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Science of Gymnastics Journal (ScGYM®)

Science of Gymnastics Journal (ScGYM®) is an international journal that provide a wide range of scientific information specific to gymnastics. The journal is publishing both empirical and theoretical contributions related to gymnastics from the natural, social and human sciences. It is aimed at enhancing gymnastics knowledge (theoretical and practical) based on research and scientific methodology. We welcome articles concerned with performance analysis, judges' analysis, biomechanical analysis of gymnastics elements, medical analysis in gymnastics, pedagogical analysis related to gymnastics, biographies of important gymnastics personalities and other historical analysis, social aspects of gymnastics, motor learning and motor control in gymnastics, methodology of learning gymnastics elements, etc. Manuscripts based on quality research and comprehensive research reviews will also be considered for publication. The journal welcomes papers from all types of research paradigms.

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Editorial Office Address

Science of Gymnastics Journal
Faculty of Sport, Department of Gymnastics
Gortanova 22, SI-1000 Ljubljana, Slovenia
Telephone: +386 (0)1 520 7765
Fax: +386 (0)1 520 7750
E-mail: scgym@fsp.uni-lj.si
Home page: <http://www.scienceofgymnastics.com>

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Photo by Simon Trček, <http://simontrcekphotography.blogspot.com/>

EDITORIAL

Dear friends,

Today we are celebrating our 10th issue of the Science of Gymnastics Journal. As this is our last issue in 2012 it is time to look back and evaluate the year. In 2012, we have published 20 articles and more than 17,000 people visited our web page. In August we received a Letter of Acceptance from the Elsevier's SCOPUS database. Along Thomson Reuters Web of Knowledge, this is the most influential science database. Last year the Journal was entered in the Copernicus Index. For 2011, our score was 5.09 which place us in the top half of scientific journals in the physical education area. In SCOPUS and Web of Knowledge, the Journal has already been quoted by other researchers. This is a source of great pride for our team and we hope the trend will continue. For those of you who would like to quote the Journal – its abbreviation in Web of Knowledge is SCI GYMNASTICS J. Notice for authors and reviewers: from now on we are using ScholarOne (<http://mc.manuscriptcentral.com/sgj>).

The Olympic Games in London were the biggest event this year for gymnastics fans. I was in London and was thrilled to watch the gymnastics competitions (artistic, rhythmic, trampoline). The FIG President, Mr Bruno Grandi, made an excellent overview of the good and the bad sides of gymnastics at the Games. This may inspire researchers to analyze the bad sides so that we can improve our sport. Additionally, it would be interesting to study (in my opinion) the most difficult combination of elements ever performed from the motor control perspective. On the high bar, Epke Zonderland connected Casina, Kovacs and Kolman salto. Simon Trček, a talented young Slovenian photographer, took a number of excellent photos of Epke Zonderland during the FIG Challenge Cup in Maribor (Slovenia) in spring 2012 where Epke performed the same combination. Simon donated one of his photos to our Journal for you to enjoy Epke's virtuosity and enormous motor control.

The first article in this issue is from the rhythmic gymnastics. Portuguese authors Susana Corujeira, Rita Santos Silva, Tiago Vieira, Cláudia Dias, Eunice Lebre, and Carla Rêgo found that competitive gymnastics affects the body composition but does not appear to compromise the nutritional status, the normal progression of puberty, bone mass and genetically defined final height. These results question the concept of simultaneous presence of malnutrition, amenorrhea and osteoporosis (FAT).

The second article is from Greece. Miltiadis Proios conducted a study on the athletic identity and achievement goals of gymnasts.

The third article comes from Slovenia. Marjeta Kovač tested the reliability and objectivity of gymnastics knowledge tests for use in schools. Similar tests can also be used in other sports.

The Portuguese, Canadian and Spanish team of authors: Lurdes Ávila-Carvalho, Panaginota Klentrou, Maria da Luz Palomero and Eunice Lebre, contributed the fourth article in which they analyzed handling, throws, catches and collaborations in elite group rhythmic gymnastics. The article offers a number of suggestions which could improve the Code of Points.

The fifth article is from Slovenia and USA and deal with media and television in particular. Simon Ličen and Andrew C. Billings scrutinized Slovenian TV presenters reporting on gymnastics.

The sixth article comes from Tunisia and United Kingdom; authors are from Bessem Mkaouer, Monem Jemni, Samiha Amara, Helmi Chaabèn and Zouhair Tabka; interesting article about take off from different tasks.

The last article comes from a Slovak and Czech group of authors lead by Anton Gajdoš along with Marie Provaznikova, Karel Bednar and Stephen J. Banjak and is the continuation of their article in the previous issue on the 150th anniversary of the first Sokol Club in Prague.

I wish you pleasant reading and a lot of inspiration for new research projects and articles,

Ivan Čuk
Editor-in-Chief

University of *Ljubljana*
Faculty of *Sport*



Youth Sport 2012



6th Conference for Youth Sport
University of Ljubljana, Faculty of Sport

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GYMNASTICS AND THE FEMALE ATHLETE TRIAD: REALITY OR MYTH?

Susana Corujeira¹, Rita Santos Silva^{1,2}, Tiago Vieira³, Cláudia Dias⁴,
Eunice Lebre⁵, Carla Rêgo⁴

¹Pediatrics Department, Centro Hospitalar de São João, Porto,

²Faculdade de Medicina da Universidade do Porto

³Nuclear Medicine Department, Centro Hospitalar de São João, Porto

⁴CINTESIS. Faculty of Medicine of Porto University

⁵Faculty of Sports of Porto University

Original research article

Abstract

In sports that require low body weight, it is questioned whether the high frequency and intensity of training can compromise growth and maturation. Aim was to evaluate the influence of gymnastics on nutritional status, body composition, pubertal development, bone mass, prediction of height and the occurrence of the Female Athlete Triad (FAT) in adolescents. Convenience sample consisted of 27 female gymnasts and 15 controls. The evaluation included anthropometric parameters, body composition (bioelectrical impedance; Tanita TBF 300[®]), pubertal stage, bone age, bone mineral density (DXA L1-L4; Lunar Expert XL[®]) and blood pressure. Body mass index and genetic height prediction were calculated. Gymnasts practice a median of 18 hours per week of exercise, six times more than the control group. There were no significant differences between groups in genetic height, menarche, pubertal stage, nutritional status and bone mass. However, gymnasts have a lower value of total body fat. Sedentary adolescents show a higher prevalence of overweight, hypertension, osteopenia and final height prediction. In this particular group of athletes, competitive gymnastics influences body composition but does not appear to compromise nutritional status, normal progression of puberty, bone mass and genetically defined final height. These results question the concept of FAT, but more studies are needed.

Keywords: *gymnastics, athletic performance, bone mineralization, body composition, exercise.*

INTRODUCTION

Exercise training has a significant benefit in physical and psychological well-being. However, intense physical training during puberty can influence growth and maturation (Malina, Bouchard & Bar-Or, 2004; Caine, Lewis, O'Connor, Howe & Bass, 2011; Erlandson, Sherar, Mirwald,

Mafuli & Baxter-Jones, 2008; Georgopoulos et al, 1999; Rêgo, 2010).

Defined in 1992 by the American College of Sports Medicine, the Female Athlete Triad (FAT) is a clinical syndrome characterized by the simultaneous presence of malnutrition, amenorrhea and

osteoporosis. The three components of FAT are closely bound, assuming that in its genesis may lie dietary restrictions, intense physical training, hormone-disruption and psychosocial factors (Filaire & Lac, 2002; Di Cagno, Baldari, Battaglia, Guidetti & Piazza, 2008; Caine, Lewis, O'Connor, Howe & Bass, 2011; Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008). The concept of FAT assumes that female athletes often have a hypocaloric diet, below the energy requirements for the practice of exercise. Also, there often coexists a high level of psychological stress, and both situations lead to dysfunction of the hypothalamic-pituitary-adrenal axis culminating in amenorrhea (Malina, Bouchard & Bar-Or, 2004; Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008; Georgopoulos et al., 1999; Rêgo et al., 1997; Filaire & Lac, 2002; Di Cagno, Baldari, Battaglia, Guidetti & Piazza, 2008). As a result of amenorrhea, the level of estrogens decreases thus increasing the risk of osteoporosis (Perini, Oliveira, Dantas, Fernandes & Filho, 2009; Birch, 2005).

The term "athletic anorexia" has been used to distinguish classical anorexia from eating disorders associated with intense physical exercise. This type of anorexia typically implies perfectionism, competitiveness, motivation and at least one unhealthy way to lose weight (fasting, induced vomiting, use of diet drugs, diuretics or laxatives). The prevalence of eating disorders in athletes is nearly 60%, while amenorrhea can be as high as 44% (Birch, 2005). Osteoporosis, defined as bone mineral density less than 2.5 standard deviations (WHO, 1994), is rarely an isolated finding in athletes, and is usually associated with extreme thinness or menstrual disorders. It is a rare disorder, and recent evidence suggests that this term should be replaced by "osteopenia" (Ferraz, Alves, Bacurau & Navarro, 2007; Birch, 2005).

It is now believed that athletes performing sports in which optimal performance is dependent, physiologically or aesthetically, on a low percentage of

body fat (of which gymnastics is an example) are more vulnerable to FAT (Perini, Oliveira, Dantas, Fernandes & Filho, 2009). It has also been suggested that the intensity and frequency of training may be directly proportional to the prevalence of the triad. Some authors define a threshold above 18 hours per week as being at high risk of FAT (Ferraz, Alves, Bacurau & Navarro, 2007).

This syndrome, revised in 2007, suffered harsh criticism in sportive circles, mainly for its sexist nature, since it refers only to female athletes. It has recently been suggested that although some components of FAT can appear alone, only a small number of athletes simultaneously presents with all three. In a study in Norwegian athletes, the simultaneous occurrence of the three components of the triad was rare (4.3%) and similar to that observed in the control group (Tarstveit & Sundgot-Borgen, 2005; Nichols, Rauh, Lawson, Ji & Barkai, 2006).

There are many myths surrounding competitive gymnastics. In Portugal, despite the large number of federated athletes, little is known about this reality.

The aim is to evaluate the influence of competitive gymnastics in the nutritional status, body composition, pubertal development, bone mass, height prediction and the presence of FAT in female adolescents.

METHODS

Descriptive, cross-sectional comparative analytical type study. The target population includes only females and was divided into two sample groups: a group of competitive athletes practicing artistic or acrobatics gymnastics and a control sedentary group practicing only obligatory school sport (3 hours per week). In the group of athletes, an inclusion criterion was weekly training over 12 hours. For the control group, adolescents were selected randomly by sending an invitation letter to a school. After a personal contact, written informed consent was obtained from all parents. Participation was

voluntary and anonymity of participants was properly preserved.

The study was conducted between January and May 2010. We recorded the following variables: chronological age, age of menarche and characterization of menstrual cycles (regularity and frequency). We carried out a food frequency questionnaire, mostly oriented to calcium supply. Characterization of training habits included age at onset of training yield (≥ 10 hours / week) and the number of hours per week of practice.

Weight and height were measured (Jelliffe, 1996; Jelliffe & Jelliffe, 1989) and body mass index (BMI) and the BMI z-score were calculated (CDC 2000). The evaluation of body composition was performed by bioelectrical impedance (Tanita TBF 300[®]) and sexual maturation was assessed according to Tanner's criteria. Blood pressure was measured three times at rest, the lowest value of the systolic blood pressure was selected and then its percentile calculated. Bone mineral density was evaluated by dual x-ray absorptiometry (DXA) at lumbar spine L1-L4, by using the Lunar Expert XL Densitometer[®]. Osteopenia was defined as a value of the bone mineral density z-score (BMD z-score) lower than 1.5 standard deviations. Bone age was determined by X-ray of the non-dominant wrist (Greulich, Pyle & Waterhouse, 1971) and subsequently the predicted height based on bone age (Ernest Prost) and also the predicted final height based on family height were calculated.

The statistical treatment of data was performed using the program Statistics Predictive Analytics Software (SPSS[®], version 18.0). Continuous variables were described as median and percentiles (25-75). Comparative analysis was performed between groups using the chi-square and Fisher testes to evaluate the qualitative data, and the Mann-Whitney test to assess the quantitative data. Significance level was considered for *p* values under 0.05.

RESULTS

Invitations were made to 77 athletes and an equal number of controls, from which the final sample of 27 athletes (35.1%) and 15 controls (19.5%) were evaluated. The median age of the athletes and controls was 14.1 years and 11.8 years respectively ($p = 0.237$). The athletes practiced acrobatics (15) or artistic gymnastics (12). The median age of onset of gymnastics was earlier in artistic gymnastics (5 years) when compared with acrobatics (9 years) ($p < 0.05$). The athletes practiced a median of 18 hours of exercise weekly, and this value was six times higher than for the adolescents in the control group ($p < 0.001$) (Table 1).

No significant differences between groups were observed with respect to the pubertal development (Tanner stage) or the age of menarche (Table 1). Irregularity of the menstrual cycle consistent with the classification of oligomenorrhoea had a high prevalence in both groups (29% versus 33% in gymnasts and controls). We did not observe any case of primary amenorrhea, but secondary amenorrhea occurred in 14% of the gymnasts and was absent in the control group.

There were no significant differences between gymnasts and the control group with regard to nutritional status (BMI z-score), bone mineral density (BMD z-score) and biological maturity (bone age). It should be noted that, although without statistical significance, the gymnasts had higher BMD and no cases of osteopenia, while the latter occurred in 20% of the sedentary adolescents. However, gymnastics had significantly less total body fat ($p = 0.005$) and lower prevalence of high systolic blood pressure ($p = 0.007$) (Table 1).

Overweight was observed in 47% of the adolescents in the control group ($p = 0.001$) and although differences between groups for height were not observed, 2/3 of the gymnasts (67%) and 40% of controls had a height below the 50th percentile (Table 2).

The predicted final height based on parental height was similar in both groups,

but when height prediction was calculated based on bone age, the athletes had a significantly lower target height ($p < 0.05$), although similar to the genetically defined

height (Figure 1).

There was no difference between groups regarding the frequency of consumption of products rich in calcium.

Table 1. *Gymnasts and control group: characterization of the sample*

	Gymnasts (n=27)	Controls (n=15)	<i>P</i>
Cronological age (years)	14,08 (10,83;16,25)	11,83 (11,25;13,00)	0,237
Menarche (years)	13 (12;14)	12 (12;12)	0,247
Exercise hours/week	18 (16;26)	3 (3;6)	<0,001
BMI Z-score	-0,20 (-0,56; 0,39)	0,77 (-0,72; 2,25)	0,076
Fat mass (%)	16,6 (9,2; 22,2)	29,8 (20,7; 33,3)	0,005
BMD Z-score	0,97 (0,4; 2,1)	0,14 (-0,83; 1,11)	0,076
Bone age (years)	13,3 (10,5;16,0)	13,0 (10,5; 15,0)	0,625
Sistolic BP \geq pc95	0% (0)	26,7% (4)	0,007
Diastolic BP \geq pc95	0% (0)	0% (0)	0,357

Continuous variables were described as median and percentiles (25-75). The Mann-Whitney test was used for the comparative analysis between groups. Abbreviations: BMD - bone mineral density, BMI - body mass index; pc - percentile; BP - blood pressure.

Table 2. *Anthropometric parameters: distribution by percentiles*

	Percentiles				<i>p</i>
	< pc25	pc25-50	pc50-85	\geq pc85	
Weight					
Gymnasts	6 (22%)	10 (37%)	11(41%)	0(0%)	0,001
Controls	3 (20%)	3(20%)	2(13%)	7(47%)	
Height					
Gymnasts	8 (30%)	10 (37%)	9(33%)	0(0%)	0,108
Controls	3 (20%)	3(20%)	5(33%)	4(27%)	
BMI					
Gymnasts	4 (15%)	9 (33%)	14(52%)	0(0%)	0,001
Controls	4 (27%)	1(7%)	3(20%)	7(47%)	

Chi-square test was used in the comparative analysis between groups. Abbreviations: BMI - body mass index; pc - percentile.

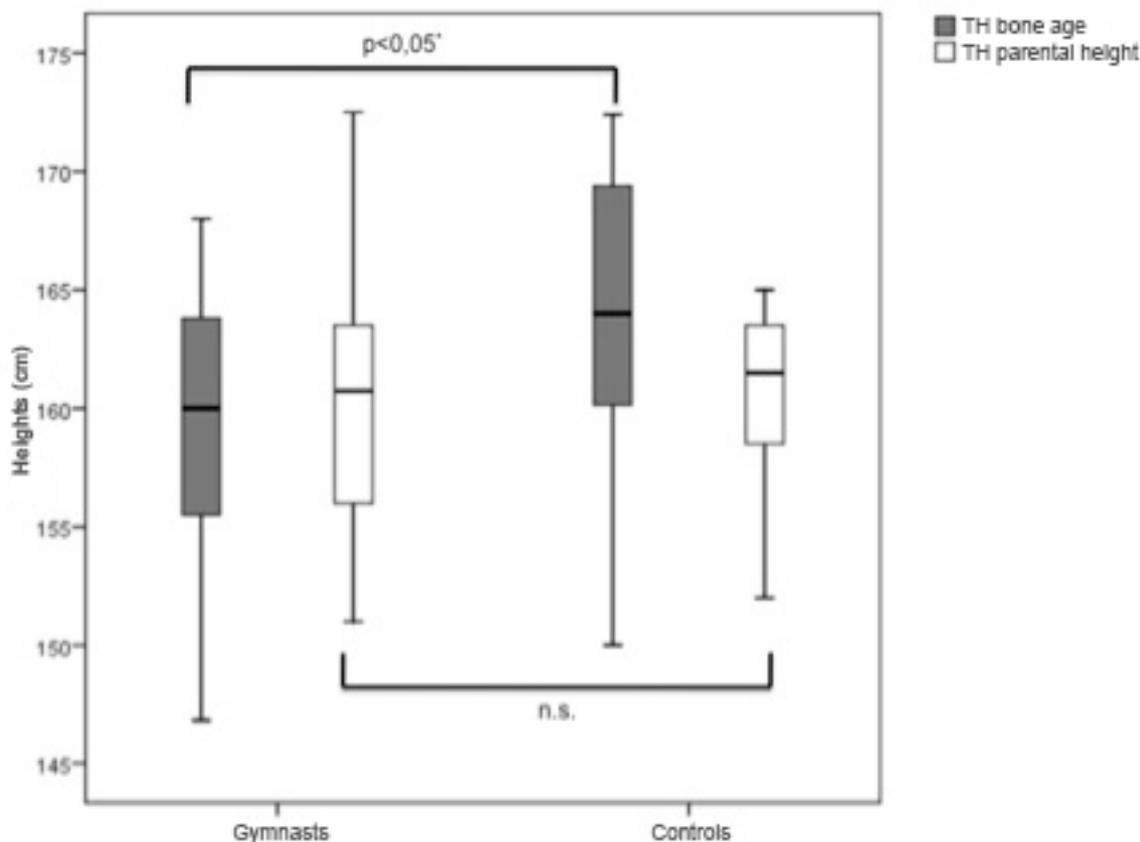


Figure 1. Prediction of target height based on parental height and on bone age. Comparison between gymnasts and controls. (When comparing both groups, the adolescents in the control group presented a calculated final height prediction based on bone age significantly higher than the genetics height. *Mann-Whitney Test. TH-Target height; n.s. – no significance)

DISCUSSION

The practice of gymnastics, regardless the modality, implies flexibility, speed and strength. The competition requires training to maximize sports performance, and taking into account the timing of development of different physical abilities throughout growth, it is mandatory that training starts early in life. Literature shows that most of the competition gymnasts start practicing this sport around the age of five years, with a weekly training input of 24-36 hours during adolescence (Perini, Oliveira, Dantas, Fernandes & Filho, 2009; Ferraz, Alves, Bacurau & Navarro, 2007). In our

sample, the age of onset of gymnastics was earlier in artistic gymnastics, as it has been described in literature. The volume of training in this group, although inferior to that described for other groups of gymnasts (Caine, Lewis, O'Connor, Howe & Bass, 2011; Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008; Rêgo et al., 1997), was considered sufficiently high (median 18 hours / week) (Table 1) to induce endocrine and metabolic changes with possible impact on growth and maturation (Caine, Lewis, O'Connor, Howe & Bass, 2011; Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008; Georgopoulos et al., 1999; Di Cagno, Baldari, Battaglia, Guidetti & Piazza, 2008).

An association between regular exercise and physical health benefits is clearly demonstrated. The main causal factor of these beneficial effects is the reduction of total body fat (Perini, Oliveira, Dantas, Fernandes & Filho, 2009). Regardless of a possible reduction of body weight, physical activity implies a favorable change in body composition with cardiovascular, endocrine and metabolic effects, in addition to psychological benefits (Malina, 2008). In gymnastics, this effect inherent to exercise will be enhanced by the aesthetic and technical requirements of the modality (Caine, Lewis, O'Connor, Howe & Bass, 2011), as it is documented in this study. Our results demonstrate that the gymnasts had a significantly lower weight than controls ($p = 0.001$, Table 2) and a favorable body composition (fat mass, $P = 0.005$) (Table 1), without significant variations in nutritional status (BMI z-sc, $p = 0.076$). There was a high prevalence of overweight (BMI $\geq 85^{\text{th}}$ percentile) in the control group and under nutrition (BMI $\leq 10^{\text{th}}$ percentile) was not found in the gymnasts group (Table II). As regards to height, there were no statistically significant differences between groups (Table II), although 60% of control versus only 33% gymnasts had a height above the 50th percentile. It can therefore be assumed that competitive gymnastics in this group of adolescents played a protective role against obesity, without reflection in height growth for age.

There were no differences between groups with regard to the biological maturity (bone age) and height prediction based on the family height (Figure 1). However, when height prediction is calculated based on bone age, the adolescents in the control group presented a final height prediction significantly higher ($p < 0.05$, Figure 1) and above that expected genetically. As mentioned above, a training load exceeding 18 hours a week, especially during periods of acceleration of growth, may have adverse consequences on growth potential (Caine, Lewis, O'Connor, Howe & Bass, 2011; Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008;

Georgopoulos et al., 1999; Di Cagno, Baldari, Battaglia, Guidetti & Piazza, 2008). This negative influence on growth comes, not only from the frequent occurrence of an improper fit between the nutritional and energy requirements of training, but also probably due to an early occlusion of the cartilage growth as a consequence of the mechanical effect of the ground impact (Rêgo et al., 1997). In fact, literature data are inconsistent regarding the impact of competitive gymnastics on height growth. Indeed, our results are at odds with some historical studies (Peltenburg, Erich & Zonderland, 1984; Damsgaard, Bencke & Matthiesen, 2000; Malina, 1994) but are in accord with most recent studies (Thomis et al., 1999; Poudevigne et al., 2003). Although historical cohort studies suggest that gymnasts have familial short stature (particularly maternal) and lower height when compared with their peers from other modalities (Peltenburg, Erich & Zonderland, 1984; Damsgaard, Bencke & Matthiesen, 2000; Malina, 1994), recent studies have not recorded a significant compromise in height growth of competitive gymnasts, but have demonstrated a late growth pattern (Erlandson, Sherar, Mirwald, Mafuli & Baxter-Jones, 2008; Thomis et al., 1999; Poudevigne et al., 2003). Thus, the recovery of stature will occur later, after the slowdown of intensity of training or abandonment of the sport (Peltenburg, Erich & Zonderland, 1984).

Another important issue, as stated in the definition of FAT, is that of sexual maturity. Normal development of puberty requires an adequate nutritional status and a total body fat of a minimum of 17%, since fat has a role in peripheral production of estrogen necessary for the occurrence of menarche. In our sample, over half (56%) of the athletes had a body fat percentage below 17%. However, there was no case of primary amenorrhea or significant differences between groups with respect to the pubertal development (Tanner stage) or the age of menarche (Table 1). Indeed, 14% of gymnasts had secondary amenorrhea, which is in agreement with most published

studies that estimate the prevalence of secondary amenorrhea in 20% of all athletes, regardless of the modality (Dadgostar, Razi, Aleyasin, Alenabi & Dahaghin, 2009; Nichols, Rauh, Lawson, Ji & Barkai, 2006). The absence of primary amenorrhea and the absence of differences in menarche and stage of maturation lead us to assume that, in this group of athletes, exercise does not induce a suppression of the hypothalamus-pituitary-gonadal axis, but only a peripheral (ovarian) suppression, particularly in periods of greater intensity of training (Matthews BL et al., 2006). Note also the high prevalence in both groups of oligomenorrhea (29% *versus* 33% in gymnasts and controls), allowing us to speculate about the relationship with overweight and obesity in the control group.

An adequate nutritional status and body composition are crucial, not only for the normal progression of puberty, but also, and particularly during adolescence, for the proper formation of bone. Health, regular exercise and a balanced diet with an adequate supply of calcium, are supporting factors for maximizing individual peak bone mass, which is genetically defined. Although not statistically significant, the gymnasts had higher bone mineral density than the control group (Table 1). We found no cases of osteopenia among the athletes compared to its occurrence in 20% of sedentary adolescents. This finding, contrary to the classical concept of FAT, has been supported by the latest published studies, which show the beneficial effects of exercise in bone mass, even in high competition gymnastics. Indeed, *Lehtonen-Veromaa* and colleagues (2001) found that there is an increase in bone mineral density at the competitive stage of the season and a decrease during periods of absence of training. The mechanical effect resulting from the steady contracture of large muscle groups allied to the frequent ground impact characteristic of this modality, and in the absence of a significant commitment of nutritional status, can guarantee a proper bone formation. In fact, of greater concern is the health of the control group, where

osteopenia affects about a quarter of the population at a crucial age for the acquisition of peak bone mass.

Finally, it is important to draw attention to the fact that 26.7% of adolescents in the control group presented values of systolic blood pressure compatible with criteria for hypertension (Table I), overlapping with those found in the Portuguese adult population or in groups of obese adolescents (Espiga de Macedo M et al., 2007; Rêgo, 2008).

Taking into account the high rate of inactivity, the high prevalence of overweight and obesity, as well as the high prevalence of osteopenia, we can consider this particular group of adolescents, randomly selected from the school community, at high risk of future cardiovascular and bone morbidity.

None of the athletes had criteria consistent with FAT. In our study, fifteen players (55%) engaged in more than 18 hours per week of exercise (with a maximum of 31 hours), a value that has been defined as that from which it can become harmful (Rêgo, 1997). If we consider that olympic athletes training can reach 60 hours per week, it may be suggested that our gymnasts do not suffer from FAT, as their training loads and requirements are not as high. Thus, the present results may be generalizable to populations with a similar training load, but not to those that have a much higher training intensity.

An important limitation of this study is that the sample has been chosen for convenience, and therefore may not be representative of the population under study. The authors would like to draw attention to the small number of participants, despite the large number of invitations made, which may have been caused by the fact that the assessments were carried out on school days. However, one cannot exclude the likely (and serious) possibility of ignorance on the part of the parents of the importance of regular medical surveillance of elite athletes.

CONCLUSION

The practice of competitive gymnastics influences body composition, reflected by a low percentage of fat mass. A weekly training load up to 18 hours is not associated with a compromise of nutritional status, pubertal development and genetically defined height. In this group of athletes, competitive gymnastics was associated with an increase in bone mineral density and none of the athletes showed FAT, suggesting a possible need for this concept revision.

The authors stress the importance of close monitoring of sports teams by doctors, nutritionists and psychological experts, as well as awareness and responsibility of training coaches and caregivers, particularly in modalities that require an image of "thinness".

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Corresponding author:

Susana Corujeira

susanamcorujeira@gmail.com

Serviço de Pediatria – UAG-MC. Centro Hospitalar de São João

Alameda Professor Hernâni Monteiro
4202-451 Porto, Portugal.

ATHLETIC IDENTITY AND ACHIEVEMENT GOALS OF GYMNASTICS ATHLETES

Miltiadis Proios

Department of Physical Education and Sport Science
Aristotle University of Thessaloniki, Greece

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Abstract

The purpose of the present study was to extend knowledge on the relationship between athletic identity and achievement goal orientations. In addition, the present study investigated the impact of independent variables, such as sport divisions and the type of sports gymnastics on the formation of athletic identity. Participants were 140 boys and girls athletes ranging from 8 to 17 years of age ($M = 11.86$, $SD = 2.21$), from three sports gymnastics (artistic gymnastics, $n = 91$; rhythmic gymnastics, $n = 37$; acrobatic gymnastics, $n = 12$). The findings of the present study established that the participants exhibit rather high perception of their athletic role, and that such perception is significantly decreased with the increase of sport division. In addition, the above mentioned findings revealed that the degree to which an athlete identifies with the athletic role can be predicted by his/ her predisposition towards achievement goal.

Keywords: *athletic identity, achievement goal orientation, social goal orientation.*

INTRODUCTION

Athletic identity is the degree to which an individual identifies herself/himself with an athlete's role (Brewer, Van Raalte, & Linder, 1993). According to Martin, Eklund, and Mushett (1997) athletic identity is a relevant psychological construct to examine because of the potentially important psychological, social and behavioral ramifications of an athletic identity. Psychological as a cognitive structure that guides and organizes the processing of self-related information (Brewer et al., 1993), social because can also be seen as a social role and affected by significant others' perceptions (Callero, 1985), while behavioral because a relation seems to exist between self-definition and behavior (Callero, 1985).

The athletic identity can be characterized as a good indicator since it shows the way in which one's athletic involvement and experience can psychologically and cognitively affect the individual. It can help determine one's changes and acceptance of certain beliefs throughout his or her entire athletic career (Miller, Melnick, Barnes, Sabo, & Farrell, 2005; Miller, 2009). Moreover, athletic identity as a self-concept can define the way in which an individual evaluates his or her competence and worth (Richards & Aries, 1999). The amount of worth and competence an individual places on self-concept may influence their self-esteem, affect and motivation (Brewer et al., 1993). Weiss and Horn (1990) supported that a

positive self-concept facilitates the attainment motivational orientation (e.g., task- or ego- orientation, or both). Tusak, Gaganel, and Bednarik (2005) found significant correlations between personality and motivational characteristics (win orientation, competitiveness and competitive motivation) and athletic identity in athletes. Another study reveals that a strong identification with the athletic role contributes to negative self-perceptions concerning social relations (Hughes & Coakley, 1991).

According to Roberts (2001) the motivation refers to dispositions, social variables, and/ or cognitions that come into play when a person undertakes a task at which he/ she is evaluated, or enters into competition with others, or attempts to attain some standard of excellence. It is assumed that such circumstances facilitate several motivational dispositions and/ or cognitive assessments that influence human behavior in achievement situations. The social cognitive approach to motivation portrays a dynamic process incorporating sets of cognitive, affective and value-related variables that are assumed to mediate and/ or moderate the choice and attainment of achievement goals (Roberts, 2001).

Achievement goal theory assumes that the individual is an intentional, goal-directed organism operating in a rational manner (Nicholls, 1984) and that achievement goals govern achievement beliefs and guide subsequent decision making and behavior within achievement contexts (Roberts, 2001). According to this theory, in achievement domains such as sport, two types of goals prevail, namely task and ego (Duda, 1992; Nicholls, 1989), or mastery and performance goals, respectively (Ames & Archer, 1988). Mastery- or task-oriented individuals have a general tendency to emphasize effort, learning and improvement, whereas performance – or ego-oriented individuals have a tendency to emphasize performance outcomes and norm – referenced success. According to Papaioannou, Ampatzoglou, Kalogiannis, and Sagovits (2008), research

in sport contexts has established that task goal orientation is positively related to adaptive, cognitive, affective and behavioral outcomes but there is no support for an adaptive role of ego goal involvement.

In the theoretical framework of the achievement goal orientation, apart from the above mentioned two (mastery and performance) goal perspectives, social approval goal orientation (Maehr & Nicholls, 1980) has also been comprised. For Maehr and Nicholls (1980), such social approval orientation emphasizes the desire for acceptance by significant others, through conformity to norms while displaying maximal effort. At the same time, Allen (2003) suggested that the social aspects of motivation in sport are the desire to develop, maintain and demonstrate social bonds or connections with others. The social aspects of motivation have been identified in a number of studies investigating participation in sport across several age groups (e.g., Allen, 2003, 2005; Stuntz & Weiss, 2003; Williams, 2004).

According to Stuntz and Weiss (2003), social relations in sport are of two distinct types, namely relationships with a close sport friend and the teammates as a group, on the one hand, and coach on the other. The Stuntz and Weiss' (2009) research clearly reveals that adolescents with stronger friendships and group acceptance are more intrinsically motivated and committed to continuing sport/physical activity; they exhibit more positive self-perceptions, and enjoy their experiences more (Smith, 1999; Weiss & Smith, 2002). Research has also established that, Youth participants who positively interact with their coaches are more likely to feel competence, exhibit higher self-esteem, enjoy their involvement, be more intrinsically motivated and stay involved with their sport (e.g., Amorose & Anderson-Butcher, 2007; Barnett, Smoll, & Smith, 1992).

Despite the fact that both athletic identity and achievement goal orientations on a theoretical level constitute two psychological constructs that share common

characteristics traits, yet references in the literature concerning the relationship between them are limited (e.g., Ryska, 2002; Baysden, Brewer, Petitpas, & Van Raalte, 1997). The attempt to contribute with new knowledge towards this direction underlines the significance of the present study. The main purpose of this study is to investigate the relations between the dimensions of athletic identity and the several aspects of achievement goal orientations. In addition, the present study also investigates the impact of independent variables, such as sport division and type of sports gymnastics on the formation of athletic identity is also investigated.

METHODS

The participants were 140 boys and girls athletes ranging from 8 to 17 years of age ($M = 11.86$, $SD = 2.21$). They came from three sports gymnastics (artistic gymnastics, $n = 91$; rhythmic gymnastics, $n = 37$; acrobatic gymnastics, $n = 12$). All the individuals in the present sample were members of fourteen teams from northern Greece, playing in four sport divisions (Division IV, $n = 49$; Division III, $n = 61$; Division II, $n = 20$; Division I, $n = 10$). Here, it should be noted that sport divisions are classified by age (e.g., IV: 7-10 years of age. III: 11-13, II: 14-15, I: 16 and above).

First of all, the consent of the team coaches' was asked. Then, the researcher met the each team's group of parents separately and, after the scope of the research was explained, their (oral) permission was asked in order their children to participate. Eventually, the athletes whose parents gave their consent filled in a questionnaire at the training site and before training started.

Athletic identity. Athletic identity was measured using the Athletic Identity Measurement Scale (AIMS; Brewer & Cornelius, 2001). AIMS consists of 7 items to which individuals respond on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). This scale contains three subscales: social identity, exclusivity and negative

affectivity. *Social identity* is the degree to which an individual views him/herself as assuming the role of an athlete. *Exclusivity* is the degree to which an individual's self-worth is established through participating in the athletic role. Finally, *negative affectivity* is the degree to which an individual experiences negative emotions from unwanted sporting outcomes. The multidimensional factorial structure of the 7-item AIMS was supported by several research conclusions (e.g., Brewer & Cornelius, 2001; Visek, Hurst, Maxwell, & Watson, 2008).

To provide further validity for the scale 7-item three factors, a confirmatory factor analysis was conducted to the sample of the present study. This model demonstrated acceptable fit to the data $\chi^2(11) = 27.35$, $p < .05$, GFI = .95, CFI = .95. RMSEA = .10. Two of the three subscales, namely *social identity* and *exclusive* ($\alpha = .69$ and $\alpha = .75$, respectively) demonstrated acceptable internal consistencies. The above mentioned value (.69) can be considered satisfactory since this factor comprises less than ten items (namely, five items) (Ntoumanis, 2001; Pallant, 2010). However, the *negative affectivity* subscale demonstrated very low ($\alpha = .25$) internal consistency and thus was excluded from the data analysis of the present study.

Achievement Goal Orientation. The participants' achievement (mastery and ego) goal orientations in sport were assessed through the Achievement Goal Scale for Youth Sports (AGSYS; Cumming et al., 2008). In response to the stem, "I feel sports have gone really well for me when..." participants indicated the extent to which they agreed or disagreed with each of the 12 items on a 5-point Likert-type scale ranging from 1 (*not at all true*) to 5 (*very true*). AGSYS was developed to provide an age-appropriate measure of mastery and ego achievement goal orientations in children. Its items feature maximum grade 4 reading levels, allowing thus researchers to use the instrument with children who can read at that age level. AGSYS clearly measures individual differences in dispositions to hold

self-referenced and other-referenced criteria for success. Fit indices compared very favorably with those reported for the TEOSQ and the POSQ with older samples. Moreover, the AGSYS subscales demonstrated high internal consistency and acceptable test-retest reliability (Cumming et al., 2008).

To provide further validity for the scale developed by Cumming et al. (2008), a confirmatory factor analysis was conducted to the sample in the present study. The initial model (12-item two factor) demonstrated no acceptable fit to the data $\chi^2(53) = 123.93, p < .05, GFI = .88, CFI = .89, RMSEA = .10$. Based on modification indices for measurement parameters (i.e., correlations, factor loadings), items "The most important thing is to be best athletes" and "The most important thing is to improve my skills" were removed. The final model showed an adequate fit to the data $\chi^2(3) = 70.2, p < .05, GFI = .92, CFI = .93, RMSEA = .08$. Coefficient alpha in each subscale was .70, .88, indicating acceptable reliability for each.

Social Goal Orientation. Three subscales from the achievement goal orientation measure by Stuntz and Weiss (2003) were used to assess reported social goal orientation towards coach praise (five items), friendship (five items) and group acceptance (four items). Participants responded to the stem and each item using a 5-point Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*).

To provide further validity for the scale developed by Stuntz and Weiss (2003), a confirmatory factor analysis was conducted to the sample in this study. The initial model (14-item three factor) demonstrated no acceptable fit to the data $\chi^2(74) = 126.99, p < .05, GFI = .89, CFI = .92, RMSEA = .07$. Based on modification indices for measurement parameters (i.e., correlations, factor loadings), the item "My sport friend encourages me after I make a mistake" was removed. The final model showed an adequate fit to the data $\chi^2(62) = 96.0, p < .05, GFI = .91, CFI = .94, RMSEA = .06$. The reliability of the social orientation scale

was also calculated using alpha coefficient. Alpha coefficients for the coach praise was ($\alpha = .68$), friendship ($\alpha = .84$) and group acceptance ($\alpha = .76$), indicating acceptable reliability for each. Coach praise coefficient, although slightly lower than the accepted value (.70), can be also accepted since this factor comprises less than 10 items (Ntoumanis, 2001; Pallant, 2005).

RESULTS

Descriptive statistics and correlations were computed for all variables (see Table 1). This sample of sports gymnastics athletes based on the assessment scale scored high in both dimensions of athletic identity, that is social identity and exclusivity. Both of these dimensions were positively related to both goal orientations subscales. Moreover, these two dimensions of athletic identity were also positively correlated to all three aspects of social orientation as well. An exception was the lack of correlation between the dimension exclusivity and the aspect friendship. In addition, the sample of the present study scored high in the mastery and moderately in the ego orientation towards achievement goal in sport, while in the case of goal achievement, on the basis of social orientation, their scores were rather moderate in all three aspects.

Two multivariate analyses of variance (MANOVAs) were conducted in order to examine the influence of divisions and type of sports gymnastics on the two dimensions of athletic identity (Tabachnick & Fidell, 1996). Initially, a one-way multivariate analysis of variance was performed with the use of 2 AIMS scales (Social Identity and Exclusive) as dependent variables and the Type of Sports Gymnastics as independent variable. In the first multivariate analysis, the results did not reveal any significant multivariate effect for the type of sports gymnastics. On the contrary, in the second multivariate analysis, the results indicated significant multivariate effects concerning the Division (Wilks' lambda = .829, $F(12,309) = 1.89, p < .05$). Subsequent

univariate analyses showed that division diversified athletic identity from exclusivity $F(3,124) = 3.15, p < .05, n^2 = .07$. In addition, the effect sizes (ES) were computed to examine the meaning of the statistical results. Such results revealed a moderate effect of the sample size ($ES = .07$), something that partly supports the previous result. Cohen (1988) maintained that for the social and behavioral sciences an effect size (ES) of 0.2 was considered small; 0.5 as a moderate ES ; and 0.8 and above as a large ES . A subsequent Tukey test for unequal values among the divisions (Stevens, 1996) followed. The results of the analysis indicated a predominance of the Division IV over Division I ($p < .05$).

To determine which of the goal orientations in sport (mastery and ego) best explain athletes' social orientations (coach praise, friendship and group acceptance) in sport, two separate multiple regression analyses were conducted (see Table 2). In each regression analysis, the two goal perspectives (mastery and ego orientation) were first entered into the equation, followed by the three types of social goal orientations (coach praise, friendship and group acceptance), in order their effect on

the dimensions of athletic identity to be investigated.

In the first regression analysis, the first dimension of athletic identity – i.e. Social Identity – constituted the dependent variable and the five dimensions of goal orientation constituted the independent variables. Results revealed a significant regression, $F(1, 137) = 17.04, p < .001$. Goal orientations were entered first and accounted for the 28.8% of the variance (19.9% for the ego and 8.9% for the mastery orientation), with ego and task orientations emerging as positive predictors. Next, social orientations were entered into the equation; only the coach praise perspective was a positive predictor, and accounted for the 4.1% of the variance.

The results of the second regression analysis on Exclusivity, the second dimension of athletic identity, revealed a significant regression $F(1, 137) = 8.91, p < .01$. Goal orientations were entered first and accounted for the 18.8% (13.6 for the ego and 5.3% for the mastery orientation) of the variance, with ego and mastery orientation as positive predictors. At the same time, social orientations that were next entered into the equation, revealed no significant regression.

Table 1. *Descriptive statistics, Cronbach α , Correlations among all variables.*

Variable	<i>M</i>	<i>SD</i>	α	1	2	3	4	5	6
1.Social identity	5.40	9.54	.69	-					
2.Exclusive	5.20	1.48	.75	.75**	-				
3.Mastery	4.64	.40	.70	.45**	.35**	-			
4.Ego	3.79	.96	.88	.45**	.37**	.38**	-		
5.Coach praise	3.90	.63	.68	.37**	.23**	.20*	.36**	-	
6. Friendship	3.90	.87	.84	.26**	.16	.12	.26**	.36**	-
7.Group acceptance	3.60	.83	.76	.30**	.25**	.12	.29	.35**	.58**

** $p < .01$; * $p < .05$

Table 2. *Multiple Regression Analyses of Achievement Goal Orientations on dimensions of the Athletic Identity.*

Step	Variable	β	t	p	ΔR^2
<i>Social identity</i>					
Step 1	Ego	.25	3.07	.01	.199
	Mastery	.31	4.05	.001	.089
Step 2	Coach praise	.22	2.89	.01	.041
	Friendship*	-	-	-	-
	Group acceptance*	-	-	-	-
<i>Exclusive</i>					
Step 1	Ego	.27	3.29	.01	.136
	Mastery	.25	2.99	.01	.053
Step 2	Coach praise*	-	-	-	-
	Friendship*	-	-	-	-
	Group acceptance*	-	-	-	-

* Excluded variables from regression

DISCUSSION

The main purpose of the present study is to investigate the relationship between the dimensions of achievement goal orientations and athletic identity. Such an aim was the result to the maintenance that goal formation, depends on one's convictions concerning the way in which a goal can be achieved, within the framework of sport, as well as that the development of athletic identity are the result of a set of cognitive procedures (Brewer et al., 1993; Nicholls, 1984, 1989), something that justifies the investigation for any shared courses between these two procedures.

The descriptive statistics results of the present study revealed that the participants in all three sports gymnastics exhibited rather high perception of their athletic role. This is evident by their high scores in the dimensions social identity and exclusivity. Thus, the participants of the present study seem to consider that their perception of their athletic role is determined by the others' perceptions, regarding sport as being the only important thing in their life, and each individual's self-esteem as well. Research, on different theoretical bases, has suggested that the development of both strong and exclusive athletic identities is, in many cases, associated with athletes who

reach the highest levels of athletic achievement (Williams & Krane, 1993).

The perception of the athletic role in the present study has been investigated in the light of the extent to which the former is diversified among the several sport divisions and sports gymnastics. The results of the present study established that the artistic, rhythmic and acrobatic gymnastics athletes are not significantly different as concerning perception of their athletic role. This might be due to the fact that sports gymnastics, at least in Greece, share some common features, such as similar rewards in case of goal achievement. According to the cognitive dissonance theory (Festinger, 1957) the relation between a person's attitudes and behavior is driven by the objective of limiting an unpleasant psychological state which occurs when two cognitions are inconsistent. Thus, the above mentioned athletes' perceptions would be expected to be diversified in case their rewards were different as well (Smith & Mackie, 2000).

However, as concerning sports divisions, the results maintained that there are significant differences in the perception of the athletic role concerning the sports of these divisions. More specifically, the findings of the present study revealed that

the athletes in Division IV scored higher in the dimension exclusivity of the athletic identity than those in Division I. A plausible explanation for such a result is that some of the participants, who were in Division I, were not committed to their sport career at the time of the investigation. Such maintenance is further supported by references that the determination of the exclusive athletic role decreases with the individuals' maturation, in combination with their exposure to several activities and effects (Brewer et al., 1993); also, there are data supporting that loss in the form of chronic competitive failure, can elicit changes in athletic identity (Brewer et al., 1999).

The finding of the present study that there are such differences in sport divisions, although unexpected, is further supported by the results of another study which exhibited differences in athletic identity among athletes in Division III and Division I (Griffith & Johnson, 2006). Nevertheless, other studies, investigating the athletic identity in relation to the level of sport participation, led to ambiguous results. More specifically, some established increased athletic identity (e.g., Good, Brewer, Petitpas, Van Raalte, & Mahar, 1993; Matheson, Brewer, Van Raalte, & Andersen, 1994; Tasiemski, Kennedy, Gardner, & Rachel, 2004), while some others revealed no difference among the several sport levels (e.g., Brown, 1998; Hurst, Hale, Smith, & Collins, 2000; Tusak, Faganel, & Bednarik, 2005). Lamont-Mills and Christensen (2006) maintain as the most consistent finding the difference in athletic identity between those who participate in sports and those who do not participate.

As concerning achievement goals, in the present study, initially the correlation among the several goal perspectives (achievement goal orientations and social goal orientations) was investigated. The results did not reveal any significantly high correlations among all the aspects of the goal. This had as a result the investigation of the two goal orientation as separate factors. The finding of the present study,

however, was contradictory to that of another study which established that social goal orientations were differentiated from the task and ego goal orientation, but types of social goal orientations were distinguishable from one another (Stuntz & Weiss, 2003; Stuntz & Weiss, 2009). Such contradictory findings between these two studies are, by all probability, due to the application of different instruments for the assessment of achievement goal orientations.

The results of an earlier study revealed that athletic identity can be predicted by means of dimensions and motivational characteristics at a percentage of 26% of the total variance, exhibiting a positive correlation to the psychological characteristics of win orientation, as well as positive and negative competitive motivation (Tusak, Faganel, & Bednarik, 2005). This result is further supported by the outcome of the present study which revealed that achievement goal orientation and social goal orientation can predict the 28.8% and 4.1% respectively of the total variance of athletic identity. In addition, the finding of the previous study concerning the correlation between athletic identity and psychological characteristics is supported by the relevant finding of the present study, which established a positive correlation to achievement goal orientations.

More specifically, the findings of this study reveal a positive correlation between social identity and exclusive athletic identity on the one hand and goal perspectives (ego and mastery orientation) on the other; while social goal orientation (coach praise) is positively correlated only with the dimension social identity. To be more specific, such a positive correlation between ego orientation and athletic identity has been maintained in an earlier study, which made use of the Task and Ego Orientation in Sport Questionnaire (Baysden, Brewer, Petitpas, & Van Raalte, 1997) and supports the present result. Nevertheless, the finding hereof that the dimensions of athletic identity (i.e. social identity and exclusivity) are positively correlated to mastery

orientation is further supported by other findings in a number of studies which established a positive correlation of task involvement with adaptive cognitive, affective and behavioral outcomes (Duda, 2001; Duda, Chi, Walling, & Catley, 1995; Ntoumanis & Biddle, 1999). The results of another study established a positive correlation of social desirability – a concept that may be implemented in the dimension social identity – with mastery orientation (Cumming et al., 2008).

As it has been already mentioned above, the present study established a positive correlation between the coach (a type of social relation) and the dimension social identity. This finding further supports the maintenance that the social structure of self-concept on athletic role is significantly influenced by significant others' perceptions (Brewer et al., 1993; Cornelius, 1995) and that social goal orientations exercise a significant influence on behaviors and motivated beliefs (Maehr & Braskamp, 1986) as well. Smoll and Smith (1993) maintained that the way in which coaches build up the sport environment, their priorities in determining goals, their values and behaviors, all have a great influence on youngsters' actual participation in physical activity. As concerning other types of social goal orientation, i.e. friendship and group acceptance, although it has been supported that they positively affect self-concepts (Smith, 1999; Weiss & Smith, 2002), the results here of have established no similar correlation – i.e. no correlation of the above mentioned type of goals to some of the dimensions of athletic identity.

The findings of the present study established that the participants exhibit rather high perception of their athletic role, as well as that such a perception is significantly decreased with the increase of sport division. In addition, it is also concluded that the degree to which an athlete identifies with the athletic role can be predicted by his/ her predisposition towards achievement goal. Such prediction can be largely achieved by the ego and mastery aspects of goal orientation and less

by the social goal orientations – more specifically by means of social relationships between athletes and coaches. Finally, it could be maintained that, based on the findings hereof, the assessment of the athletic identity can assist coaches to apprehend their athletes' conviction concerning their athletic role, as well as to adapt such convictions to the eligible framework.

To conclude with, in the present study, the limited number of participants from each type of sport gymnastics narrows the generalization of results for each individual type of sport gymnastics. A future research on a larger sample, in the above mentioned framework of gymnastics, would greatly add to this end.

The limited number of children who participated in the sports gymnastics, at the area where the present study was conducted, resulted in the usage of a small sample size, especially in acrobatics. This constitutes a rather significant limitation, as it hinders the generalization of the results in this very area. Another limitation that could be mentioned for the present study is the segmental (non-thorough) investigation of the notion of athletic identity, due to the exclusion of the subscale negative affective.

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Corresponding author:
Miltiadis Proios,
mproios@phed.auth.gr
Iatrou Zanna 17,
54643 Thessaloniki,
Greece

ASSESSMENT OF GYMNASTIC SKILLS AT PHYSICAL EDUCATION – THE CASE OF BACKWARD ROLL

Marjeta Kovač

University of Ljubljana, Faculty of Sport, Slovenia

Original research article

Abstract

Article presents a model of the assessment of gymnastics skill. The presented task, backward roll, includes descriptions of movement, test criteria with a measurement scale and a description of standards based on the number and type of mistakes. Videotaped student performances (N=36) were evaluated by three external evaluators to assess their level of performance. Differences in performance between genders were tested by using the analysis of the variance. Cronbach's reliability coefficient alpha and a calculation of concordance between respective evaluator's grades and a common test object were used for the evaluation of reliability and objectivity of task. No statistically significant differences between the performance of boys and girls were observed. It can be concluded that the test task is equally suitable for both genders. The reliability and objectivity of assessment were high, which indicates an appropriate selection of test criteria and descriptions. Whilst preparing analytical criteria for the assessment task, teachers should prepare descriptions of movement and clear criteria for different levels of executions. These criteria help both the teacher and the student to gain good insight into the quality of student's knowledge and simultaneously enable a teacher to help the student with further practicing and acquisition of basic motor skills. For formative assessment, it has to be mentioned that the measuring scales and criteria should differ according to the purpose of evaluation, the developmental stage of pupils and the complexity of evaluated movement.

Keywords: *physical education, gymnastics, assessment, test task, metric characteristics.*

INTRODUCTION

Assessment is a broad term defined as a course of action for generating and acquiring information that is used for making decisions about students, programmes and national curricula. Among physical education (PE) teachers, the assessment of students is one of the most troublesome issues they encounter (Carroll, 1994; Kirk, 2001; Kovač, Strel, & Majerič, 2008b; van Vuuren-Cassar, 2010). A considerable number of PE teachers think that with assessment the real value of the subject (i.e. to be physically active, to enjoy

movement) is not being realised, and many of them are opposed the idea of examinable PE altogether because of the difficulties with assessment (Kirk, 2001). Kirk (2001) also believed that PE should be included in assessment, while the exclusion from recording and reporting would have been fatal to PE's continuing existence in the compulsory curriculum, but PE teachers have to rethink some of their conventional assumptions about assessment, particularly assumptions about its purpose and its methods. They had to focus on the positive

educational benefits for students and the professional benefits for teachers.

Good teachers should be skilled not only in instructional methods, but also in evaluation and assessment practices that allow them to gauge individual student learning and adapt activities according to student needs (Colby & Witt, 2000). In such a way, students receive information about their progress in learning; parents also want to know about their children's physical development and motor competences. For PE teachers, the assessment serves an important function in the further process of teaching; they can identify where students have troubles, and they can make the decisions about areas that require further training (Kovač & Novak, 2001).

Numerous authors, whose research deals with the assessment of knowledge (theoretical and performance of different skills) in PE, agree that students' performance and knowledge need to be assessed with deliberation and diverse methods (Brau-Antony & David, 2002; Burton, 1998; Kovač et al., 2008b; Majerič, 2004; Newton & Bowler, 2010; Popham, 2011; Reynolds, Livingston & Wilson, 2010). In addition, the developmental level of students should be considered as well as the type of learning, i.e. the way knowledge is being acquired. In the process of the acquisition and stabilisation of motor skills, teachers can offer efficient support for the further learning of students by providing suitable feedback (Morrow, Jackson, Disch, & Mood, 2005). This is particularly important, as the automatic control of incorrect motor patterns hinders or even prevents the formation of more complex motor structures (Magill, 2004).

Various practices have emerged from among assessment of so-called practical work in PE. Some of the models have included the use of motor skill and fitness tests, while others used tables of points awarded for results in areas such as swimming and athletics, and also the so-called "subjective assessment" of the teacher on matters such as gymnastics, dance and game performance (Brau-Antony

& David, 2002; Estrabaud, Marigneux, & Tixier-Viricel, 2000; Lockwood & Newton, 2004; Popham, 2011). To carry out "subjective assessment" many teachers have used their own professional expertise. They assess students' skills through observation, for example during the game or uncontrolled practising. This type of assessment is undoubtedly economical; however, it has several limitations, as it is usually intuitive and adjusted to the level of knowledge and social relationships of the group; it is also based solely on the experience of the teacher and most often does not conform to educational curriculum, regulations for the evaluation and assessment as well as professional recommendations that suggest assessment with the use of evaluation criteria (Brau-Antony & David, 2002; Estrabaud et al., 2000; Rutar Ilc, 2003; Williams, 1996). Although the criteria for the assessment that is practiced in schools are "written in teachers' minds", they are not shared with students, which is one of the basic conditions of fair evaluation (Quiot, 2003; Rutar Ilc, 2003). Therefore, teachers should prepare and inform the pupils about the clear and precise criteria of evaluation.

Criteria can be very different: they can be based on the description of the execution quality of the movement and the use of acquired skills in real-life specific situation or they can be based on "check-up lists" of errors; they can be simple (two-level: yes/no, acquired/not acquired, safe/dangerous execution) or very precise (multi-level with a description of every level). Complex descriptions in PE allow better insight into the knowledge of an individual student. Such an analytical approach is based on very precise identification of deviations from correct execution. Deviations, also called mistakes, are evaluated according to the magnitude as large (they disturb the movement or make it difficult) or small (they have smaller effect on the correct execution), according to the type as technical mistakes (present in every sport), aesthetic mistakes (e.g. gymnastics, dance) or rhythmic mistakes (dance) (Kovač

et al., 2008b). This kind of assessment can be used for formative purposes. Formative assessment involves providing information to learners in the course of their learning journey so that they remain on or regain the right track (Kirk, 2001). Nevertheless, it is very important that the criteria are modified according to the age of pupils, to contents that are being evaluated and the purpose of evaluation (quick assessment of progression, evaluation of demonstration, and identification of key mistakes) (Kovač et al., 2008b; Newton & Bowler, 2006).

Gymnastic contents have been part of the PE curriculum ever since PE was first introduced in the education system (Kompara & Čuk, 2006). In recent Slovenian PE curricula for the primary school, gymnastics is still one of the most important elements, while it offers a great range of locomotive, stability and body control movements, which are highly important for the development of children (Kovač & Novak, 2001). Gymnastics requires a great diversity of movements: transitions from dynamic to static elements and vice versa, and frequent changes of the body position in space. Successful performance of each element requires accurate muscular activity of specific intensity, through the space and at the right moment (Novak, Kovač, & Čuk, 2008). During the teaching process, teachers should select the appropriate teaching method, recognise mistakes, and give the students appropriate feedback information to improve their movement (Pehkonen, 2011). Practice without feedback information negatively influenced the pupils' outcome in lessons in which teachers remained passive observers (Yerg & Twardy, 1982). For helping PE teachers in the teaching process, different test tasks were prepared and the different methods of descriptions of task were applied (Kovač et al., 2008b). In the analytical method that is the most suitable for formative assessment (Majerič, 2004; Kovač et al., 2008b), each task includes descriptions of movement and clear criteria for different levels of executions

(descriptions of mistakes that students could make during the execution).

In this study, one of the most common gymnastics skills, the backward roll, is presented. We attempt to determine if the construction of task is appropriate for the evaluation of students. Therefore, the measurement characteristics of task and the differences in performance between genders were analysed.

METHODS

The test sample included 36 students (16 boys and 20 girls) enrolled in the eighth grade of primary school. Only healthy boys and girls who were not exempt from physical education for health reasons and whose parents had given their written consent to participate in the measurements were included. Girls were taught by female and boys by male PE teachers.

Instrument. The gymnastic test task was prepared by Kovač and Čuk (2002, in Majerič, 2004). The analytical method of assessment is used. The task includes: a) descriptions of movement and certain mistakes; b) criteria with measurement scale and description of standards.

a) The task is divided into separate phases of movement. Each phase has descriptions of technically appropriate execution and certain mistakes that are most common and can appear during the movement. According to their structure, mistakes can be divided in technical (deviation of technique from ideal execution) and aesthetic (deviation in elegance and poise of execution); according to the severity of deviation, mistakes can be small or large. Small mistakes are mistakes that do not have a significant effect on the execution skill, but rather create a small instability of execution. Large mistakes are those that significantly influence the correct execution or else prevent the pupil from performing a skill.

b) A six-level measurement scale (0 to 5 points) is used. In setting the scale it is

important for the differences in execution at individual levels of the measuring scale are approximately the same (demands have to progress in equal degree from one level to another). Standards are based on the quality of execution with the number and importance of mistakes (small / large) that can appear during the performance.

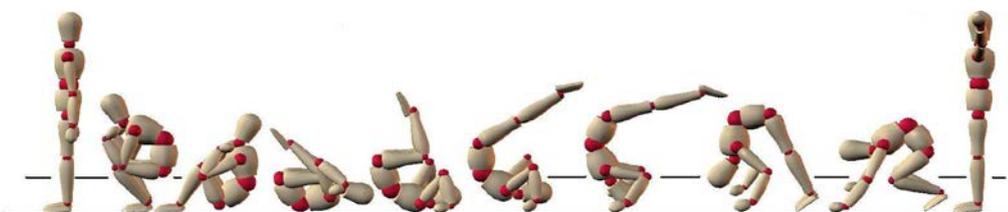
Space. Gym hall, 10 meters × 4 meters.

Accessories. Four mats (2 meters × 1 meter), 6 to 12 cm high; standing board, 10 to 12 cm high.

Set-up: Two mats 6 to 12 cm high, placed one behind the other, touching along shorter side. A pupil who cannot execute a skill on his/her own on mats level with the floor can perform a skill on mats with a downward slope created by placing a higher end of a springboard under the beginning of the first mat.

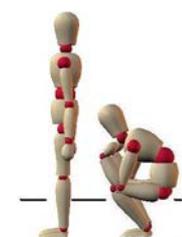
Description of the task and kinogram.

Starting from upright standing position, bending of legs into crouching position then backward roll with bent arms and the support of hands to crouching position, followed by leg extension into a standing upright position with arms sideways.



Description of technique and mistakes

1) Transition from standing position into crouching position



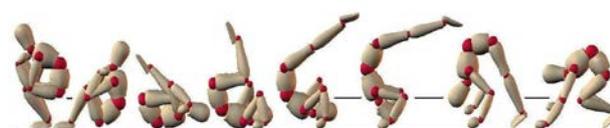
Description.

Pupils crouches with a slight lean forward, bends the arms and places the hands parallel to the shoulders.

Technical mistakes (large).

In transition into crouch and slight forward fold, student supports him/herself with hands.

2) Backward roll to tucked front support



Description.

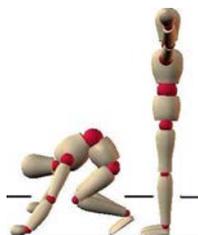
From crouching position sit on the mat as close to the heels as possible and roll backward over the head, shoulders and back in a tight tucked position, chin pressed into chest. Active support with open palms and fingers wide and a strong extension of elbow joint (arms) when crossing the vertical position. Legs either bend or straight.

Technical mistakes (large).

Uncoordinated transition from crouching position into roll (fall backward). Body not completely tucked during the roll. No active support with hands and no extension of elbow. Roll ends in wide straddle tucked front support.

<i>Technical mistakes (small).</i> Transition into crouch is not smooth.	<i>Technical mistakes (small).</i> Transition from crouching position into roll is not smooth. Chin not sufficiently pressed into chest. Hands are not parallel.
<i>Aesthetic mistake (large).</i> Completely relaxed body.	<i>Aesthetic mistake (large).</i> Completely relaxed body and legs. Legs overly widely apart (more than shoulder width).
<i>Aesthetic mistake (small).</i> Slightly relaxed body.	<i>Aesthetic mistake (small).</i> Slightly relaxed body and legs. Legs slightly apart (less than shoulder width). Feet not pointed.

3) From tucked front support lift into standing position, arms beside the ears



<i>Description.</i> After extension of arms fast transition into upright standing position.
<i>Technical mistakes (large).</i> Hands sliding over the mat directly prior to a transition from crouching into standing position.
<i>Technical mistakes (small).</i> Transition from crouching position into standing position is not coordinated.
<i>Aesthetic mistake (large).</i> Completely relaxed body, feet wide apart.
<i>Aesthetic mistake (small).</i> Relaxed body, feet slightly apart.

Criteria

Measurement scale (points)	DESCRIPTION OF STANDARDS
5	Student performs backward roll independently, with reliability, <i>without</i> technical and aesthetic mistakes.
4	Student performs backward roll independently, but not with complete reliability; during the execution he/she makes <i>small</i> technical <i>or</i> aesthetic mistakes.
3	Student performs backward roll independently, but not with complete reliability; during the execution he/she makes <i>one large</i> technical mistake <i>and</i> several <i>small</i> aesthetic mistakes; or several small technical <i>and</i> aesthetic mistakes.
2	Student performs backward roll independently, but not reliably; execution includes large technical <i>and</i> aesthetic mistakes.
1	Pupil performs backward roll in easier conditions or environment (down the slope, over the shoulder, into kneeling or straddle position, with help).
0	Pupil cannot perform backward roll (he rolls backwards, but does not execute rotation around transversal axis).

The data was collected during the regular PE classes. After warming up, the test task was explained and demonstrated to students; then students performed it under the same conditions three times. Their second and third performances were videotaped.

Tasks' performances were evaluated with a unique protocol by three PE teachers. Before the assessment they read the description of task and criteria carefully. Then they independently assessed both performances (36 students, 72 executions) on videotape in normal speed. In the assessment, they were not allowed to stop the tape, watch it in slow motion or watch it more than once. For evaluation, they used points from 0 to 5 according to the above criteria. The better score of each student was used for statistic procedures. After one month, one of the evaluators repeated the evaluation three times in one-day intervals.

The data was processed using the SPSS statistics application for Windows. Factor analysis, Cronbach's reliability coefficient

alpha and calculation of concordance between respective evaluator's grades and the common test object were used for evaluation of reliability and objectivity. To analyse the differences in performance between genders, the analysis of the variance was used. All statistics used an alpha level of $p < 0.05$.

RESULTS AND DISCUSSION

Differences in scores between genders.

The average marks of students were slightly lower than the average of six possible marks on a 0- to 5-point measuring scale. The evaluators did not use the highest and the lowest scores. The distribution of scores was normal. The received scores of girls were slightly higher than boys, but the differences between genders were not statistically significant ($p=.447$). We concluded that the group of students were homogenous and the test task is equally suitable for both genders.

Table 1. *Basic statistic parameters and analyse of variance between the genders.*

	N	AS	SD	SE	mi n	ma x	Bar tt-Sig	F	p
bo	16	1.8	1.1	.27	1	4	.61	.59	.44
ys		1	1					1	7
girl	20	2.1	1.1	.25	1	4			
s		0	0						
tot	36	1.9	1.1	.18	1	4			
al		7	0						

Legend: N – number of students; AS – mean scores; SD – standard deviation; SE – standard error; min – minimum score; max – maximum score; Bartt- Sig - Test of variance homogeneity; F – F-test; p - statistical significant differences

The backward roll is important movement in childhood development, especially for one's orientation in space (it is executed backward, which is an unusual direction of human movement). The average values for executed movement were slightly lower than expected, as the backward roll has been a part of the PE curriculum in all grades of schooling (Kovač & Novak, 2001). Examination of the time allocated for various types of activity throughout the

world reveals how, in practice, competitive sport activities such as ball games and track and field athletics dominate the physical activity experiences of pupils (Hardman, 2008). As open-ended curricula provide teachers with a higher level of autonomy (Colby & Witt, 2000), it often happens that teaching is not systematic. Furthermore, in Slovenia teachers spend too few lessons on gymnastics, which leads to very modest knowledge of gymnastics in students (Bučar

Pajek et al., 2010; Kovač, 2006; Majerič, 2004; Štemberger, 2003).

We have to acknowledge that what students actually do during a lesson is more important than the time allocated for practice (Da Costa & Piéron, 1992; Metzler, 1983; Phillips & Carlisle, 1983). Pehkonen (2011) found that the quality of practice had the highest explanatory power for improving gymnastics skills. Children find it easiest to learn basic gymnastic skills in the first years of school. In Slovenia, PE is taught by general teachers in the first years. Self-evaluation regarding their own competences showed that they had insufficient knowledge in the following areas: how to implement gymnastics and ball games, and how to organize effective PE classes (Kovač, Strel, & Jurak, 2008a). Silverman (1991) also reported that due to the complexity of the PE learning environment, students are engaged in more complex motor activities for less than 30% of class time, and only half of this at a level appropriate to student needs and readiness.

The period between the ages of ten and fifteen is characterised by fast growth, especially of the limbs (Jürimäe & Jürimäe,

2000). Changes to an individual's size and strength will have a pronounced effect on learning (Kirk, 2001; Magill, 1994). The problem occurs when students, due to accelerated development of the body and insufficient strength in the arms and shoulders (Strel, Kovač, & Jurak, 2007), are unable to support their hands during the roll and then move their body around the shoulder or even cannot roll their body back at all. Coping with these changes may be a source of clumsiness as some young people struggle to match their existing skills and their expectations of their competence with changes to their bodies (Kirk, 2001). Regarding planned strategies for the realisation of lessons, teachers have to allow enough time for practising, change the learning environment, and respect the learning needs of their students.

Objectiveness and reliability of assessment. The objectivity of the assessment was examined with measurement compatibility between the scores of single evaluators and the common object of assessment (the first main component of scores of all three evaluators).

Table 2. Correlation between three evaluators and Cronbach's alpha .

evaluator	E ₁	E ₂	E ₃	Cronbach's α
E ₁	1.0			.95
E ₂	.98	1.0		.98
E ₃	.86	.90	1.0	.90

Table 3. First main component.

Component	λ	Cum. % of variance
K₁	2.83	94.21

Correlation between the marks of three evaluators is very high. The first main component has represented slightly more than 94% of total variance of all evaluators, indicating that the selected criteria were appropriate. Despite the fact that one of the evaluators was not a specialist in

gymnastics, all three evaluators marked according to the descriptions of mistakes and described standards for individual measuring level; as a result, a correlation of the marks of individual evaluators with the first main component was very high. Slightly lower consistency among

evaluators was revealed by Majerič, Kovač, Dežman and Strel (2005) when evaluating long jumping with approach (0.84). It can be concluded that with appropriate criteria every PE teacher who is well prepared for the evaluation could objectively evaluate different motor skills.

The reliability of the test assignment was checked using Cronbach's alpha

coefficient by which we examine the internal robustness of marks after several repetitions (Sagadin, 1993). To find out the reliability of the assessment of backward roll, one of the three evaluators assessed all tested individuals three times within three days.

Table 4. Reliability of the assessment.

	Basic statistic parameters					Correlations		
	N	A	S	min	max	Ea	Eb	Ec
		S	D					
Ea	36	2.06	1.15	0	4	1.0		
Eb	36	2.03	1.13	0	5	.95	1.0	
Ec	36	1.97	1.10	0	5	.92	.98	1.0

alpha = .98

Legend: E – evaluator; a – first assessment; b – second assessment; c – third assessment

Very high correlations between the scores point to evaluation with the same criteria at all three times of evaluation, regardless of the one-day interval between each evaluation. The reliability of assessment can be increased through good assessment measures (Marentič Požarnik, 2000). Undoubtedly, the descriptions of technical and aesthetic execution of tasks and the criteria were sufficiently precise for the evaluator to mark the execution similarly at different times. Furthermore, other authors reported the high reliability for assessment of different motor skills with the analytic method of assessment (Majerič, 2004).

Whilst preparing analytical criteria for assessment task, which should be based on the magnitude and frequency of mistakes, teachers should divide individual movement into parts that will allow students to recognise their own mistakes and enable a comparison with correct execution. These criteria help both teacher and the student to gain good insight into the knowledge of the student and at the same time enable a teacher to help the student with further

practice and the acquisition of knowledge (Colby & Witt, 2000; Kovač et al., 2008b; Quiot, 2003). This type is useful mostly for the evaluation and examination of basic movements that are essential for the acquisition of future content (Majerič, 2004) and therefore have to be correctly learned (Burton, 1998; Magill, 2004). Specifically, mistakes in the execution have two-fold effect: first, they prevent the efficiency of future learning; and second, insufficient execution can endanger the safety of a student or even cause an injury.

CONCLUSION

To be effective, teachers need to be responsive to the learning needs of their students through mastering important subject content, integrating concepts and implementing teaching strategies that are responsive to a diversity of students (Dill, 1990; Whipp, 2004). This can only be achieved if the learning process is appropriately organised with a sufficient number of lessons, optimal teaching techniques and appropriate methodical procedures. Good teachers should be skilled

not only in teaching methods, but also in the positive educational benefits of evaluation and assessment practices that allow them to gauge individual student learning and adapt activities according to student needs; learning experiences and assessment tasks must be very closely related, often involving simple or minor modifications between one and the other (Kirk, 2001).

The backward roll is one of the most common items of content in PE in all grades. Bučar et al. (2010) reported that more than 90% of PE teachers implemented this acrobatic element in the last three grades of primary school. By including different rolls in the lessons plan, teachers will be able to improve or at least maintain the level of movement abilities in their students throughout the years. Successful performance of these skills requires accurate muscular activity of specific intensity (muscular strength in arms and shoulders), through the space (coordination in movement backward around the frontal axis) and at the right moment (timing) (Novak et al., 2008). A prepared model task with description of movement and certain mistakes and precise criteria are focused on individual student learning and providing suitable feedback. They serve as important function in the further process of teaching; teachers can identify where students have troubles; therefore, they can further adapt teaching process.

Teachers could also prepare tasks and criteria in a similar way for other motor skills forming part of the curriculum. For formative assessment, it has to be mentioned that the measuring scales and description of standards should differ according to the purpose of evaluation (finding quality, quantity and meaning of knowledge; identification of the importance of mistakes; improvement of teaching methods), the developmental stage of pupils and the complexity of evaluated movement. As every teacher is autonomous in the evaluation process, the analysis of individual criteria will be welcome in the professional evaluation of the aptness of their decisions, as well as in the evaluation and assessment

procedures of practical knowledge of students.

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Corresponding author:

Assoc. prof. Marjeta Kovač, PhD

marjeta.kovac@fsp.uni-lj.si

Head of Department for Physical Education

University of Ljubljana,

Faculty of Sport

Gortanova 22

1000 Ljubljana, Slovenia

Phone: + 386 01 520 77 37

Fax: + 386 01 520 77 40

HANDLING, THROWS, CATCHES AND COLLABORATIONS IN ELITE GROUP RHYTHMIC GYMNASTICS

Lurdes Ávila-Carvalho¹, Panagiotou Klentrou², Eunice Lebre¹

¹Porto University, Sports Faculty, Portugal

²Brock University, Department of Kinesiology, Ontario, Canada

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Abstract

Apparatus technique is crucial in the Rhythmic Gymnastics (RG) performance evaluation because of its high impact on the final score and it is the particular requirement of this sports. The technical vigour required in the use of apparatus evidences the need to study the composition of high level routines. An analysis of the apparatus work in high level group routines will give a new insight in the understanding of RG. With this in mind, we used the groups' composition forms submitted during the Portimão World Cup series from 2007 to 2010 to analyse the apparatus difficulty profile of the RG high level group routines. A total of 126 group routines from 28 countries were analysed. It is concluded that hoop routines had the most balanced apparatus technique whereas the poorest technical apparatus work was seen in clubs maybe because is the only double apparatus. According to the competition success analysis, success in high level RG group competition could be explained by: higher training volume (hours per week) (43%), higher use of throws (6%) and collaborations with risk (16,5%). These risky technical elements performed by the higher level groups require an anticipation coincidence ability that is linked with the loss of visual contact with the apparatus.

Keywords: *apparatus handlings, throws, catches, collaborations, group rhythmic gymnastics.*

INTRODUCTION

Group rhythmic gymnastics (RG) was included in the Olympic Games for the first time in 1996 in Atlanta, Georgia, United States. Since then, the standards of group performance have progressively improved. The RG Code of Points (CoP) of the International Federation of Gymnastics (FIG) provides the universal guidelines established by the scientific and technical committees with the objective to evaluate the performance and promote the development of the sport.

As the CoP changes every Olympic cycle, the routine requirements become more demanding and increasingly difficult (Lisitskaya, 1995). According to Bobo (2002) the RG performance evaluation is a judgment process and not an arbitration. The author explains that the main difference is that in RG there is no direct confrontation between gymnasts, the judge is not involved in the routine development, and the judge has to evaluate the performance according to a set of agreed guidelines namely the

CoP. In addition, the judge evaluates simultaneously technical and artistic/expressive parameters (Bobo, 2002). This requires high intellectual activity and experience. Aesthetic and technical judgment share emotional perception, as well as detailed and objective analysis of the routine. This process requires a comprehensive and analytical understanding of RG, difficult to reconcile issues in a single perception (Bobo, 2002).

The RG performance is evaluated in a competition setting by a final score that includes 3 sub-scores: Difficulty, Artistic and Execution (Fédération Internationale de Gymnastique, 2009a). The main liability of the final score depends on the apparatus (one component of Difficulty) and Artistic score (Lebre, 2007). This is why RG is a sport that requires increased coordination of body and apparatus movements (Tsopani, Dallas, Tasika, & Tinto, 2012).

The increasing apparatus demands have made this component of the final score more precise in last modifications of CoP (Ávila-Carvalho et al., 2008). Apparatus difficulty is crucial in the performance evaluation because of its high impact on the final score. According to Avilés (2001), the current trend in the routine composition is the increase in variety of both body and apparatus movements, an originality search, a high level of technical skill in apparatus handling together with a high execution efficacy in specific technical elements, the development of a strong identity based on the individual or group characteristics, an increase in the number of risk and outstanding elements in the composition, and the increase in artistic value of the composition. According to Lisitskaya (1995), the virtuous interaction to the gymnasts with the apparatus increased the difficulty of the apparatus elements in the RG routines that characterizes the evolution of the sport. In group routines the success is achieved when there is a high degree of synchrony between the gymnasts and apparatus movements (Lisitskaya, 1995).

The high technical requirements in RG for both body and apparatus movement

require coach's constant attention to guarantee appropriate execution not allowing an automation of incorrect movements (Botti & Nascimento, 2011). A correct distribution in space and a balanced conceptual and emotional expression of the different group work are also according to Lisitskaya (1995) success requirements in RG group routines. In RG practice, there is a concern both with refinement and improvement of technique, and with the physical and motor performance of the gymnasts (Botti & Nascimento, 2011). According to the authors, the RG practice sessions were generally long, homogeneous, and repetitive. Gymnasts are required to apply high level technique in order to achieve the specific movements' complexity while also demonstrate creativity, beauty, feelings, sensations, behaviours and actions (Botti & Nascimento, 2011).

Anticipation and synchronicity are additional required and trained abilities that RG gymnasts must develop in order to achieve a successful apparatus technique. This is the ability to anticipate the trajectory of a visual stimulus moving in space, and to organize a motor response based on temporal anticipation (Rodrigues, Vasconcelos, Barreiros, & Barbosa, 2009). This capacity allows, for example, the interception trajectory, such as a ball passed between two opposing athletes (Rodrigues, Carneiro, Cabral, Vasconcelos, & Barreiros, 2011). In RG throws, catches and collaborations the apparatus trajectory and speed drive the body action and amplitude necessary for an error free catch of the apparatus. The general criteria of judges assessment are quantitative (number and variety of body and apparatus elements) and qualitative (difficulty level and execution quality) (Bobo, 2002).

The technical vigour required in the use of apparatus evidenced the need to study the composition of high level routines. However, the literature on apparatus technical analysis is sparse. There are very few studies (Lebre, 1993, 2007) including our previous apparatus studies, related to the specific requirements of this sport. An

analysis of the apparatus work in high level group routines will give a new insight in the understanding of RG. With this in mind, we used the groups' composition forms submitted during the Portimão World Cup series from 2007 to 2010 to analyse the apparatus difficulty profile (handling, throws, catches and collaborations) of the RG high level group routines.

METHODS

A total of 126 group routines from 28 countries were analysed. Data were collected during 4 years (2007 to 2010) during the RG World Cups in Portimão, Portugal. This study was approved by the FIG Scientific Committee and World Cup Organization. The analysis of the apparatus elements in each routine composition was carried out based on the information provided by the competition forms that each group has to provide prior to the competition. We worked based on the forms

instead on the video recording because in order to ensure that the analysis would not be affected by mistakes made during the group's performance in the competition.

First, the sample (126 group routines) was split in four groups according to the type of apparatus (rope, hoop, clubs and ribbon). Each RG group had to perform two competition routines, one with five similar apparatus and other with two different apparatus. Once the sample was split according to the apparatus type then we grouped the 189 different routines was split by apparatus types into two apparatus routines. Then we further classified all the apparatus handling in three main categories according to the arm movement amplitude (short and large handlings), and if the apparatus movement was performed on the gymnasts' body or on the floor. Table 1 presents the included apparatus movements in the different handling categories by apparatus.

Table 1. *Handling categories by apparatus.*

Apparatus/ Handlings	Short Handlings	Large Handlings	On body or Floor Handling
	Skips/hops into the rope	<ul style="list-style-type: none"> • Passing into the apparatus • Handling (swigs, 8 movements, circumduction) • Tosses • Rotation with open and stretched rope held in the middle or in end 	<ul style="list-style-type: none"> • All apparatus movement without hands • All apparatus movement on the floor
	Hand rotations Rotations around them axis	<ul style="list-style-type: none"> • Passing into the apparatus • Handling (swigs, 8 movements, circumduction) 	<ul style="list-style-type: none"> • All apparatus movement without hands • All apparatus movement on the floor • Passing over the apparatus • Roll on the floor • Roll on the body
	Mills	<ul style="list-style-type: none"> • Asymmetric movements • Handling (swigs, 8 movements, circumduction) 	<ul style="list-style-type: none"> • All apparatus movement without hands • All apparatus movement on the floor
	Snakes Spirals	<ul style="list-style-type: none"> • Tosses • Handling (swigs, 8 movements, circumduction) • Boomerang 	<ul style="list-style-type: none"> • All apparatus movement without hands • All apparatus movement on the floor • Snakes on the floor • Spirals on the floor

Legend:  - rope,  - hoop,  - clubs,  - ribbon

A ranking analysis was then done according to the 2010 Moscow World Championship placements in order to examine if the choice of handling elements

and the weekly training volume (training hours per week) had a relationship with the performance result. Weekly training volume was determined by the training hours per

week via questionnaire with two questions (How many training sessions have you per week? How many hours you train in each training sessions?). To this end, we grouped the competition routines into two groups according to their ranking. The finalists group included the top eight groups and the non-finalists group included all remaining competition routines. Then we compared the total number and difficulty value of throws and catches between finalists and non-finalists. Apparatus throws and catches are a fundamental technical movements to RG apparatus, it will be considered a throw when the gymnasts projects the apparatus in the air, in coordination or not with body movements, catches will be considered only those performed by the same gymnast that throw the apparatus. Additional criteria that increase the apparatus difficulty in throws and catches elements score according to the CoP were also considered. These common throws and catches additional criteria were: 1) without hands help, 2) outside of visual contact, 3) during a flight, 4) during a body rotation, 5) below the leg(s), 6) with a total or partial body passing in the apparatus, and 7) in floor position. The special throws categories were: 1) re-throw, and 2) without hands with other apparatus.

The last analysis was in regards to the elements of collaborations among gymnasts according to the CoP. The collaborations are technical cooperation elements unique to the group routines. This kind of group technique can be performed by all gymnasts or by part of the group, in direct contact or by the apparatus, moving in different directions, formations or travelling types. We classified the technical collaborations in three categories: 1) collaborations without apparatus throw, 2) collaborations with apparatus throw, and 3) collaborations with risk. The last must be performed with apparatus throw and loss of visual contact with the apparatus before the catch. With this type of collaborations the group can further increase the technical value if the gymnasts pass above, below or through one or several apparatus or partners during the

apparatus flight, or if the gymnasts pass through the apparatus during her flight.

For the statistical analysis we used the Statistical Package for the Social Sciences - Version 20.0 (SPSS 20.0, Chicago, USA).

Descriptive statistics were calculated using the mean values as a measure of central tendency and standard deviation (sd) as measure of dispersion. When data distribution normality was verified by the Kolmogorov-Smirnov we used *student* t-test to determine whether there were significant differences between groups. When data distribution normality wasn't verified non-parametric tests were applied (Kruskal-Wallis and Mann-Whitney) to determine whether there were significant differences between groups.

Regression analysis was used to analyse the relationship between ranking position (dependent variable), and the independent variables of handling categories, throws and catches, collaboration elements, and training volume (weekly training volume).

Significance level was set at $\alpha = 0.05$ (corresponding to a confidence level of 95%).

RESULTS

Significantly higher value of *short handlings* was found in ribbon compared with all other apparatus (Table 2).

No significant differences were found in *short handlings* between rope and hoop. In the *large handling* category, rope had significantly higher mean value compared with all other apparatus. No significant differences were found in the *large handlings* between ribbon and hoop (Table 2). Significantly higher mean value of on *body or floor handling* category was found in hoop compared with all other apparatus while no significant differences were found in this category between rope and ribbon. Only in clubs we found significant differences in all of the three apparatus handling categories, where a significantly lower value was found in two of the three handling categories (Table 2). In terms of *SUM handlings*, significant higher values

were found in both the ribbon and the rope as compared with all other apparatus (Table 2).

The regression analysis used to further examine whether handling technique in each apparatus was associated with the World Championship ranking position of each group, had shown that only the *On body and/or floor handling* with hoop was significantly positively related to the ranking position ($\beta=0,704$; $r^2=0,064$; $p=0,046$). According to these results, the group routines that had less *on body and/or floor handling* in hoop routines had a better

ranking position. On the other hand the regression analysis has shown that weekly training volume was negatively associated with the World Championship ranking position ($\beta=-0,599$; $r^2=0,424$; $p<0,001$). According to these results, the groups who trained more hours per week had a better ranking position and the weekly training volume explained 42% of the competition results.

Throws and catches quantitative and qualitative values according to the final ranking position are shown in Table 3.

Table 2. Descriptive and Inferential statistics of handling categories by apparatus.

Apparatus	Statistics/Categories	Short handling	Large handling	On body/floor handling	Sum handling
 (n=63)	mean±sd	2,97±2,35	22,62±8,71	1,83±1,67	27,41±9,76
	Min.- Max.	0-9	5-42	0-7	9-48
 (n=63)	mean±sd	4,30±4,30	6,76±4,58	6,87±3,23	17,94±8,24
	Min.- Max.	0-20	0-19	2-16	3-36
 (n=35)	mean±sd	7,03±4,00	3,11±2,47	1,00±1,08	11,14±4,55
	Min.- Max.	0-15	0-10	0-4	4-22
 (n=28)	mean±sd	22,75±5,67	8,25±5,20	2,71±2,62	33,71±7,65
	Min.- Max.	11-36	0-20	0-10	20-46
Kruskal-Wallis test	P=	<0,001*	<0,001*	<0,001*	<0,001*
Post-hoc comparison (Mann-Whitney test)	p<=0,001				
					
					
					
					

Legend:  - rope,  - hoop,  - clubs,  - ribbon, *p < 0,001

Table 3. Descriptive and Inferential statistics of throw and catches according to the final ranking position of the group routine.

Ranking	Finalists (n=54)			Non Finalists (n=72)			T-test (a)
	Mean±sd	Min.	Max.	Mean±sd	Min.	Max.	Mann-Whitney test (b)
Throw (n°) (n=51/70)	10,04±4,19	3,00	19,00	9,26±4,11	1,00	20,00	0,307 (a)
Throw (value)	1,09±0,49	0,30	2,30	1,01±0,47	0,10	2,20	0,335 (a)
Catches (n°)	6,06±4,64	0,00	22,00	5,40±4,80	0,00	19,00	0,288 (b)
Catches (value)	0,92±0,65	0,00	2,60	0,79±0,67	0,00	2,50	0,237 (b)

Legend: n° - number, n – sample, value – according to FIG code of points, sd - standard deviation

Table 4. Descriptive and Inferential statistics of collaboration elements according to the final ranking position.

Ranking position	Finalists (n=54)			Non finalists (n=72)			Mann-Whitney (a)
	Mean±sd	Min.	Max.	Mean±sd	Min.	Max.	T-test (b) P=
Collaborations without throw (n°)	2,24±1,78	0	6	2,33±1,67	0	8	0,769 (a)
Collaborations with throw (n°)	4,24±2,81	0	12	3,60±2,35	0	9	0,165 (b)
Collaborations with risk (n°)	5,93±2,00	2	10	4,97±1,71	2	10	0,005* (b)
Collaborations without throw (value)	0,22±0,18	0,00	0,60	0,23±0,17	0,00	0,80	0,769 (a)
Collaborations with throw (value)	0,96±0,62	0,00	2,60	0,81±0,55	0,00	2,10	0,176 (b)
Collaborations with risk (value)	2,86±0,89	1,00	4,50	2,49±0,81	0,80	5,00	0,017* (b)

Legend: n° - number, n - sample, value - according to FIG code of points, sd - standard deviation, * p < 0,02

As shown, although the value of *throws and catches* was higher in the finalists' than in the non-finalists' routines this difference was not significant. In addition, the regression analysis had shown that only throws were significantly negatively related with the ranking position both in terms of the number of throws used ($\beta=-0,545$; $r^2=0,062$; $p=0,006$) and of the value of throws used ($\beta=-4,468$; $r^2=0,057$; $p=0,007$). According to these, the group routines that had more throws (number and value) were better ranked.

The quantitative and qualitative results for collaborations according to the final ranking are shown in Table 4.

Only the collaborations with risk (number and value) showed significant differences between the finalists and the non-finalists.

This was confirmed by the regression analysis as only the collaborations with risk was significantly negatively related to the ranking position both in terms of their number ($\beta=-1,924$; $r^2=0,165$; $p< 0,001$) and their value ($\beta=-3,469$; $r^2=0,112$; $p< 0,001$). According to these, the group routines that had more collaborations with risk in the routines had a better ranking. Furthermore, the number collaborations with risk explained 16,5% of the competition's final ranking.

DISCUSION

This study is one of few that attempted to quantify the apparatus technical elements included in the elite RG group routines. From this analysis it is apparent that the technical apparatus elements used in the routine composition varies according to the type of apparatus. This is consistent with the previous study by Bobo (2002) on individual routines according to which the apparatus choice has to do with both its nature and specific characteristics (Vidal, 1997) (size, shape, weight).

Apparatus Handling

According to our previous studies, (Ávila-Carvalho et al., 2008; 2009, 2011) the *passing of the apparatus* and tosses elements were the most common technical elements used by the group routines with 5 ropes in the World Cups of 2007 and 2008. In the present study, these specific rope elements were included into the large handlings, which again was the category of the highest value. The rope technical category with the lowest mean value was the *short and on body or floor* handlings. In general, the rope has been described as the apparatus of a low versatility in terms of apparatus technique (Bozanic & Miletic, 2011). In addition, the *skips and hops* into the rope was less used apparatus category previously reported in 5 rope routines

(Ávila-Carvalho et al., 2009). This kind of elements was included in short handling category and their inclusion in high level group routines was decreased from 2007 to 2008 (Ávila-Carvalho et al., 2011). Rope's physical characteristics, deformable and soft, create a challenge in performing, error free technical elements without hands or in a floor position and this explains the minimal use and low mean value of handling on the body or the floor.

According to Ávila-Carvalho, Palomero, & Lebre (2009), the hoop handling movements (large handling in our study) was the most used skill in the 3 hoops and 4 clubs high level group routines. In our study *the on body or floor handling* was the highest used skill of hoop. However, the large total number of skills included in this category may have influenced these results. Unlike the previous studies, where handling and rotation elements reported the highest mean value in hoop group routines (Ávila-Carvalho et al., 2008; Ávila-Carvalho, Palomero, & Lebre, 2010a), in our study were the *on body or floor handling* elements that presents the highest mean value in hoop routines. This means that the handling and rotation elements were executed without hands and on floor position explaining the higher values in *on body or floor handlings* in our study. This suggests that elite RG group routines with hoop present a superior apparatus mastery that is not so evident in the other apparatus. This agrees with previous studies that have reported a higher versatility in hoop technique over that seen in rope, ball and clubs. Versatility in RG means that, using each apparatus, the gymnasts can perform a variety of elements in a variety of combinations, including the use of different body parts (Bozanic & Miletic, 2011).

The clubs was the only apparatus that reported a significant difference compared with all of the others apparatus, in all of handling categories analysed. This suggests that clubs present a higher technical challenge. According to Ávila-Carvalho, Palomero, & Lebre (2011), the asymmetric

movements was the least used technical category in hoop/clubs elite group routines in 2007 and 2008. This technique was included in the large handling category of our study that was also the least used apparatus handling for all apparatus analysed. For clubs, the highest technical value was recorded in the category in short handlings, which include only mills, which is characterized by small, repetitive, figure eight rotations, with same amplitude, same speed, in the same direction but executed in different time with both hands. Although mills used in hoop/clubs routines have previously reported high values mills technique decreased from 2007 to 2008 World Cup competitions (Ávila-Carvalho et al., 2011). In fact, clubs was the only apparatus with a lower value in three of the four handling categories analysed. According to Tsopani et al. (2012), the low value of qualitative execution in clubs is because clubs require a clean execution by both hands and this requires a high coordination level (Vidal, 1997). This low qualitative technique in clubs could be linked with internal data memory, otherwise preceded experience (Tsopani et al., 2012). Most humans preferentially use their right hand in daily activities, while about 10% use the left hand (Rodrigues et al., 2009). One factor that seems to affect more or less functional asymmetry is the task complexity. In clubs gymnasts perform the majority of elements with both hands, which requires perfect coordination between them, as well as between the apparatus and body difficulties and between the gymnasts.

In ribbon, the Ávila-Carvalho, Palomero, & Lebre (2010a) study reported higher use of snakes and spirals. In our study these elements were included in the category of short handling, which was also the most used ribbon category and with the highest reported values amongst all apparatus analysed. We think that due to its flexible nature ribbon must be in constant motion in order not to lose its form and result in technical error as specified in the CoP (Fédération Internationale de Gymnastique, 2009a). This constant

apparatus motion may have been the reason for the higher handling values observed in ribbon. On the other hand, snakes and spirals are the typical ribbon handling elements (Bobo (2002).

Apparatus technique by ranking position

In RG, gymnasts are expected to execute a high number of motor skills in order to structure their competitive routines (Tsopani et al., 2012). According to the CoP, the body technical elements are valid only if executed in conjunction with apparatus technical elements leading to a more complex and demanding performance. Thus, for a group to achieve higher ranking position a complex coordination between body and apparatus work is required. To this end, the RG practice sessions are generally long, homogeneous, and repetitive, and are focused on the refinement and improvement of technique, including physical and motor performance of the gymnasts (Botti & Nascimento, 2011). Such sessions result in better recall of information in executing the skills (Tsopani et al., 2012). It was, therefore, not surprising that weekly training volume explained 42% of competition success.

Previous studies on apparatus technique in RG group routines reported higher values related to throws criteria than catches elements (Ávila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2010a, 2011). In the routines analysed, the authors reported a generalized strategic decision by elite groups to increase throws difficulties and decrease catches difficulties (Ávila-Carvalho et al., 2011). However, when the routines were performed with two different apparatus more catches elements were performed (Ávila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2011). The specific throw criterion that had been mostly used by elite groups was the throw elements during flight (Ávila-Carvalho et al., 2010a; Ávila-Carvalho, Palomero, & Lebre, 2010b). In terms of catches the specific criterion previously used varied according to the apparatus. For flexible apparatus like

ribbon and rope, there was higher use of catches during a rotational body element because of the movement fluidity needed to preserve the apparatus' form as per the CoP requirements. For the routines performed with rigid apparatus (hoop), most catches were performed without hands help (Ávila-Carvalho et al., 2010a, 2010b). In the present study there were also higher values related to throws' criteria than to catches' criteria, but with no differences between the finalists and the non-finalists groups. According to the CoP (Fédération International de Gymnastique, 2009b), the use of catches criteria can result to equally high technical values as throws elements. Thus, the choice of apparatus elements depends on the coach's strategy to increase the value of the composition by a less risky way. However, the use of different kind of catches could be more valuable as they can increase the artistic impression of the routine. According to the regression analysis, the group routines that utilized more throws criteria had a better ranking position. The best RG groups presented a more risky apparatus technique that required a momentary loss of contact between gymnasts and apparatus.

Only the collaborations with risk reported significant differences between finalists and non-finalists group routines. Previous studies have also reported high values in collaborations with risk, when the routines were performed with same apparatus like 5 ropes or hoops (Ávila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2010a), or during pre-Olympic, preparatory competitions (Ávila-Carvalho et al., 2011). When the competition routines were performed with two different apparatus like 3 ribbons & 2 ropes (Ávila-Carvalho et al., 2010a), or 3 hoops & 4 clubs (Ávila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2011) the collaborations mostly used were those performed with throw. However, when we analysed the collaborations according to the ranking position, we didn't find any difference between groups in collaborations with throw.

The risk in collaboration technical elements is characterized by the loss of visual contact with the apparatus during the throw. This loss of visual contact with the apparatus increases the gymnast's anxiety that may in turn result in coordination and balance difficulties, and reduced focus and attention. This decreases efficiency in processing information by interfering in the sense-perceptive, decision-making and implementation mechanisms (Ariza-Vargas, Domínguez-Escribano, López-Bedoya, & Vernetta-Santana, 2011). These observations induce a strategic choice by the coaches to use risky collaborations in the composition of higher level routines to catch the jury attention and to promote a public surprise. The more experienced gymnasts may experience less anxiety with this visual constraint. According to Davlin et al. (2001), the vision is largely responsible for balance maintenance. However, the role of visual cues for gymnasts is still under debate. Vuillerme et al. (2001) demonstrated that gymnasts are less affected by the loss of vision during balance tasks as they were more capable than other athletes to cope with the lack of vision. The anticipatory timing or coincidence-anticipation (CA) is a term developed by Belisle (1963) and is the ability to anticipate the trajectory of a visual stimulus moving in space, and to organize a motor response based on temporal anticipation (Rodrigues et al., 2009). In collaborations with risk, the gymnasts have to predict the body's rotational movement (displacement and speed) that allows the apparatus interception in the right place at the right time. This is supported by a study by Rodrigues et al. (2011) according to which old groups demonstrated higher accuracy in the execution of complex tasks. This suggests that higher experience and ability to coordinate and modify responses based on the feedback processes of both receptors and effectors can lead to increased accuracy (Rodrigues et al., 2011). If one assumes that the best group routines were performed by more experienced gymnasts, it is not

surprising that these routines had more risk elements that require a high AC ability.

The present study has some limitations that should be considered. The CoP adjustments which have taken place every four years (Olympic cycle) introduce some specific changes on the competition routines and in this study we analysed the routines in 2007 and 2008 that were prepared according to a different version of Cop than the routines from 2009 and 2010.

CONCLUSION

It is concluded that hoop routines had the most balanced apparatus technique whereas the poorest technical apparatus work was seen in clubs maybe because is the only double apparatus. According to the competition success analysis, success in high level RG group competition could be explained by: higher training volume (hours per week) (43%), higher use of throws (6%) and collaborations with risk (16,5%). These risky technical elements performed by the higher level groups require an anticipation coincidence ability that is linked with the loss of visual contact with the apparatus.

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Corresponding author:
Lurdes Ávila-Carvalho;
lurdesavila4@hotmail.com
Porto University,
Sports Faculty,
Portugal

TWO PERSPECTIVES ON ONE COMPETITION: SLOVENIAN COVERAGE OF ARTISTIC GYMNASTICS AT THE 2008 SUMMER OLYMPICS

Simon Ličen¹, Andrew C. Billings²

¹University of Ljubljana

²University of Alabama

Original research article

Abstract

Televised sports images are complemented by the speech of network-employed announcers who dramatize the narrative and interpret the on-screen events. The purpose of this study was to analyze Slovenian coverage of artistic gymnastics events at the 2008 Beijing Summer Olympics. Over 7 hours of broadcasts were recorded and analyzed. All references to athletes or teams spoken by the commentators were transcribed and coded according to a 17-item taxonomy to study discursive framing in sports broadcasting. Frequencies of each category of descriptors were then calculated and compared between groups. A total of 4,472 descriptors were transcribed and coded: 56% were spoken by the play-by-play announcer and 44% by the technical commentator. The color commentator provided more evaluative descriptions and background information (especially concerning the gymnasts' routines), while the play-by-play announcer offered more factual commentary, as well as more attributions of personality. Evaluative commentary most often relied on assessments of athletic talent and ability, experience, and consonance. It also featured emphases on national feelings. The share of broadcasters' subjective commentary in gymnastics is considerably higher than that found in team sports. Commentators wield tremendous narrative power with the masses as their dialogue transcends topics in sports.

Keywords: *Olympics, media content, identity, sports broadcasting, media bias.*

INTRODUCTION

Sports events rank among the world's most popular television offerings. Broadcasts of elite competitions attract massive audiences: the International Olympic Committee (2008), for instance, estimates that 3.6 billion people—83% of the total potential TV audience and 53 percent of the world's population at the time—watched some of the 2008 Beijing Olympics. Many viewers of televised sports experience a strong emotional involvement in this activity (Hastorf and Cantril, 1954). Further, many viewers regard the Olympics

not only as a sporting contest, but also as the greatest spectacle on Earth. Athletes in most sports are regarded as reaching the highest pinnacle of achievement when attaining a gold medal; in many sports and certainly in gymnastics, Olympic success eclipses national and even international championship titles. Hence, some sports organizations, including USA Gymnastics, try to capitalize on this presumed pinnacle event by organizing their exposure strategies around this event in an attempt to

increase both outreach and revenues (King, 2010).

Sports broadcasts combine televised images of athletic competitions and the speech of network-employed announcers. Their role transcends that of objective reporters: they explicate events, as well as include dramatic features to complement the athletic drama and generate involvement and excitement for the television viewer (Bryant, Comisky and Zillman, 1977). Broadcasting styles and contents differ between societies and are to some extent culturally defined, yet common principles pervade the telecasts, including “us” versus “them” dichotomies and favorable commentary about participants with whom viewers and announcers are likely to be already familiar—including, but not limited to, the network’s “own” national representatives (Billings, MacArthur, Ličen and Wu, 2009; Woo, Kim, Nichols and Zheng, 2010; Ličen and Billings, in press). Analyses conducted from a sociological perspective have also found gender bias in sports broadcasting which are typically expressed as issues of differences between the sexes (Billings, 2008; Angelini and Billings, 2010).

In the Slovenian television industry, sports broadcasters are referred to as “commentators” or “reporters.” Their duties while speaking on-air include describing the course of events and providing some subjective commentary; they are thus what is referred to in English-speaking TV markets as “play-by-play announcers.” Technical commentators occasionally join these reporters as their role typically includes conveying in-depth technical information. As a general rule, technical commentators (known, among other, as “analysts” or “color commentators” in English-speaking TV markets) are usually prominent former athletes or coaches whose task is to entertain the audience and provide technical insight. Professionals argue that the main task of the announcers is to prepare the ground for the color analysts since they are supposed to be the stars of the broadcasts (Hedrick, 2000).

The purpose of this study is to analyze Slovenian coverage of artistic gymnastics events at the 2008 Beijing Summer Olympics. Previous studies have analyzed the content of aggregated Olympic broadcasting (see Billings, 2008) while some (see Angelini and Billings, 2010) have isolated the “big five” sports in American Olympic broadcasting for analysis which included gymnastics along with diving, swimming, track and field, and beach volleyball. However, gymnastics competitions have never been studied separately outside the United States. This study aims to determine the content of the dialogue spoken by the announcing team during Slovenian renderings of Olympic artistic gymnastics events.

In many countries, artistic gymnastics events are among the most popular contents in Olympic broadcasting. During the 2008 Beijing Games, U.S. broadcasting company NBC dedicated it over 14 hours of the network’s prime-time Olympic coverage, making it the sport that received the most attention during the Olympic fortnight (Billings, Angelini and Duke, 2010). Within those telecasts, most of the evaluative commentary referred to athletic ability (68.2% of all evaluative dialogue), followed by references to experience (12.9%), consonance (12.4%), composure (2.2%) and athletic strength (1.8%). Descriptors assessing concentration, commitment, courage and intelligence each collected less than 1% of evaluative commentary (Angelini and Billings, 2010). Figures for the entire prime-time programming were slightly different as athletic ability totaled 34.2% of the dialogue in prime-time broadcasting, followed by background commentary (23.5%), factual descriptions (19.2%), references to experience (10.3%), and evaluations of consonance (4.4%). Descriptors assessing body size and emotions accounted for around 2% of the commentary, while nine other categories of references (specifically, concentration, strength-related athletic skill, composure, commitment, courage, intelligence, extroversion, introversion, and

attractiveness) each collected less than 1% of the total commentary (Billings, Angelini and Duke, 2010). Although the frequency of specific types of descriptors changed, overall proportions remained similar to those recorded in U.S. Olympic broadcasting four years earlier (Billings and Angelini, 2007).

Television broadcasters dramatize their narrative and provide interpretation of the events shown on screen (Comisky, Bryant and Zillman, 1977). Different studies showed that the ratio of informative vs. evaluative dialogue varies considerably between societies; in different nations in Asia, Europe and the United States, subjective commentary amounted to between 27 and 41 percent (Bryant, Comisky and Zillman, 1977; Ličen and Doupona Topič, 2008; Woo, Kim, Nichols and Zheng, 2010). All studies observed broadcasts of team sports (NFL football, basketball, and baseball, respectively). Within individual sports, gymnastics has been found to contain a consistent form of divergent talk and is the individual sport most likely to contain biases. It tends to be considered prototypically feminine, a frame further increased by dialogic constructions of women athletes according to an adolescent or even prepubescent ideal (Angelini and Billings, 2010).

Dramatic ascription is much more likely to be used to bolster an athlete rather than dismantling them. Apparently, announcers do not think that disparaging a player or team is appropriate behavior, or they do not find it effective for creating excitement. Instead, they rely heavily on interpersonal conflict between teams and individual athletes to generate the “drama of sports” (Bryant, Comisky and Zillman, 1977).

A case study of a basketball game in Croatia has shown that when a color commentator teamed up with the play-by-play announcer, the former generated 75% of the dialogue, with the remaining 25% being spoken by the color commentator. The pundit was in charge of delivering opinions and evaluations as two in three

remarks he made were subjective. This was significantly more than the announcer’s share of subjective dialogue (Ličen and Doupona Topič, 2008).

Media research that focuses specifically on gymnastics is scarce, especially outside the United States. Slovenia has a considerably differing societal and gymnastical context: it is a post-socialist parliamentary democracy that seceded from Yugoslavia in 1991 with a population of two million, boasting ten Olympic medals won in gymnastics events since 1924. This is relatively few by many nations’ standards but enough to evoke among a large part of the population a sense of national pride bolstered by relatively infrequent individual achievements: the late Leon Štukelj is still considered a recognizable Slovenian personality even though he won his six Olympic medals between 1924 and 1936. In recent times, several competitors won medals at world and European championships, securing the sport steady media interest. This article aims to identify which topics announcers engaged in during Slovenian broadcasts of artistic gymnastic events at the 2008 Beijing Olympics: because of the highlighted differences between societies, Slovenian announcing style will presumably differ from that of American sportscasters. Reportedly, the lack of editorial policies on the Slovenian public television broadcaster allowed for comments that would be deemed sexist and racist in other societies to be spoken on-air. Announcers also tended to rely on different types of descriptors when speaking about Slovenian/foreign and male/female athletes, yet nationality and gender did not influence the attribution of positive commentary (Ličen and Billings, 2012). Hopefully, the results of this study shall provide insight specifically into gymnastics broadcasting in a post-socialist nation and thus pave the way for content analyses of sportscasts in other post-socialist societies.

Presumably, the color commentator¹ in Slovenian broadcasts will produce more evaluative commentary and make more remarks about personality and physicality than the reporter². The latter is in turn expected to provide significantly more factual and background commentary. Four hypotheses were thus formulated to guide this study of Slovenian gymnastics broadcasting:

Hypothesis 1: The color analyst will produce significantly more evaluative descriptors than the play-by-play announcer.

Hypothesis 2: The color analyst will produce significantly more personality and physicality descriptors than the play-by-play announcer.

Hypothesis 3: The play-by-play announcer will produce significantly more background descriptors than the color analyst.

Hypothesis 4: The play-by-play announcer will produce significantly more neutral descriptors than the color analyst.

Previous research has shown that evaluative commentary amounts to between 27 and 41 percent of the dialogue in team sports; however, differences exist in commenting individual vs. team sports. There is little information on the share of objective vs. subjective commentary in individual sports; hence, an additional research question was formulated to determine the content of the commentary and the share of objective vs. subjective commentary in Slovenian Olympic gymnastics airings.

Research question: What are the proportions of objective and subjective commentary in gymnastic broadcasts on TV Slovenija?

¹ Again, the “expert” member of the commenting team whose main role is to provide technical insight.

² The reporter (also known as play-by-play announcer) describes the events in largely objective terms.

METHODS

A total of 7 hours and 7 minutes of men’s and women’s artistic gymnastics broadcasts from the 2008 Beijing Olympics were recorded and analyzed. The material included live and delayed coverage of both qualifying and final stages of the competition. From TV Slovenija’s programming and audience reports released after the Games it was determined that TV Slovenija aired a total of 13 hours and 28 minutes of Olympic artistic gymnastics events; however, many of these broadcasts were not recorded and analyzed in this study because of last-minute lineup changes as TV Slovenija aired over 230 hours of live and delayed sports events (not counting studio programming) and editorial picks were made on a daily basis.

All broadcasts were commented by a male play-by-play announcer, Peter Kavčič³, and a male color commentator, Ivan Čuk⁴. Only their dialogue was analyzed for descriptors because this dialogue can be supervised and controlled by network editors and producers (see Billings, 2008).

In the first phase of the coding procedure, all the dialogue spoken on-air by the commentators during the analyzed broadcasts was transcribed by the leading author into Microsoft Excel spreadsheets with the unit of analysis being the descriptor, defined as any adjective, adverb, adjectival phrase or adverbial phrase applied to an athlete. Simultaneously, the identity (including gender and nationality) of both athletes and speakers were identified. Then, each noun and descriptor referring to

³ Peter Kavčič is a sports journalist and broadcaster for TV Slovenija. In addition to gymnastics, he reports from football and track and field competitions.

⁴ Ivan Čuk, PhD, is a Full Professor of Gymnastics at the University of Ljubljana and a former gymnastics coach. He has been a color commentator in gymnastics broadcasts on TV Slovenija for many years. Both commentators agreed for their identities to be disclosed in this article.

athletes, teams, or gymnastic routines was coded according to a 17-item taxonomy, which is an expanded version of the classification introduced by Billings and Eastman (2003) to study discursive framing in sports broadcasting. Each descriptor was classified as belonging to one of the following categories: (a) concentration [i.e. “didn’t look as if he was concentrating on the match”]; (b) strength/speed-based athletic skill [i.e. “shows his strength”]; (c) talent/ability-based athletic skill [i.e. “the best gymnast on the rings”]; (d) composure [i.e. “can perform a bit more poised”]; (e) commitment [i.e. “came to Beijing with a single goal”]; (f) courage [i.e. “were most afraid of the pommel horse”]; (g) experience [i.e. “has Olympic experience”]; (h) intelligence [“he is rather crazy”]; (i) consonance [i.e. “the stars aligned for him”]; (j) expectations about performance [i.e. “first favorite”]; (k) outgoing/extroverted [i.e. “the amount of communication with part of the audience”]; (l) modest/introverted [i.e. “has no reason to smile”]; (m) emotional [i.e. “tears of joy”]; (n) attractiveness [i.e. “one of the most elegant competitors”]; (o) size/parts of body [i.e. “grabbed his thigh”]; (p) background [i.e. “the Chinese”] and (q) factual and other. Frequencies of each category of descriptors were then calculated. Significant differences between groups were detected with chi-square analyses by using the percentage of overall comments spoken by each commentator as expected frequencies (consistent with the work of Billings, 2008, and Billings, Angelini and Duke, 2010). For example, because 56% of all descriptors were spoken by the play-by-play announcer, it was expected that he would also make roughly the same proportion of comments about concentration, skill, emotionality, and so on. Two independent researchers recoded 30% of the coverage, with overall intercoder reliability using Cohen’s (1960) *kappa* reaching 91%.

RESULTS

A total of 4,472 descriptors were transcribed and coded from the broadcasts that were analyzed. Of those, 2,505 (56%) were spoken by the announcer and 1,967 (44%) by the technical/color commentator. Table 1 shows the distribution of evaluative commentary between the two broadcasters.

Hypothesis 1 predicted that the color commentator would produce significantly more evaluative descriptors than the play-by-play announcer. As the last row in Table 1 shows, Ivan Čuk as the technical analyst indeed produced significantly more evaluative commentary than what would be expected if deriving from the total share of his commentary ($\chi^2(1) = 27.80; p < 0.01$). A more detailed analysis by categories reveals further ramifications of the disparity: the analyst made significantly more comments about concentration ($\chi^2(1) = 11.89; p < 0.01$), athletic strength and speed ($\chi^2(1) = 22.56; p < 0.01$), and consonance ($\chi^2(1) = 138.78; p < 0.01$). However, the play-by-play announcer actually offered more evaluative commentary assessing composure ($\chi^2(1) = 4.88; p < 0.05$), commitment ($\chi^2(1) = 4.48; p < 0.05$), and, by a large margin, experience ($\chi^2(1) = 74.95; p < 0.01$). Comments about courage and intelligence were so few that a reliable χ^2 analysis could not be conducted. All in all, the total distribution of evaluative commentary supports the assumption that the color commentator would provide more evaluative commentary than the play-by-play announcer, thus confirming Hypothesis 1.

Hypothesis 2 focused on the depictions of personality and physicality, positing that commentary discussing these two traits would be most frequently found in the pundit’s dialogue. Table 2 presents the distribution of dialogue about athletes’ personality and physicality between the pool of on-air talent.

Table 2 shows that the play-by-play commentator actually mentioned significantly more personality descriptors. The total difference ($\chi^2(1) = 14.03; p < 0.01$)

derives from a great imbalance of assessments of emotionality ($\chi^2(1) = 25.41$; $p < 0.01$) as other types of comments were equally split among the two announcers. Despite the prevision, it was the announcer, not the color commentator the one that provided significantly more attributions of personality and physicality descriptors about competitors. Hypothesis 2 is thus rejected.

The third type of commentary was neutral dialogue between the two

announcers. This dialogue was divided into two categories: one included references to background information and the other comprised of factual and other information about the competitors. Hypotheses 3 and 4 provide the assumption that the play-by-play announcer will convey more of both background and factual commentary. Table 3 shows the distribution of both types of comments.

Table 1. *Evaluative attributions by commentator.*

Category	Play-by-play commentator		Color commentator		$\chi^2(1)$	<i>p</i>
	N	Share	N	Share		
Concentration	12	29.3%	29	70.7%	11.89	***
Athletic skill— Strength/Speed	9	20.4%	35	79.6%	22.56	***
Athletic skill— Talent/Ability	312	54.9%	256	45.1%	0.26	
Composure	49	69.0%	22	31.0%	4.88	*
Commitment	43	69.4%	19	30.6%	4.48	*
Courage	8	72.7%	3	27.3%	1.25	
Experience	182	85.4%	31	14.6%	74.95	***
Intelligence	1	25.0%	3	75.0%	1.56	
Consonance	249	34.3%	477	65.7%	138.78	***
Stated expectations	258	53.2%	227	46.8%	1.55	
<i>Total</i>	1123	50.4%	1102	49.6%	27.80	***

* indicates χ^2 significance at $p < 0.05$.

*** indicates χ^2 significance at $p < 0.01$.

Italicized χ^2 values indicate categories where one or both groups had an expected value of less than five.

Table 2. *Personality and physicality attributions by commentator.*

Category	Play-by-play commentator		Color commentator		$\chi^2(1)$	<i>p</i>
	N	Share	N	Share		
Outgoing/Extroverted	10	71.4%	4	28.6%	1.35	
Modest/Introverted	10	83.3%	2	16.7%	3.64	
Emotional	102	77.9%	29	22.1%	25.41	***
Attractiveness	24	51.1%	23	48.9%	0.46	
Size/Parts of body	11	42.3%	15	57.7%	1.98	
<i>Total</i>	157	68.3%	73	31.7%	14.03	***

*** indicates χ^2 significance at $p < 0.01$.

Table 3. *Background and neutral attributions by commentator.*

Category	Play-by-play commentator		Color commentator		$\chi^2(1)$	<i>p</i>
	N	Share	N	Share		
Background	795	52.7%	713	47.3%	6.59	*
Factual	430	84.5%	79	15.5%	167.54	***

* indicates χ^2 significance at $p < 0.05$.

*** indicates χ^2 significance at $p < 0.01$.

Table 4. *Objective vs. subjective commentary by commentator.*

Category	N	Share
Concentration	41	0.9%
Athletic skill— Strength/Speed	44	1.0%
Athletic skill— Talent/Ability	568	12.7%
Composure	71	1.6%
Commitment	62	1.4%
Courage	11	0.2%
Experience	213	4.8%
Intelligence	4	0.1%
Consonance	726	16.2%
Stated expectations	485	10.8%
Outgoing/Extroverted	14	0.3%
Modest/Introverted	12	0.3%
Emotional	131	2.9%
Attractiveness	47	1.1%
Size/Parts of body	26	0.6%
Background	1508	33.7%
Factual	509	11.4%
Objective commentary	2017	45.1%
Subjective commentary	2455	54.9%
<i>Total</i>	1123	50.4%

Data from Table 3 shows that the announcer did not give significantly more background descriptors; rather, the color commentator spoke more in terms of additional information than his fellow announcer ($\chi^2(1) = 6.59$; $p < 0.05$). In this study, all specific references to gymnastic routines and acrobatic exercises (e.g., “this was a handspring, a salto forward with 2/1 twist”) were classified as background commentary. This pairing was purposely selected to differentiate additional (hence the selection of the “background” category) sport-specific commentary from other types

of factual and neutral dialogue. As this analysis was part of a larger study which applied an existing taxonomy (Billings and Eastman, 2003) to study a number of Olympic events (see Ličen and Billings, 2012), it was not possible to add a sport-specific category assembling “descriptions of routines” to further differentiate it from other types of background information (e.g., nationality). Hence, background commentary—plenty of which consisting of references to routines—was more frequently provided by the technical analyst, rejecting Hypothesis 3. In turn, the play-by-play announcer provided much more factual commentary than the technical analyst ($\chi^2(1)$

= 167.54; $p < 0.01$). This confirms Hypothesis 4.

Finally, a research question was formulated to determine the frequencies of each type of comments in gymnastic broadcasts on TV Slovenija. Table 4 shows that both announcers spoke a total 2,017 objective descriptors (defined as factual and background commentary combined) and 2,455 subjective descriptors (understood as the sum of evaluative commentary, personality, and physicality ascriptions). This equals in a 45/55 ratio of objective vs. subjective commentary. The single type of comment that was most frequently spoken by the announcers was background information (33.7%). Evaluative dialogue most often involved assessments of consonance (16.2%), athletic talent and ability (12.7%), and speculations on likely outcome, placings etc. (10.8%). All in all, in gymnastics broadcasts on TV Slovenija, objective commentary constitutes 45% of the dialogue, while subjective commentary amounts to 55% of on-air speech, answering research question 1.

DISCUSSION

Starting from behind, this content analysis has shown that the share of broadcasters' subjective commentary in gymnastics is considerably higher than that found in team sports (Bryant, Comisky and Zillman, 1977; Woo, Kim, Nichols and Zheng, 2010). This holds true even when comparing gymnastics and team sports broadcasts within Slovenia (Ličen and Doupona Topič, 2008), eliminating the possibility of specific cross-cultural influences. Individual sports thus provide ample opportunity for interpretation. What this means for the viewers can be only partially predicted: actual meaning is produced through "a negotiation of the many levels of meanings implicit in the text and the many levels of social group, class, and individuality embedded in the audience member" (Real, 1989: 59). The learning experience is thus an individualized occurrence. Nonetheless, there are likely

some general characteristics that apply to broadcasting content world-wide: even though the shares of distinct types of comments were significantly different than those found in U.S. prime-time broadcasting (Billings, Angelini and Duke, 2010), evaluative commentary in both nations most often relied on assessments of athletic talent and ability, experience, and consonance.

The technical commentator provided abundant background information which included details about gymnastic routines and acrobatic exercises. This confirms that sports broadcasts provide information in addition to entertainment, fulfilling the content and mission traditionally ascribed to public broadcasting (and, to some extent, to the media in general). Since its foundation in 1927, the core responsibility of the British Broadcasting Corporation was to "inform, educate and entertain." This ethos is widely adopted in other European countries (Holtz-Bacha and Norris, 2001). Although the role of sport media is often perceived as limited to entertainment, this study confirms that sportscasts can provide sports-specific information, in addition to information about the world in general (Real, 1989; Billings, 2008).

Approximately five percent of the dialogue consisted of personality and physicality descriptors. As competitors in the Olympics are deemed representatives of distinct social groups (typically their nations, but also gender groups etc.), the way they are described might influence the perception of all members of the same group (Tajfel, 1981). Artistic gymnastics is especially prone to gender stereotypes as it is considered a "female-appropriate" sport (Vincent, Imwold, Masemann and Johnson, 2002). It is also a specific sport in that aesthetics can influence the score awarded by the judges. Here, most descriptors that were coded as focusing on attractiveness actually referred to elegance (e.g., "an extremely elegant competitor"). At times, female competitors were referred to as "girls" (Sl. *dekleta*), potentially constructing their image according to an adolescent ideal (Duncan, Jensen and Messner 1993).

However, analogous descriptors were used to describe male competitors as they were referred to as “boys” (Sl. *fantje*). Such descriptions fall short of journalistic standards which state that males and females above the age of 18 are to be referred to as men and women, respectively (Reuters, 2008). Here, they likely served more to establish a sense of familiarity with the competitors, rather than diminishing their value.

In addition to providing sports-specific information, TV Slovenija’s technical analyst provided copious amount of interpretive commentary aimed at explaining athletic success and failure to the viewers. The role was filled by a gymnastics expert and former coach. During the broadcasts, he often provided insight into the routines, directing the viewers’ attention to technically relevant details (e.g., “his shoulders are leveled with the bottom part of the rings”) and explaining consequences of successful or mistaken exercises (e.g., “this is one tenth of a point’s deduction as there was a slight lost of balance”). Such subjective commentary is certainly admissible and desirable when the person providing it is an expert in the sport.

Content analyses often study potentially nationalized sports broadcasting. The construction of an imagined national community by employing the rhetoric of the first person plural has been found to occur in many nations (Billig, 1995) including Slovenia (Ličen and Billings, 2012). In gymnastics, every Slovenian national mentioned during broadcasted dialogues was referred to as “ours” at least once (e.g., “our Mitja Petkovšek”), and 26 out of a total of 149 descriptors (17.4%) pertaining to Slovenian athletes involved this attributive pronoun. This may still seem relatively small until compared to entities such as U.S.-based NBC, who as the result of a conscious effort to ban specific pronouns to determine “their” team never used this attributive pronoun (0.0%) when describing American athletes (Billings, 2008). Only two athletes representing Slovenia competed in the gymnastics competition in Beijing,

and only one of them was shown during the broadcasts analyzed in this study. This does not suffice to generalize any nation-specific findings that might surface from a comparison of the network’s “home” and “rival” athletes; however, it does point to a clear tendency to emphasize national feelings. Also noteworthy is the lack of derogatory commentary found in Slovenian athletic broadcasts (Ličen and Billings, 2012); even though Mr. Kavčič and Mr. Čuk openly cheered for Slovenian competitors, their emotional outpurs were limited to expressions of support for Slovenian athletes and did not cross into insulting or derisive references to other competitors’ looks, clothing, names, or past experiences.

CONCLUSION

Media portrayal plays an essential role in securing the exposure and popularity of any sport. Ideally, TV networks that broadcast sports appoint independent and trained professional announcers to provide detailed accounts of a sports competition. However, experience from Slovenia and some other post-socialist nations (Ličen, 2009) shows that sometimes, announcers with limited knowledge or skills are hired to comment on sports that are less popular in that particular environment. This was not the case for broadcasts of Olympic gymnastics in Slovenia as a former coach was hired as technical analyst to complement a play-by-play announcer.

One of the potential limitations of this study is the small sample of announcers whose dialogue was observed. Analyzing the dialogue of the network’s two regular gymnastics broadcasters certainly provides a representative picture of media content in this sport but might differ from announcing styles in other individual sports. Yet, this testifies that two commentators wield tremendous narrative power with the masses: the couple was thus the only source of both technical information and personal stories. As a consequence, their commentary and approach became TV

Slovenija's stance and policies on one of the most popular Olympic sports.

This study has shown that as much as 55% of on-air dialogue during gymnastics broadcasts was evaluative—a share considerably higher than those found in studies involving team sports broadcasts. The color commentator provided more evaluative descriptions and background information (especially concerning the gymnasts' routines), while the play-by-play announcer offered more factual commentary, as well as more attributions of personality. Gymnastics broadcasts thus offer plenty of opportunities to entertain, inform, and educate even about topics that go beyond topics in sports (see Real, 1989; Billings, 2008). Further analysis should be aimed to assessing the extent to which broadcasters in different societies actually engage in them and thus provide viewers with an experience that goes beyond the enjoyment of gymnastic routines.

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Corresponding author:

Simon Ličen. PhD

Slamnikarska 6

SI-1234 Mengeš

Slovenia, EU

Simon.Licen@guest.arnes.si

+386-41-397-139 (Cell)

simonlicen (skype)

KINEMATIC AND KINETIC ANALYSIS OF COUNTER MOVEMENT JUMP VERSUS TWO DIFFERENT TYPES OF STANDING BACK SOMERSAULT

Bessem Mkaouer¹, Monem Jemni², Samiha Amara¹, Helmi Chaabèn¹,
Zouhair Tabka³

¹Higher Institute of Sport and Physical Education of Ksar Said, Tunisia

²School of Science, University of Greenwich, London, United Kingdom

³Faculty of Medicine of Sousse, Tunisia

Original research article

Abstract

The aim of this study was to compare the take-off's kinetic and kinematic variables between three types of jumps from a standing position: counter movement jump with arm swing (CMJa), standing back somersault with landings on the spot (BSIs) and standing back somersault with rear displacement at landing (BSId). Five elite level male gymnasts (age 23.17 ± 1.61 years; height 165.0 ± 5.4 cm; weight 56.80 ± 7.66 kg) took part in this investigation. A force plate and a 3D movement analysis system were synchronized and used for data collection. Statistical analysis via non-parametric Kruskal-Wallis test showed a significant difference between the take-off variables. The vertical component of force, peak power, impulse and displacement of the centre of mass were significantly different ($P < 0.01$). Similarly, the horizontal component of force, maximum speed, peak power and displacement of the centre of mass were significantly different ($P < 0.01$). However, vertical velocity remained relatively constant. In conclusion, the standing back somersaults performed on the spot's variables (without back displacement) were very similar to the ones analysed during counter movement jump with arm swing. The standing back somersault with landing on the spot allowed better force impulse. This was facilitated by a take-off closer to the centre of mass, unlike the standing back somersault with rear displacement in landing. Analysing kinetic and kinematic together, allowed the endorsement of linear regression equations enabling the prediction of some variables from others.

Keywords: *gymnastics, take-off, thrown off centre, reaction force.*

INTRODUCTION

Jumps take an important part of gymnastics men and women's daily routines. Gymnasts' ability to transmit their impulse from their feet to their upper bodies following rebounds is crucial, allowing acrobatic skills such somersaulting and twisting. Artistic gymnastics has seen amazing evolution throughout the last five

decades (Jemni, Friemel, Sands & Mikesky, 2001). Exhibited strength, power, flexibility and spatial awareness via the incredible complicated aerial skills have contributed in shaping a new profile of the modern gymnast (Jemni, 2011; Jemni, Sands, Friemel, Cooke & Stone, 2006). This lately is nowadays able to perform triple tacked

somersaults and even quadruple twists in one straight back. How could they do it? How important is to learn the “perfect” jumping technique? Are there any variables to analyse enabling coaches to dissociate the “good”, the “bad” and the “useful” jumps?

Vertical jumps are used in a plenty of sports. Their primary goal is usually to reach the greatest possible height (Psycharakis, 2012). Other goals could also include rotation in acrobatic somersaulting. Gymnasts’ jumping ability is often linked to successful performance (especially in floor routines and vault) and is sometimes considered as an overall indicator of gymnastics proficiency. Gymnastics’ performance is largely defined by the ability to successfully jump complex forward and backward rotating skills. Video analysis of world-class gymnastics competitions has shown gymnasts performing more backward rotation skills than forward ones (McNitt-Gray, 1992; Munkasy, McNitt-Gray, Michele & Welch, 1996; Harski, 2002; Sadowski, Boloban, Wiśniowski, Mastalerz, & Niżnikowski, 2005). This current study would put some more insight on the nature of the backward take-offs. Analysing the mechanics of ground reactions forces during different jumping cases could add significant understanding and tools for coaching. Reaction force passes through the centre of mass (COM) during vertical jump; meanwhile this force would be thrown off centre forward during a backward rotation. Performing somersaults from a standing position requires a production of significant amount of force and velocity during take-off phases. The transfer of force depends on the gymnast’s ability in backward rotating skills. Relatively large number of authors have analysed various executions of backward somersaults (Payne & Barker, 1976; Bruggemann, 1983; Lacouture, Junqua, Duboy, & Durand, 1989; Knoll, 1992; Newton, Turner, & Greenwood, 1992; Hong & Brüggemann, 1993; McNitt-Gray, Munkasy & Welch, 1994; Duboy, Junka, & Lacouture, 1994; Medved, Tonković & Cifrek, 1995). Conversely, there is a paucity of literature that explores ground reaction

forces during take-offs. Mc Nitt-Gray, Hester, Mathiyakom and Munkasy (2001) studied the mechanical demand during landing after three skills: the forward somersault, the backward somersault and the drop jump. Medved (2001) has studied ground reaction force during gymnasts’ take-off while performing two skills: backward somersault and straddle jump, both performed from a standing position. Lebeuf, Lacouture and Bessonnet (2003) analyzed the COM path during a successful and a failed backward somersault. Other studies have examined the vertical jump as in artistic gymnastics (Marina, Jemni & Rodríguez, 2012; Sands, 2011; Sands, Stone, McNeal, Jemni & Haff, 2006; Swartz, Decoster, Russell & Croce, 2005; Marina, Busquets, Padulles & Camps, 2005; Marina, 2002). Very recently, Marina, Jemni, Jimenez & Rodríguez (2012) have thoroughly investigated jumping abilities in significant number of gymnasts and compared them to a matching control group. They have come-up with a very important conclusion showing that studying jumping ability should take few variables into consideration. Flight time, contact time and power output are not enough to dissociate gymnasts; other variables such as Bosco expression and flight to contact times ratio should also be calculated for a more significant profiling purpose. For these reasons, the current study has not only analysed dynamic data acquired by a force plate but also kinematic data collected by synchronised cameras.

The purpose of this study was to compare the take-off’s kinetic and kinematic variables underpinning gymnasts’ ability to perform the counter movement jump with arms swing (CMJa), the standing back somersault with landing on the spot (BSIs) and the standing back somersault with rear displacement in landing (BSId).

METHODS

Five elite level male gymnasts (age 23.17 ± 1.61 yrs; height 165.0 ± 5.4 cm; weight 56.80 ± 7.66 kg) took part in this

study. The inclusion criteria were: to be ranked at international level with participation in world cups and/or championships; average training volume around 25 hours per week; healthy without any muscular, neurological or tendinitis injuries; able to perform back somersaults on the spot. After being informed on the procedures, methods, benefits and possible risks involved in the study, each subject reviewed and signed a consent form to participate in the study. The experimental protocol was performed in accordance with the Declaration of Helsinki for human experimentation and was approved by the university ethical committee.

The investigation's design contained a dual approach: kinematic and kinetic of three types of take-offs from a standing position. The direction of reaction forces was different between the three skills during the push-off phases (Figure 1):

- It passes through the centre of mass (COM) during the counter movement jump with arm swing (CMJa) (Figure 1a);
- It is thrown off centre forward but close to the COM during the standing back somersault with landings on the spot (BSIs) (Figure 1b);
- It is very thrown off centre forward during the standing back somersault with rear displacement at landing (BSId) (Figure 1c).

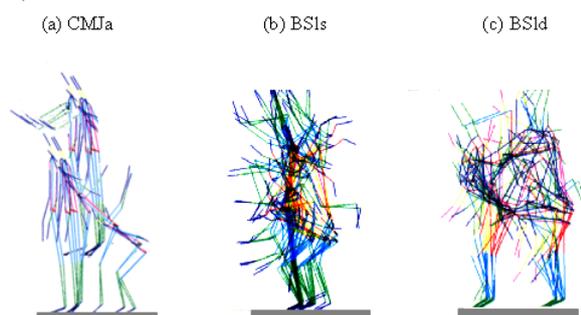


Figure 1. Kinogrammes of three types of take-off from a standing position. (a) counter movement jump with arm swing; (b) standing back somersault with landings on the spot; (c) standing back somersault with rear displacement in landing.

Kinetic data were acquired using a 60×40 cm Kistler force plate (Kistler

Instruments, Switzerland. Ref. 9281C). Sampling frequency was 500 Hz, and the measuring range was set between 10 to 20 kN. Vertical (F_y) and horizontal (F_x) force variables, the COM displacement (dx ; dy), velocity (v_x ; v_y), peak power (P_x ; P_y) and impulse (I_x ; I_y) were analysed. Analysis was performed with a Bioware Performance Software 5.1.1 (Kistler Instruments, Switzerland).

Kinematic data were acquired using two high-speed cameras (NAC HSV-500C3; 250 Hz) in NTSC format with VCR C3D and SVHS tape. A motion analysis software (Movias, NAC Corp, Santa Rosa, CA) was used to process the data. 20 retro-reflective body markers were attached to the gymnasts' bodies allowing digitisation using a video based data analysis system (Movias for Windows 2.0.4). The body segments' centres of mass were computed using Matshui model (1983). Take-off angle (α_T), shoulder angle (α_S), hip angle (α_H) and knee joint angle (α_K) were analysed and compared at the different take-offs. Angular displacements of these respective joints (θ_S , θ_H and θ_K) and their angular velocities (ω_S , ω_H and ω_K) were calculated in the sagittal plane. Data acquisition and testing were carried out in a laboratory setting. All tests were performed within a 3-day period, starting at 4:00_{PM} up to 6:00_{PM} under the following environmental condition: average temperature 23°C (minimum 20, maximum 26°C). The force plate was synchronized with the two high-speed cameras. The first camera was placed in front of the subject and the second sideways, each at 5m from the centre of the force plate (figure 2). All participants wore only a short during testing to allow digitising. They were given ten-minute warm-up period including light jog, stretching and several jumps and somersaults with stable landing. Each gymnast performed each jump three times in separate days. The choice of jumps and/or somersaults was randomised using Latin Square randomisation protocol (Zar, 1984).

The execution of each skill was separated by a two-minute recovery period between repetitions. Two international

judges marked each somersault by referring to the Code of Points FIG (2009). Only the best somersault was retained for analysis and comparison.

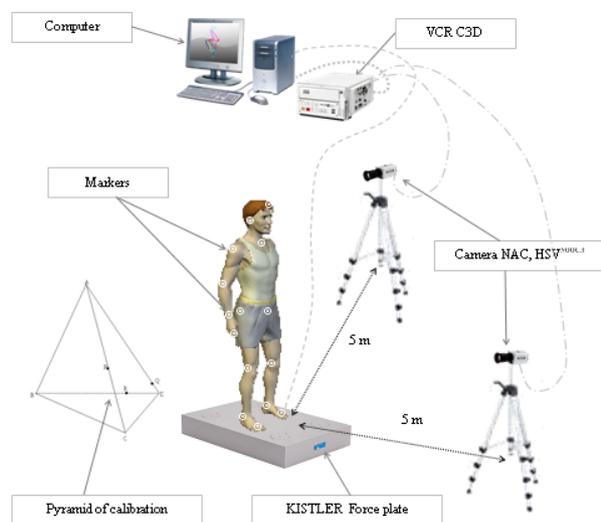


Figure 2. *Experimental setup.*

Data are reported as mean \pm standard deviation (SD). The distributions' normalities, estimated by the Kolmogorov-Smirnov test, varied between variables. Therefore, we used the non-parametric Kruskal-Wallis test to compare all take-offs' variables, while the U test of Mann-Whitney was applied to pair-wise the somersaults and CMJ comparison. Spearman correlation analysis was performed to check any relations between the CMJ and the back somersaults. The results are considered significantly different when the probability is less than or equal to 0.05 ($P \leq 0.05$). Statistical analyses were performed using the software package SPSS version 13.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

All kinetic data for the BSld have almost doubled in comparison to the tow other conditions. Significant statistical increases were noticed in all horizontal components: the horizontal force component (Fx) has increased by 63.36% during the BSld when compare to the CMJa and by 39.18% when compared to the BSls ($P < 0.01$) (Table 1). Similar results were

noticed for the horizontal velocity (vy): [+41.36% compared to CMJa ($P < 0.05$), (+51.49% compared to BSls ($P < 0.01$)), the horizontal peak power (Px): [+50.87% compared to CMJa ($P < 0.01$) and +50.34% compared to BSls ($P < 0.01$)] and the horizontal impulse (Ix): [+36.23% compared to CMJa ($P < 0.05$) and +51.03% compared to BSls ($P < 0.01$)] (Table 1).

The magnitude of change has ranged between 10% to 22% when it came to compare the vertical components. Force vertical component (Fy) has significantly increased by 10.04% during the CMJa in comparison to the BSld ($P < 0.01$). Similarly, peak power's vertical component (Py) has significantly increased during the same take off compared to the tow other conditions: [by 19.031% compared to BSld ($P < 0.01$) and by 11.81% compared to BSls ($P < 0.05$)].

Looking at the absolute data, the CMJa and BSls showed the highest level of vertical force, followed by BSld (1808.89 \pm 97.06 N; 1806.87 \pm 78.08 N; 1625.55 \pm 62.64 N respectively). Moreover the horizontal component of force was the highest during the BSld take-off (very thrown off centre). The BSld developed more force than the BSls and the CMJa (209.44 \pm 4.80 N; 126.65 \pm 22.14 N; 127.38 \pm 7.97 N respectively) (Figure 3).

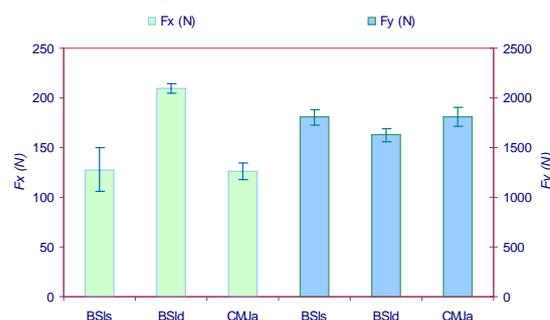


Figure 3. *Horizontal and vertical forces produced during the three take offs.*

Vertical axis' variables were different during the impulse of the three take-offs (214.91 \pm 9.37 N/s; 194.72 \pm 3.82 N/s; 176.31 \pm 20.82 N/s respectively for CMJa, BSls and BSld). Moreover, the horizontal axis of the impulse was higher during the BSld compared to the BSls and to the CMJa (23.80 \pm 3.84 N/s; 18.28 \pm 2.68

N/s; 17.91 ± 6.09 N/s respectively) (Figure 4). Impulse's vertical component of (I_y) has significantly increased during the BSls compared to the other conditions: [by 21.89% compared to BSld ($P < 0.01$) and by 10.37% compared to CMJa ($P < 0.05$)].

Vertical velocity was almost the same between BSls, BSld and CMJa (3.05 ± 0.04 m/s, 3.40 ± 0.40 m/s; 3.57 ± 0.37 m/s respectively); however, and as expected, the horizontal velocity was the highest during BSld, followed by the BSls and CMJa (0.41 ± 0.07 m/s; 0.29 ± 0.05 m/s; 0.20 ± 0.04 m/s

respectively). This increase is indeed a basic condition allowing backward rotation, and is supported by the fact that power generated on the horizontal axis was greater during the BSld compared to BSls and CMJa (279.00 ± 60.34 W; 138.08 ± 35.00 W; 137.54 ± 27.62 W respectively). In contrast, the peak power produced on the vertical axis was more important during CMJa and BSls than during BSld (4774.12 ± 231.98 W; 4269.72 ± 245.65 W; 4010.94 ± 368.00 W respectively) (Figure 5).

Table 1. Comparative statistics of the three take-offs.

Variables	Kruskal Wallis		Mann-Whitney Test						
	Test		CMJa vs. BSls		CMJa vs. BSld		BSls vs. BSld		
	K ²	Sig.	Z	Sig.	Z	Sig.	Z	Sig.	
Kinetic	F _x (N)	9.517	0.009**	-0,522	0,602	-2,619	0,009**	-2,619	0,009**
	F _y (N)	9.380	0.009**	-0,104	0,917	-2,611	0,009**	-2,611	0,009**
	V _x (m/s)	11.060	0.004**	-2,193	0,028*	-2,402	0,016*	-2,611	0,009**
	V _y (m/s)	5.840	0.054	-2,402	0,016*	-1,358	0,175	-0,94	0,347
	dx (m)	9.500	0.009**	-0,522	0,602	-2,611	0,009**	-2,611	0,009**
	dy (m)	7.620	0.022*	-1,358	0,175	-1,567	0,117	-2,611	0,009**
	P _x (W)	9.380	0.009**	-0,104	0,917	-2,611	0,009**	-2,611	0,009**
	P _y (W)	8.340	0.015*	-2,193	0,028*	-2,611	0,009**	-0,731	0,465
	IF _x (N/s)	10.640	0.005**	-2,402	0,016*	-1,984	0,047*	-2,611	0,009**
	IF _y (N/s)	11.180	0.004**	-2,611	0,009**	-1,984	0,047*	-2,611	0,009**
	Kinematic	α_T (°)	12.50	0.002**	-2,611	0,009**	-2,611	0,009**	-2,611
α_S (°)		8.960	0.011*	-2,402	0,016*	-2,611	0,009**	-0,731	0,465
α_H (°)		2.060	0.357	-0,313	0,754	-1,567	0,117	-0,731	0,465
α_K (°)		9.380	0.009**	-2,611	0,009**	-2,611	0,009**	-0,104	0,917
θ_S (°)		6.720	0.035*	-0,731	0,465	-2,611	0,009**	-1,567	0,117
θ_H (°)		12.500	0.002**	-2,611	0,009**	-2,611	0,009**	-2,611	0,009**
θ_K (°)		1.820	0.403	-0,104	0,917	-1,358	0,175	-0,94	0,347
ω_S (°/s)		7.580	0.023*	-0,731	0,465	-2,402	0,016*	-2,193	0,028*
ω_H (°/s)		0.420	0.811	-0,522	0,602	-0,313	0,754	-0,522	0,602
ω_K (°/s)	7.460	0.024*	-1,984	0,047*	-2,611	0,009**	-0,94	0,347	

* Significant at $P < 0.05$; ** Significant at $P < 0.01$

Kinematic study has provided the following results: the take-off angle (α_T) relative to the vertical axis was significantly decreased in the BSld condition in comparison to the two other conditions ($P < 0.01$): by 5.01% and by 13.45% compared to BSls and to CMJa respectively. Similarly, the angle of shoulder joint at

take-off (α_S) was also significantly decreased by 18.22% during the BSld compared to the CMJa ($P < 0.05$). The angle of knee joint at take-off (α_K) was significantly decreased at almost a similar percentage during the same skill compared to CMJa (18.72%) ($P < 0.01$) (Figure 6).

Furthermore, the angular displacement of the shoulder joint (θ_S) was significantly increased by 9.65% in the CMJa condition compared to BSld ($P<0.01$). More considerable change was noticed in the hip joint. Its angular displacement (θ_H) has significantly increased compared to the two other conditions ($P<0.01$): by 34.50% and by 14.70% compared to BSld and to BSls respectively.

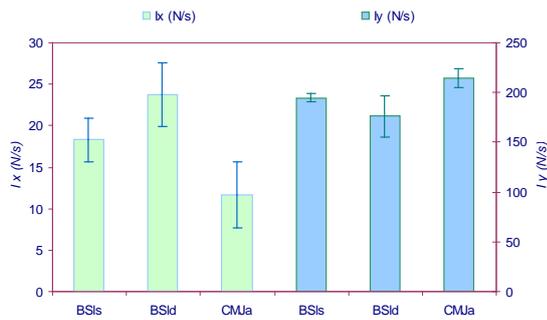


Figure 4. Horizontal and vertical impulse generated during the three take-offs.

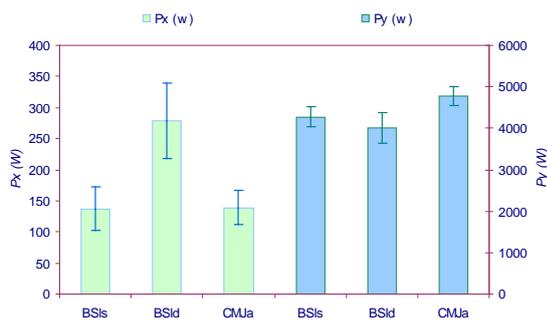


Figure 5. Horizontal and vertical peak power generated during the three take-offs.

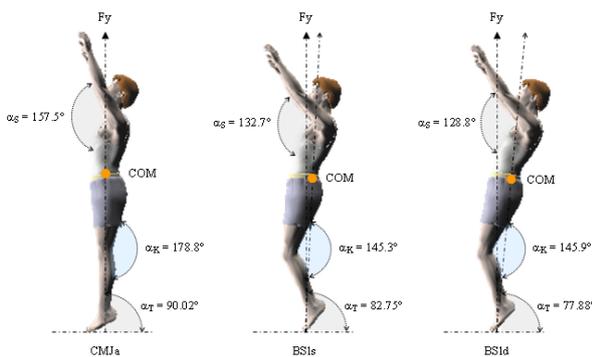


Figure 6. Joint angles during the three take-offs.

Angular displacement of the arms was larger during the CMJa compared to the BSld ($157.51\pm6.77^\circ$ and $128.81\pm7.63^\circ$ respectively) and the flexion of the hip joint

was also more important ($55.48\pm2.05^\circ$; $47.32\pm2.36^\circ$ and $36.33\pm2.65^\circ$ respectively for CMJa, BSls and BSld). Angular velocity of the knee joint (ω_K) was likewise increased during the CMJa compared to the other situations by 27.95% v BSld ($P<0.01$) and by 19.70% v BSls ($P<0.05$). The angular velocity of the shoulder joint (ω_S) was itself, significantly increased in the BSld condition with respect to the two others ($P<0.05$): by as high as 65.53% compared to BSls and by 71.86% compared to CMJa (Figure 7).

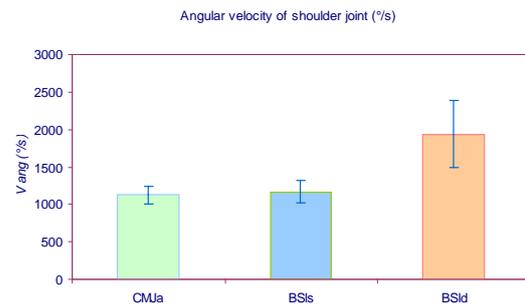


Figure 7. Angular velocity of shoulder joint during the three take-offs.

Lastly, the centre of mass's (COM) vertical velocity (v_y) and the angular velocity of the knee joint (ω_K) did not vary during the different take-offs. In the same way, the hip joint's angle (α_H) at take-off and its angular displacement (θ_H) remained

Correlation analysis showed only one significant relation ($P<0.05$) across all data. It was between the BSls and CMJa and in particular between the vertical component of force (F_y) and displacement (dy) of the COM ($r = -0.900$ and $r = 0.884$ respectively) (Figure 8a and b).

Correlation between the kinematic and kinetic variables showed a significant relation at ($P<0.05$), between the take-off angle (α_T) and the horizontal displacement (dx) of the COM ($r = -0.900$). Similarly, there was a significant correlation at ($P<0.05$), between force's vertical component (F_y) and the angular displacement of the knee joint (θ_K) ($r = -0.900$). A highly significant correlation at ($P<0.001$) was also found between the

vertical peak power (P_y) and the angle of the hip joint (α_H) ($r = 1.000$).

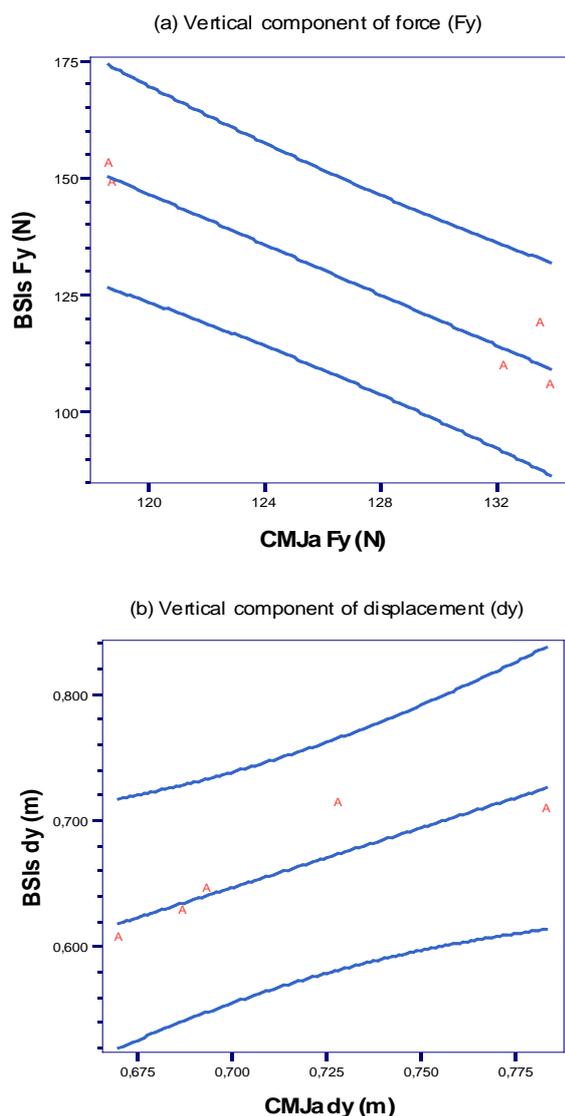


Figure 8. Correlation between SBLs and CMJa

DISCUSSION

This study is focused on the variables that could affect the take-off phases by comparing them between three different jumps/skills. It is indeed well documented that different types of take-offs significantly affect the range of motion (ROM) of the lower limbs and therefore the entire height of the jump and the resultant power output (Marina, Jemni & Rodriguez 2012). In this study, the angle of the knee joints (θ_z) was significantly higher during the CMJa than during the BSls and the BSld. This variation

of ROM during the take-offs could be explained by the direction of reaction force with respect to the COM. If the direction of the force is off COM this could lead to some “wasted effort” and therefore not enough height could be reached. Several studies confirmed that the optimal knee angle that produced the best vertical displacement in gymnasts was around 90° (Salles, Baltzopoulos and Rittweger 2011, Moran and Wallace 2007, Mathiyakom, McNitt-Gray and Wilcox 2006). In this current study, the five gymnasts have reached an average height of $0.71 \pm 0.04m$ during the CMJa, whereas they only reached $0.65 \pm 0.04m$ and $0.60 \pm 0.03m$ during the BSls and BSld respectively (Figure 9). Their horizontal displacement, however was expectedly the highest during the BSld, caused by a take-off very thrown off centre and allowing rotation, as described by Medved et al. 1995; Munkasy et al. 1996; Medved 2001; Leboeuf et al. 2003.

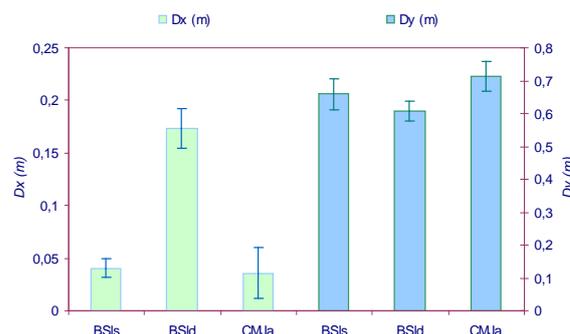


Figure 9. Horizontal and vertical displacement of the COM reached during the three take-offs.

Our investigation confirms, as previous studies, that CMJ allows more significant displacement. This was indeed shown by the knees’ angle that was significantly more important during the CMJs’ take-off compared to BSld and to BSls. Clansey and Lees (2010) suggested a strong relationship between the ROM of the knee and the hip joints during the vertical jump. This could explain the large knee amplitude during the CMJa in our study.

Table 2 highlights the main kinetic and kinematic findings of this study in comparison between the three take-offs. Comparison between the back somersaults showed that the BSld developed less force

and impulse on the vertical axis compared to the BSIs. However, there was a significant increase of the strength, maximum speed, impulse, peak power and displacement at the horizontal axis, as suggested by Medved (2001) and Leboeuf et al. (2003). Comparison between the BSId and CMJa showed, indeed, a very significant difference for all variables except for the vertical velocity of the COM that remained almost at the same level (Table 1). These results confirm similar investigation by Leboeuf et al. (2003), in which they showed that gymnast would miss the back somersault if he was inclined backwards during the take-off. Contrariwise, there was a great similarity between the CMJa and BSIs in most variables, with the exception of the vertical impulse and peak power that were significantly lower, as also suggested by other authors (McKinley and Pedotti, 1992; Medved 2001; Mc Nitt-Gray 2001).

Table 2. *Variation of the main kinetic and kinematic variables at three take-offs.*

Variables	CMJa	BSIs	BSId	
Kinetic	F _x (N)	↘	↘	↗
	F _y (N)	↗	↗	↘
	V _x (m/s)	↘	↘	↗
	dx (m)	↘	↘	↗
	dy (m)	↗	↗	↘
	P _x (W)	↘	↘	↗
	P _y (W)	↗	↘	↘
	I _x (N/s)	↘	↘	↗
	I _y (N/s)	↗	↗	↘
Kinematic	α _T (°)	↗	↘	↘
	α _S (°)	↗	↘	↘
	α _H (°)	↗	↘	↘
	θ _S (°)	↗	↗	↘
	θ _H (°)	↗	↗	↘
	ω _S (°/s)	↘	↘	↗
	ω _K (°/s)	↗	↘	↘

* Where: (↗) is increase; (↘) is decrease.

The increased horizontal force during the BSId was firstly caused by the take-off, which was thrown off centre, secondly by a surplus of horizontal displacement as suggested by (Mc Nitt-Gray, 2001; Medved 2001; Leboeuf et al. 2003). Leboeuf et al. (2003) mentioned that, if a back somersault is performed correctly, the pulse force would be around 200 N/s. These figures are indeed higher than the ones found in the current study as our gymnasts' force pulse ranged between 194.72 ± 3.82 N/s; 176.31 ± 20.82 N/s respectively for the BSIs and BSId (Figure 4). This difference might be related to the fact that our gymnasts performed the somersaults on the spot whereas in Leboeuf et al. (2003)'s study, they performed it after a snap down.

Interestingly, the correlation analysis showed a significant relation between CMJa and BSIs at the force's vertical component and the displacement of COM ($R^2 = 0.94$; $R^2 = 0.78$ respectively). Moreover, correlation analysis between kinetic and kinematic variables showed significant relations between the following: take-off angle (α_T) and horizontal displacement (dx) ($R^2 = 0.89$); vertical force component (F_y) and angular displacement of the knees joint (θ_K) ($R^2 = 0.75$); vertical peak power (P_y) and the hips joint angle (α_H) ($R^2 = 0.97$). Thus, we could suggest a linear regression to predict the kinetic performance variables from the results of the kinematic study and vice versa. The regression equations would be:

Prediction of kinetic variables from kinematic data:

$$d_x (m) = -2.26 + (-0.02 \times \alpha_T (^\circ))$$

$$F_y (N) = 2429.88 + (-9.26 \times \theta_K (^\circ))$$

$$P_y (W) = -185737.31 + (1061.23 \times \alpha_H (^\circ))$$

Prediction of kinematic variables from kinetic data:

$$\alpha_T (^\circ) = 91.48 + (-36.02 \times d_x (m))$$

$$\theta_K (^\circ) = 219.35 + (-0.08 \times F_y (N))$$

$$\alpha_H (^\circ) = 175.16 + (0.00 \times P_y (W))$$

Where: (dx) is the horizontal displacement of the COM; (F_y) is the

vertical force component; (P_y) is the vertical peak power; (α_T) is the take-off angle; (θ_K) is the angular displacement of the knee joint; (α_H) is the angle of hips joint.

The above equations could indeed be considered as a “god saver” for those who can’t afford kinematic lab facilities. Some kinematic variables could indeed be predicted based on accurate kinetic data collection and vice versa.

CONCLUSION

The purpose of this study was to compare the take-off’s kinetic and kinematic variables between (CMJa), (BSIs) and a (BSId). Kinematic analysis showed that gymnasts performed a more important flexion of the knees and an inclination of the trunk during the CMJa than during the two other standing back somersaults. This range of motion seems to allow for better vertical force, displacement and peak power. In addition, it allows a minimum loss of force and power on the horizontal axis.

The kinetic analysis showed great similarities between the BSIs and the CMJa variables of strength, impulse, displacement and peak power on both the vertical and horizontal axis. As for the BSId, this take-off very thrown off centre forward, seemed to disfavour the gymnast from reaching a maximum elevation of the centre of mass during the standing back tucked somersault.

As expected, the take-off that passes through the COM, allowed better amplitude of movement than the take-offs thrown off centre forward. The CMJa and BSIs showed the highest level of vertical displacement, force and peak power followed by BSId. This implies that, for a better performance of the standing back somersault, it is necessary that the impulse pass through the nearest point to the COM. Investigating kinetic and kinematic variables together, allowed the endorsement of linear regression equations enabling the prediction of some data from others. As practical implications, we recommend coaches to carefully monitor the position of gymnast's

shoulders and to avoid a backwards inclination at the take-off during a standing back somersault.

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Corresponding author:

Bessem Mkaouer, PhD

bessem_gym@yahoo.fr

Department of Individual Sport and Physical Activities, Higher Institute of Sport and Physical Education of Ksar Said.

2011 Manouba, Tunisia.

Tel: +216 23066716

SOKOL SLETS – THE ESSENCE OF GYMNASTICS IN CZECHOSLOVAKIA, CZECH AND SLOVAK REPUBLIC (CELEBRATING 150 YEARS OF GYMNASTICS)

Anton Gajdoš, Marie Provaznikova, Karel Bednar and Stephen J. Banjak

Bratislava, Slovakia

Original research article

Abstract

History of Sokol gymnastics started in Prague in 1862. The most important task of Sokol organization was healthy nation, which can be more productive and self defending. For the purpose of mass national exercise the Slets were organized. Since organized the first Slet in 1882 and the last one 2012, Slets lived ups and downs, sometimes were even bigger event than Olympic Games. Slets were very influential events, therefore politics interfered and adopted aims and means of Slets; changing name into Spartakiada. With democratic changes in Europe, Slets got new design and image. Internationally idea of Slets was adopted by FIG and in 1953 the first Gimnaestrada has been organised. Despite Sokol is not so powerfull as it was, the main idea of national healthy physical exercise lives further.

Keywords: *gymnastics, sokol, slets.*

INTRODUCTION

One hundred and fifty years ago, on February 16, 1862, the „Prague Gymnastic Unit“ came into being at the Prague Normal School, located then on Panska Street, Bohemia (Gajdoš 2012).

The English term of „sokol“ is falcon; a „slet“ is a rally, gathering or demonstration. The term slet is derived from the Czech „sletat se“, a flying together toward a destination from all the Slav Sokol communities in the world. Pan-slet refers to a gymnastic festival in which Sokols from all nations participate.

The Czech Sokol Society and then the Czechoslovak Sokol Union organized the slets in Prague to demonstrate achievements in the Sokol physical education and national cultural programs and, up to 1918, the Slav Sokol aspiration for freedom and democracy

and liberation of their oppressed nations from foreign bondage. The early slet-festivals were staged at Rifleman Island in Prague, Prague-Bubeneč Park Field, Letna Stadium, and Strahov Stadium. Foreign civil and military dignitaries, along with representatives of educational institutions and physical culture organizations, came to the slets to pay tribute to the Sokols and their achievements, and to learn the principles of Tyrs' Sokol system of physical education. Slav Sokol societies, organizations and federations sent to the slets not only representatives but their gymnasts as well to perform in the slet program. Thus, gymnasts came from Russia, Serbia, Slovenia, Croatia, Bulgaria, the United States, Poland, and Yugoslavia, with larger representations after World War One.

Pan-Sokol Slet, Prague, June 18-19, 1882

Staged at Rifleman Island and directed by Dr. Miroslav Tyrs, the chief physical director of the Sokol of Prague and the founder of the Sokol movement. 700 gymnasts performed from 76 Sokol units in Bohemia and Moravia-Silesia. Sokols from Paris, Croatia and Ljubljana, Slovenia participated.

Pan-Sokol Slet, Prague, June 27-30, 1891

This slet was planned for June 1887 but was forbidden by the Austrian authorities. It was then organized two years later and staged at the Prague-Bubeneč Park Field. In its program participated 207 Sokol units with 2373 performing gymnasts and 5520 Sokol members in official uniforms in the grand parade. Two hundred and twenty-four six-man teams registered for gymnastic competitions. Sokols from the United States, Croatia, Slovenia, Galicia and Paris (gymnasts from the French Gymnastic Federation) also participated in the program. At that time the Czech Sokol Union consisted of 229 local units with 24.268 members.

Pan-Sokol Slet, Prague, June 28 – July 1895

Staged in Letna Stadium which was constructed to accommodate 8.000 performing gymnasts and 50.000 spectators. Directed by the CSU chief physical director, JUDr. Jindra Vanicek. 7.533 members in official uniforms marched in the grand parade with other members from 346 Sokol units. 4.287 gymnasts performed in the program. 439 six-man teams participated in gymnastic competitions. At this time, the Czech Sokol Union consisted of 405 local units with 44.660 members, of which 11.225 were active gymnasts. Sokols from Paris, Croatia, Slovenia and Galicia attended the slet.

Pan-Sokol Slet, Prague, June-July 1st, 1901

Staged again at Letna Stadium, now enlarged to accommodate 75.000 spectators. Directed by Jindra Vanicek. 11.095 members in uniforms among thousands of others in national costumes marched in the grand parade through the streets of Prague. 6.705 men, 867 women and 19.000 juniors performed in the program. Sokols from the United States, Russia, Croatia, Slovenia, Galicia and Montenegro, along with officials from Denmark and Bulgaria, attended the slet. At the end of 1900, the Czech Sokol Union consisted of 37 districts, 571 local units with 47.420 members, of them 9.808 active gymnasts.

Pan-Sokol Slet, Prague, June 16 – July 1st, 1907

Staged at Letna Stadium under the auspices of the Slav Sokol Federation, directed by its chief physical director, Jindra Vanicek. 12.415 men and women in uniforms and national costumes marched in the grand parade. 8.100 men and 2.372 women performed in the various gymnastic compositions. In the program was a number, the „Chess Tournament,“ symbolizing the Hussite victory under Jan Zizka over the Hungarian and Czech King Zigmund in 1422 at Nemečky Brod, Bohemia. Its first presentation was on June 8, 1907. The singing society „Hlahol“ presented a concert at the city auditorium to welcome and honor the official guest delegations of the Slav Sokol organizations. The slet was attended by Sokols from Paris, Russia, Serbia, Croatia, Slovenia, Galicia, Bulgaria, and the United States. The Slovak Sokol U.S.A. for the first time sent a 7-man team which performed one day in the slet program. On Childrens Day (June 16th) 1.800 boys and girls performed in games, races and various contests. On Juniors' Day (June 23rd) 2.000 boys and 600 girls performed (boys in two divisions: 1.400 students, ages 8-14 and 600 industrial apprentices, ages 14-18) the routine calisthenics, games and races. June

27th Prague Choir „Hlahol“ Concert held at the city auditorium to honor officials from foreign governments and institutions and the Slav Sokol organizations. On June 28th Low and High Divisions and Championship Gymnastic Competitions were held; a concert at the stadium in the afternoon. On June 29th gymnastic competitions continued. In the afternoon there was a joint performance of men and women with Indian clubs; exhibition of gymnastic champions on apparatus, and a performance by French and Belgian gymnasts on apparatus. On June 30th at Letna Stadium there was a grand parade in the morning through the streets of Prague with 12.144 uniformed men and women. Thousands of marchers stopped at the Old City Square in front of the Old Town Hall of Prague to pay tribute to the City Council and the people of Prague for their hospitality, the significant contributions of money, and food, and for the housing facilities. In the afternoon 8.000 men presented their symbolic mass calisthenics; 2.372 Sokol women performed exercises with Indian clubs, and were followed by an exhibition of men's wrestling. At the end of the afternoon program, results of the gymnastics competitions were announced. On July 1st, 1907 at Letna Stadium track and field competitions progressed in the morning along with a Sokol calvary exhibition. In the afternoon selected district groups presented artistic gymnastics and special compositions with gymnastic implements. (Note: Because the programs of the later Pan-Sokol Slets were quite similar to the program of the 1907 Vth slet, descriptions of these later events will include only the participants and their numbers, and special events presented for the first time.)

Pan-Sokol Slet, Prague, May 25 – June – July 1st, 1912

Staged at Letna Stadium under the direction of Jindra Vanicek, chief physical director. Presented under the auspices of the Slav Sokol Federation commemorating the 50th anniversary of the Sokol movement

(1862-1912). 23.000 Sokol men and women in official uniforms and regional costumes marched in the grand parade. 17.000 men, women and juniors performed in the program. A „Marathon“ tableau was staged in the stadium symbolizing the historic scene in ancient Athens after the battle of Marathon. This spectacle replaced „The Chess Tournament“ that was presented at the previous slet. The cities of Paris London and Petrohrad and their scientific institutions sent their representatives to the slet. Foreign and Slav Sokol organizations participated, among them the Gymnastic Federation of France, the Sokol of Paris, Slav Sokols from Russia, Serbia, Croatia, and Slovenia, and the Czech and Slovak Sokol of the United States.

Pan-Sokol Slet, Prague, June 1920

Staged at Letna Stadium under the auspices of the Czechoslovak Sokol Union and directed by Jindra Vanicek. On Sunday, June 6th, students from grammar and high schools opened the slet festivities in the presence of President T.G.Masaryk and 60.000 spectators. About 34.000 junior gymnasts (boys and girls, ages 14-18) participated and performed in their own grand parade, in the Junior Sokol Day, and in one day of the main gymnastic program. With 36 square feet of space needed for one performing gymnast in mass calisthenics, only about 10.000 gymnasts could be squeezed into one performance out of the registered 20.000 men and the same number of women. Divided in two divisions, all the attending gymnasts performed on the main slet days. The human colossus of 36.000 marchers moved through the Prague city sections and through historic Wenceslaus Square (Vaclavske Namesti). Thousands of marchers together with the officials of the Czech Sokol Union and of the General Slet Committee, stopped at the Old City Square in front of the Old City Townhall, to pay tribute to the City Council and the people of Prague for their unprecedented hospitality and contribution to the successful fulfillment of the Seventh Sokol Slet. On the

28th, at the presidential seat at Hradcany, the officials of the Czech Sokol Union's presidium and of its Gymnastic Department, along with representatives of the Yugoslav Sokol Federation, presented to President T.G. Masaryk a marble-based bronze and gold studded plaque of an enlarged Sokol membership emblem with the engraved words: „The Grateful Sokols – June 1920!“ On one of the ribbons was pinned an actual membership emblem. Post-World War One financial, economic, and business conditions in general and food shortages in particular were so serious that there had been strong sentiment in the leadership of the organization as well as among the membership for the postponement of the projected 1920 slet. The main problem was how under such conditions the slet General Committee could secure enough housing facilities and sufficient quantities of food for the slet kitchens, city hotels and restaurants, to feed hundreds of thousands of slet participants as well as the people of Prague and visitors from other nations. The problem was largely resolved through dollar loans and through contributions of flour and foodstuffs by the American Czech and Slovak Sokol organizations and other societies. Moreover, the City Council and the departments of the national governments greatly assisted in terms of housing facilities and food supplies. A tax on the membership helped to relieve the financial burden. Thus, the slet preparations were able to commence in full force.

Pan-Sokol Slet, Prague, June 3 – July 6, 1926

The extensive and diverse program of the VIII Pan-Sokol Slet was staged at the newly-constructed Strahov Stadium with tribunes and galleries for 135.000 spectators and an arena for 15.000 performing gymnasts in one mass calisthenics composition. It was scheduled for 17 days in the stadium, the city auditorium, various playhouses, the National Opera House, and in various city and school facilities (including swimming pools), on historic city squares

(such as the Prague Old City Square) and in the Slovak mountains for the winter games. The events at the stadium were directed by Jindra Vanicek, assisted by the chief physical directness, Sis. Milanda Mala. Most of the events outside the stadium were directed by the leaders of the performing groups. The slet program consisted of the following elements:

Gymnastics

Mass performances of calisthenic compositions; group exhibitions of exercises with various implements; group performances of guest Slav Sokol organizations; presentation of Czech, Moravian and Slovak folk dances; exhibition of military drills (by units of infantry, cavalry, and artillery); children's games and races; a symbolic gymnastic presentation by thousands of men and women of a „Sun City“ tableau; gymnastic competitions of men, women and juniors; competitive games of Sokol children; water sport contests; track and field contests; Slav Sokol Federation championships; winter sport contests; and combative contests and a decathlon.

Demonstrative

Grand march of all members; juniors' and childrens' grand march; students' grand march; welcoming mass gatherings; tribute to official delegations from foreign countries. Registered for the slet program and performing in individual events were 82.400 Sokol men and women, 63.000 junior boys and girls, and 40.000 Sokol children. The daily performances at the stadium were observed by some 100.000 spectators.

Slav Sokol Official Delegations or Participating Gymnasts

Yugoslavia (3.530 men and women with 220 juniors); Lusatian Croat's Society (150 members); Ukranian Sokol Union from Poland; Polish Sokols (unofficially for political reasons); American Czech and Slovak Sokols.

Following foreign Guest Gymnastic Societies were present: French Gymnastic Union, British Gymnastic Society, Belgian Gymnastic Union, Rumanian Teachers

Association, Dutch Gymnastic Union, Finnish Gymnastic Society.

Pan-Sokol Slet, Prague, June and July, 1932

Staged at Strahov Stadium under the direction of Dr. Aug. Heller and Prof. Marie Provaznikova, Czechoslovak Sokol Union chief physical directors; and commemorating the 100th birthday anniversary of Dr. Miroslav Tyrš the founder of the Sokol movement. Participating in mass performances such as calisthenics with wands, Indian clubs, etc.; winter and water sports; track and field events; gymnastic competitions; various athletic, fencing, volleyball, basketball, handball and tennis, rowing, and canoeing contests; in the Czechoslovak Sokol Union and Slav Sokol Federation gymnastic championship, decathlon and regular competition on apparatus; contact and combative games; in grand arches and other massive gatherings; and a dramatic tableau „Olympic Feast“ (Hod Olympijsky) were 41.000 men, 38.000 women, 25.000 junior boys, 26.000 junior girls, 13.000 Sokolads, 14.120 Sokolettes, 7.840 high school students plus foreign guests and other Slav Sokol participants, and uncounted thousands of otherwise non-performing Sokol members in the grand marches. The slet's general program was chaired by the president of the Czechoslovak Sokol Organization, Dr. Stanislaus Bukovsky, and the programs on the main slet day was presented in the presence of the president of Czechoslovakia, T.G. Masaryk and the members of his cabinet.

Pan-Sokol Slet, Prague, June – July, 1938

Staged at Strahov Stadium at a time when the Czechoslovak armed forces stood on the border ready for a confrontation with the Nazi aggressors; and was directed by the Czechoslovak Sokol Union chief physical directors, Dr. Miroslav Klinger and Prof. Marie Provaznikova. The Sokol gymnastic festivities were chaired by the Czechoslovak

Sokol Union president, Dr. Stanislaus Bukovsky. The Czechoslovak president, Dr. Eduard Benes, with the members of his cabinet, observed on particular days the performances of the best of the youth and adult citizens of the nation. Present on some days were also members of the Czechoslovak parliament and representatives (ambassadors) of 30 foreign countries. Between 50.000 and 130.000 spectators (on July 3rd some 200.000) observed the various performances of husbands, brothers, sisters, sons and daughters, regardless of weather conditions, on the special student, Sokol children, juniors, seniors, army, and guest organization days. (This was the sixth time that Prague heartily welcomed the American Czech and Slovak Sokols). Participating in the festivities and performing their designated mass calisthenics, folk dances and other mass compositions in the slet program, which were arranged similarly to those of the preceding Pan-Sokol Slet in 1932, were the following divisions listed by age of the participants: (Note: The numbers provided are approximations based on the size of the slet field, the normal spacing between performers, and the practice of dividing categories of participants into groups of 15.000 with groups alternating performances on different days):

Student's Day 50.000 students (boys and girls); Sokol Children's Day 40.000 Sokolads and Sokolettes, Sokol Junior's Day 63.000 junior boys and girls, Sokol Seniors' Day 34.000 men and 31.000 women registered performers. On Sunday July 3rd, 27.600 presented Pechacek's mass calisthenics, the „Oath to the Republic,“ to Jan Seehak's music played by a 100-member slet band.

Grand Marches

Students' Day 50.000 students marched (boys and girls) under a forest of national flags and school banners, to music provided by 20 marching bands. Sokol Children's Day 27.420 Sokolads and Sokolettes marched under 423 banners from 50 districts, guided by 2.350 of the unit directors and instructors, with music

provided by 23 marching bands. Junior's Day 60.675 junior boys and girls marched under 665 banners accompanied by 32 bands, guided by 3.900 of their district and local leaders. With them marched 310 boys and girls from the Vienna metropolitan area and 800 Yugoslav juniors.

The Last Slet Day

73.840 men and women in official uniforms, gym uniforms, national costumes and civil attire, marched under 1.000 flags and banners, accompanied by 100 bands (2.953 musicians); as did foreign guest delegations: American Czech and Slovak Sokol (135); British (19); Belgians (254); Bulgarians (939); French (204); Dutch (22); Yugoslavs (4.387); Lithuanians (182); Latvians (87); Rumanians (271); Russians (32); Ukranians (60).

Performances

225.000 registered gymnasts of both sexes participated in mass traditional calisthenics with mass formation entry and retreat marches to and from designated markers; included were students, Sokolads, Sokolettes, junior boys and girls, senior men and women. District and regional group gymnastic exhibitions: mass gymnastic exercises with Indian clubs, wands, hoops, small wooden rings, and other implements. Exhibitions of exercises in building pyramids: foreign guest group combinations and Slav Sokol organizations from America, Belgium, Great Britain, Bulgaria, France, Holland, Lithuania, Latvia, Rumania and the Ukraine. Mass exercises with implements: wands, Indian clubs, etc.; combinations of exercises with Maypole (calisthenics and dances); building pyramids; display of scene „Build and Defend“; gymnastic competitions in apparatus exercises; track and field events; water sports events; winter games; heavy athletic contests; weight lifting; wrestling; hammer throw; tug-of-war; light athletic contests: shot-put, javelin throw, races, relays, fencing, grand marches; gymnastic championship competitions of the Czechoslovak Sokol Union, Slav Sokol Federation, and the International Gymnastic Federation.

Political changes after WWII

A few months after the slet, Hitler invaded and dismembered Czechoslovakia and the Nazi occupants dissolved the Czechoslovak Sokol Union, sent to concentration camps and murdered the Sokol leaders, and confiscated all Sokol funds and properties. The American Czech and slovak Sokol organizations consequently took over the responsibility for the continuation of the Sokol movement outside the country of its origin.

In 1945 in liberated Czechoslovakia, the Sokol was reactivated and the next XI Pan-Sokol Slet was projected. The slet was staged in June 1948 at Strahov Stadium under the direction of Dr. Aug. Pechlat and Prof. Marie Provaznikova. But earlier in February 1948 another enemy occupied war-fatigued Czechoslovakia. The communists, controlled by the Soviet Union, took over the government during a short and almost bloodless revolution. The Sokol slet thus became a demonstration against the communist aggressors. The communists with the Soviet army in readiness on the border and with an army of their own and Soviet agents let the Sokol go through the scheduled programs. Soon after the slet, the Sokol organization again was dissolved and the leaders persecuted or imprisoned. Some escaped into exile, among them the Sokol national president, Dr. Antonin Hrebik and the chief physical directress, Prof. Marie Provaznikova. American Czech and Slovak Sokols were not represented at this slet, but their organizations carried on the tradition of the Sokol movement founded by Tyrs.

Spartakiada replaces Slet

After 1948 new socialist elements in physical education are beginning to reveal. Artistic Gymnastics in many cases was initially in deep crises. It was reflected in rapid decline in membership and number of experienced coaches and trainers. This reduced also the efficiency of our gymnasts.

Organizational independence of artistic gymnastics made it possible to create a good basis for special training. At the end of 1948 was Army gymnastic club /AGC/ in Prague founded, with 25 associating sports industries, which had very strong gymnastics section. In 1949 at the AGC first army gymnasts representatives of Czechoslovakia were gathered together: L. Sotornik, Zd.Ružička, V. Matlocha, and later, M. Kolečka, J.Škvor, J.Mikulec, J.Houdek, J.Nekola. In 1951 F.Daniš, Vl. Karas, Vl.Kejř and Vl.Prorok joined the AGC. In Czechoslovakia, since 1950 they start to use the name artistic gymnastics /instead of instrumental gymnastics/ and introducing performance classes under the system of unified sports qualification. Domestic competitions are increasingly under the influence of international competitions, sports team training has a higher quality. After 1957, when the Czechoslovak Union of physical education /CUPE / was founded, deepen the socialist system of physical education, whose main features were the Communist ideism, mass of people, scientism. This system lasted until 1989, when a big social change throughout Czechoslovakia was made and this was due to Velvet Revolution.

Every five years, when the Czechoslovak Socialist Republic celebrates the anniversary of the triumphant culmination of the fight for national liberation and the liberation of this country by the Soviet army, the festivities are crowned with the Czechoslovak Spartakiade. Millions of gymnasts, sportsmen and tourists prepare and realize the biggest physical culture festival which has no like in the world. The Czechoslovak Spartakiade means above all else mass physical culture performances. Their origin dates back to the beginnings of the physical culture movement in Bohemia and with the exception of the period of the two World Wars they have been organized for over one hundred years now. Their new tradition dates from

1955, when the mass physical culture performances acquired a socialist character after the victory of the working class in Czechoslovakia. There is no town or even village in Czechoslovakia where the population does not begin to practise the Spartakiade compositions one year before the commencement of the celebrations of the anniversary. These movement compositions, which proved successful in the competition of works by the best physical culture specialists, are intended for all categories of the population — from children of preschool age over youth up to adults. The well proved system of the training and control gatherings of voluntary trainers and teachers on different regional levels ensures that they are thoroughly acquainted with and instructed in the intentions of the creators of the individual movement compositions, this resulting in their training proceeding in the same way, with - out any deviations, throughout the whole Republic. The commencement of the training process is naturally proceeded by the production of printed matter containing descriptions of the compositions, musical recordings, implements and other aids.

The mass gymnastic performances - Spartakiades formed a solid basis of the socialist system of physical culture for its content versatility, variety of forms, time longevity and increasing massification. Spartakiades were always carried out in a huge stadium in Prague's Strahov where could be around 200,000 viewers. Spartakiade first held in 1955 on the occasion of 10-th anniversary of the liberation of Czechoslovakia. At the Strahov trained more than half a million children, youth and adults. They performed in 29 songs, which was a very comprehensive program for trainees and the audience. Therefore, at the second Spartakiade in 1960 the trainees performed in 19 songs.

The Strahov Gate of Strong guys took a title: Socialism is our victory. It reflected the fact that since 1960 our country bears the name Czechoslovak Socialist Republic. Third Spartakiade took place in 1965, next Spartakiade should take place in 1970, but due to the occupation of Czechoslovakia by the armies of Warsaw Pact it was not realized, so the fourth Spartakiade took place in 1975. Fifth Spartakiade was in 1980.

The sixth last held in 1985, where trainees performed in 15 songs. "Spartakiade is one of the greatest sporting events I've ever seen in my life" spoke enthusiastically President of the International Olympic Committee Juan Antonio Samaranch.

In all fifteen compositions were created for the Czechoslovak Spartakiade 1985 and practically one million persons learned and rehearsed them twice weekly at physical training clubs and during voluntary physical culture sessions at schools. In the spring of 1985 all these gymnasts performed their respective compositions at one of the 1,400 local and district Spartakiades in front of 2,300,000 spectators. The best of them were then chosen to take part in the final performances at the Strahov Stadium in Prague. This stadium, the biggest in the world, covers an area of more than six hectares and 13,824 can perform on it at once, its surface being marked especially for the purpose. The grandstands and galleries can hold over 200,000 spectators. During the two afternoon programmes of the Czechoslovak Spartakiade 1985 a total number of 172,496 gymnasts took part in the individual compositions, watched by 940,000 spectators during the general rehearsals and four main days. Throughout one whole year sportsmen contributed to the Czechoslovak Spartakiade 1985 with top competitions such as the Druzba (Friendship)

sporting gymnastics event and women's athletics and archery contests on one hand and by means of the realization of over 12,000 mass events in which 9,089,243 persons participated on the other hand. The Sokol competition in military defence skill, for example, was marked by the participation of 556,000 competitors and the trade union contest by 120,000 volleyball players. Over 500,000 young people from the age of 10 to 18 competed for the badge for skill in individual disciplines. The unique swimming relay race of 1,000 x 100 metres was taken part in by the inhabitants of 45 towns and the so-called jeizera. Fifty ski running competition enjoyed the participation of 10,000 skiers. Tourists also played their part in the Spartakiade year. Three and a half million marched, cycled, boated and travelled on skis in the course of 2,751 events of the most varied kinds. Most of the participants already had many an event behind them such as the biggest long-distance march in Central Europe, covering the distance from Prague to Prcice with the record number of over 35,000 participating persons. Many of the events were original ones such as the march held under the name Round the Czech Socialist Republic In One Day. This event actually comprised 48 marches, the destination of one being the starting place of the next. Another meritorious activity was the Spartakiade Forest, during which tourists planted 450,000 forest trees. The tourist activity organized in the framework of the Czechoslovak Spartakiade 1985 culminated in Prague with a national Spartakiade tourist rally at Džbán on the outskirts of Prague, where over 6,000 tourists from all over the Czechoslovak Socialist Republic gathered at a tent town. Numerous cultural events also formed a part of the programme of the Czechoslovak Spartakiade 1985. Days of culture and physical culture took place at all district towns in the Czechoslovak Socialist Republic before the district Spartakiades.

During the Spartakiade finale in Prague gala performances of the individual regions took place during which the best artists, professional ensembles and amateur groups appeared. All Prague's theatres gave performances for the participants in the Czechoslovak Spartakiade 1985, every museum, gallery and exhibition hall was open to visitors and, apart from this, dozens of other cultural events took place in all the districts of Prague. Great attention was aroused by the traditional Friendship Evenings in the Sports Hall, where during four evenings 14,000 spectators watched an outstanding international gymnastic festival. In all gymnasts from 10 countries performed in a single, perfectly organized and mastered programme. The Spartakiade is not, however, an event for one year only, but represents the climax of five years of systematic physical culture activity.

At the same time it is also a means of attracting others to regular exercising and sport. Today, when healthy movement is the order of our age, mass forms of physical culture activities are being sought in the world. In Czechoslovakia, however, they do not have to be sought, because in this country it is possible to continue in a tradition of over one hundred years' standing, to observe development and to adapt physical culture to the interests and needs of the individual categories.

Slets are organised again

New period for Sokol's life in Czechoslovakia started after "Velvet revolution" 1989. Czechoslovak Sokol Organisation (ČOS) had to fight to receive its property in Czech and also Slovak Republic. Sokol's movement in both newly developed republics had and still have generational problems. In the 1991 leaders of ČOS decided that Sokols must prepare the great festival - Slet again. The Slets were determined for 6 years period beginning in 1994.

From 5th - 6th July 1994 - it was organized XII. Slet with participation of

23000 gymnasts, among them were 1800 guests from other countries. Slet was organized on the great Strahov Stadium. In July 2000 XIII. Slet was organized at small Rošický stadium in Prague where participated 21 500 gymnasts. XIVth Slet in July 2006 was again at Rošický stadium in Prague with 17000 gymnasts. Last Slet - XVth was held in Prague at Stadium Synot Tip Arena, Vršovice between 1st - 7th July 2012. Gymnasts (from Czech Republic, USA, Canada, Danmark, France, Swiss) all together 10500 from all over the world took part celebrating 150 years of Sokol organization. Again there were many (together 22) special compositions for children and senior group in two days.

Internationally idea of slets was adopted by FIG and in 1953 the first Gimnaestrada has been organised. Despite Sokol is not so powerfull as it was, the main idea of national healthy physical exercise lives further.

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Corresponding author:

Anton Gajdoš, PhD

anton.gajdos@gmail.com

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Slovenski izvlečki / Slovene Abstracts

Susana Corujeira, Rita Santos Silva, Tiago Vieira, Cláudia Dias, Eunice Lebre in Carla Rêgo

GIMNASTIKA IN ŽENSKA TROJICA (FAT): MIT ALI RESNICA?

V športih, ki zahtevajo nizko telesno težo, je vprašanje, ali je mogoče z visoko gostoto in intenzivnostjo vadbe ogroziti rast in razvoj. Cilj je bil oceniti vpliv gimnastike na prehransko stanje, telesno sestavo, pubertetni razvoj, kostno maso, napovedovanje višine in pojavu ženske trojice (FAT), pri mladostnikih. Vzorec merjenk je sestavljalo 27 telovadk in 15 deklet v kontrolni skupini. Vzorec spremenljivk so sestavljali: telesne značilnosti sestave telesa (bioelektrični upor, Tanita TBF 300 ®), ocena pubertetnega obdobja, starost kosti, mineralno gostoto kosti (DXA L1-L4, Lunar Expert XL ®) in krvni tlak. Izračunana sta bila indeks telesne mase in napoved genetske telesne višine. Telovadke imajo običajno 18 ur na teden vadbe, 6-krat več kot v kontrolni skupini. Ni bilo pomembnih razlik med skupinami pri napovedi genetske telesne višine, prve menstruacije, pubertetnega obdobja, stanja prehranjenosti in kostne mase. Telovadke imajo nižjo vrednost celotne telesne maščobe. Sedeče mladostnice kažejo večjo prekomerno težo, hipertenzijo, osteopenijo in končno genetsko napoved telesne višine. Pri telovadkah gimnastika vpliva na sestavo telesa, vendar se ne zdi, da ogrožajo prehranski status, normalno napredovanje puberteto, kostne mase in genetsko napoved končne telesne višine. Ti rezultati postavljajo pod vprašaj koncept FAT, vendar bi bile potrebne dodatne raziskave na tem področju..

Ključne besede: gimnastika, športne zmogljivosti, mineralizacijo kosti, sestava telesa, vadba.

Miltiadis Proios

ŠPORTNIKOVA PODOBA IN CILJI USPEŠNOSTI TELOVADCEV

Namen raziskave je bil razširiti znanje o odnosu med športno podobo in usmeritve doseganja ciljev. Poleg tega je študija raziskovala vpliv neodvisnih spremenljivk, kot so obiskovanje športnih oddelkov in vrsto panoge pri oblikovanju športne podobe. Vzorec merjencev je predstavljalo 140 fantov in deklet od 8 do 17 let ($M = 11,86$, $SD = 2,21$), trih gimnastičnih športov (športna gimnastika, $n = 91$, ritmična gimnastika, $n = 37$; akrobatskika, $n = 12$). Izsledki te študije kažejo da telovadci dokaj visoko dojemajo njihove športno vlogo, in da se ta občutek občutno zmanjša s športnimi dosežki. Lahko se tudi napove stopnja, do katere se lahko športnik identificira s športno vlogo ter napovedati njegovo/njeno dovtetnost do doseganja ciljev.

Ključne besede: športnikova podoba, dosežek, ciljna usmerjenost.

Marjeta Kovač

OCENJEVANJE GIMNASTIČNIH ZNANJ PRI ŠPORTNI VZGOJI – PRIMER PREVALA NAZAJ

V članku predstavljamo model ocenjevanja gimnastičnih spretnosti pri šolski športni vzgoji. Predstavljena naloga preval nazaj vključuje opis gibanja, merila z mersko lestvico in opisnike; ti predstavljajo standardizirano izvedbo, ki temelji na številu in vrsti napak. Izvedbe učencev (N=36) so ocenjevali trije neodvisni zunanji ocenjevalci s pomočjo videoposnetkov. Z analizo variance smo preverjali razlike v izvedbah med spoloma. Zanesljivost testne naloge smo ocenili s Cronbachovim koeficientom zanesljivosti alfa, objektivnost pa z izračunom skladnosti med ocenami posameznih ocenjevalcev in skupnim predmetom merjenja. Ugotovili smo, da se učenci in učenke statistično značilno ne razlikujejo med seboj v prikazanem znanju, kar pomeni, da je naloga enako primerna za oba spola. Zanesljivost in objektivnost ocenjevanja sta bili visoki, kar kaže na primerno sestavo meril in opisnikov. Ko učitelj pripravlja analitična merila za ocenjevanje gibalnih nalog, opisu gibanja doda jasna merila za mogoče napake v izvedbi. Merila pomagajo tako učitelju kot učencu, da dobita boljši vpogled v kakovost učenčeve izvedbe, hkrati pa lahko učitelj pomaga učencu pri prilagoditvi nadaljnje vadbe. Omeniti pa je treba, da je za formativno ocenjevanje pomembno, da učitelj oblikuje merske lestvice in opisnike glede na namen ocenjevanja, razvojno stopnjo učencev in kompleksnost gibanja.

Ključne besede: športna vzgoja, gimnastika, preverjanje, naloga, merske značilnosti

Lurdes Ávila-Carvalho, Panagiotis Klentrou, Eunice Lebre

ROKOVANJA, METI, LOVLJENJA IN SODELOVANJA PRI VRHUNSKIH RITMIČARKAH SKUPINSKIH SESTAV

Tehnika rokovanja z orodjem je ključnega pomena v ritmični gimnastiki (RG) pri ocenjevanju, saj ima velik vpliv na končni rezultat. Pri skupinskih sestavah je tehnika rokovanja z orodjem izjemno zahtevna, zato je smiselna analiza teh sestav, saj lahko dobimo nov vpogled v razumevanje RG. Z vidika težavnosti je bilo analiziranih 126 sestav skupin iz 28 držav, ki so sodelovale na tekmah svetovnega pokala v Portimão v obdobju 2007-2010. Najbolj uravnotežena težavnost je pri obroču in najmanj pri kijih, ki je edino dvojno orodje. Najboljši napovedovalci uspešnost na tekmovanju so večji obseg vadbe (število ur na teden) (43%), večja izvedba metov (6%) in sodelovanjem s tveganjem (16,5%) . Te prvine sodelovanja s tveganjem predstavljajo tiste prvine, kjer je potrebno predvidevanje leta in mesta pristanka orodja brez vidne kontrole nad orodjem.

Ključne besede: orodja, meti, lovljenja, sodelovanja, skupinska sestava.

Simon Ličen, Andrew C. Billings

DVA POGLEDA NA ENO TEKMOVANJE: SLOVENSKI TELEVIZIJSKI PRENOSI GIMNASTIKE Z OI 2008

Televizijski športni prenos dopolnjuje govor reporterjev in njihovih gostov, ki dramatizirajo in pojasnjujejo dogodke na malih zaslonih. Namen študije je bil analizirati slovenske prenose športne gimnastike na olimpijskih igrah v Pekingu leta 2008. Analizirano je bilo več kot 7 ur prenosov. Vsi opisi in navedbe komentatorjev so bili prepisani in kodirani v skladu z 17-vrstno razvrstitvijo za študij športnih TV programov. Izračunana je bila pogostnost vsake vrste ter primerjavi med njimi. Skupno je bilo ugotovljeno 4472 opisov: 56% jih je bilo izgovorjenih pri reporterju in 44% pri strokovnem komentatorju. Reporter je uporabljal bolj splošne opise (predvsem o telovadcih), medtem ko je strokovni komentator bolj opisoval športno nadarjenost in sposobnosti, izkušnje ter skladnost sestav. Del komentiranja so tudi poudarki domovinskim čustvom. Delež subjektivnega komentiranja je bistveno večji kot pri ekipnih športih. Komentatorja pa ob gimnastiki v dialogu uporabljata tudi veliko informacij z drugih področij

Ključne besede: olimpijske igre, medijske vsebine, identiteta, pristranskost

Bessem Mkaouer, Monem Jemni, Samiha Amara, Helmi Chaabèn, Zouhair Tabka

PRIMERJAVA KINEMATIČNIH IN KINETIČNIH ZNAČILNOSTI VSKOKA STEGNJENO IN DVEH VRST SKRČENEGA SALTA NAZAJ

Cilj te raziskave je bil primerjati kinetične in kinematične spremenljivke med tremi vrstami skokov iz stoje na nogah: vskok stegnjeno z zamahom v vzročenje (CMJa), skrčeni salto nazaj z doskokom na mesto odriava (BSIs) in skrčeni salto nazaj (BSId). Izmerjenih je bilo pet vrhunskih telovadcev (starost $23,17 \pm 1,61$ let, višina $165,0 \pm 5,4$ cm, teža $56,80 \pm 7,66$ kg) na tenziometrijski plošči in s kinematičnim 3D sistemom. Statistična analiza s pomočjo ne-parametričnega testa Kruskal-Wallis je pokazala velike razlike med skoki. Razlikujejo se navpična del sile odriava, maksimalna moč, impulz sile in premik težišča ($p < 0,01$), podobno pa tudi vodoravni del sile odriava, najvišja hitrost, maksimalna moč in premik težišča znatno razlikuje ($p < 0,01$); medtem ko največja navpična hitrost ostaja relativno konstantna. Skrčeni salto nazaj, kjer je mesto odriava enako mestu doskoka je po svojih kinematičnih in kinetičnih značilnostih zelo podobno vskoku stegnjeno. Analiza kinetičnih in kinematično skupaj je omogočila oblikovanje regresijskih enačb, ki omogočajo napovedi nekaterih drugih spremenljivk.

Ključne besede: gimnastika, odriv, sila reakcije.

Anton Gajdoš, Marie Provaznikova, Karel Bednar and Stephen J. Banjak

SOKOLSKSKI ZLETI – BISTVO TELOVADBE V ČEŠKOSLOVAŠKI, ČEŠKI IN SLOVAŠKI REPUBLIKI (OB PRAZNOIVANJU 150 LET TELOVADBE)

Zgodovina Sokolske telovadbe se je pričela leta 1862 v Pragi. Najpomembnejša naloga Sokola je bila zdravje naroda, ki bi tako postal bolj produktiven in samo obramben. Za navduševanje in vadbo širokih ljudskih množic so bili organizirani Zleti. Od izvedbe prvega Zleta leta 1882 in zadnjega leta 2012 so Zleti doživeli vzpone in padce, včasih pa so bilki cello večja prireditev kot olimpijske igre. Zleti so bili zelo vplivni, zato jih je izkoristila tudi politika, ki je prevzela cilje zletov in jih preimenovala v Spartakiado. Z demokratičnimi spremembami v Evropi so Zleti dobili novo podobo. Mednarodno gimnastična zveza je idejo Zletov prevzela in je leta 1953 organizirala prvo Gimnaestrado. Čeprav Sokolsko gibanje ni več tako pomembno kot je bilo včasih, ideja o ljudski zdravi telesni dejavnosti živi dalje.

Ključne besede: sokol, zleti, 150 letnica