Original Article

Percentagewise presence of judging scores in the European, World Championships and Olympic Games in the Men's Artistic Gymnastics from 2006 to 2011 year

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Published online: September 30, 2013

(Accepted for publication July 20, 2013)

DOI:10.7752/jpes.2013.03049;

Abstract:

The main goal of this paper is a comparison of the percentagewise presence of the scores by the quality levels from the C.I. competition. Establishment of the differences between certain apparatus, competitions and judges' commissions stems from the set goal. There is a big difference in the variability of results at Olympic Games, World and European Championship. Generally, the lowest average score at the competitions was on the pommel horse, and the highest one, on the vault. The article can provide useful information on the role of tactics in gymnastics competition in the team and all around competition.

Key words: Men's Artistic Gymnastics, judging, code of points, percentile, results

Introduction

The first unique instructions The Fédération Internationale de Gymnastique (FIG) for evaluation of gymnastic exercises were created in 1949. year known as "Code of Points" (CoP) for the assessment of the artistic gymnastics includes seven levels of degree of difficulty. The difficulty value (DV) of the exercise is determined according to the content and difficulty of the routine. Initial degree of severity represents the level A, and the next levels are B,C, D,E,F and G (FIG, 2009). The latest one is the greatest degree of severity. The main purpose and goal of the Code of Points for evaluating is provision of more objective evaluation of exercises. Independent members of the Refereeing Commission (D & E commission) are on all apparatus: D commission evaluates (weight, special requirements, and bonus points) and the assessment starts from 0.0 points to more and E commission the performance of an exercise (performance techniques, body posture and balance) and provides deductions for the performance from 10.0 points to lower. D commission determines the initial assessment of an exercise, and the E commission registers performance errors due to technical performance, body posture and balance of exercise performance so that those two grades would at the end sum up in the final one.

Several authors have tried to evaluate the quality of judging at different gymnastics competitions. In his research on judging in real time, Sands (2010) mentioned the biggest problem of evaluation and that is: reliability and validity. In his paper, the author mentions that the referees could use modern technology and with that, immediately after the performance, give their deductions so that a smaller number of referees would stay at rank. Other authors have dealt with this issue, too, such as Čuk and Forbes (2006) who have made the program B Jury Judging Real Time System (RTJS) at the Australian Institute for Sport. The program has improved the objectivity of the evaluation by Jury B Execution Deductions entered during the performance and it cannot be changed, referees must deduct quickly and precisely each time they see an error. Čuk and Atiković (2009) on the sample of the 44 gymnasts who competed at the OG 2008 in Beijing in all around, tested the equality between disciplines. Vault has the highest A scores, while pommel horse the lowest A scores. T-tests showed that those two disciplines significantly differ from other disciplines in average for 0.4 points. Factor analysis extracted 3 factors, with 67% of explained variance. Leskošek et al. (2010) in results show very high reliability and satisfactory validity of judging at the University Games it should be emphasized that judging quality differs between apparatus, sessions and judges. In different sessions and apparatus all reliability measures (Cronbach's alpha range from 0.92 up to 0.99, ICC, Armor's theta) are higher than .90. Those indices tend to be a little lower in the all around finals than in qualification and apparatus finals. There appears to be no systematic differences in reliability between apparatus. Vault scores tend to have lower reliability than other apparatus in qualification and all around. Armor's theta ranged from .92 (on the floor) to .98 (rings and high bar), where as in Belgrade Armor's theta ranged from .93 (rings and vault all around finals) to .99 (high bar qualifications and apparatus finals). Finals, but not in apparatus finals. High bar scores have the highest reliability in qualification session and apparatus finals, but only average in all around finals. Atiković et al. (2011) analyzed the score of judges

from the World Championship in men's artistic gymnastics, held 2009 in London. Analysis problem was determination of the differences on individual apparatus between judges E1 to E6 and apparatus. Vault has the highest D and E scores, while pommel horse the lowest D and E scores. T-tests showed that those two disciplines significantly differ from other disciplines. Results show very high reliability (e.g. Cronbach's alpha range from 0.94 up to 0.98). Atiković (2012) in this paper try to determine the relationship between biomechanical parameters of vault flights with respect to new models of initial vault difficulty values in men's artistic gymnastic. After implementing the regression analysis, it could be established that the best model derived only the second flight phase with 95% of explained variance. Leskošek et al. (2013) found that the new CoP solved the problem of invariant difficulty scores, most efficiently toward the end of the observed period (2011). Execution scores showed a clear decreasing trend, both in absolute value and also in it's ratio with difficulty score.

Method and method

The final scores that gymnasts got for the presented compositions in qualifying heats (C.I.) at the European Championships, World Championships and Olympic Games were the subject of the analysis. Determination of the sensitivity of the Code of Points from 2006 to 2009 and from 2009 to 2012 cycles on some apparatus for the proper distinction between gymnast from different levels was the problem of the analysis. Quality levels were formed on the basis of expert knowledge. The height of the final score represented the basis of shaping the quality levels. The sample was made up of the scores that the contestant received at the following competitions: Olympic Games – OG (2008), World Championships – WCh (2011-2006), European Championship – ECh (2011-2006). From official Book of results we made six variables of judges D and E scores, and one for final score F (D+E score) from six apparatus for men: floor exercise (FX), pommel horse (PH), rings (RI), vault (VT), parallel bars (PB) and horizontal bar (HB). To evaluate all judges scores we used SPSS 20.0 to calculate: % - Percentile by grades, Kolmogorov-Smirnov test (KS-test) normality of the variables distributions. The main goal of this paper is a comparison of the percentagewise presence of the scores by the quality levels from the C.I. competition. Establishment of the differences between certain apparatus, competitions and judges' commissions stems from the set goal.

Results

In casew of the VT (table 1), it can be seen that the scores mostly go in the range of 6.0 to 6.9 points. We can conclude from the results that, at the all aforementioned competitions in score ranging from 6.0 to 6.9 points, the highest percentage of competitors is represented at WCh 61.4%, ECh 64.7% and OG 78.0% of all scores. Also, in the range of scores at the OG from 6.0 to 6.9 points, there are scores on FX 53.2% and PB 61.3%. What was stated above shows us that the change of the rules for this apparatus is required. Revision of the results of KS test showed that the distribution of results in just six variables, statistically, was not significantly different from the normal distribution of the results, and those are: DFX OG (.074), DPH ECh (.067), DPH OG (.339), DRI OG (.314), DPB OG (.291) i DHB OG (.508).

Table 1. Percentagewise presence of scores in quality levels of D score of the Judges' Commission

D score	0.0-0.9 p.	1.0-1.9 p.	2.0-2.9 p.	3.0-3.9 p.	4.0-4.9 p.	5.0-5.9 p.	6.0-6.9 p.	7.0-7.9 p.	Type of Competitions
Floor	0.2	0.0	0.0	0.6	18.9	56.7	23.4	0.0	EC
	0.0	0.0	0.0	0.7	17.7	55.3	26.0	0.0	WC
	0.0	0.0	1.2	0.0	1.2	44.1	53.2	0.0	OG†
	0.0	0.0	0.4	7.4	30.2	46.7	15.1	0.0	EC†
Pommel horse	0.1	0.0	0.2	6.2	25.4	52.3	15.5	0.0	WC
	0.0	0.0	0.0	0.0	10.5	60.5	28.9	0.0	OG†
	0.0	0.2	1.3	5.7	24.4	43.9	23.1	1.1	EC
	0.1	0.2	0.7	3.8	21.8	46.5	25.2	1.3	WC
Rings	0.0	0.0	0.0	0.0	2.8	35.7	50.0	11.4	OG†
	0.0	0.0	0.0	0.0	2.4	25.2	64.7	7.4	EC
	0.0	0.0	0.0	0.7	3.1	26.1	61.4	8.5	WC
	0.0	0.0	0.0	0.0	1.3	2.7	78.0	17.8	OG
Parallel bars	0.0	0.2	0.6	5.0	28.0	44.8	21.1	0.0	EC
	0.0	0.2	0.4	3.3	20.3	50.4	24.8	0.2	WC
	0.0	0.0	0.0	0.0	6.6	26.6	61.3	5.3	OG†
	0.0	0.4	0.6	5.1	19.7	49.5	23.2	1.1	EC
High bar	0.0	0.1	1.3	4.8	22.3	47.4	21.9	1.9	WC
	0.0	0.0	0.0	0.0	3.9	48.6	43.4	3.9	OG†
	0.0	0.0	0.0	0.0	3.9	48.6	43.4	3.9	OG†
	0.0	0.1	0.4	2.4	14.5	42.4	36.7	3.3	

Legend: E – judges score, D – judges score, F – final score, KS test – Kolmogorov Smirnov test normality of the distribution, Avg. – Average score, †Sig. – Level of significance ($p < 0.05$), ECh – European Championships, WCh – World Championships, OG – Olympic Games.

The results, shown in (Table 2), indicate that the structure of the final scores E of the Judges' Commission, in the majority of devices, go in the range of scores from 8.0 to 8.9 points. In the case of VT, it can be observed that the lowest deductions of scores mostly go in the range of 9.0 to 9.9 points. We can conclude from the results that, at the all aforementioned competitions at range from 8.0 to 8.9 points, this kind of distribution is represented at all devices but at vault apparatus, in terms of percentage. The largest number of represented E scores, without taking in consideration the VT, is located in RI as follows: ECH 67.7%, 71.0% and WCH OG 85.7%. Revision of the results of KS test showed that the distribution of results in just two variables, statistically, was not significantly different from the normal distribution of the results, and those are: EPH OG (.159) i ERI OG (.135).

Table 2. Percentagewise presence of scores in quality levels of E score of the Judges' Commission

E score	0.0-0.9 p.	1.0-1.9 p.	2.0-2.9 p.	3.0-3.9 p.	4.0-4.9 p.	5.0-5.9 p.	6.0-6.9 p.	7.0-7.9 p.	8.0-8.9 p.	9.0-9.9 p.	Type of Competitions
Floor	0.2	0.0	0.0	0.0	0.0	0.0	2.7	18.9	62.8	15.2	EC
	0.0	0.0	0.0	0.0	0.0	0.3	3.3	17.8	63.4	14.8	WC
	0.0	0.0	1.2	0.0	0.0	0.0	0.0	6.4	53.2	38.9	OG
Pommel horse	0.0	0.2	0.0	0.2	0.9	3.6	12.2	34.6	38.6	9.5	EC
	0.0	0.0	0.0	0.1	0.1	1.7	7.6	27.6	54.5	8.2	WC
	0.0	0.0	0.0	0.0	0.0	0.0	1.3	9.3	74.6	14.6	OG†
Rings	0.0	0.0	0.2	0.0	0.2	0.4	5.2	25.1	67.7	0.9	EC
	0.1	0.1	0.0	0.0	0.2	0.6	4.4	20.2	71.0	3.1	WC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	85.7	11.4	OG†
Vault	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	22.6	73.3	EC
	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.3	22.9	71.5	WC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	89.0	OG
Parallel bars	0.0	0.0	0.2	0.0	0.0	0.0	2.0	16.9	61.6	19.1	EC
	0.1	0.1	0.0	0.1	0.1	0.2	3.9	18.2	60.0	16.9	WC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	33.7	62.1	OG
High bar	0.0	0.0	0.0	0.0	0.4	1.3	5.8	26.0	58.3	7.9	EC
	0.1	0.0	0.0	0.0	0.0	1.2	7.3	31.5	58.4	1.3	WC
	0.0	0.0	0.0	0.0	0.0	0.0	2.6	12.0	72.0	13.3	OG
Avg.	0.0	0.0	0.1	0.0	0.1	0.5	3.2	15.6	54.0	26.2	

Legend: E – judges score, D – judges score, F – final score, KS test – Kolmogorov Smirnov test normality of the distribution, Avg. – Average score, †Sig. – Level of significance ($p < 0.05$), ECh – European Championships, WCh – World Championships, OG – Olympic Games.

The results, shown in (Table 3), indicate that the structure of the final scores (F) at competitions in the majority of devices, go in the range of scores from 13.0 to 15.9 points. In the example of competition at the VT, it can be noted that the scores mostly go in range of 15.0 to 15.9 points at the ECh that is, in terms of percentage it is represented 45.9%, WCh 48.2% and at OG 52.0%. We can conclude from the in the range of 14.0 to 14.9 points, there is PB 31.6% and 27.2% HB. In terms of percentage, by the number of scores at the ECh, there is in the range of scores from 15.0 to 15.9 points on VT 38.5% and PB 46.5%. From the results from the WCh we can conclude that, in the range of scores from 13.0 to 13.9 points, there is RI 31.6%. In the range of scores from 14.0 to 14.9, there is PH 34.7%, PB 33.3% and HB 29.1%. In terms of percentage, the most represented, by the number of scores at the WCh, is in the range of scores from 15.0 to 15.9 points on the VT 48.2%. From the results from the OG we can conclude that in the range of scores from 13.0 to 13.9 points, unlike the other competitions, there is not one discipline. In the range of scores from 14.0 to 14.9 points, there is FX 50.6%, PH 44.7%, PB 33.3% i HB 47.3%. In terms of percentage, the most represented, by the number of scores at the OG, is in the range of scores from 15.0 to 15.9 point on VT 52.0% and PB 46.6%. Revision of the results of KS test showed that the distribution of results in eight variables, statistically, was not significantly different from the normal distribution of the results, and those are: FFX WCh (.003), FPH WCh (.000), FRI WCh (.000), FVT ECh (.003), FVT WCh (.000), FPB WCh (.000), FHB ECh (.003), FHB WCh (.000). From the results from the WCh we can conclude that, in the range of scores from 13.0 to 13.9 points, there is RI 31.6%. In the range of scores from 14.0 to 14.9, there is PH 34.7%, PB 33.3% and HB 29.1%. In terms of percentage, the most represented, by the number of scores at the WCh, is in the range of scores from 15.0 to 15.9 points on the VT 48.2%. From the results from the OG we can conclude that in the range of scores from 13.0 to 13.9 points, unlike the other competitions, there is not one discipline. In the range of scores from 14.0 to 14.9 points, there is FX 50.6%, PH 44.7%, PB 33.3% and HB 47.3%. In terms of percentage, the most represented, by the number of scores at the OG, is in the range of scores from 15.0 to 15.9 point on VT 52.0% and PB 46.6%.

Table 3. Percentagewise presence of scores in quality levels of final F score of the Judges' Commission

F score	0.0-8.9 p.	9.0-9.9 p.	10.0-10.9 p.	11.0-11.9 p.	12.0-12.9 p.	13.0-13.9 p.	14.0-14.9 p.	15.0-15.9 p.	16.0-16.9 p.	Type of Competitions
Floor	0.2	0.0	0.7	2.5	17.3	37.6	31.9	9.8	0.0	EC†
	0.1	0.1	0.7	3.1	15.7	32.1	34.7	13.1	0.4	WC
	0.0	0.0	0.0	0.0	1.3	10.4	50.6	37.7	0.0	OG†
Pommel horse	0.9	3.4	5.6	13.5	25.7	23.5	21.2	6.1	0.0	EC†
	0.6	0.7	3.9	8.6	19.0	34.0	25.1	7.7	0.4	WC
	0.0	0.0	0.0	0.0	10.5	27.6	44.7	15.8	1.3	OG†
Rings	0.5	1.1	3.4	7.1	21.5	34.3	22.7	8.7	0.7	EC†
	0.4	0.9	2.1	5.5	16.1	31.6	31.1	10.5	1.8	WC
	0.0	0.0	0.0	0.0	1.4	15.7	37.1	38.6	7.1	OG†
Vault	0.0	0.0	0.0	0.0	0.5	5.7	29.0	45.9	19.0	EC
	0.0	0.1	0.0	0.3	0.8	6.5	31.7	48.2	12.4	WC
	0.0	0.0	0.0	0.0	1.4	0.0	2.7	52.1	43.8	OG†
Parallel bars	0.2	0.0	1.6	4.6	19.4	29.8	31.7	12.3	0.5	EC†
	0.2	0.0	1.6	4.4	18.9	29.1	33.3	12.0	0.4	WC
	0.0	0.0	0.0	0.0	2.7	5.3	29.3	46.7	16.0	OG†
High bar	0.5	0.9	2.3	7.7	15.8	36.7	27.2	8.8	0.0	EC
	0.6	0.4	3.1	6.5	19.9	33.4	29.1	6.8	0.1	WC
	0.0	0.0	0.0	0.0	1.3	23.7	47.4	25.0	2.6	OG†
Avg.	0.2	0.4	1.4	3.5	11.6	23.2	31.1	22.5	5.9	

Legend: E – judges score, D – judges score, F – final score, KS test – Kolmogorov Smirnov test normality of the distribution, Avg. – Average score, †Sig. – Level of significance ($p < 0.05$), EC – European Championships, WCh – World Championships, OG – Olympic Games.

Discussion

The rationale of this study was based on the hypothesis that since the energy cost (EC) of walking or running on sand is proven bigger than the firm surface, beach volleyball may have increased aerobic demands than indoor volleyball. Hence, beach volleyball training and competition may possibly cause some aerobic adaptations in indoor volleyball players.

Many athletes and coaches have previously used sand training as a successful adjunct to firm surface training regimes (Berger, 1980; Wischnia, 1982; Oviatt and Hemba, 1991). Studies by Zamparo et al. (1992), Lejeune et al. (1998) and Pinnington and Dawson, (2001a and b), have quantified the EC of running on sand and found it to range between 1.2 to 1.6 times firm surface values at comparable running speeds. Pinnington and Dawson (2001b), revealed that iron men athletes ran at steady state on soft dry beach sand at 8 and 11 km·h⁻¹ the aerobic EC was approximately 1.4 times greater than when running on grass at comparable speeds. Zamparo et al. (1992) reported that net total EC of running on sand was 1.1-1.4 times greater than running on a firm surface at running speeds ranging between 7 and 14 km·h⁻¹. Lejeune et al. (1998) measured the aerobic EC of running on an artificial circular sand track and reported that the EC of sand running increased 1.6 fold relative to running on a firm surface. This value agrees more closely with the aerobic EC reported by Pinnington and Dawson (2001a) for recreational runners, who ran on soft dry beach sand compared to running on grass, but is greater than the value (1.38) found for the iron men (Pinnington and Dawson 2001b). It is possible that specific training responses associated with habitual sand running, elicited by the iron men when running on sand, may have resulted in a reduced submaximal VO₂ at comparable running speeds compared to non-habituated sand runners. These investigations provide some insight into the physiological training stimulus that may accrue by running on sand, compared with a firm surface.

Our study revealed that VO₂ consumption of indoor volleyball players was significantly reduced after a beach volleyball season (12 weeks) in 8, 10, and 12 km·h⁻¹ ($p < .05$, $p < .01$, $p < .001$ respectively) running on treadmill. Additionally, there was a significant reduction of HR in all speeds and difference in RER. These results suggest that beach volleyball training and competition evoked specific training adaptations that resulted in an improved RE compared to the indoor volleyball effect. Furthermore, the improvement in VO_{2max} seems to confirm other studies' evidence suggesting that VO_{2max} is an important determinant of the O₂ cost of running and RE (Bransford & Howley 1977; Morgan et al. 1989; Morgan & Craib, 1992; Bernard et al. 1998). However, wide variations in RE have also been observed within groups of trained runners with similar VO_{2max} values (Conley and Krahenbuhl 1980; Morgan et al. 1992; Bernard et al. 1998). No differences in RE have also been reported between trained and untrained subjects (Dolgener 1982). The lack of agreement in the literature concerning the effects of physical training or VO_{2max} on RE suggests that the differences in VO_{2max} pre and post beach volleyball season used for comparison in the present study may limit the inferences that can be made from the data.

In the light of previous studies (Pinnington and Dawson 2001ab, Lejeune et al. (1998) Zamparo et al. (1992) which given evidence of increased EC in sand, we could claim that our results seem to be an extension of

their theory. Since moving on sand demands increased EC, systematic training and competition on sand could result an improvement in RE and an increase in $\text{VO}_{2\text{ max}}$.

We assume that the specific physiological adaptations responsible for the improved RE and $\text{VO}_{2\text{ max}}$ of volleyball players after beach volleyball training and competition, include differences in muscle oxidative capacity, anaerobic threshold and oxygen deficit temperature, heart rate, ventilation, RER, $\text{VO}_{2\text{ max}}$, body mass, and other biomechanical variables (Morgan et al., 1989; Daniels & Daniels, 1992; Morgan & Craib, 1992; Pate et al., 1989; Saunders et al., 2004). Additionally, another parameter that could possibly have influenced RE is the adaptation and better response of the thermoregulatory mechanisms in high temperature, since plenty of matches occur in any time of the day, and during summertime in Greece temperature often reaches 35-40°C. A positive association between body temperature and VO_2 constant-load exercise and submaximal exercise performed under hyperthermic conditions has been documented (MacDougall et al., 1974; Saltin & Stenberg, 1964). It has been suggested that the temperature related rise in VO_2 is linked to added peripheral blood flow and sweating demands, increased ventilatory rate, and decrease in the efficiency of oxidative phosphorylation (Brooks et al., 1970; Brooks et al., 1971; Gaesser & Brooks., 1984).

Conclusions

In order to determine the difference between scores and discipline at the competitions in men's artistic gymnastics, the differences in scores between disciplines and competitions were tried to be found (Olympic Games, World Championships and European Championships from 2006 to 2012). Grades E and D vary between disciplines. There is a big difference in the variability of results. Generally, the lowest average score at the competitions was on the PH, and the highest one, on the VT. Similar results from the Olympic Games in 2008 were acquired by the authors (Kolar et al., 2005, Čuk and Atiković, 2009, Leskošek et al., 2013). Scores on the vault should be equal in scores at all disciplines but is not currently the case. With the Code of Points (FIG, 2009), the results for all six disciplines are not equal by the Judges' Commission D, E and by the final results F.

Conflicts of interest

No

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