ELITE FEMALE GYMNASTS AT TWO OLYMPIC GAMES – QUALITY OR LUCK?

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Abstract

Relatively small number of gymnasts participate at the Olympic Games and even smaller number participates at Olympic Games consecutively, due to numerous different reasons. Therefore, this paper aims are: 1) to determine the number of female gymnasts who participated in the C-I competition at Olympic Games held in 2012 and at Olympic Games held in 2016; 2) to determine characteristics and differences in results of consecutive participants at these two Olympic Games; 3) to determine differences between consecutive participants and other competitors at the afore defined competitions. It was found that 25 female gymnasts participated at two consecutive Olympic Games. From one to another Olympic Games, consecutive participants have numerically increase all scores; significantly increased Execution and Final Scores on the uneven bars; significantly decrease Execution and Final Score on the balance beam. Compared to other gymnasts from the 2012 and 2016 Olympic Games, consecutive participants had numerically higher values in all variables, but only some of them have been determined as significantly different. Consecutive participants confirmed the possibility of continuous quality of skills development in mid 20s.

Keywords: *consecutive participants, C-I competition, 2012-2016 Olympic Games, ANOVA.*

INTRODUCTION

Being an Olympic athlete is a dream of many people and the aim of most elite athletes. Different studies quote somewhat different time which is needed in order to achieve Olympic quality: Ericsson, Charness, Feltovich and Hoffman (2006) and Gladwell (2009) state that it takes around 10 000 working hours to achieve the Olympic quality; Arkaev and Suchilin (2009) state that it takes at least 8-10 years to reach top artistic gymnastics quality in girls and 10-12 years in boys; Gibbons et al. (2002) reported that it takes 11 to 13 years of practice in order to reach elite performances; Tucker (2011) believes that superior performances can be achieved within a significantly shorter period of time.

It is often heard that in order to reach high levels of ability, a person needs to have an innate potential called *talent*. Talent term for an aptitude, a special gift of above-average ability in a certain area, here in the area of sport motor actions, and for the person possessing these abilities. In regard to sport, three forms of talent can be differentiated: general motor talent (high motor learning ability, good motor ability,

broad repertoire of movements), sport talent (extraordinary ability and readiness to deliver sport performances), and sport-specific talent (existence of specific physical and psychological prerequisites necessary for delivering excellent performances in a certain sport discipline; Haag and Haag, 2003). Howe, Davidson and Sloboda (1998) analysed positive and negative evidence and arguments about talent. They concluded that early experiences, preferences, opportunities, habits, training and practice are the real determinants of excellence. When those are controlled, there is a little evidence of individual differences in the learning speed and quality.

In 1985, Bloom provided his opinion on the importance of talent in relation to other factors which are key in achieving the Olympic quality: „…no matter what are the initial characteristics of the individuals, unless there is a long and intensive process of encouragement, nurturance, education, training, the individuals will not attain extreme levels of capability in the particular fields."

Regardless of which theory we accept, all of them have one fact in common and that is that there are no "shortcuts" in achieving world-class performances. What is more, it is a long-term and complex process.

In the case of artistic gymnastics, this long-term process should be planned in accordance with the international gymnastics evolution tendencies and the anticipation of the sport's technical development pursuant to the changes which occur in the Code of Points (CoP) every four years (Arkaev, 1997; Rozin, 1997; according to Donti, Donti, & Theodorakou, 2014). Since the 70s, it has been pointed out that there are no unique methods of teaching and training in gymnastics (Živčić, 2000). Nevertheless, all applied methodical procedures aim to achieve the quality of the performance.

The complexity of the process of achieving an Olympic level in gymnastics is presented in the review article by Malina et al. (2013). They reported that training loads and sequencing of training activities in artistic gymnastics vary among individuals with regard to their age, competitive level, season and coach. The previous study show that: 1) the average time of training (reported by gymnasts at major championships) is approximately 30 hours per week. They state that the USA Gymnastics proposed the „optimal plan" for the training of elite senior US female gymnasts. The plan included two daily sessions (morning 2-3 hours, afternoon 3-4 hours) 6 days a week; 2) time of training overlaps in females and males and increases with age and level of competition; 3) the objective criteria for determining the intensity of training was not found; 3) the specific training activities (warm-up, stretching, strength training, instruction and repetition of specific skills and routine, rest between repetitions, dance, and choreography, etc.) are not usually reported; 4) a little attention is paid to the sex of gymnasts. The authors concluded that gymnastics training is more complex and includes more factors than just hours of training per week or number of repetitions. Furthermore, although this report was made in 2013, they concluded that reported information may not be representative for the elite gymnasts today since gymnasts face increasing demands at every new Olympic Cycle.

In order to achieve top results, today's gymnasts have to possess not only a high level of special physical qualities, perfect technique and will power, but also high work capacity and enthusiasm (Arkaev & Suchilin, 2009). From their initial training and during the process of achieving the Olympic level, CoP changes 2 to 3 times causing significant redirecting and change of content and the structure of most segments in the gymnasts' training process 2-3 times. All those changes within training do not only refer to the decision on what the gymnasts should learn, but also on how they should learn it in order to be

successful after 6 – 8 years of training when it is time to win or lose (Donti, Donti, & Theodorakou, 2014). In order to optimally use their biological chances and successfully compete in their first (and, probably, the last) Olympic Games (OG), girls at the age of 14 must have mastered the arsenal of world level exercises in gymnastics, so that, over the next two years, they can basically "catch up" at the competitions and training sessions, and meet the puberty period fully equipped (Arkaev & Suchilin, 2009).

Due to all those changes, gymnasts' training can often be risky and too demanding. The capabilities of gymnasts' anthropological aspects are pushed in order to reach the maximum. Such training very often leads to injuries or „burning out". Consequently, gymnasts, often leave the sport before they are old enough to compete internationally (at the age of 16). From the authors' experience, if they "survive" the whole process of training, most female gymnasts, in particular All-Around Competitors, end their careers before their twenties and after having competed at one OG.

According to the current regulations, female gymnasts have the right to participate in the Olympic Games when they are 16 years old (as a part of a team; Federation Internationale de Gymnastique, 2016).

In Women's Artistic Gymnastics (WAG), a maximum of 98 gymnasts have the right to participate at OG: 1) 96 gymnasts who achieve their participation right as a) a part of one of 12 qualified teams; b) based on an individual All-Around result from the World Championship (WC) that takes place one year before the OG (first 24 ranked); c) as medal winners (from the WC that takes place one year before the OG). Additional two gymnasts refer to: a) 1 gymnast who does not qualify for the OG in the qualifying competitions based on her individual or team result, but who comes from a country where gymnastics is not developed as a sport; b) 1 (the best) gymnast from the country which is organizing the Olympic Games and who does not ensure participation through the qualification system (http://corporate.olympics.com.au/files/dmfile/FIG_Gymnastics_April2011.pdf.)

After having qualified for the OG and taking into account structural complexity of this sport and the aspiration to achieve gymnasts' maximum in a relatively short career, the issue of OG competing tactics becomes extremely important (Arkaev & Suchilin, 2009). Regardless the fact that almost solely All-Around female gymnasts qualify for the OG, they are not obligated to compete on all apparatuses at OG. This rule is mostly used by: 1) competitors who accomplish their aim just by participating at OG; 2) competitors who believe that their All-Around result, as opposed to their result on a single apparatus, is not good enough for the final competition.

Based on the aforementioned, the authors posed the problem of this paper: to analyse characteristics of female gymnasts who manage to be consecutive participants at two OG. Accordingly, this paper aims to: 1) determine the number (percentage) of female competitors who competed at two successive OGs; 2) determine exercising quality of female gymnasts who participated at two consecutive OGs; 3) determine differences between consecutive participants and other competitors from OG2012 and OG2016.

METHODS

The sample included all the elite senior female gymnasts who participated in the C-I competitions at OG held in 2012 (OG2012; N_1=97) and 2016 (OG2016; N_2=98). The sample has been divided into two groups depending on the number of participations at OG (female gymnasts who participated at two consecutive OGs (FG2×OG) and female gymnasts who participated only at one OG (FG1×OG). At OG2012 group of FG2×OG (N=25) was

21.04±4.93 years old, while at OG2016 they were 25.07±4.93 years old. Female gymnasts who participated only at OG2012 (N=72) were 20.23±3.80 years old, while ones that participated only at OG2016 (N=73) were 19.45±3.13 years old.

Average age of FG2×OG without Oksana Chusovitina (who was vault finalist at OG2012 and OG2016, and whose age make her an outlier not only in artistic gymnastics but in most elite sports (her participation at the Summer OG in Rio made her the oldest female gymnast in Olympic history) was 20.45±3.83 years old, while at OG2016 they were 24.22±3.73 years old.

The variable sample is represented by a set of *Vault Difficulty Scores (VTDS)*, *Vault Execution Scores (VTES), Vault Final Scores (VTFS), Uneven Bars Difficulty Scores (UBDS)*, *Uneven Bars Execution Scores (UBES), Uneven Bars Final Scores (UBFS), Balance Beam Difficulty Scores (BBDS)*, *Balance Beam Execution Scores (BBES), Balance Beam Final Scores (BBFS), Floor Difficulty Scores (FXDS)*, *Floor Execution Scores (FXES)* and *Floor Final Scores (FXFS)* obtained at the Qualification Competition (C-I) at OG2012 and at OG2016 by the apparatus competitors, and *All-Around Score (AA)* obtained at the same competitions by the All-around competitors.

The values of the mentioned scores have been retrieved from the specialized web site for gymnastics results (www.gymnasticsresults.com, accessed on the 18th of October 2016.).

Previous studies presented detailed descriptive parameters of analyzed variables for the same competitions (Massida & Calo, 2012; Leskošek, Čuk, & Bučar, 2013; Atiković et al., 2014; Erceg, Delaš Kalinski, & Milić, 2014) as well as generally satisfactory metric characteristics of those scores (Bučar, Čuk, Pajek, Karácsony, & Leskošek, 2012; Bučar Pajek, Čuk, Pajek, Kovač, & Leskošek, 2013).

Data analysis included calculations of Mean±Standard deviations. One Way repeated measures ANOVA was used to determine differences between the performances of FG2×OG. One Way ANOVA for independent samples was used to analyze differences between FG1×OG and FG2×OG (from the OG2012 and from the OG2016). Data was considered significant if $p<.05$. All calculations were performed using software package Statistica 12.0. (StatSoft, Tulsa, Oklahoma, USA).

RESULTS

Competitive tactics of FG2×OG, at both Olympic Games, is shown in Figure 1.

Although it is a multi-structural sport and there is a complex system of qualification for the OG, the largest number of FG2×OG (on both OG) competed at all four apparatuses. At OG2012, 16 of 25 FG2×OG were All-Around competitors and 9 were Apparatus competitors. At OG2016, 14 of 25 FG2×OG were All-Around competitors and 11 were Apparatus competitors. The change in the tactics for FG2×OG can be observed in the number of those who have competed on only one apparatus. At OG2012, the total number of FG2×OG who competed at only one apparatus was 1, while at OG2016 were 11 FG2×OG who competed at only one apparatus (43% of all FG2×OG).

Exercising characteristics and differences for FG2×OG are shown in Table 1.

The analysis determined that a total number of 25 female gymnasts had the experience of previous OG. Most of the consecutive Apparatus Competitors on the OG2012 competed floor, while the lowest frequency of consecutive Apparatus Competitors has been determined at the uneven bars. At OG2016 the highest

frequency of consecutive Apparatus Competitors has been determined at the balance beam and the lowest at the floor. Compared to their results from the OG2012, at OG2016 Apparatus Competitors FG2×OG achieved higher values in VTES, UBDS, UBES, UBFS, FXDS, FXES, FXFS variables, and lower values in VTFS, BBDS, BBES, and BBFS. However, numerically significant differences were found only in the values of UBES, UBFS, BBES and BBFS.

Comparison of the results achieved by All-Around competitors FG2×OG at OG2012 and at OG2016 resulted in numerically slightly higher AA value at the latter.

The characteristics and the differences in relation to FG2×OG and FG1×OG (from the OG2012 and the OG2016) are shown in Table 2.

Table 1
Differences of FG2×OG performance at the OG2012 and at the OG2016.

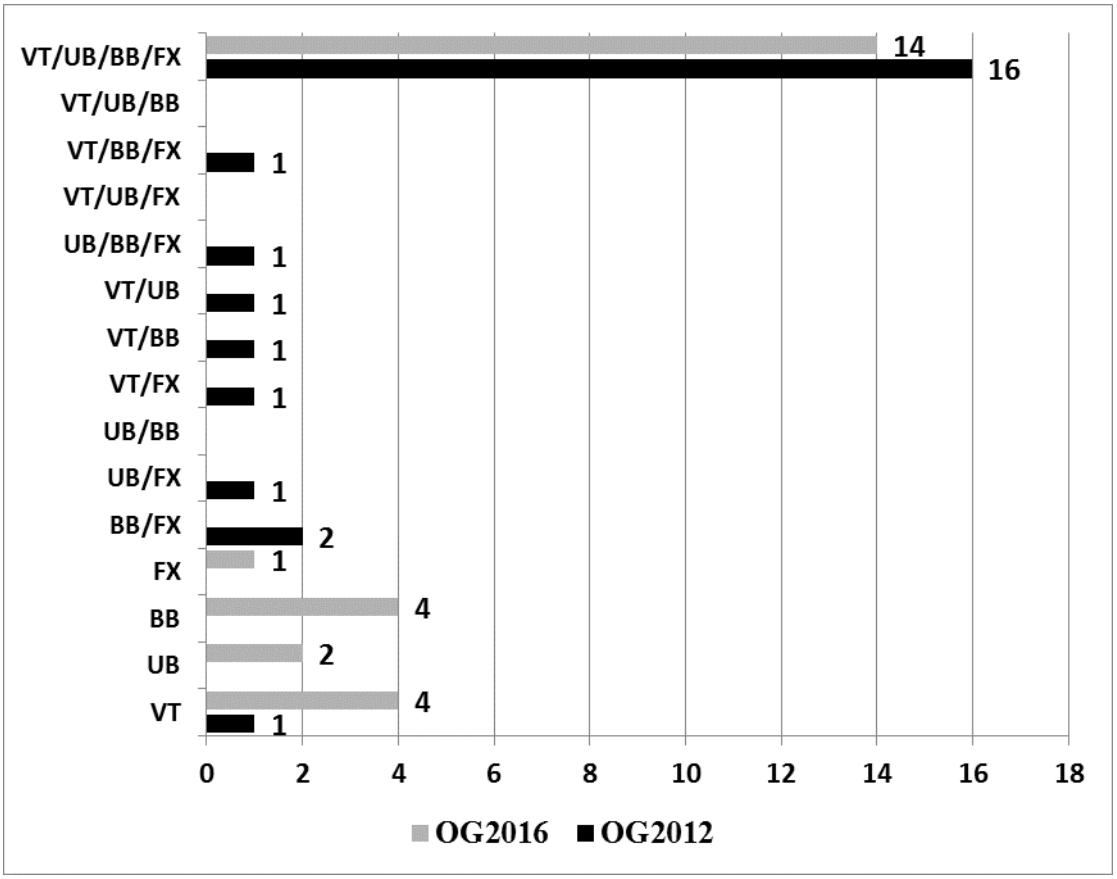
		2012		2016	ANOVA		
	N_1	M±SD	N_2	M±SD	F	p	η^2
VTDS	6*	6.08±0.45	15	5.47±1.32	1.50	0.27	0.23
VTES		8.51±0.60		8.79±0.88	0.05	0.84	0.01
VTFS	18	14.42±0.91		14.39±1.63	1.18	0.30	0.09
UBDS	17	5.87±0.62	15	6.60±2.21	1.65	0.22	0.12
UBES		8.14±0.36		8.53±0.39	28.55	<0.01	0.70
UBFS		14.01±0.92		14.59±0.81	23.27	<0.01	0.66
BBDS	19	5.78±0.44	16	5.75±0.44	0.75	0.40	0.05
BBES		8.11±0.62		7.86±0.55	5.60	0.03	0.27
BBFS		13.89±0.97		13.61±0.83	4.92	0.04	0.25
FXDS	20	5.50±0.49	12	5.63±0.59	0.27	0.61	0.02
FXES		8.11±0.66		8.21±0.49	0.06	0.81	0.01
FXFS		13.56±1.04		13.82±1.01	0.09	0.77	0.01
AA	16	56.02±2.76	14	56.48±2.50	0.14	0.71	0.02

Legend: N_1 – number of FG2×OG at the OG2012, N_2 – number of FG2×OG at the OG2016, M±SD – Mean value ± Standard deviation; ANOVA - One Way repeated measures ANOVA was used: F – F value, p – p value, η^2 – effect size, (partial) eta squared, VTDS - Vault Difficulty Score of Apparatus competitors, VTES - Vault Execution Score of Apparatus competitors, VTFS - Vault Final Score of Apparatus competitors, UBDS - Uneven Bars Difficulty Score of Apparatus competitors, UBES - Uneven Bars Execution Score of Apparatus competitors, UBFS - Uneven Bars Final Score of Apparatus competitors, BBDS - Balance Beam Difficulty Score of Apparatus competitors, BBES - Balance Beam Execution Score of Apparatus competitors, BBFS - Balance Beam Final Score of Apparatus competitors, FXDS - Floor Difficulty Scores of Apparatus competitors, FXES - Floor Execution Score of Apparatus competitors, FXFS - Floor Final Scores of Apparatus competitors, AA – All-Around Score of All-Around competitors, *For the FG2xOG the OG 2012 data records, included vaules of the VTDS, VTES and the VTFS, while for all the other competitors it indicated only values of the VTFS

Table 2
Differences between the FG2×OG and FG1×OG performances.

				2012			
		FG1×OG		FG2×OG			
	N_1	M±SD	N_2	M±SD	F	p	η^2
VTDS	12	5.63±0.74	6	6.08±0.45	1.92	0.18	0.11
VTES		8.39±0.71		8.51±0.60	0.12	0.73	<0.01
VTFS	47	13.97±0.88	18	14.42±0.91	4.11	0.05	0.06
UBDS	59	5.62±0.74	17	5.87±0.62	2.00	0.16	0.03
UBES		7.70±0.89		8.14±0.36	4.10	0.05	0.05
UBFS		13.32±1.37		14.01±0.92	4.23	0.04	0.05
BBDS	62	5.47±0.61	19	5.78±0.44	5.23	0.02	0.06
BBES		7.45±1.00		8.11±0.62	8.29	0.01	0.09
BBFS		12.92±1.31		13.89±0.97	10.52	<0.01	0.11
FXDS	59	5.36±0.44	20	5.50±0.49	1.46	0.23	0.02
FXES		8.07±0.45		8.11±0.66	0.09	0.76	0.00
FXFS		13.37±0.84		13.56±1.04	0.68	0.41	0.01
AA	43	52.91±3.51	16	56.02±2.76	10.18	<0.01	0.15
				2016			
	N_1	M±SD	N_2	M±SD	F	P	η^2
VTDS	49	5.42±0.56	15	5.47±1.32	4.56	0.04	0.07
VTES		8.78±0.48		8.79±0.88	2.65	0.11	0.04
VTFS		14.18±0.79		14.39±1.63	6.41	0.01	0.09
UBDS	58	5.74±0.64	15	6.60±2.21	2.88	0.09	0.04
UBES		8.03±0.66		8.53±0.39	8.08	0.01	0.10
UBFS		13.76±1.17		14.59±0.81	6.56	0.01	0.08
BBDS	54	5.62±0.57	16	5.75±0.44	1.03	0.31	0.01
BBES		7.75±0.81		7.86±0.55	0.22	0.64	0.00
BBFS		13.36±1.26		13.61±0.83	0.61	0.44	0.01
FXDS	49	5.34±0.76	12	5.63±0.59	1.75	0.19	0.03
FXES		7.89±0.47		8.21±0.49	4.55	0.04	0.07
FXFS		13.18±1.02		13.82±1.01	4.12	0.05	0.06
AA	44	54.17±3.11	14	56.48±2.50	6.07	0.02	0.10

Legend: N_1 – number of FG1×OG, N_2 – number of FG2×OG, M±SD – Mean value ± Standard deviation; One Way ANOVA was used: F – F value, p – p value, η^2 – effect size, (partial) eta squared, VTDS - Vault Difficulty Score, VTES - Vault Execution Score, VTFS - Vault Final Score, UBDS - Uneven Bars Difficulty Score, UBES - Uneven Bars Execution Score, UBFS - Uneven Bars Final Score, BBDS - Balance Beam Difficulty Score, BBES - Balance Beam Execution Score, BBFS - Balance Beam Final Score, FXDS - Floor Difficulty Scores, FXES - Floor Execution Score, FXFS - Floor Final Scores, AA – All-Around Score



Legend: VT- vault, UB – uneven bars, BB – balance beam, FX – floor

Figure 1. Combinations of competed apparatuses at the OG2012 and at the OG2016 by FG2×OG.

Group of FG2×OG had numerically higher values than other competitors at OG2012 and at OG2016. By using ANOVA, it was determined that FG2×OG (compared to FG1×OG from OG2012) had significantly higher values in VTFS, UBES, UBFS, BBDS, BBES and BBFS variables while in other variables significant differences were not determined. Significantly higher scores also have been determined in All-Around competitors FG2×OG, in comparison to All-Around competitors FG1×OG.

At OG2016, FG2×OG had significantly higher values in VTDS, VTFS, UBES, FXES and FXFS (than the FG1×OG from the OG2016) while in other variables differences were not determined. All-Around competitors FG2×OG from the OG2016 also had significantly higher values than All-Around competitors FG1×OG.

DISCUSSION

From the total number of female gymnasts that competed at OG2016, 25 (cca. 26%) of them had an experience of previous OG (OG2012). Analysis of the scores which are obtained by FG2×OG, from the OG2012 to the OG2016, generally determine the following: 1) they decrease difficulty of performed vaults, but increase the quality of performance; 2) they significantly improve the quality of performance (UBES) and significantly increase the final score on uneven bars (UBFS); 3) they significantly decrease the

quality of performance and this results in a significant decrease of final score on the balance beam, compared to the results from the OG2012; 4) they increase numerical values of difficulty and the quality of the performance on the floor, compared to the results achieved in the OG2012.

Determined reductions in some scores (VTDS, BBES, and BBFS) is not proper to attribute only to lower gymnasts competition quality, but also to the changes that have occurred in the CoP 2013-2016 (FIG, 2009) in relation to the CoP 2009-2012 (FIG, 2013). Namely, compared to the CoP 2009-2012, in the CoP 2013-2016 some most frequently performed vaults (often the vaults of the highest Difficulty Values, performed on all levels of the major competitions) went through the reduction of the Difficulty Value (Delaš Kalinski, Atiković, Jelaska, & Milić, 2016).

According to the analyzed CoPs, lower ES on the balance beam can not be associated with some significant changes in the rules on this apparatus. However, based on higher values of the BBDS it is possible to assume that the performance of more complex and difficult elements was not that stabile and correct, what led to lower scores of the BBES at OG2016 in relation to the OG2012.

However, the following question arises: did the increase of most scores at OG2016 enable FG2×OG to qualify for the finals?

Referring to the original results, we notice the following: if compared to the OG2012, 14 of 25 FG2×OG All-Around competitors, at OG2016, remained; 10 of 25 FG2×OG have reduced the number of competed apparatuses; one of 25 FG2×OG have increased the number of competed apparatuses and have became All-Around competitor; one of them competed the same (one) apparatus at both OG. From 14 All-Around FG2×OG at OG2016, nine entered All-Around Finals (Elisabeth Black, Carlotta Ferlito, Vanessa Ferrari, Jessica Brizeida Lopez Arocha, Aliya Mustafina, Alexandra Raisman, Elisabeth Seitz, Giulia Steingruber and Teramoto Asuka) and seven entered the apparatus final competitions (vault finals: Giulia Steingruber; uneven bars finals: Aliya Mustafina, Elizabeth Seitz, Jessica Brizeida Lopez Arocha, Gabrielle Douglas, floor finals: Alexandra Raisman, Vanessa Ferrari, Giulia Steingruber).

Four FG2×OG out of eleven, who have competed only one apparatus at OG2016, entered the final competitions (Catalina Ponor on the balance beam, Maria Paseka and Oksana Chousovitina on the vault, and Erica Fasana on the floor).

Based on the aforementioned results of FG2×OG, the quality of all FG2×OG at OG2016 is unquestionable. The assumption is that those consecutive participants used the period of time between the two OG to stabilize and upgrade previously acquired skills. Longer period of complex motor skills learning (primarily skills of elite artistic gymnastics) is needed if we want to acquire the highest stage of motor skills (Schmidt, & Wrisberg, 2008).

At both OG FG2×OG, compared to FG1×OG, had numerically higher values of all scores but significant differences between FG2×OG and FG1×OG have been found only in 50% of the variables (in VTFS, UBES, UBFS, BBDS, BBES and BBFS variables at OG2012, and in VTDS, VTFS, UBES, UBFS, FXES and FXFS variables at OG2016; Table 2). Besides the quality difference among these two groups of competitors, we also assume the impact of age, i.e., longer sports carrier and longer period of deliberate practice.

At OG2012, compared to FG1×OG, FG2×OG had numerically higher values of VTDS and VTES, and significantly higher values of VTFS. Furthermore, at OG2016, compared to FG1×OG, FG2×OG had numerically higher values of VTES and significantly higher values of VTDS and VTFS. Referring to the original results it has been revealed that 5 FG2×OG (of the

total number of 18 Vault Qualifiers) participated at the Vault Qualifications at OG2012, out of which four FG2×OG competed Vault Finals at OG2012 (Maria Paseka, Oksana Chusovitina, Brittany Rogers, and Elsabeth Black). At OG2016, five of 19 Vault Qualifiers were FG2×OG, out of which even three FG2×OG competed in Vault Finals at OG2016 (Maria Paseka, Giulia Steingruber and Oksana Chusovitina). Taking into account the facts of having analysed scores from C-I competition, and the scores of the 1st vault of Vault Qualifiers count for Team Result and Individual All-Around Result (FIG, 2009, 2013), it is not surprising that for the 1st vault Vault Qualifiers chose vaults with numerically higher *DVs* (and sometimes significantly higher) from those performed by All-Around Competitors (Delaš Kalinski, Atiković, Jelaska, & Milić, 2016). Whereas the FG2×OG at both OG formed 1/4th of the group of Vault Qualifiers, and that five (OG2012) or three (OG2016) competed in Vault Finals, their higher scores on vault, compared to FG1×OG, were only logically-achieved results.

Higher values of VTFS of FG2×OG, despite the reduction of the Difficulty Values of the most frequently performed vaults (CoP, 2013), confirm their progression in the quality and complexity of the performed vaults and support a conclusion that female gymnasts can have prolonged development of skills after the age of 20 (Zurc, 2017).

Significantly higher values for FG2×OG in the UBES variable, at OG2012 and at OG2016, confirmed the results of the previous studies. Namely, Ferreirinha et al. (2011) determined that the uneven bars are apparatus which needs more time to train in order to achieve higher technical and aesthetic level of performance. Since for the FG2×OG higher average values of age have been determined at both OGs (at OG2012 FG2×OG was 21.04 old and FG1xOG was 20.23 old; at OG2016 FG2×OG was 25.07 old and FG1xOG was 19.45 old), and probably a longer sports carrier than other female Olympic Games gymnasts, the obtained result can be justified. However, due to the lack of information on the training process of the previously mentioned female gymnasts, and the fact that training workloads as well as sequencing of training sessions are highly variable among individuals/gymnasts (Malina et al, 2013), the influence of longer sports carrier and longer time of deliberate practice on superior levels of performance of uneven bars by FG2×OG remains unknown.

At OG2012, all scores achieved on the balance beam by FG2×OG were significantly higher from the scores achieved by FG1×OG at the same apparatus. Accordingly, it is possible to assert that on this apparatus, FG2×OG group significantly differs from other gymnasts in their technical and aesthetical quality of performance. During the original data introspection, it was found that FG2×OG group included 3 gymnasts (Alexandra Raisman, Catalina Ponor and Gabrielle Douglas) who entered balance beam finals at OG2012. From other 19 FG2×OG who at OG2012 competed on the balance beam in the qualification competition, 11 of them were ranked among first 31 places and the remaining 8 among 57 places. In accordance with those results, the balance beam competing quality can be clearly visible and the obtained results are logical. At OG2016, despite the certain numerical dominance of FG2xOG in all balance beam variables (compared to FG1xOG), significant differences have not been determined.

At both analysed OG, FG2xOG had numerically higher values of all floor variables, than FG1xOG, but the significant difference has been determined only at OG2016 in FXES and (probably) consequently in the FXFS. The reason for significantly higher quality of FG2xOG, compared to FG1xOG, probably stems from the fact that even 4 competitors from

the group FG2xOG, at OG2016, competed in floor finals (Alexandra Raisman, Vanessa Ferrari, Erika Fasana and Giulia Steingruber), and that a member of the FG2xOG group at OG2016 also was Aliya Mustafina, who won the third place in floor finals at OG2012. The difference between FG2xOG and other gymnasts in FXES, support the conclusion how the chronologically older gymnasts have potentially higher forms of capital, compared to a chronologically younger gymnast, is their ability to express themselves artistically (Kerr et al., 2015). The importance of artistry in women's artistic gymnastics has been a concern of the International Gymnastics Federation and was incorporated in its execution score since 2009.

Nine out of 14 FG2xOG All-Around competitors at OG2016 competed in All-Around Finals, six competed in one Apparatus Finals while four competed in two Apparatus Finals. Apart from the fact that participation in any final competition at OG is a major proof of gymnasts quality, due to the fact that nine FG2xOG competitors who competed in All-Around Finals (from OG2012 and from OG2016) make 37% of overall competitors of All-Around Finals, the significant difference between FG2xOG and FG1xOG in AA variable, at both OG, is rather logical.

CONCLUSION

The results of this study determined that the number of FG2×OG (from OG2012 to OG2016) was 25 (almost ¼ of all competitors) which, according to the authors, should not be considered low. At Olympic Games from OG2012 to OG2016, FG2×OG numerically increased most of their scores, placed high at most final competitions, and confirmed the possibility of continuous quality of skills development in mid 20s.

Higher values of FG2×OG in relation to FG1×OG, at both analyzed Olympic Games, suggest that FG2×OG competitive compositions generally have been above-average with regards to the difficulty values. Apart from the mentioned, they have been performed more correctly in the technical and aesthetical sense. Accordingly, such exercising is definitely one of the key factors responsible for their repeated participation at the Olympic Games.

Pursuant to the obtained results, several conclusions can be made and they are as follows: 1) FG2×OG are probably a subject of adequately planned programs that enable their technical and execution evolution; 2) continuous progress of FG2×OG group could be interpreted as resulting from will power, high working capacity and love for hard work which continuously keeps and encourages them to continue to improve their performances; 3) (presumably) higher chronological age of female gymnasts (since FG2×OG are at least 20-year-old), which is characterized by the stability of the motor programs, probably plays a role in competing of FG2×OG.

However, a factor which can be considered as the most important in reaching, retaining and improving that quality, from one Olympic Games to another (individual characteristics of gymnasts, early experiences, preferences, opportunities, habits, training or practice), remains to be determined in other studies.

"The pathway from genes to talent to greatness is often very nuanced and complex" (Kaufman, 2013)

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