo vreme*, p. 5.

Đikanović, S. (1972). *Društveno-ekonomska uslovljenost razvoja košarke u Metohiji za poslednjih deset godina* (Socio-economic dependence of basketball development in the Metohija in the past ten years). Final paper. Univerzitet u Beogradu, Fakultet fizičke kulture.

First BSK - S.k. 1913 game. (1942, April 12). *Novo vreme*, p. 5.

Gentleman's fight between SK 1013 - BTK. (1943, July 9). *Novo vreme*, p. 4.

Interesting games happend on Easter. (1943, April 22). *Novo vreme*, p. 4.

Jajčević, Z. (1987). *Sportska publicistika u Hrvatskoj. Prilozi za povijest sportske publicistike*. (Sports journalism in Croatia Contributions to the history of sports journalism). Zagreb: Knjižnice grada Zagreba.

Kobali, M. (1986). Stvaranje košarke u Zagrebu (The beginning of basketball in Zagreb). *Povijest sporta*, *67*, 33−40.

Kokalj-Kovačević, M. (2003). Šport med Drugo svetovno vojno (Sports before II WW). U *Seminar za mentorje zgodovinskih kružokov* (pp. 62−65). Ljubljana: Društvo prijateljev mladine Slovenije.

Košarkaška nostalgija. n.d. Preuzeto 4. oktobra 2006. godine sa web sajta: http://hrsport.net/Sportnet-klub/Tema.aspx?pID =1197544.

Marić, D. (1996). *Povijest zadarske košarke 1930-1995*. (History of Zadar basketball 1930 - 1995). Zadar: Zadiz.

Marović, D. (1982). Počeci košarke u Splitu (The beginning of basketball in Split). *Povijest sporta*, *53(13)*, 323−332.

Miklović, A. (1972). *Evolucija košarke u Novom Sadu* (Novi Sad basketball evolution). Final paper. Univerzitet u Sarajevu, Visoka škola tjelesne kulture.

Morina, A. (1968). *Evolucija košarke u APK* (The Autonomous Province of Kosovo basketball evolution). Final paper. Univerzitet u Sarajevu, Visoka škola tjelesne kulture.

Nenadović, D. (1942a, May 11). Obilić je uspeo da se revanšira S.k. 1913 sa 30 : 17 (10 : 13) [Obilić made revanche to S.k. 1913 with 30 : 17 (10 : 13)]. *Novo vreme*, p. 5.

Nenadović, D. (1942b, April 14). Košarka se sviđa našoj sportskoj publici (Our sports audience love basketball). *Novo vreme*, p. 5.

Nenadović, D. (1942c, August 14). Nacionalna služba skup svih sportista (National Guard gathering of all players). *Novo vreme*, p. 8.

Nenadović, D. (1942d, August 18). Nacionalna služba Beograd 31 : 20 (13 : 8) [National Guard vs. Belgrade 31 : 20 (13 : 8)]. *Novo vreme*, p. 5.

Near 1500 spectators in basketball game. (April 18, 1942). *Kolo*, p. 27.

Paleka, V. (1976). *Razvoj košarke u Zadru* (Developmnet of basketball in Zadar). Final paper. Univerzitet u Zagrebu, Fakultet fizičke kulture.

Paunić, S. (1981). *Geneza i razvoj košarke u Jugoslaviji* (The genesis and development of basketball in Yugoslavia). Doctoral dissertation, Univerzitet u Beogradu, Fakultet fizičke kulture.

Paunić, S. (2007). *Geneza i razvoj košarke u Jugoslaviji* (The genesis and development of basketball in Yugoslavia). Kovin: Ženski košarkaški klub.

Pavlin, T. (2005). *Telesno, kulturno in športno organizaovenje na slovenskom pred Prvo svetovno vojno in po njej* (Physical, cultural and sports organizing in Slovenia before and after World War I). Ljubljana: Fakultet za šport.

Pavlović, D. P. (1989). *Fizička kultura u NOB na teritoriji današnje SR BiH u vremenu od 27. jula 1941. do 9. maja 1945. godine* (Physical Culture in the National Liberation Fight on the territory of Socialist Republic of B&H in the period from July 27, 1941 to May 9, 1945). Unpublished doctoral dissertation. Univerzitet u Novom Sadu, Fakultet fizičke kulture.

Petrić, T. (2000). Zašto je Split „najsportskiji grad na svitu". Nima sporta do Splita. Slobodna Dalmacija, 21. februar 2000 (Why Split is the "sportiest" city in the World. No sports without Split). Retrived from: http://arhivaslobodna dalmacija. hr/2000221/prilozisp2-htm.

Petrović, Z. (1969). *Razvoj košarke u Kragujevcu* (Development of basketball in Kragujevac). Final Paper. Univerzitet u Beogradu, Fakultet fizičkog vaspitanja.

Simović, S., Pavlović, P., Pantelić, K., & Grgić, Z. (2010). Basketball in the Territory of Former Yugoslavia in 1941. *SportLogia*, *6(2)*, 11−25. doi: 10.5550/sgia. 1002011

Sokolović, M. (1975). *Sve o košarci. Sportska biblioteka* (Everything about basketball. Sports library). Gornji Milanovac: NIP "Dečije novine".

Stojković, S. (2005). *Nebojša Popović uvek prvi* (Nebojša Popović always first). Beograd: Košarkaški savez Srbije i Crne Gore, Košarkaška fondacija.

Sports games I volume. Basketball. (1942). Zagreb: Upravno zapovedništvo ustaške mladeži, Odjel za tjelesni odgoj.

They play on the first day of Easter. (1942, April 1). *Novo vreme*, p. 5.

Today starts the tournament of the Basketball Association. (1943, May 15). *Novo vreme*, p. 4.

Received: December 15, 2010
Accepted: April 12, 2011

Correspodence to:
Petar Pavlović, PhD
Faculty of Physcal Education and Sports
Bul. Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina
Phone: 00387 66 70 64 58
E-mail: ffvis@blic.net

THE IMPORTANCE OF STRENGTH IN SPORT DANCE PERFORMANCE TECHNIQUE

Adriana Lukić[1], **Snežana Bijelić**[1], **Meta Zagorc**[2], **and Lejla Zuhrić-Šebić**[3]

[1]Faculty of Physical Education and Sport, Banja Luka, Bosnia and Herzegovina
[2]Faculty of Sport, Ljubljana, Slovenia
[3]Faculty of Sport and Physical Education, Sarajevo, Bosnia and Herzegovina

SHORT SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.061L COBISS.BH-ID: 2102808 UDC: 793.3:796

SUMMARY

Strength is a motor ability that largely determines the features of a move. In the area of conventional sports, that is the very facet that serves as the basis for its importance, which is corroborated by several studies. In sport dance, it is usually demonstrated in the form of repetitive and explosive strength and in the function of introducing nuances in the dynamics of dance performance. How big the importance of some manifestations of strength for the quality of Latin-American and Ballroom dances performance as sport dance disciplines is, is the topic that this paper deals with. The research included 49 sport dancers of both genders, age 12-15. The results of the research point out to the fact that there are different approaches in validation of the contribution of strength for the quality and performance of Latin-American and Ballroom dance. Namely, strength as a motoric ability has statistically significant effects on the quality of Latin-American performance technique, while in Ballroom dances it does not appear to be statistically significant. The obtained differences in the significance of the contribution in the observed dance disciplines are, for sure, a confirmation of the necessity to have an individual approach in planning and programming of training process, particularly for Ballroom and Latin-American dances.

Key Words: strength, influence, sport dance.

INTORODUCTION

Sport dance can be described as a specific blend of art and sport, which enables the dance pair, in an original way, to express true emotions provoked by different types of music and mold it into a harmonic mixture of beautiful moves. The skill to link and harmonize complex dance structures of different dances, in space and time determined by rhythm, creates a certain esthetical impression which makes the dancer an artist, as well as the need to show and prove even better. The quality of a dancer's technique and the artistic performance depends on a wide spectrum of motor abilities. To date researches in sport dances have yielded some interesting information on the valorisation of individual motoric abilities in the area of technical performance of certain dance disciplines (Kostić, 1997; Lukić, 2006; Lukić, Bijelić, & Jovanović, 2008; Lukić, 2010; Uzunović, 2008). Likewise, numerous researches from the dance area also corroborate a great influence of basic motoric abilities on a successful dance expression (Lukić, 2006; Uzunović, 2004; Uzunović, Kostić, Zagorc, Oreb, & Vlašić, Oreb, & Leščić, 2009). Given the kinetic structure of dance technique, that is, the dance activity in general, it can be said that the most active is the caudal part of the body, which is also the "basic"motor of the move. The lower limbs, their muscles and the abdominal part of the body are mostly responsible for a successful implementation of the tasked dance technique. The ability to contract them swiftly and to relax them determines the necessary dynamics of the dance performance, the ability to react timely with specific muscle groups influences rational utilization of the dancer's energy, as well as the very appearance of muscles largely contribute to the esthetic expression of the move performance. The strength motoric ability in dance activities plays an important role. It appears in different manifestations, and the type of dance activity determines the level of utilization

of its potentials. In sport dance, specifically, it is mainly present in the form of repetitive and explosive muscle potential, and there are numerous researches that proved it (Kostić, 1997; Lukić, 2006; Uzunović, 2004). This paper explores the repetitive and the explosive muscle potential of the caudal part of the body of sport dancers. Bearing in mind the diversity of techniques of the performance of dance belonging to the discipline of Latin-American and Ballroom dances, there is a need for a different valorization of strength as a motor ability of important for the quality of performance in the mentioned dance disciplines. The level of influence of strength on the Latin-American dance performance technique in comparison to Ballroom dances is the topic of this paper. Given the facts stated above, the objective is to determine the form of the correlation between strength and Latin-American and Ballroom dances. The hypotheses of the paper are:

- H_1 – statistically important prediction of efficiency of performance techniques of Ballroom dances, based on motoric strength ability, is expected;
- H_2 – statistically significant prediction of efficiency of performance techniques of Latin-American dances, on the basis of the motoric strength ability, is expected.

METHODS

Sample of participants

A representative, purposeful and stratified sample of interviewees was used, comprising 49 sport dancers, of whom 25 female and 24 male dancers. The sample encompassed dancers from 12 to 15 years of age, belonging to the age cohort of juniors 1 and juniors 2. They compete as part of dance divisions D3 and D4, whose program covers choreographies assembled from basic and more complex elements of dance performance techniques. They have all actively participated in the training process for 2 years and have trainings three times a week.

Sample of variables

For the purposes of this research, one predicative (defined through 3 strength tests) and two criterion variables (defined through 3 Latin-American (LA) and 3 Ballroom (ST) dances have been selected. The predicative variable will serve to test the correlation and possible predication of successfulness in performance of Latin-American and Ballroom dances. It is comprised of: 1 upper body lifting - MPGDT; 2. Throwing medical ball from the lying position - MBMLE ; 3. Jump from the spot - SKOKUDAL. The predicative variable is made of standardized tests for the evaluation of the motoric strength ability and they possess the necessary metric characteristic (Metikoš, Hofman, Prot, Pintar, & Oreb, 1989). The criterion variables of Latin-American dances (LA) and Ballroom dances (ST) will be used to assess the speed and the quality of the acquisition of the tasked dance structures. The criterion variable is comprised of three out of the total of five ST dances. Due to mutual contrasting in the dynamics and the paste of performing LA dances, we selected Samba, Cha cha cha and Jive, and from ST dances we selected the English waltz, Tango and Quick step. Each of these dances is defined by the basic technique elements (Howard, 2002; Laird, 1992) and, put together, they comprise a criterion of Latin-American dances and one criterion of Ballroom dances. All technique elements have been prescribed and adopted by the International Dance Sport Federation-IDSF. The assessment of the quality of the basic technique elements of Latin-American and Ballroom dances was done by a jury commission using marks ranging from 0 to 10. The jury commission was comprised of licensed referees of sport dance of the Bosnia and Herzegovina Sport Dance Association.

Test description

The predication variable system is made of standardized tests for the assessment of the strength motor ability: MPGDT, MBMLE and SKOKUDAL. These tests possess the necessary metric features. Testing the criterion variables was done by a verified jury commission, which simultaneously also assessed thequality of performance (Nagode-Ambrož, 1992) of the tasked dance structures on the scale of 0 to 10 points. The arithmetic mean result of all points will be used to place the obtained values of each interviewee into the basic elements of Latin-American (LA) and Ballroom (ST) dances quality assessment scale.

Quality of performance of different dance structures of LA and ST dances assessment scale:

Point	
0	None of the elements successfully performed.
1	One element correctly performed, but out of the rhythm.

2	One element correctly performed in rhythm, but others poorly and out of the rhythm.
3	One element performed in rhythm, but others performed in a wrong sequence and out of the rhythm.
4	Two elements correctly performed, but out of the music rhythm.
5	Two elements correctly performed in rhythm, but others performed out of the rhythm.
6	Elements performed in a correct sequence, but without a rhythm.
7	Elements performed in a correct sequence, but only two in the rhythm.
8	Elements performed in a correct sequence, but occasionally out of the rhythm.
9	Elements performed in a sequence and rhythm, but without the presentation of the move characteristic.
10	Elements performed in rhythm, sequences and with a good presentation of the move characteristics.

Statistical data processing

The results obtained from the research have been processed using the procedures of descriptive and comparative statistical analyses. For comparative statistics, we used the parameteric statistics, and within it: correlational and regressiona analyses. As the level of statistical importance, we set $p < .05$. The statistical data processing was done on a personal computer Pentium IV, with the use of the aplication statistical programs SPSS (version 10.0) and Statistics.

RESULT AND DISCUSSION

Table 1 shows the correlation matrix of strength and efficiency in performing Ballroom (ST) dance techniques. It is obvious in the table that the efficiency of performance of Ballroom dances is under a big influence of the long jump test, which is representative of explosive strength (.300). Ballroom dances are performed in pair, in a compact hold, in which the upper part of the body of the dancers is at rest. The stability of the dancer depends exactly on the correct positioning of the upper part of the body and its stillness in a progressive move character which dominates in standard dances. Taking that into consideration, it is perfectly understandable that there is absence of statistical significance of correlation link between the other two tests which are representative of repetitive and explosive strength of the upper part of the body. The explosive strength of the legs is a motoric ability which is exhibited in ST dances in lifting and lowering the body axis as a consequence of activating the leg muscles, and in quick dances (such as Quick step) it becomes particularly apparent. The long jump test - SKOKUDAL, trains explosive strength of lower extremities, and in such an explanation lies the logical link between the obtained results. Table 2 shows the results of multiple correlation ($R = .312$) which provide information of qualitative correlation between the predicative and the criterion variables and the regressive coefficient ($R^2 = .098$) which points out to the regressive impact of the predication variable on the criterion. The multiple correlation coefficient (R) shows a very small correlation between the strength motoric ability and the efficiency of performing basic elements of Ballroom dance techniques. The regression coefficient is very low and explains 9.8% of the mutual variability with the criterion, which points out to the absence of predicative influence on it. Table 3 shows the values of the standardized Beta vector which are positive, but not sufficiently statistically significant for a possible prediction of the criterion variable. Strength as a motoric ability does not have a large influence on the efficiency of performance of basic technique element performance of Ballroom dances for the reason that the technical requirements there boil down to correct use of certain parts of the foot while moving, move control in space and harmonization of such moves with music paste and rhythm (Lukić, 2006). Ballroom dances are performed with circular moves on the dance floor and the dancers always have the task to show the characteristics of the temperament of each dance, and their common facet is a wave-like, soft and elegant presentation of choreographic moves. Dance figures comprising the choreography for each dance ("little routine") criterion variables in beginners (Associate) dance level do not really have big demands in terms of exhibiting strength (particularly repetitive), such as the case in the presentation of the temperament of Latin American (LA) dances (Howard, 2002). Similar findings were confirmed in the research on the influence of strength on the successfulness of Ballroom dance performance (Uzunović, 2004) where the aspects of strength exhibition in sport dance were viewed separately for each dance for female and male dancers.

TABLE 1

Correlation matrix of strength and standard dances

Motor abilities	ST
MPGDT	.195
MBMLE	.220
SKOKUDAL	**.300***

* Correlation is significant at the .05 level

Legend: **ST** – Ballroom dances; **MPGDT** – upper body lifting; **MBMLE** – throwing medical ball from the lying position; **SKOKUDAL** – jump from the spot.

TABLE 2

Regression analysis of strength and standard dances

R	R^2	Std. Error	*F*	*p*
.312	.098	1.437	1.623	.197

a. Predictors: (Constant), MPGDT, MBMLE, SKOKUDAL

Legend: ***R*** – multiple correlation coefficient; R^2 – determination coefficient; ***Std. Error*** – standarda error of estimate; ***F*** – *F*-ratio; ***p*** – statistical significance.

TABLE 3

Regression analysis of strength and standard dances

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
		B	Std. Error	Beta		
1	(Constant)	2.980	2.325		1.281	.207
	MPGDT	.004	.014	.054	.328	.745
	MBMLE	.020	.040	.086	.516	.608
	SKOKUDAL	.019	.016	.227	1.224	.227

a. Predictors: (Constant), MPGDT, MBMLE, SKOKUDAL
b. Dependent Variable: ST

Legend: **MPGDT** – upper body lifting; **MBMLE** – throwing medical ball from the lying position; **SKOKUDAL** – jump from the spot; **B** – beta coefficient; ***t*** – *t*-value; ***p*** – statistical significance; **ST** – standard dances.

Of all the tests defining the strength influence, only the explosive strength test for both genders turned to be statistically important, but its contribution did not have the ultimate statistical importance in the strength domain. At higher dance levels however, Member and Fellow, where complex dance choreographiesare performed with the interpretation of numerous syncope steps and plays with the tempo and tact of the music, it should be known that strength as a motoric ability surely becomes apparent and becomes an indispensible facet of the entire dance expression. This research showed the absence of the regressive influence, which is only logical given the said manifestation characteristics of selected dance choreographies while requirements at this dance level were not high.

Table 4 shows the correlation analysis of strength and efficiency of performance of Latin-American dances. It is obvious from the table that the two strength tests show a statistically significant correlation with the Latin-American dance performance technique. Strength as a motoric ability in Latin-American dances becomes apparent with the increase of bodily expression while presenting the character of the dance that is being performed. In some dances (Samba and Cha-cha-cha), it is exhibited through the abdominal part of the body (MPGDT - .434) when presenting an expressive swaying the hips and moving the stomach muscles, and in some (Jive), in the form of explosive strength of the legs (SKOKUDAL - .432) when performing a correct basic sways (basic movement) typical for Jive. The results are presented in the table 5 and they point out to a high multiple correlational links between the predicative and criterion variables (*R*) at the level of .511. The determination coefficient (R^2) which determines the predicative importance of the strength ability for the efficiency of performance of the basic elements of the LA dance technique is .261. That means that 26% of the explained variability of the criterion variable is set by the predicative variable. The remaining 84% is under the influence of unexplained factors. On the basis of the *F* test, it is concluded that on the basis of the motoric strength ability, the successfulness of the

performance of the basic elements of the LA dance technique can be predicted. These parametric values are important at the .003 level. Table 6 shows Beta coefficients providing information on the partial influence of each test on the efficiency of performance of basic elements of the LA dance technique. A statistically significant influence (.041) is seen in the long jump from the spot test – SKOKUDAL, which is one of the forms of showing explosive strength of the legs. Latin-American dances – Samba and Jive in the technical performance of the basic steps are characterized by the so called "bounce" action of the body consisting of flexing and extending the jump joint and the knee joint (Laird, 1992). This activity is done at the speed directed by the music tempo, and if we take into consideration that these two dances are among the fastest of all Latin-American, the explosive strength ability of the caudal part of the body is of great importance for the efficient, that is, technically correct performance of the dance. The explosive strength test SKOKUDAL –long jump also appears to be important (.053) in the predication of the efficiency of performance of basic LA dances, which is also logical, taking into consideration the tempo (speed) of performance of swift sudden changes of direction and leg changes, which were set as a task throughout all choreographies of the selected LA dances. From all the above, it is obvious that explosive strength is one of the most common forms of strength presentation, at least when it comes to sport dance and this level of dance knowledge. Given its contribution to the total bodily presentation in sport dance, the future research from this motoric aspect could be directed towards examining the importance of strength and its manifestation forms in the highest dance levels and in the levels where premium dance results are achieved.

TABLE 4

Correlation matrix of strength and Latin-American dances

Motoric abilities	LA
MPGDT	**.434***
MBMLE	.133
SKOKUDAL	**.432***

* Correlation is significant at the .01 level

Legend: **LA** – Latin-American dances; **MPGDT** – upper body lifting; **MBMLE** – throwing medical ball from the lying position; **SKOKUDAL** – jump from the spot.

TABLE 5

Regression analysis of strength and Latin-American dances

R	R^2	Std. Error	*F*	*p*
.511	.261	1.030	5.292	**.003**

a. Predictors: (Constant), MPGDT, MBMLE, SKOKUDAL

Legend: ***R*** – multiple correlation coefficient; $\boldsymbol{R^2}$ – determination coefficient; ***Std. Error*** – standarda error of estimate; ***F*** – *F*-ratio; ***p*** – statistical significance.

TABLE 6

Regression analysis of strength and Latin-American dances

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
		B	Std. Error	Beta		
1	(Constant)	2.864	1.668		1.718	.093
	MPGDT	.019	.010	.290	1.940	.059
	MBMLE	-.025	.028	-.131	-.893	.377
	SKOKUDAL	.024	.011	.354	2.104	**.041**

a. Predictors: (Constant), MPGDT, MBMLE, SKOKUDAL

b. Dependent Variable: LA

Legend: **MPGDT** – upper body lifting; **MBMLE** – throwing medical ball from the lying position; **SKOKUDAL** – jump from the spot; **B** – beta coefficient; ***t*** – *t*-value; ***p*** – statistical significance; **LA** – Latin-American dances.

CONCLUSION

The examination of the relevance of the influence of strength on the sport dance performance technique was implemented on a representative sample of sport dance dancers, age 12 to 15. The predicative variable was comprised of three tests of strength: MPGDT, MBMLE and SKOKUDAL, and the criterion variable elements of the technique of selected Latin-American and Ballroom dances. On the basis of the analysis of the results obtained and their interpretation, the following conclusions have been drawn:

- From the regressionanalysis results it can be concluded that the motoric strength ability cannot serve to predict the efficiency of performance of the Ballroom dance technique elements. There is a correlation with explosive strength, but it is not high enough to establish a positive regression between strength and Ballroom dances.
- From the regression analysis results, it can be concluded that strength can serve to predict the efficiency of performance of the Latin-American dance technique elements.

The results show that the strength aspect does provide a large contribution to the successfulness of performance of Latin-American dances, unlike the situation in the Ballroom dances. In this dance discipline too, there is a statistically significant importance of explosive muscle potential, which points out to the fact that conditional training of dancers, at least when it comes to strength, needs to be focused on this type of its action manifestation. The obtained results show the necessity of having a separate approach to planning and programming the training process particularly for Latin-American dances, given the diversity in dynamics, technique, time and special requirements of performance, dance expression, and engaging different motoric potentials. This kind of research is a contribution to a better organization of training process especially when it comes to individual access to training motor skills that have a dominant influence on the technique of particularly Latin American and Ballroom dances. Bearing in mind that there are just a few research in the field of sport dance, and that there is a special need for those who treat the individual effect of motor abilities on the efficiency of the dance performance, it can be said that the contribution of this paper is that it encourages other research projects in which should be looked and studied all aspects that determine the sports result in dance. Open questions, doubts and new ideas that arise when reading this article are some guidelines for new research in the field of sport dance.

REFERENCE

Howard, G. (2002). *The Technique of Ballroom Dancing. Internacional Dance Teachers Association Ltd.* Brighton: Publish by International Dance Publications.

Jocić, D. (1991). *Predviđanje uspjeha u plesovima na osnovu morfološkog, motornog, kognitivnog i konativnog statusa* (Prediction of success in dances based on morphological, motor, cognitive and conative status). Unpublished doctoral dissertation. Univerzitet Beograd, Fakultet fizičke kulture.

Kostić, R. (1997). The Influence of a Two-week training on the Motor Abilities of Female Dancers (Uticaj dvonedeljnog treninga na motoričke sposobnosti plesačica). In R. Kostić (Ed.), *Šesti međunarodni simpozijum »FIS komunikacije 1997« u fizičkom vaspitanju, sportu i rekreaciji* (pp. 107–114). Niš: Filozofski fakultet, Institut fizičke kulture.

Laird, W. (1992). *Technique of Latin dancing*. Brighton: Publish by International dance Publication.

Lukić, A. (2006). *Relacije nekih motoričkih sposobnosti i efikasnosti izvođenja osnovnih elemenata tehnike u sportskom plesu* (Relations between some motor skills and efficiency of performing the basic elements of technique in sport dance). Unpublised Master's thesis. Univerzitet Banja Luka, Fakultet fizičkog vaspitanja i sporta.

Lukić, A., Bijelić, S., & Jovanović, S. (2008). *Uticaj ravnoteže na predikciju uspješnosti u Standardnim plesovima (*The influence of balance on prediction of success in the Standard dances). In B. Krsmanović and T. Kaleši (Eds), *XVI međunarodni interdisciplinarni simpozijum "Ekologija, sport, fizička aktivnost i zdravlje mladih*. Novi Sad: Novosadski maraton.

Lukić, A. (2010). *Efekti proprioceptivnog treninga na razvijanje ravnoteže i poboljšanje tehnike izvođenja u sportskom plesu (*The effects of proprioceptive training to development of balance and improvement of techniques involved in sport dance). Unpublished doctoral dissertation. Univerzitet Banja Luka, Fakultet fizičkog vaspitanja i sporta.

Metikoš, D., Hofman, E., Prot, F., Pintar, Ž., & Oreb, G. (1989). *Mjerenje bazičnih motoričkih dimenzija sportaša* (Measurement of basic motor dimensions of athletes). Fakultet za fizičku kulturu. Zagreb.

Nagode-Ambrož, B. (1992). *Kriteriji sojenja za standardne in latinsko - ameriške plese (*The judging criteria for Ballroom and Latin-American dances). Ljubljana: Udruženje plesnih vaditeljev, učiteljev in trenerjev Slovenije.

Uzunović, S. (2004). *Uticaj antropomotoričkih sposobnosti na uspješnost u sportskom plesu* (Influence of motor abilities to success in sport dance). Unpublised Master's thesis. Univerzitet Niš, Fakultet fizičke kulture.

Uzunović, S., Kostić, R., Zagorc, M., Oreb, G., & Jocič, D. (2005). The effect of coordination skills on the success in standard sports dancing (Efekti koordinacije na uspjeh u standardnim plesovima). In N. Dikic, S. Zivanic, S. Ostojic, and Z. Tornjanski (Eds.), *Book of Abstracts of 10th Annual Congress European College of Sport Science* (pp. 270–271). Belgrade: European College of Sport Science.

Uzunović, S. (2008). The transformation of strength, speed and coordination under the influence of sport dancing (Transformacija snage, brzine i koordinacije pod uticajem modernog sportskog plesa). *Facta Universitas*, *6*, 135–146.

Vlašić J., Oreb, G., & Leščić, S. (2009). *Povezanost motoričkih i morfoloških obilježja s uspjehom u društvenim plesovima* (Relationship between motor and morphological characteristics with the success in social dances). *Hrvatski sportskomedicinski vijesnik*, 30–37.Vlašić J., Oreb, G. i Leščić, S. (2009). *Povezanost motoričkih i morfoloških obilježja s uspjehom u društvenim plesovima. Hrvatski sportskomedicinski vijesnik*,
30–37.

Received: September 29, 2010
Accepted: April 15, 2011

Correspodence to:
Adriana Lukić, PhD
Faculty of Physical Education and Sport
Bul. Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina
Phone: 00387 65 56 76 12
E-mail: adri.lukic@gmail.com

WRITING SKILLS AT UNIVERSITY LEVEL

Danica Pirš[1], Tea Pirš[2], and Dalibor Kesić[3]

[1]Faculty of Sport and Physical Education, Niš, Serbia
[2]Faculty of Philosophy, Niš, Serbia
[3]Faculty of Philology, Banja Luka, Bosnia and Herzegovina

SHORT SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.069P COBISS.BH-ID: 2103064 UDC: 003:378.4

SUMMARY

It is beyond questioning that out of all skills students say they want to strengthen, writing poses the biggest challenge. As students in western countries enter the university, writing almost always takes on a new and challenging dimension. As students leave their protected classrooms at the *Gymnasium* for the mass education settings at universities, they quickly realize that the demands placed on them also change just as drastically. Although some elements of the kind of writing required of students at the university are taught at the secondary schools, where they are mainly required to analyze texts and then to add their own opinions, students generally find that at university quite a different kind of writing is demanded of them than they have been prepared for. Students find they are required to navigate across a much more complex terrain than they had to at the secondary schools.

Key words: writing skills, university level of teaching, academic language, English language.

INTRODUCTION

At university, students are expected to learn to write specific types of technical texts that are pertinent to the fields they are studying (Graefen, 1996). This includes adopting a style of writing appropriate to the academic field and genre the student is writing in. Students must also learn to apply a rhetoric that is characterized by an exact, systematic logical argumentation and empirical rationale. Academic writing requires students to incorporate and synthesize diverse sources of knowledge into an authoritative viewpoint.

The personal views that were called for at the secondary schools are subordinated to the ability to integrate authoritative others into a multi-perspective, where one's own voice also takes on the persona of an authority (Bartholomae, 1985). When incorporating the ideas of other researchers, students are also responsible for demonstrating critical evaluations of the works of these researchers, both in and of themselves and in comparison to other related texts (Flower & Hayes, 1980). Many students are not even aware that they are meant to assume authority in their papers – after all they are only novices – so many students consider their task to be a collation of other peoples' views, objective and impersonal (Foster & Russell, 2002, p. 220). It is not without good reason that the term "academic writing" is not used to describe the writing students carry out at the secondary schools, but is restricted to identifying the kind of writing that is carried out at universities and beyond.

Because these characteristics of text production are not just extensions of skills learned at preparatory schools but unique skills that specifically belong to a university education (Foster & Russell, 2002), learning to adjust to this incorporative rhetoric as distinct from the rhetoric of personal argument practiced at the secondary school often "creates significant dissonance for German students" (Foster & Russell, 2002, p. 193). In a study conducted at two major German universities, Foster and Russell (2002) found that: "Students identify the writing required in seminar papers as the single most difficult learning/writing challenge at university" (p. 217). Kruse, Jakobs, and Ruhmann (1999) also found writing in English to be one of the greatest chal- lenges to students in their learning process at univer- sity and that many students have difficulties adapting the rhetorical strategies they brought with them from secondary

schools to the new strategies they need for academic writing. Despite these differences students are confronted with in their writing needs at universi- ties, until recently the teaching of academic writing was not regarded as worthy of receiving much atten- tion from universities throughout Europe. In the context of contents of the courses taught in the mother tongue, university educators and administra- tors generally presume that their students have already been sufficiently prepared for the kind of writing they will do at university during their time at secondary schools, and that the kind of writing they will have to carry out is simply an extension of that (Furchner, Ruhmann, & Tente, 1999). It is generally assumed that those students who make it to the university can then learn to adapt their writing strategies to their new academic disciplines more or less on their own (Kruse, et al., 1999), based on the theory that once learned is forever learned. From the first semester on, students find they have to accommodate the new academic writing skills they need to learn to the content material they are learning in their courses.

There is little help available to assist students in learning to integrate the new language and knowledge of their varying disciplines with the different structures and mechanics required in the diverse genres and rhetorical modes they meet in their disciplines (Foster & Russell, 2002). Left to themselves, students must through trial and error meet the challenge of new and more complex writing needs at university by adapting and adopting new processes to those skills which they have already acquired. Students of English as a foreign language have been somewhat more fortunate than other students, for example those at Faculties of Physical Education and Sports, in that since the late

1960s academic writing in English courses have fre- quently become a part of the regular curriculum. However, the titles of these courses notwithstanding, as a part of the EFL program, they often tend to be more of a substitute for language skills classes focusing on grammar, vocabulary, and punctuation than on the actual academic writing needs of their students. Thus students in these departments, too, feel the pressure to adapt to the needs of academic writing on their own.

THE CHANGING UNIVERSITY SCENE

As times have changed, so have the needs of students and the society they live in. Universities are under pressure to respond to these new needs of students and society. The new European BA/MA system of study that has been recreating courses of study at almost all European universities since the beginning of this millennium is one of the most serious attempts by politicians and educators to modernize the university curriculum so that it reflects these needs However, what has possibly had even more influence than the new BA/MA curriculum on universities' abilities to meet these needs of their students and society is the changes in numbers which have been taking place at universities over the past decades. Although the term "elite university" is often heard when politicians talk about today's universities, the term "mass university" is more fitting to most institutes of higher education.

Throughout the 1970s and 1980s, most universities in Europe changed from elite to mass universities (Rienecker & Jorgensen, 2003). Approximately, three out of four of these Abitur holders go to university at some point (Antweiler, 1996). These changes have brought a more diverse student population, many of whom are not as well prepared as their carefully selected elite pre-decessors were. Over the past decades, as at other time of increases in student population (Flexner, 1930), the number of faculty positions has not kept pace with student numbers. Many of the classes which are classified as "seminars" appear more like lectures than the cozy classrooms of old.

Just at a time when a more diverse student population is in greater need of exclusive counseling and attention, educators are forced to divide their time among ever-greater numbers of students. Despite (or possibly because of) these changes in student composition and population, recent European reforms in the programs of study have made attempts to shorten or at least limit the length of time students study. At the same time, governments have also been concerned with the high dropout rates of students and have put pressure on universities to improve the learning situation (Kramer, 2003).

As universities have moved away from the elite system of education over the decades to the mass education of today, writing at universities has also taken on a different role. The major purpose of the writing students carry out at a university is not to express ideas that are to be transmitted to the world at large or to be discussed with the professor and fellow students.

Most writing students do at university today has taken on the all-encompassing role of being a method of evaluation. Writing is often the factor which decides whether a student is successful at university or not. A student's ability to master seminar papers, reports and exams determines whether a student will be successful at university. Writing has become the

key to survival in many fields of study. Being responsible for ever larger numbers of students, teachers are finding that little time is left to view writing as a learning process in which valuable one-to-one feedback can create a learning atmosphere in which students can grow and develop. Most writing assignments at universities become isolated writing experiences for students (Graff, 1987); they act as pivotal qualifications for the continuation of their university careers, and can make or break students' personal goals.

MEETING THE CHALLENGES OF A CHANGING WORLD

Despite the need for evaluative material and the time pressures of mass education, it is important not to forget that beyond being a valuable tool for weeding out the good from the bad (Johnson, Johnson, & Smith, 1991), the real objective in teaching and learning academic writ- ing at universities extends long past the day the graduate walks out the doors of the university for the last time. Today's technological advancements in our globalized world have underscored the importance of life-long learning for the individual and society at large. The learning for today must also focus on continued learning tomorrow. Setting their goals to prepare their students to become active life-long participants in the written discourse communities of their choices is one method by which German uni- versities, for example, can make a valuable move toward addressing the future needs of their students to remain active participants and creators of their own contin- ued learning.

WRITING IN MANY GENRES

However, there is more at stake than just the students' survival at university and beyond. Both individual students and society at large are dependent on how well students learn to write. "As the kinds of organizations and the jobs in them that students will enter have become more specialized, the writing has become more specialized as well" (Foster & Russell, 2002, p. v). The ability of students to meet the demands of different genres and rhetorical settings in the workforce depends in large part on whether and how they have developed their writing at university (Foster & Russell, 2002). "In a larger sense, written communication is essential to the successful continuation and future development of important institutions – profes- sional, governmental, industrial, commercial, and nonprofit – that increasingly depend on specialized written communication in a global environment" (Foster & Russell, 2002, p. 1). Students will need a great- er diversity of linguistic resources and rhetorical flexibility to successfully enter professions and insti- tutions and to transform those institutions as the pace of change continues. Students need sufficient practice in the new genres and rhetorical strategies that belong not only to the world of academia (Swales, 1990) but to the world which the students will be entering after university. Research in genre theory verifies the need of students to gain practice in the targeted genres. So ministries of education continually take note of uni- versities' responsibilities to improve students' writing.

CONCLUSION

In addition to students' needs to practice writing in multiple genres and rhetorical modes while at university, they also need opportunities in which they can practice writing for the sake of practice (Kruse, et al., 1999) or to put it in Krashen's (1984) terms for "sheer practice" (p. 33). There is much to be said for the old adage "practice makes perfect". Just like dancers do not go out on the stage without practicing first, academic writers, too, need opportunities to practice academic writing when there is no grade or teacher evaluation at stake. Such an environment promotes experimentation with new ideas, styles, and techniques. How are students to learn whether or not their ideas are practicable unless they try them out? Most students, however, are not willing to take risks in writing when they know it could damage their grade. When writers feel free to experiment and to express themselves, they are also more likely to enjoy putting their ideas down on paper so that others can read them. It can also be assumed that when students are given the opportunity to practice expressing their ideas in a stake-free environment, they will be likely to acquire a more favorable attitude toward writing than when only practicing writing under the threat of receiving a grade each time they write.

REFERENCES

Antweiler, O. (1996). Deutschland (Germany). In O. Antweioler et al. (eds), *Bildungssysteme in Europa* (Educational systems in Europe). Weinheim: Beltz.

Bartholomae, D. (1985). *Inventing the University*. New York: Guildford.

Flexner, M. (1930). *Universities: American, English, German*. New edition (1994). New Brunswick N.J.: Transaction Publishers.

Flower, L. S., & Hayes, J. R. (1980). *The Dynamics of Composing: Making Plans and Juggling Con- straints.*

In Cognitive Processes in Writing. Hillsdale, N. J.: Erbaum.

Foster, D., & Russell, B. (2002). *Writing and learning in cross-national perspective: Transition from secondary to higher education*. Rutledge, co-published with the National Council of Teachers of English

Furchner, I., Ruhmann, G., & Tente, C. (1999). *Von der Schreibberatung fur Studierende zur Lehrberatung fur Dozenten* (Instructions for pedagogic students). Neuwied; Kriftel: Luchterhand.

Graefen, G. (1996). *Der Wissenschahftliche Artikel Textart und Textorganisation* (Scientific Articles, Type and Organization of Texts). Frankfurt /M: Lang

Graff, G. (1987). *Professing Literature*. Chicago: University of Chicago Press.

Johnson, D., Johnson, R., & Smith, K. (1991). *Active Learning: cooperation in the College Classroom*. Edina, Minnesota: Interaction Book Company.

Kramer, F. (2003). *Creating a basis for a Faculty-Oriented Writing Programme*. Dordercht: Kluwer Academic Publishers.

Krashen, S. (1984). *Writing: research, theory and applications*. Oxford: Pergamon Institute of English

Kruse O., Jakobs E., & Ruhmann, G. (1999). *Schlusselkompetenz Schreiben: Konzepte, Methoden, Projekte fur Schrebbratung und Schreibdidaktik an der Hochschule* (Key writing competences, concepts, methods and didactic writing at University). Neuwied, Kriftel: Luchterhand

Rienecker, L., & Jorgernsen, P. S. (2003). *The (im) possibilities in teaching university wiring in the Anglo--American tradition when dealing with continental student writers*. In Teaching Academic Writing at European Higher Education. Dordecher: Kluwer Academic Publishers,

Swales, J. (1990). *Genre Analysis: English in academic and research settings*. Cambridge: Cambridge University Press.

Received: October 15, 2010
Accepted: Jun 4, 2011

Correspodence to:
Danica Piršl, MSc
Faculty of Sport and Physiacl Education
Čarnojevića 10a
18000 Niš
Serbia
Phone: +381 64 26 22 350
E-mail: danicapirsl@yahoo.com

GENE THERAPY AND ITS IMPLICATIONS IN SPORTS

Biljana Vitošević[1]

[1]Faculty for Sport and Phisical Education, Leposavić, Serbia

SHORT SCIENTIFIC PAPER
DOI: 10.5550/sgia.110701.en.073V COBISS.BH-ID: 2103320 UDC: 616-085:575.113]:796

SUMMARY

Thanks to the very successful Human Genome Project and the identification of genes involved in genetic disease, we now have the ability to treat many conditions. However, the identification of the genes which code certain phenotype characteristics has opened the way for abuse in the fields of sport and physical exercise. The principles of gene therapy and the ways in which genes are transferred have completely been copied from gene therapy and are now being used to increase the physical abilities of athletes. The genes most frequently used by athletes include: the the ACE gene, the ACTN3 gene, myostatin, the erythropoietin gene, PPAR-delta and the like. The misuse of these genes with the aim of increasing physical abilities has already become part of sport and is extremely difficult to identify, since genes and gene sequences entering the human body are proteins that are already structural and functional parts of the organism. On the other hand, viral vectors as the instruments for gene transfer attack and destroy the human immune system, and the reaction of the human body can be negative, with a danger of insertional mutagenesis and the appearance of oncogenes. Gene therapy might actually be much more useful in treating sports injuries, but even these procedures are still far from clinical practice. There is a fine line between gene therapy and gene doping in athletes. A number of growth factors will enhance repair, but it happen that expression of these factors increase the strength of bones and tendons, so that giving an advantage to competitors. First of all, it is necessary to acquaint athletes as much as possible with the negative consequences of using gene therapy. However victory and glory may be strong achievements, the health of these young people, and respect for fundamental and ethical principles, humanity, and fair play game have a more lasting value and represent the heavier weight on the scales.

Key words: gene transfer, candidate gene, performance enhancement.

INTRODUCTION

During the last decades of the 20th century, modern medical science has undergone an extraordinary expansion in terms of new discoveries. The greatest achievement has been the discovery of the genetic factors responsible for certain conditions. The international program for sequencing the entire human genome was started in 1990, and a complete DNA sequence was released in 2004. Prior to that it was believed that there were around 100.000 genomes which code proteins and determine what human life will look like, but with this project a much smaller number of genes has ben discovered, somewhere between 25.000 and 30.000. The direct benefit to be drawn from these data is the ability to make more precise diagnoses in the case of genetic disorders and the development of new strategies for treating monogenetic and polygenetic disorders.

Gene therapy is a medical procedure which uses nucleic acids for the purpose of replacing or completing damaged genes. Gene therapy was first tried out on humans in 1990, and since then this method has been used on over one thousand people over the world. Synthetic or recombined DNA is used, genetically modified stem sells, bare nucleic acids, the antisens technique (for example, "inhibiting" genes, the correction or modification of genes), genetic vaccines, RNA interference, and xenotransplantation of animal cells (Baoutina, Alexander, Rasko, & Emslie, 2007). Nevertheless, even though the progress made in gene therapy is evident in terms of conventional therapy, its practical application is still limited, since

it is encumbered by many difficulties. The fact that the gene therapy carries a great risk with it is confirmed by the data that three out of eleven children, for example, who received gene therapy for severe combined immunodeficiency related to the X chromose, became ill with leukemia, which resulted in the death of one of the children (Cavazzana-Calvo, Lagresie, Hacein-Bey-Abina, & Ficher, 2005).

One of the basic prerequisites for gene therapy is the cloning of a given gene. This refers not only to the structural gene, but also to the segments of DNA which participate in the regulation and expression of that gene. The next step is to determine the specific target cells, tissue or organ, as well as to determine the way the gene will be introduced into the human body. Gene therapy is usually preceded by research involving animal models, which has led to the creation of the cystic fibrosis model, the Duchenne muscular dystrophy, Huntington's disease, and Friedreich's ataxia.

Gene transfer into the target tissue is carried out in two ways: *ex vivo* (outside of the body) and *in vivo* (within the body itself). In the case of *ex vivo* transfer, the cells or the tissue which have been taken from the patient are treated and then returned into the body of the patient. *In vivo* gene transfer is the most direct means of gene transfer and in theory can be used to treat many hereditary disorders.

There are two basic types of gene transfer: *viral* and *non-viral*.

Viral vectors – A great number of different viruses can be used to transfer genetic material into cells.

- *Oncoretroviruses* belong to the group of RNA viruses which can be integrated into the DNA of the host, by making a copy of their RNA using the enzyme for reverse transcriptase. The provirus that is thus created represents a matrix for the creation of iRNA for various viral proteins and the new genome RNA of the virus. If the virus is in a stable manner introduced into the stem cells which will further continue to divide, all of the cells that will develop from them will inherit a copy of the virus genome. One of the problems that occur during the use of a retrovirus as the vector system is that they can accept and transfer into the target cells relatively small segments of DNA, which limits their use, in addition to the fact that they can be integrated into cells immediately following an infection, while the number of cells which is continuously being divided is small.
- *Lentiviruses* are complex viruses which infect macrophages and leukocytes and can also be integrated into cells which are not undergoing a process of division.
- *Adenoviruses* are suitable for gene therapy because they can infect a great number of different cells and can carry larger segments of DNA. The unwanted sideffects of their use are the stimulation of the immune response of the host, in addition to the possible malignant characteristics of the virus itself.
- *Herpesviruses* are mainly used for targeted gene therapy of the CNS and for treating neurological disorders such as Parkinson's disease. Their flaw is their potentially toxic effect on the cells of the nervous systema and the induction of an immune response, in addition to poor integration and instability.

Non-viral vectors – The advantage of these vectors is that they do not cause an immune response, they are safer and simpler to use, but their effectiveness is limited.

- *The DNA itself* is often directly inserted into the cells, but its use is limited only to the expression of hormones or proteins which in small doses can have a significant clinical effect (for example, erythropoietin).
- *Electroporation* consists of application of a high voltage current to target cells. This causes the pores on the cell membrane to open, so that the exogenous DNA can enter the cell.
- *The "gene gun"* is a device for injecting cells with genetic information. Heavy metal (gold, silver, wolfram) particles are used, coated with plasmid DNA. These particles are delivered to the target tissue with the help of a helium propellant, and the DNA reaches the nucleus of the target cell and is integrated into the genome DNA.
- *The transfer of DNA by means of liposomes* – liposomes are vesicles with a liquid content surrounded by a two-layer lipid shield, which can facilitate the delivery of exogenic DNA into the target cell. Their flaw is their less efficiency in gene transfer, and their advantage is that they can enter the cell larger segments of DNA from viral vectors.
- *Receptor-mediated endocytosis* represents a type of gene transfer using liposomes, in which the target is receptor on the cell surface. The success of this way of transferring the gene can be increased if the gene products include adenoviruses or influenza viruses.

Somatic stem cell therapy – Stem cells are unspecialized cells which are defined by their capacity

to reinvent itself and their ability to differentiate into specialized cells of many cell lines. Bone marrow transplantation is a form of somatic stem cell therapy, but is accompanied by a risk of infection due to immunosuppression and graft versus host disease.

Stem cell transplantation (for example, pluripotent hematopoietic stem cells) in utero offers a perspective for a new way of treating many genetically conditioned disorders. The immaturity of the fetal immune system allows tolerance of foreign cells, and do not require similarity between the donor and fetal cells.

Embrionic stem cell therapy – These cells originate from embryonic cells during the blastocyst phase, and are pluripotent, which means that they can develop each of the three germ layers, or all the cell types that exist in an adult human body. These cells can also be used in gene transfer technology as a "vehicle" for genes which partici-pate in the correction of the phenotype.

Gene therapy, as a clinical reality, is still in the stages of development. Even though the clinical circumstances of the work are higly controlled and regulated, the patients are exposed to great risk and therapy failure. Success also depends on the type of vector used, the vector administration procedures, the immune response of the body, the gene expression, as well as the potential oncogenic effect, depending on the mutation of normal genes as well as the result of the integration with the host genome.

THE IMPLICATIONS OF GENE THERAPY IN THE FIELD OF SPORT

Thanks to the success of the Human Genome Project, we now are facing the possibility of identifying genes involved in genetic disorders such as diabetes, Alzheimers disease, Parkinson's disease, muscle dystrophy and the like (Turnpenny & Ellard, 2007). Nevertheless, instead of solving certain problems and treating certain diseases, the discovery of the genes responsible for certain physical characteristics has brought whole series of possibilities for manipulation in areas such as sport and physical exercise.

A great many factors determine sport success: genetics, training, diet, motivation, the advantage of proper sports equipment, and the like. Genetics has a great influence on the components of sports performance such as strength, endurance, muscle fiber type distributions, anaerobic threshold, lung capacity, neuromuscular coordination, temperament and the like. It is a fact that physical ability, determined through innate physical characteristics, irrespective of training and diet, has been the cause of much research interest, so that the genes which determine certain physical abilities have become an object of study. Despite the possible role of genetics in the phenotype of elite athletes, the number of genes which are thought to influence the level of physical abilities is not great, since genetic preconditioning is polygenic, which means that more genes with a smaller effect can determine certain physical characteristics (Brutsaert & Parra, 2009).

Genes, which are assumed to be the cause of a characteristic phenotype based on their function, are *gene candidates*. The list of gene candidates for the improvement of physical abilities is not final, as is constantly being updated with new genes, while an entire group of other genes which code metabolic enzymes is being analyzed.

The principles of gene therapy and the means of gene transfer have been completely borrowed from gene therapy and are being used to increase the physical abilities of athletes (Vitošević, 2011).

Gene doping is the term applied to the use of getic manipulation to improve athletic performance. The World Anti-Doping Agency (WADA) prohibits this practice as specifically "the non-therapeutic use of cells, genes, genetic elements, or the modulation of gene expression, having the capacity to enhance athletic performance".

The genes most frequently used by athletes are: the ACE gene, the ACTN3 gene, myostatin, the erytropoietin gene, PPAR-delta, and the like.

The ACE (Angiotensin-Converting Enzyme) gene – has a key role in the regulation of the renin-angiotensin-aldosterone system. The ACE catalyzes the conversion of angiotensin I to angiotensin II and has an important role on electrolyte balance and systemic blood pressure (Rieder, Taylor, Clark, & Nickerson, 1999) and has also been proven to have a role in the degradation of bradykinin which can inhibit growth. Skeletal muscles have their own renin-angiotensin system, which can be important for tissue growth and muscle hypertrophy. In this case we can assume that genetic variation in the system leads to differences in muscle mass phenotypes, making ACE a candidate for sprint or power performance. Most of the data indicates polymorphism, which is characterized by the presence (insertion, I allele) or absence (deletion, D allele) of 287-bp sequence in intron 16, resulting in three genotypes: II and DD homozygote s, and ID heterozygous.

Data that can be found in the literature regarding the roles of certain alleles in the ACE enzyme geno-

type are controversial. By studying the connection between the presence of different alleles and elite sport, various data have been obtained. For example, the greater presence of I alleles has been noted among athletes involved in higher-endurance sports, long-distance running, mountain climbing, diving and the like, while the presence of D alleles was greater in sports involving strength, sprinting, short-distance swimming and the like (Costa, Silva, Breitenfeld, Marques, Marinho, Garrido et al, 2008; Nazarov, Woods, Montgomery, Shneider, Kazakov, Tomilin et al, 2001; Tsianos, Sanders, Dharait, Humphris, Grant, & Montgomery, 2004; Woods, 2009). Several studies have failed to identify any association between the ACE I/D polymorphism and elite human performance. Taylor, Mammote, Fallon, and Bockxmeer (1999) examined 120 Australian national athletes from sports deemed to demand a high level of aerobic fitness (hockey players, cyclists, skiers, track and field athletes, sweemers, rowers and gymnasts) and found no difference in ACE genotype and allele frequency compared with controls. Similarly, the cohort examined by Karjalainen, Kujala, Stolt, Mantysaari, Viitasalo, Kainulainen et al. (1999) of 80 elite endurance athletes from Finnish national teams and one of the largest (192 athletes) studies by Rankinen, Wolphart, Simoneau, Maier-Lenz, Rauramaa, Rivera et al. (2000) which also included skiers, long and middle distance runners, cyclists and biathlon, was also result in failure to demonstrate an association between elite athletes and the ACE genotype. The possible mechanism of the effect of the ACE genotype on skeletal muscles probably occurs at the cellular level, and perhaps through the influence of the angiotensin II on the redirection of blood flow from type I muscle fibres to type II muscle fibres, which is a favoured process in power performance. The greater local production of angiotensin II will then increase muscle contraction to the maximum (Rattigan, Dora, Tong, & Clark, 1996). The other potential mechanisms by means of which various levels of angiotensin II could influence human performance, are via its effect as the direct stimulator of cellular growth (both hypertrophic and hyperplastic), as well as the induction of various endogenous growth factors and the facilitation of the sympathetic transmission by the increase of the release of noradrenaline from peripheral sympathetic nerve terminals and the central nervous system (Jones & Woods, 2003; Saxena, 1992). Brown, Balis, Gandhi, and Adama (1998) also cite the degradation of bradykinin which can influence the effectiveness of skeletal muscles through the effect of bradykinin on muscle blood flow and substrate utilization.

Regardless of the controversial interpretation of ACE gene polymorphism, its effect on human performance is evident, but that future research will shed light on the molecular mechanisms of action.

Alpha-actinin 3 (ACTN3) are a family of actin-binding proteins, which play an important role in maintenance and regulation of the cytoskeleton. Two isoforms of the alpha-actinin found in the human body, alpha-actinin 2, can be found in all the skeletal muscle fibres (slow and fast) as well as in the cardiac muscle and the brain, while alpha actinin 3 is limited only to type 2, fast fibres in the skeletal muscle. North, Yang, Wattanasirichaigoon, Millis, Easteal, & Beggs (1999) identified polymorphism in the ACTN3 gene, known as R577X, which is contained in the conversion of the codon for arginines (R) in position 577 with a stop codon (X). This change has lead to two versions of the ACTN3 in the human body, the functional R-allele and the zero X-allele. The homozygote for the X allel (the XX genotype) results in the complete absence of the alpha actinin in the human body. The XX genotype frequency differs in the population of humans in a range of approximately 1% among Africans, approxi-mately 18% among Europeans and of around 25% among Asians (Mills, Yang, Weinberger, Vander-Woude, Beggs, Eastel et al., 2001). It has been estimated that around one billion people worldwide are deficient in alpha-actinin 3. Alpha-actinin 2 is similar to alpha-actinin 3 and on the basis of that similarity it was believed that alpha-actinin 3 is functionally redundant, which means that its flaw is replaced, in terms of function, by alpha actininin 2. Nevertheless, research has shown that the ACTN3 has an independent function, which indicates a separate evolution and different expressivity, so that the ACTN2 cannot completely compensate for the loss of ACTN3.

Numerous studies have indicated a positive association between R alleles and the capacity to form strong muscle contractions. On the other hand, the presence of the X allele can be a predisposition for greater endurance in physical activity. Using these assumptions as a starting point, Yang, MecArthur, Gulbin, Hahn, Beggs, Easteal et al. (2003) used a sample of 302 caucasian elite athletes involved in 14 different sports, and found a higher frequency of 577R alleles among sprint and strength athletes, while the athletes involved in endurance sports showed slightly higher frequencies of the XX genotype compared with controls. More and more often, the possible role of the ACTN3 gene in the determination of the distribution of the type of muscle tissue is mentioned. Yang's assumption that alpha-actinin 3

enhances the formation of fast muscle fibres was confirmed, but other means and interaction between alpha actinines with metabolic enzymes in the regulation of the distribution of muscle fibres were not excluded.

Despite the different results, we can conclude that the polymorphism of the ACTN3 gene has a confirmed biological effect on skeletal muscles, and thus, the loss of alpha-actinin 3 from fast muscle fibers has a detrimental effect on sprint and power activities. The different percentage of the mutation of this gene has indicated that the natural selection in the evolution of man has had a balancing effect. In some cases, speed is preferable, and in others, endurance, which is why both types of the gene are present in the population.

Myostatin gene – Myostatin is a protein, a member of the TGFβ superfamily (the transforming growth factor beta). This protein is made up of two identical subunits, each of which contains 110 amino acids, in their inactive form, and for its activation we need a protease, which replaces the NH3 group with the more active COOH group. The gene which codes myostatin is marked as MSTN or GDF-8 (the factor of growth and differentiation – 8). Myostatin is primarily produced in the skeletal muscle cells, circulates through the blood and lymph and affects muscle tissue, slowing down the development of muscle stem cells. It has been proven to inhibit kinase which causes muscle hypertrophy through the synthesis of proteins. Thus, myostatin acts in two ways: inhibits muscle differentiation and inhibits protein synthesis.

This protein is active in the skeletal muscles prior to and after birth, and imposes a normal limit on muscle growth. The mutation which reduces the production of functional myostatin leads to an increase in muscle tissue. People suffering from this mutation of the homozygote have significantly increased muscle mass, while those with a mutation of the heterozygote have increased muscle mass to a slightly lesser exent.

The confirmation of the connection between myostatin and the size of the skeletal muscles has launched an entire series of questions about the role of myostatin as a potential means for the increase of the overall performance in sport. The increase in muscle mass also means an increase in overall strength, and it is considered that the inhibition of myostatin can significantly increase physical ability, despite the fact that an increased growth of muscle cells carries with it the risk of the reduction of the overall strength based on the cell and histological changes in the muscle cells.

Future research will certainly determine the role of myostatin in the human body in more detail, as well as its influence after birth and in adult human tissue, the interaction with other growth factors and its role in the regeneration of tissue after injury.

The insulin-like growth factor I (IGF-I) – is a protein which is important for skeletal and muscle development. It is a mediator of the growth hormone and affects cells through the receptors of the tyrosine kinase, but it can also bind with an insulin receptors. The activity of the IGF-1 includes: the stimulation of cell growth, the activation of the protein synthesis and glucose and glycogen uptake (Barton-Davis, Shoturma, & Sweeney, 1999), the inhibition of degradation of muscle proteins, regeneration of tissues, the modulation of the immunological response, affecting the synthesis of cytokines and immune system cells (Humbel, 1990).

Several mutations on this gene are known to affect an increase in muscle mass, and a significant connection between the IGF-1 genotype and the increase in dynamic strength has also been determined (Musaro, McCullagh, Paul, Houghton, Dobrowonly, Molinaro et al., 2001; Sweeney, 2004). The role of the IGF-1 is also very significant in muscle damage and reparation processes, where it affects the activation of satellite cells and proliferation, which then connect muscle fibres and lead to their regeneration (Engert, Berglund, & Rosenthal, 1996). Several growth factors including insulin-like growth factor (IGF-1) and transforming growth factors (TGF-β1 and β2) enhance and accelerate the normal bone regeneration pathways (Landesberg, Roy, & Glickman, 2000).

The vascular endothelial growth factor (VEGF) – The gene that codes this factor can affect the formation of new blood vessels. Vascularization is determined by means of blood flow, and not average use. In the case of increased physical activity, the need for blood flow is increased six to eight times in comparison to blood flow during rest. By creating VEGF in the muscles, the necessary vascularization is increased, and in that way the muscles get the necessary nutritive substrates and the oxygen necessary for muscle contraction.

By the use of this factor in athletes, by means of better supply of oxygen and nutritiens to the tissue, a fatigue can be delayed to a significant extent, and the production of energy can be improved and metabolite production decreased.

PPAR – delta (Peroxisome proliferator-activated receptor - delta) – is a nuclear protein receptor, which functions as transcription factors for the

regulation of gene expression in adipose tissue, the heart and muscles, placenta and the like. Studies carried out on animals have shown that the PPAR-delta plays an important role in the metabolic adaptation of many tissues to the changes in the outside environment, and which take part in the regulation of the metabolism of fatty acids in skeletal muscles and adipose tissue through the expression of genes involved in the takeover of fatty acids, beta-oxydation, the creation of energy and the formation of "slow"muscle fibres (Evans, Barish, & Wang, 2004). These results open numerous questions regarding the manipulation and solutions for complex physiological abilities such as fatigue and endurance.

Erythropoietin (EPO) – is a glycoprotein hormone secreted in the liver and kidneys. It induces erytropoiesis through the stimulation of receptors on the stem cells of bone marrow, which guide their differentiation into erythrocytes.

Patients who suffer from severe anemia, cancer patients after chemotherapy or patients with kidney failure, may benefit tremendously from therapy of EPO, because their bodies produce inadequate amounts of erythrocytes.

For the past ten years, synthetic version of EPO is often used by athletes for increasing the oxygen carrying capacity of the blood. But, increasing the number of erythrocytes, EPO increases the risk of hypertension, heart attack or stroke. As the athlete becomes dehydrated during training, blood volume is reduced, which increases the possibility of thrombosis.

GENES USED FOR TREATING SPORTS INJURIES

Gene therapy can be succesffuly used to treat sports injuries, which include muscle injuries, ligament and tendon ruptures, cartilage lesions, bone fractures and the like. By transfering genes which code the corresponding growth factors into the injured tissue, tissue regeneration can be improved. Considering the fact that bone development includes the activation of several genes in the differentiation of the osteoblast from mesenchymal precursor cells (IGF, FGF, transforming growth factor β, VEGF), the application of these genes has, in the animal models, shown a significant improvement in the speed of fracture healing (Southwood, Frisbie, Kawcak, & McIwraith, 2004). A number of these factors (VEGF) and bone morphogenic protein, activate osteoblasts improving the rate of bone repair. Thus delivery of the DNA encoding such growth factors will enhance repair. Although this is allowed as a therapeutic tool, it happen that expression of these factors increase the strength of bones and tendons, so that giving an adventage to competitors. Therefore, although these treatments are promising, the clinical application is limited.

Insufficient data has been collected on gene transfer in ligament, tendon and cartilage treatments, since what we are dealing with is another type of tissue, but these procedures should soon become a part of clinical practice. VEGF (vascular endothelial growth factor) is expressed in ruptured and foetal human Achilles tendons, but not in normal adult Achilles tendons (Pufe, Petersen, Tillman, & Mentlein, 2001).

Muscle injuries constitute between 10 and 55% of all injuries sustained by athletes. Local ingestion of IGF-1, basic fibroplast growth factor (bFGF), or nerve growth factor (NGF) after injury increases the number and size of regenerating myofibers in different animal studies (Hoffmann & Gross, 2009; Skuk & Tremblay, 2008). Such strategies should be applied to patients suffering from muscular diseases but not to athletes to speed up a healing process because there are many more risks than potential benefits.

Nitric oxide (NO) is a fundamental participant in the basic biology of sports related injury. This molecule plays a role in the physiology of articular cartilage, tendon ligament, muscle, bone, intervertebral disc and synovium. Gene therapy techniques may allow alteration of local NO concentrations. Ongoing studies are beginning to provide answers on many questions and may allow for the eventual clinical use of gene therapy in the treatment of musculo-skeletal injury (Huard, Li, Peng, & Fu, 2003).

One important aspect of regenerative medicine is tissue engineering. It includes three main elements: cells, factors or stimuli (growth factors, cytokines) and biomaterials (Service, 2008). The biomaterials for tissue engineering, which can be derived from natural (like collagen), or synthetic sources (polymers of lactic and glycolic acid), need to be biodegradable and biocompatibile. Due to the vascularization, healing of bone often precedes readily, but the soft tissues like cartilage, tendons and ligaments are poorly vascularized and heal slowly. Stem cells present an ideal and promising option for tissue engineering of tendons (Sharma & Maffulli, 2008). Mesenchymal stem cells (MSCs) are capable of undergoing differentiation into a variety of specialized mesenchymal tissues, including bone, tendon, cartilage, muscle, ligament, fat and marrow stroma (Caplan & Bruder, 2001; Sharma & Maffulli, 2006). Another potential application of MSCs is ex vivo, de novo tissue engineering. This technique

involves construction of whole body tissues in the laboratory, and their inplantation into patients. Several studies have demonstrated engineering whole tendons in such a manner (Calve, Dennis, Kosnik, Baar, Grosh, & Arruda, 2004; Cao, Liu, Wei, Xu, Cui, & Cao, 2006).

These strategies are currently at an early stage of development and their full impact needs to be the focus of intense research.

DETECTION OF GENE DOPING

Gene doping is difficult to detection using standard doping tests. The proteins transferred by means of genes are human in origin and do not differ from the rest of the endogenous constituents. Blood and urin tests are not suitable, because the recombinant protein is expressed locally and thus a biopsy is necessary for tissue sampling. The use of protein markers, as indicators of any disturbances in normal physiology is a possible solution, with a previous individual analysis (screening) of the set of proteins under physiological conditions, and during the study phase, the use of microchip technology and DNA barcodes is necessary.

Given the many different genes that are used in doping, it is necessary to know their expression and metabolic pathway. Since 2000 it has been possible to identify recombinant EPO. The electrophoretic mobility technique provides a direct measurement of urine levels and it is based on the principles that the rHuEPO molecule is less negatively charged than the endogeneous EPO molecule. It may also be possible to detect minute traces of gene transfer vectors using highly sensitive polymerase chain reaction - based techniques such as single-copy primer-internal intron-spanning PCR procedure described by Beiter, Zimmermann, Fragaso, Armeanu, Lauer, Bitzer et al. (2008). Another approach is to use indirect technique to demonstrate potential gene doping by looking for the consequence of the genetic manipulation such as changes in patterns of target gene expression (trancriptomics), proteins (proteomics) or their metabolites (metabalomics).

Affinity-based biosensors (ABBs) would be suited for application of strategies involving the detection of gene or delivery vector DNA sequence, recombinant protein product, or other indirect biomarkers. ABB based on use of oligonucleotide probes specific for the endogene-ous sequence. It can be used to detect the recombinant protein by utilizing specific antibodies (Minunni, Scarano, & Mascini, 2008).

ETHICAL ASPECTS OF THE USING GENE IN SPORT

In accordance to the principles of the World Health Organization, in medical ethics, adhering to two principles is of primary importance: respect for man and loyalty to the ideal of humanity. But gene therapy abuse in sport dissolves these very principles of humanity. The creation of a super athlete is in direct opposition to the basic ethical principles, endangers the health of the athlete, and the very spirit of sport could be disrupted. Fair play includes equality of circumstance and mutual respect, as well as the satisfaction of victory, while every other type of victory would be a form of cheating of nature and humanity. It is necessary to make a clear line of division between therapy, and help sick and vulnerable on the one hand, and abuse on the other, at the same time passing judgment on it, in a legal, moral and ethical sense.

CONCLUSION

One of the most important aspects of the development of genetics is the possibility of successful gene therapy. We now have the ability to treat many genetic and non-genetic disorders, which were only until recently untreatable. However, it is necessary to overcome many difficulties in its application, until it is fully incorporated in clinical practice. The viruses that transfer genes attack and destroy the immune system. Once introduced, a gene cannot be extracted, and the reactions of the body could be negative, as the introduction of a foreign gene might cause insertion mutagenesis. These are just some of the problems being faced in gene therapy application.

Even though we believe that gene therapy in the treatment of sport injuries is more effective than conventional methods, its application is still limited and has not been studied in full detail. *There is a fine line between gene therapy and gene doping in athletes*. A number of growth factors will enhance repair, but it happen the expression of these factors increase the strength of bones and tendons, so that giving an adventage to competitors. Therefore, although these treatments are promising, the clinical application is limited.

At the moment there are no evidence that gene doping is being practiced by athletes, but there is a concern that it will be used in the near future. First of all, it is necessary to meet athletes with the consequences of gene doping, provide to them clear information and present potential risks. What is most

concerned is the abuse of the therapeutic aspects of gene therapy, its application to the germinative cells and application in the field of sports for performance enhancement. The coordination of efforts by international scientific and sports communities to develop successful detection strategies are essential to overcome that problem. Victory and glory are strong arguments, but the health of young people, respect for fundamental and ethical principles, humanity, fair play game have a more lasting value and represent the heavier weight on the scales.

REFERENCES

Baoutina, A., Alexander, I. E., Rasko, J. E. J., & Emslie, K. R. (2007). Potential use of gene transfer in athletic performance enhancement. *Molecular Therapy*, *15(10)*, 1751–1766.

Barton-Davis, E. R., Shoturma, D. I., & Sweeney, H. L. (1999). Contribution on satellite cells to IGF-1 induced hypertrophy of skeletal muscle. *Acta Physiologica Scandinavica*, *167*, 301–305.

Beiter, T., Zimmermann, M., Fragasso, A., Armeanu, S., Lauer, U. M., Bitzer, M., et al. (2008). Establishing a novel single-copy primer - internal intron - spanning PCR procedure for the direct detection of gene doping. *Exerc Immunol Rev*, *14*, 7–85.

Brown N. J., Blais C., Gandhi S. K., & Adam A. (1998). ACE insertion/deletion genotype affects bradykinin metabolism. *J Cardiovascul Pharmacol*, *32*, 373–377.

Brutsaert, T. D. & Parra, E. J. (2009). Nature versus nurture in determining athletic ability. *Med Sport Sci. Basel, Karger*, *54*, 11–27.

Calve, S., Dennis, R. G., Kosnik, P. E., Baar, K., Grosh, K., & Arruda, E. M. (2004). Engineering of functional tendon. *Tissue Eng*, *10(5-6)*, 755–761.

Cao, D., Liu, W., Wei, X., Xu, F., Cui, L., & Cao, Y. (2006). In vitro tendon engineering with avian tenocytes and polyglycolic acids, a preliminary report. *Tissue Eng*, *12(5)*, 1369–1377.

Caplan, A. I., & Bruder, S. P. (2001). Mesenchymal stem cells: bilding blocks for molecular medicine in the 21 st century. *Trends Mol Med*, *7(6)*, 259–264.

Cavazzana-Calvo, M., Lagresie, C., Hacein-Bey-Abina, S., & Ficher, A. (2005). Gene therapy for severe combined immunodeficiency. *Annu Rev Med*, *56*, 585–602.

Costa, A., Silva, A.J., Breitenfeld, L., Marques, M. C., Marinho, D., Garrido, N., et al. (2008). ACE genotype and critical velocity in elite swimmers. *Archivos de Medicina del Deporte*, *XXVI (129)*, 34.

Engert, J. C., Berglund, E. B., & Rosenthal, N. (1996). Proliferation precedes differentiation in IGF-1 stimulated myogenesis. *J Cell Biol*, *135*, 431–440.

Evans, R. M., Barish, G. D., & Wang, Y. X. (2004). PPARs and the complex journey to obesity. *Nat Med*, *10*, 355–361.

Hoffmann, A., & Gross, G. (2009). Innovative strategies for treatment of soft tissue injuries in human and animal athletes. *Med Sport Sci, Basel, Karger*, *54*, 150–165.

Huard, J., Li, J., Peng, H., & Fu, F.H. (2003). Gene therapy and tissue engineering for sports medicine. *J Gene Med*, *5*, 93–108.

Humbel, R. E. (1990). Insulin-like growth factors I and II. *Eur J Biochem*, *190(3)*, 445–462.

Jones, A., & Woods, D. R. (2003). Sceletal muscle RAS and exercise performance. *Int J Biochem Cell Biol*, *35*, 855–866.

Karjalainen, J., Kujala, U. M., Stolt, A., Mantysaari, M., Viitasalo, M., Kainulainen, K., et al. (1999). Angiotensinogen gene m235t polymorphism predicts left ventricular hypertrophy in endurance athletes. *J Am Coll Cardiol*, *34*, 494–499.

Landesberg, R., Roy, M., & Glickman, R. S. (2000). Quantification of growth factor levels using simplified method of plateled-rich plasma gel preparation. *J Oral Maxillofac Surg*, *58*, 297–300.

Mills, M., Yang, N., Weinberger, R., Vander Woude, D. L., Beggs, A. H., Eastel, S., et.al. (2001). Differential expression of the actin-binding proteins, alpha-actinin-2 and 3 in different species: implications for the evolution of functional redundancy. *Hum Mol Genet*, *10*, 1335–1346.

Minunni, M., Scarano, S., & Mascini, M. (2008). Affinity-based biosensors as promising tools for gene doping detection. *Trends Biotechnol*, *26*, 236–243.

Musaro, A., McCullagh, K., Paul, A., Houghton, L., Dobrowolny, G., Molinaro, M., et al. (2001). Localised IGF-1 transgene expression sustains hypertrophy and regeneration in senescent skeletal muscle. *Nat Genet*, *27*, 195–200.

Nazarov, I., Woods, D., Montgomery, H., Shneider, O., Kazakov, V., Tomilin, N., et al. (2001). The angiotensin converting enzyme I/D polymorphism in russion athletes. *European Journal of Human Genetics*, *9(10)*, 797–801.

North, K. N., Yang, N., Wattanasirichaigoon, D., Mills, M., Easteal, S., & Beggs, A. H. (1999). A common nonsense mutation results in alpha-ac-

tinin-3 deficiency in the general population. *Nat Genet*, *21*, 353–364.

Pufe, T., Petersen, W., Tillman, B., & Mentlein, R. (2001). The angiogenic peptide vascular endothelial growth factor is expressed in foetal and ruptured tendons. *Virchows Arch*, *439(4)*, 579–585.

Rankinen, T., Wolphart, B., Simoneau, J., Maier-Lenz, D., Rauramaa, R., Rivera, M. A., et al. (2000). No association between the angiotensin-converting enzyme ID polymorphism and elite endurance athlete status. *J Appl Physiol*, *88*, 1571–1575.

Rattigan, S., Dora, K. A., Tong, A. C., & Clark, M. G. (1996). Perfuzed skeletal muscle contraction and metabolism improved by angiotensin II-mediated vasoconstriction. *Am J Physio*, *271*, E96–E103.

Rieder, M., Taylor, S., Clark, A., & Nickerson, D. (1999). Sequence variation in the human angiotensin converting enzyme. *Nature Genetics*, *22*, 59–62.

Saxena, P. R. (1992). Interaction between the rennin-angiotensin-aldosteron and sympathetic nervous systems. *Journal of Cardiovascular Pharmacology*, *19*, S80–S88.

Service, R.F. (2008). Tissue engineering. Coming soon to a knee near you: cartilage like your very own. *Science*, *322*, 1460–1461.

Sharma, P., & Maffulli, N. (2006). Biology of tendon injury: healing, modeling and remodeling. *J Musculoskelet Neuronal Interact*, *6*, 181–190.

Sharma, P., & Maffulli, N. (2008). Tendinopathy and tendon injury: the future. *Disability and Rehabilitation*, *30(20–22)*, 1733–1745.

Skuk, D., & Tremblay, J. P. (2008). Implantation of myogenic cells in skeletal muscle. In A. Atala, R. Lanza, J. Thomson, & R. Nerem (Eds.), *Principles of Regenerative* (pp. 782–793). Amsterdam: Elsevier.

Southwood, L. L., Frisbie, D. D., Kawcak, C. E., & McIwraith, C.W. (2004). Delivery of growth factors using gene therapy to enhance bone healing. *Vet Surg*, *33*, 565–578.

Sweeney, H. L. (2004). Gene doping. *Sci Am*, *21*, 63–69.

Taylor, R. R., Mammote, C. D. S., Fallon, K., & Bockxmeer, F. M. (1999). Elite athletes and the gene for angiotensin-converting enzyme. *J Appl Physiol*, *87*, 1035–1037.

Tsianos, G., Sanders, J., Dharait, S., Humphries, S., Grant, S., & Montgomery, H. (2004). The ACE gen polymorphism and elite endurance swimming. *European Journal of Applied Physiology*, *93(3)*, 360–362.

Turnpenny, P., & Ellard, S. (2007). *Emerys elements of medical genetics* (13th ed). Philadelphia: Elsevier Limited.

Vitošević, B. (2011). *Biologija razvoja čoveka sa osnovama genetike* (Biology of human development with the basics of genetics). Kruševac: Sigraf.

Woods, D. (2009). Angiotensin-converting enzyme, renin-angiotensyn system and human performance. *Med Sport Sci, Basel, Karger*, *vol 54*, 72–87.

Yang, N., MacArthur, D. G., Gulbin, J. P., Hahn, A. G., Beggs, A. H., Easteal, S., et al. (2003). ACTN3 genotype is associated with human elite athletic performance. *Am J Hum Genet*, *73*, 627–631.

Received: November 11, 2010
Accepted: January 12, 2011

Correspodence to:
Biljana Vitošević, PhD
Dositeja Obradovića, bb
38218 Leposavić
Serbia
Phone: 00381 64 89 04 625
E-mail: biljana.vitosevic@pr.ac.rs

for experimental research or in a descriptive way for descriptive science areas.

- *Scientific work review* is a review of papers on a specific topic, works of an individual researcher or a group of researchers whose aim is to summarize, analyze, evaluate or synthesize already published information. It brings new syntheses which also include results of author's own research.
- *Short scientific article* is an original scientific article which may skip some elements of IMRAD. It concisely presents results of a completed own research or of an ongoing research.
- *Scientific gathering presentation* is a comprehensive article that has previously been briefed to a scientific gathering, but it has not been published in its comprehensive form in the Paper Collection Book of the gathering.
- *Professional article* is a review of something that is already known, with an emphasis on the usability of the results of the original research and the spread of knowledge. The complexity of the text is adjusted to the needs of the professional and scientific aspects of the journal.

After reviews have been done, the editorial board will analyze them. If needed, the paper is sent back to the author who must comply with the suggestions and objections made by the reviewers. Once they have redone the paper, the authors need to specifically describe, on a *separate sheet of paper*, how they have resolved the reviewer's suggestions.

Only those papers that have been placed in one of the categories and which have *two positive reviews will be published.*

Text style and organization

Scientific articles must adhere to the IMRAD scheme (Introduction, Methods, Results and Discussion).

Title

The title page of the manuscript should contain the following information: (1) a concise, but informative title. Use of abbreviations is not encouraged; (2) the author's names (do not include degrees); the last one is introduced by "&"; (3) the affiliation of the authors, town and state; (4) the name and address of the corresponding author (must include title, degree and position of the corresponding author, phone and fax numbers – zip code for the country and city, and email address).

Summary and key words

The summary should be brief and Self-explanatory. It should cover a general presentation of the topic (the purpose and the objective of the paper),

ili na deskriptivan način za deskriptivna naučna područja.

- *Pregledni naučni članak* predstavlja pregled najnovijih radova o određenom predmetnom području, radova pojedinog istraživača ili grupe istraživača sa ciljem da se već publikovane informacije sažmu, analiziraju, evaluiraju ili sintetizuju. Donose nove sinteze koje, takođe, uključuju i rezultate sopstvenog istraživanja autora.
- *Kratki naučni članak* predstavlja izvorni naučni članak kod kojih neki elementi šeme IMRAD mogu da budu ispušteni. Ukratko sažima rezultate završenog izvornog istraživačkog rada ili rada koje je još u toku.
- *Izlaganje sa naučnog skupa* predstavlja cjelovit članak koji je prethodno referisan na načnom skupu, ali u obliku cjelovitog članka nije objavljen u zborniku naučnog skupa.
- *Stručni članak* predstavlja prikaz već poznatog, s naglaskom na upotrebljivost rezultata izvornih istraživanja i širenja znanja, a zahtijevnost teksta prilagođena je potrebama stručnosti i naučnosti časopisa.

Nakon primljenih recenzija uredništvo ih analizira. Ukoliko je to potrebno, rad se vraća autoru koji je dužan uvažiti sugestije i primjedbe recenzenata. Kada preradi svoj rad autor-i treba da, na *posebnom listu papira*, konkretno navedete kako su razriješili sugestije vezane za recenziju.

Objavljuju se samo radovi koji su svrstani u jednu od kategorija i koji *imaju dvije pozitivne recenzije.*

Stil i organizacija teksta

Naučni članci se organizuju po šemi IMRAD (Introduction, Methods, Results, i Discussion).

Naslov rada

Naslov rada treba da sadrži sledeće informacije: (1) kratak ali informativan naslov u kome se ne preporučuje korištenje skraćenica; (2) ime autora bez titule gdje se ispred posledenjeg autora stavlja "i"; (3) institucija u kojoj autor-i radi, grad i država; (4) ime i adresa autora predviđenog za korespodenciju (naučno zvanje, položaj, broj telefona i faksa, poštanski broj grada, državu i e-mail adresu).

Sažetak i ključne riječi

Sažetak treba da bude kratak i razumljiv sam po sebi. U sažetku se ne traba pozivati na tekst članka. Treba da obuhvati opšti prikaz teme (predmet i cilj rada), rezultate i zaključak. Autori ne bi trebali da tom

results and conclusions. Authors should not use abbreviations. The abstract should include 150-250 words.

Three to six words, which are not part of the title, need to be singled out. The Key words need to reflect the contents of the paper.

Introduction

This part of the paper ought to inform the reader of the issues dealt with in the research and the results of previous analyses. The purpose of the research should also be clearly stated in this part.

Methods

This part should consist of the following subtitles: entity sample, variables, procedures, tastings, statistical analysis.

Units of measurement, symbols and abbreviations must conform to international standards. Measurements of length, height, weight and volume should be given in metric units (meter, kilogram, liter).

Results

The results should be presented as tables, graphs and pictures, possibly processed statistically and be concisely presented in the text.

Tables, graphs and pictures showing the results of individual analyses need to be indicated in the text for easier reader navigation.

Discussion

The authors are expected here to comment on the results and compare them with literature data. The discussion must be professional and correspond to experimental data. Practical implications are welcome.

Conclusion

Contains clearly stated scientific assertions, open issues and recommendations for further research.

Tables, graphs and pictures

Each table and any illustration (black and white only) must be submitted on a separate sheet of paper. Tables should be numbered in the order in which they occur in the text and referred to as, for example, "Table 1.". Each table should be accompanied by a short title. Tables should be accompanied with interpretations (legends). It will also be deemed informative if the tables include indications of important correlations and relevant variables.

prilikom koriste skraćenice. Sažetak treba da sadrži 150-250 riječi.

Potrebno je izdvojiti i dati tri do šest ključnih riječi koje se ne nalaze u naslovu. Ključne riječi moraju da odražavaju suštinu sadržaja rada.

Uvod

Ovaj dio rada treba da informiše čitaoca o problemima datog istraživanjai rezultatima prethodnih analiza. Cilj istraživanja takođe treba jasno navesti u ovom dijelu.

Metode

Ovaj dio treba da se sastoji od sledećih podnaslova: uzorak entiteta, varijable, procedure testiranja, statistička analiza.

Mjerne jedinice, simboli i skraćenice moraju da poštuju međunarodne standarde. Mjere dužine, visine, težine i zapremine moraju da budu u metričkim jedinicama (metar, kilogram, litar).

Rezultati

Rezultati bi trebalo da budu predstavljeni kroz, tabele, grafikone i slike, statistički obrađene i koncizno interpretirane.

Tabele, grafikoni i slike koje pokazuju rezultate pojedinih analiza trebaju da budu naznačene u tekstu kako bi se pažnja čitaoca skrenula na njih.

Diskusija

Od autora se očekuje da iznesu dokaze istraživanja i da ih uporede sa dosada objavljenim istraživanjima u toj oblasti. Diskusija mora da bude stručna i u skladu sa podacima eksperimenta. Poželjno je da diskusija obuhvati i praktične implikacije rada.

Zaključak

Sadrži jasno izrečene naučne tvrdnje, otvorena pitanja i preporuke za daljnja istraživanja.

Tabele, grafikoni i slike

Svaka tabela, grafikon i slika (samo u crno bijeloj tehnici) treba da bude dostavljena na posebnom listu papira. Tabele treba da budu numerisane po redoslijedu kojim se pojavljuju u tekstu i označena kao npr. "Tabela 1". Svaka tabela treba da ima kratak naslov. Potrebno je dodati legende za tabele. Takođe bilo bi informativno ako bi se u tabelama naznačile značajnije korelacije i značajnije varijable.

a resolution not smaller than 300 dpi and in a .jpeg format. Each figure needs to have a short title. In case that the figures are taken over from another paper, the title should not include the original name. In such a case, the source where the picture was taken from should be indicated under the picture.

If tables, graphs and pictures contain special symbols, or are prepared in a special program, they must be submitted in a separate file, with clearly indicated order of their inclusion in the text.

Article technical form

Articles are written and published in Latin alphabet, and, when needed, in other alphabets, in the Serbian language (ijekavica dialect) and the English language. Any deviation from this, needs to be agreed with the editorial board in advance. If author's native language is not Serbian, Croatian or Bosnian their papers will bi translated by editorial board. When translating the paper authors are suggested to engage someone whose native language is English.

Texts are to be written in Microsoft Word Windows program, on A4 paper format. Text is to be written in the Times New Roman font, size 12 pt in 1.5 spacing, aligned on both sides, with a 1 tub denting of the first row of a paragraph, with 2.5 cm paper margins. If it is necessary to indicate a word or a sentence in the text, use the italic. Text size should conform to 15 pages. The editorial board may accept a bit longer papers, but it will seldom do so.

Articles and abstracts should be written in the third person, neutrally, adhering to a good style and defined linguistic norms.

Refereneces

The journal uses the Harvard reference system - APA standards for referencing literature.

Sending papers

Authors must sent papers on a DVD, which must bear: (1) the name of the author, (2) the title of the paper, (3) Word program that has been used.

Papers are to be sent to the following address:

Uredništvo lista „SportLogia“
Fakultet fizičkog vaspitanja i sporta
Bulevar Petra Bojovića 1A
78000 Banja Luka
Bosnia and Herzegovina

or

E-mail address: ffvis@blic.net

liciji najmanje 300 dpi i formatu .jpeg. Svaka slika treba da ima kratak naslov. U slučaju da su slike preuzete iz nekog drugog rada, u naslovu ne bi trebalo da se nalazi orginalini naziv. U takvom slučaju potrebno je da se ispod slike nalazi Izvor odakle je slika preuzeta.

Ukoliko tabele, grafikoni i slike sadrže posebne znakove, te su rađeni u posebnom programu, dostavljaju se na posebnom fajlu, sa tačno navedenim rasporedom po kojem se uključuju u tekst.

Tehničko oblikovanje članka

Članci se pišu i štampaju latiničnim pismom, po potrebi i drugim pismima, na srpskom (ijekavica) i engleskom jeziku. Svako odstupanje od navedenog, treba posebno unaprijed dogovoriti s Uredništvom. Ako se radi o autorima kojima maternji jezik nije srpski, hrvatski ili bošnjački njihove radove na srpski prevodi uredništvo. Autori su dužni da prilikom prevođenja rada na engleski jezik angažuju stručne osobe, najbolje one kojima je maternji jezik engleski.

Tekstovi se pišu u Microsoft Word Windows programu, na papiru A4 formata. Tekst se piše u Times New Roman fontu, veličine 12 pt u proredu 1,5, poravnat sa obje strane, sa uvlačenjem prvog reda pasusa od 1 tab, sa marginama papira 2,5 cm. Ukoliko je u tekstu potrebno posebno označiti neku riječ ili rečenicu, koriste se kosa slova (italik). Obim teksta treba da sadrži do 15 strana. Uredništvo može prihvatiti i malo duže radove ali će to činiti rijetko.

Članke i sažetke treba pisati u trećem licu, neutralno, pridržavajući se dobrog stila i utvrđenih jezičkih normi.

Literatura

Časopis koristi Harvard reference system APA standard kod navođenja literture.

Slanje radova

Autori radove šalju na DVD-u na kome mora da stoji: (1) ime autora, (2) naslov rada, (3) World program koji je korišten.

Radovi se šalju na sledeću adresu:

Urednivštvo lista „SportLogia“
Fakultet fizičkog vaspitanja i sporta
Bulevar Petra Bojovića 1A
78000 Banja Luka
Bosna i Hercegovina

ili

E-mail adresu: ffvis@blic.net

rd International scientific congress

Anthropological aspects of sports, physical education and recreation

3 Međunarodni naučni kongres

Antropološki aspekti sporta, fizičkog vaspitanja i rekreacije

a Luka,

novembar 2011. godine

УНИВЕРЗИТЕТ У БАЊОЈ ЛУЦИ 1975 UNIVERSITY OF BANJA LUKA

FAKULTET FIZIČKOG VASPITANJA BANJA LUKA