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HAMSTRING/QUADRICEPS STRENGTH RATIO AS A PREDICTOR OF INJURIES IN YOUNG FEMALE ATHLETES OF ARTISTIC GYMNASTICS

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SUMMARY

Women's Artistic Gymnastics (WAG) is a sport with a high incidence of injuries in the lower limbs, especially at the knees. Muscle imbalance has been associated to injuries in high jumping impact sports as WAG. The purpose of this study was to investigate if the H/Q ratio is a predictor of injuries in initial categories of women's artistic gymnastics. Thirteen gymnasts had their H/Q ratio analyzed and divided into 3 groups for comparison. The results found no significant differences between groups: age, experience and weekly training load. Therefore, the H/Q ratio isn't a predictor of injury to gymnasts that are older, more experienced and have a higher training load.

INTRODUCTION

Research has shown that older gymnasts, with more experience and that have a higher weekly training load have a higher injury incidence [1, 2, 6]. This higher lower limb injuries incidence has been explained by the great amount of landings in WAG, exposing the lower limbs to high loads from the body. The muscle imbalance between the knees extensors and flexors muscles has been considered as an important injury predictor after jumps and landings [4, 5]. The purpose of this study was to investigate if the H/Q ratio is a predictor of injuries in initial categories of women's artistic gymnastics.

METHODS

Thirteen young women's artistic gymnasts, age between 8 and 13 years, participated in this study. These gymnasts were divided into 3 groups for H/Q ratio comparison: Age – (1) Pre-Infant – 8 to 10 years and (2) Infant – 11 to 12 years; Experience: (1) Youngers – Between 1 and 1 year and 11 months of training; (2) Older – More than 2 years of training; Training Load: (1) Little – 6 to 8 hours/week; (2) Medium – 10 to 15 hours/week.

The H/Q ratio was calculated from the values of peak of torque for knee extension and flexion measured by Biodex

Isokinetic Sistem III (Biodex Medical, Inc., Shirley, NY). We performed two sets of 4 reps at 60o/sec concentric/concentric, and the best values were used to attempt data analysis. A comparison of the H/Q ratio between groups was tested by a simple regression using the SPSS 18.0 software.

RESULTS

From Table 1 we can analyze the values of the ratio H/Q within groups in which the gymnasts were pooled to make the comparison. According to Dvir [3] values of H/Q ratio close to 0.60 are considered normal. For subjects analyzed in this study we observed values between 0.48 and 0.52, close to 0.60.

The regression results presented in Table 2 show that there was no significant difference in the H/Q ratio among groups, to the right leg [$F = 0.40$ (3.9) ns] and for the left leg [$F = 0.12$ (3.9), ns], thus showing that the younger and older gymnasts, the more experienced and less experienced, and the gymnasts who train 6 to 8h/week and from 10 to 15h/week have the same risk of injury at the lower limbs. Although studies have shown that the older, more experienced and with more hours of training female gymnasts have more incidence of injuries at lower limbs, we observed in this study that perhaps these injuries are not related to muscle imbalance between the quadriceps and hamstrings, and the H/Q ratio predicts 12% and 4% of lesions in the lower right and left limb, respectively, and these values were considered very low.

The literature has linked the high number of injuries in older gymnasts with a higher level of skills performed by these athletes. Higher the category in which the gymnast is in competition, and greater the degree of difficulty of the exercises required and consequently, higher the involvement in hours of practice to be able to learn all the skills, increasing the number of exposures to risk factors injury. [1, 2, 6].

CONCLUSION

Despite the limited number of subjects, it was concluded that young female athletes of Artistic Gymnastics with different levels of experience and training workloads have the same risk of injury when analyzing the risk factor imbalance between the knee flexors and extensors muscles. Thus, other factors such as technical skill level, among others may be more instrumental in increasing the number of lesions in older gymnasts.

One limitation of the study was not to have access to older gymnasts such as the juvenile and adult categories with high-level training, which have a workload of training between 35 and 42 hours / week, and are the population with most risk of injury .

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Table 1 – Mean (standard deviation) of H/Q ratio at right and left lower limb at the groups age, experience and training load.

	Age		Experience		Load	
	Pre Infant (n=6)	Infant (n= 7)	Young (n= 8)	Older (n=5)	Little (n= 7)	Medium (n= 6)
I/Q Righth Leg	0,48 (,067)	0,52 (,072)	0,51 (,049)	0,50 (,1)	0,51 (,072)	0,49 (,076)
I/Q Left Leg	0,50 (,052)	0,52 (,091)	0,50 (,062)	0,52 (,095)	0,51 (,092)	0,51 (,050)

Table 2 – Linear Regression of the groups over the H/Q ratio on right and left leg.

Leg	Groups	Coef. of Regression (B)	Coefic. of Standard. Regression (β)	Test t	P<
Right	Age	0,00	0,03	0,09	n.s
	Experience	-0,01	-0,11	-0,34	n.s
	Load	0,04	0,32	1,00	n.s
			R ² =	0,12	
			R =	0,34	
Left	Age	0,03	0,18	0,52	n.s
	Experience	-0,01	-0,08	-0,25	n.s
	Load	0,02	0,12	0,35	n.s
			R ² =	0,04	
			R =	0,2	