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THE TEMPORAL VARIABLES DURING THREE TYPES OF VAULTING IN GYMNASTICS

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SUMMARY
The aim this study was to evaluate the effects of the type of vault on the table at the gymnastics. The participants were the finalists of the 14-16 years old Brazilian gymnastics competition. The temporal variables during the vault are affected by the type of the vault. However, the second flight time does not depend on the type of the vault or the type of posture during this flight.

INTRODUCTION
The vault is one of exercises in gymnastics which is performed by men and women. During the competition, each athlete jumps twice over the table. The phases of the vault are the running, springboard contact, first flight, vaulting table contact, second flight and landing [1]. Although a lot of combinations during the vaulting, three general types of vaulting exist [2]: handspring, Yurchenko and Tsukahara. The aim of this study is to compare the temporal variables related to the vault across the types of vaulting.

METHODS
The vaulting of eleven male and 15 female Brazilian elite gymnastic athletes competing at the Finals of the 14-16 years old National Competition, 2011, were shot with a digital camera (HDR XR100, Sony Inc). The sampling frequency was 120 Hz. For the analysis, it was considered 22 male vaults and 29 female vaults. The camera was perpendicular to the sagital plane of the vaulting table. It was measured the support time on the springboard, the first flight time, the support time on the vaulting table and the second flight time. Those time variables were compared across the types of vaulting (handspring, Yurchenko and Tsukahara) and the types of jump (tuck, pike and extended) by the use of the two-way analysis of variance (ANOVA).

RESULTS AND DISCUSSION
The averages and standard deviations of the time variables across types of postures (Figure 1) and types of vaulting (Figure 2) were compared.

The two-way ANOVA showed that the time on the springboard was affected by the type of the vault ($F_{(2,46)}$=14.3 $p<0.001$). The Yurchenko vault takes the longest time on the springboard ($p<0.05$).

The first flight time was affected by the type of the vault ($F_{(2,46)}$=14.8 $p<0.001$). The shortest first flight occurred during the Tsukahara vault ($p<0.05$).

The support time on the vaulting table was affected by the type of the vault ($F_{(2,46)}$=30.1 $p<0.001$) and the posture during the second flight ($F_{(2,46)}$=3.9 $p=0.02$). The support time on the vaulting table was the longest during the Tsukahara vault ($p<0.05$) and the tuck vault showed the tendency to be the shortest ($p=0.05$).

The Yurchenko vault takes the longest time on the springboard. The round off is a movement that takes time to be performed and causes such a long time on the springboard. Although, the increase time on a compressed spring may reduce the mechanical energy for the vault, because during the contact to springboard, some joint are not extending but closing their angles. As a consequence, the athlete should generate more mechanical energy rotating as fast as possible during the round off.

The Tsukahara vault has the shortest first flight. Lowering the time for the first flight decreases the height of the flight and reduces the impact forces on the vaulting table. It helps the athlete to perform the half turn off the springboard and hit the table.

The Tsukahara vault takes the longest support time on the vaulting table. During the contact with the vaulting table, the athlete must change the body attitude and orientation. Both postural changes consume time and increase the contact to the vaulting table.

The time of the second flight is not affected by the vault or the postures that the athlete performs during this phase. The mechanical energy depends on the linear and angular momenta during the flight. Although the time was similar, the needs for mechanical energy of each vault are different. It suggests that propulsion on the vaulting table is affected by the type of the vault, but it is constrained by the fact that the flight time will not change.

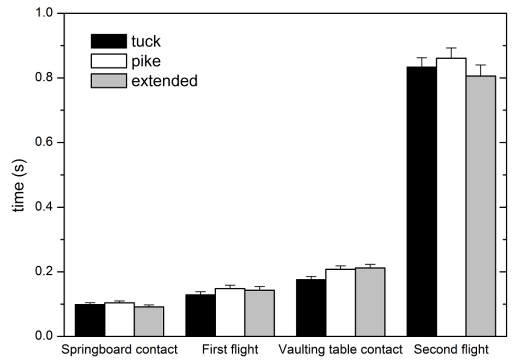

Figure 1 – Average and standard deviation of the time variables across the three types of postures during the phases of the vault.

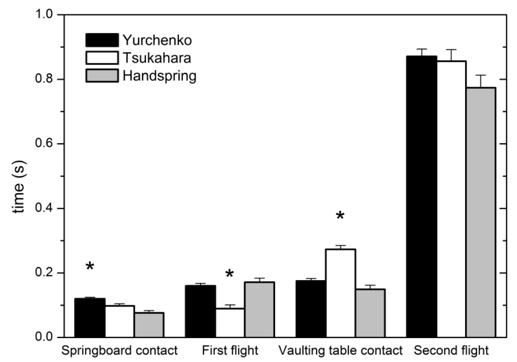

Figure 2 – Average and standard deviation of the time variables across the three types of vaulting during the phase of the vault.

CONCLUSIONS

The time variables of the Vault depends on the type of vaulting will be performed. Although handspring, Yurchenko and Tsukahara have different temporal behaviors before the second flight, all of them showed the same time for the second flight.

REFERENCES

1. PRASSAS, S.; KWON, Y.H.; SANDS, W.A. (2006). Biomechanical Research in Artistic Gymnastics: a Review. *Sports Biomech*, **5(2)**: 261-291.
2. BRADSHAW, E. (2004). Gymnastics. Sports Biomech, **3(1)**: 125-144