THE COMPARISON OF BALANCE ABILITY BETWEEN JUDO PLAYERS AND NON- ATHLETES

Ching-Cheng Chiang, Jinn-Yen Chiang[1] and Tzyy-Yuang Shiang
National College of P. E. & Sports, Taiwan
[1]China Medical College, Taiwan

This present study investigated the balance ability between elite judo players and non-athletes. The subjects consisted of two groups. The judo players group consisted of ten elite judo players with mean age 21.2 ± 1.5 years and the second group consisted of ten non- athletes with a mean age of 19.2 ± 1.9 years. There were two tests in the study: the static balance test and the dynamic balance test. The equipment used in this study included Kistler force plate system and tensiometer. The results of this study were analyzed by a t-test in order to detect the difference in balance standing time on one leg with eyes closed, center of pressure (COP) of body sway and time of balance recovery between two groups. In the static balance tests, the radius of body sway COP judo players group was significantly smaller than that of the non-athlete group ($P < 0.05$). In the dynamic balance test, there was also a significant difference in the time of balance recovery between two groups ($p < .05$).

KEY WORDS: balance, static balance, dynamic balance, judo

INTRODUCTION: Body balance and postural control are required during daily activities, such as standing in a moving bus or train. Postural control training is more important for people who are visually impaired, those patients affected by cerebrovascular accident as well as for the elderly. Furthermore, balance ability is essential for top athletes, in order to reach peak performance in sport competitions. Balance is also a very important factor for athlete talent identification since only in dynamic balance during human movement, can muscle create adequate power and strength. Several previous studies have compared the ability of balance between older people with stroke, those with Parkinson's disease and unaffected older people. Lord, Ward, & Williams (1996) reported that exercise could significantly improve dynamic postural stability in older persons and have elucidated some possible mechanisms by which such improvements may be mediated. Therefore, this study investigated the difference of balance ability between the judo players and non-athletes.

METHODS: The subjects included two groups: the judo players group which consisted of ten male judo players (mean age 21.2 ± 1.5 years) and the group consisting of ten non-athletes (mean age 19.2 ± 1.9 years). Exclusion criteria were history of severe heart disease, vertigo, epilepsy, and total hip replacement. The subjects were asked to kick a ball with a single leg twice before the commencement of the test. The leg selected to kick the ball was defined as the dominant leg, while the other leg was referred to as the supporting leg. The investigation is divided into two main sections: static balance test (SB) and dynamic balance test (DB). The SB part is divided into two separate tests:

1. Standing on supporting leg with eyes closed test (Figure 1): Every subject was required to repeat the same test three times. Data of this test was recorded by measuring maximum time of standing.
2. Body sway test (Figure 2): Each subject stood in the standard Romberg position (feet together) on a Kistler force platform for 20 seconds. This test was performed three times. The sampling rate was 100Hz and sampling time was 20 seconds. The amount of COP sway was calculated by measuring the mean radius of the COP locus pattern.

Figure 1 - Standing on one leg with eyes closed form.

Figure 2 - Form of body sway test.

The dynamic balance test examined the human postural control by determining dynamic balance during balance recovery perturbations. Each subject stood on two legs with eyes open on the Kistler force platform. A cable with tensilmeter (IMADA FB50K) was connected between the subject and capstan (Figure 3). The balance disturbance was created by disconnecting the cable without warning when the cable tension reached 10% of each subject's body weight. Subjects were instructed to recover standing balance as soon as possible after balance disturbance. The amount time of balance recovery was recorded by measuring the time from perturbation to recover standing balance. All data was calculated by Bioware software of Kistler force plate system. T-test was used to examine statistical differences between two groups with significant level at 0.05.

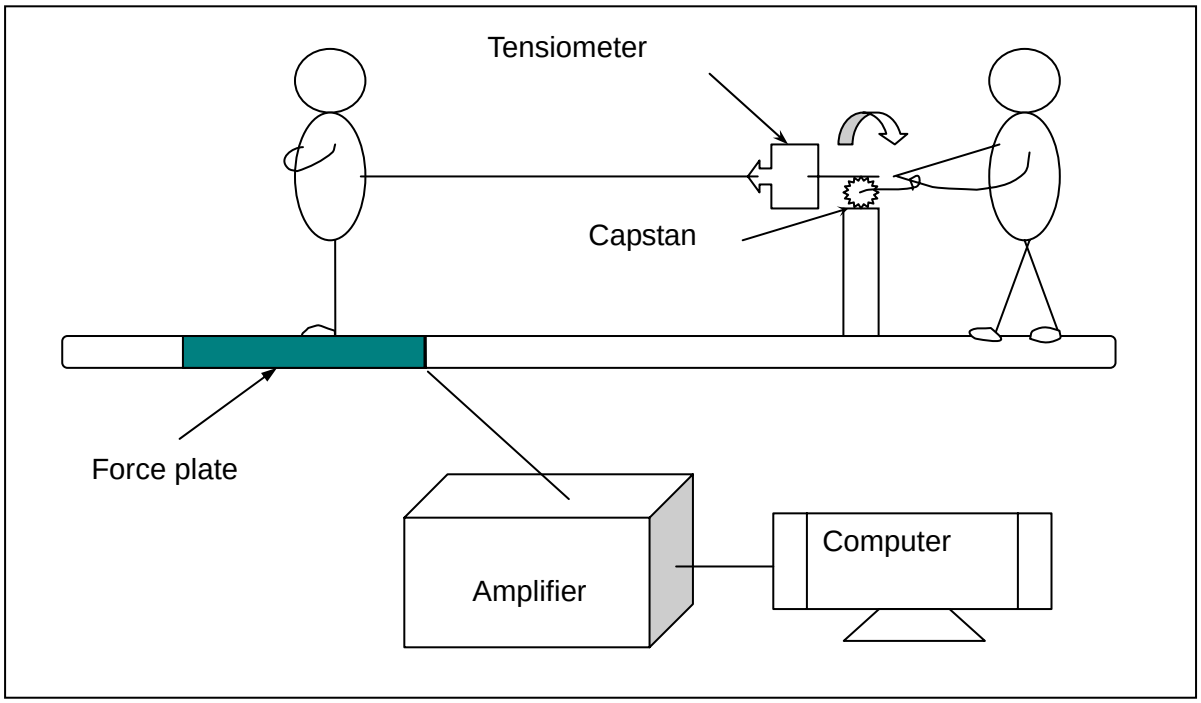

Figure 3 - Representation of dynamic balance test.

RESULTS AND DISCUSSION: The results of the both static and dynamic balance tests are listed in table 1. In the static balance test, no significant difference in the one leg standing with eyes closed test could be found between the judo player and non-athlete groups. The radius of body sway COP of judo player group was significantly smaller than the normal male group ($p < .05$). Interesting insight is gained by examining static balance tests, one with eye closed and another with eyes open. Judo players have better static balance ability than non-athletes. This result suggested that regular sport training can significantly enhance the static balance ability. There is an agreement between current work and Lord's study (1996). Lord suggested that regular exercise is essential for both healthy non-athletic persons and patients with disease. In clinical application, measuring body sway COP by using force platform is an effective and reliable way to assess balance ability which is in agreement with other studies (Andres, 1980; Nashner, 1979, Odenrick, 1987).

In the dynamic balance test, there was also a significant difference in the time of balance recovery between the two groups ($p<.05$). Judo players recovered from balance perturbation faster than non-athletes. This finding is not too surprising considering that judo players are frequently involved in activities such as Nage-waza during competition. Most judo techniques are aimed at unbalancing the opponent without loosing balance themselves, a skill which requires high postural control ability in dynamic situations.

Single leg standing with eyes closed test is often used to measure the balance ability of athletes. It has been illustrated that the selection of a reliable testing method is of central importance to the measurement of this characteristic. As clearly shown in Table 1, the static measurement of balance ability, has frequently failed to unveil any significant difference. Thus, it is possible that dynamic measurements would be the preferred method.

Table1 Means, Standard Deviations, and T-test Results for Balance Tests of Judo Player Group and Normal Male Group. (n = 10)

Balance tests	Judo player (M± S.D.)	Normal male (M± S.D.)	t	p
Static balance test				
One leg standing with eyes closed (sec)	47.3± 27.6	72.9± 25.8	.85	.401
Radius of body sway COP (cm)	0.6± 0.1	0.8± 0.2	2.25	.045 *
Dynamic balance test				
Time of balance recovery (sec)	1.3 ± 0.1	1.6± 0.2	3.05	.013 *

*p <.05

CONCLUSION: In summary, the goal of this study was to compare the balance ability between judo players and non-athletes. Based on the findings of this study, it is suggested that regular exercises would significantly improve balance ability. If physical exercises could be implemented among non-athletes, it would most certainly improve balance and general health. In addition, improved balance ability would decrease the high incidence of falling and subsequent fractures in the growing population of elderly people. Several traditional as well as new balance test methods were examined in order to determine the better quantitative index for static and dynamic balance. Hopefully, the appropriate balance test method and quantitative index can be determined and used in rehabilitation and sport fields as a consequence of the results obtained through this study. Future research should focus on investigating the effect of sport activities on balance ability, with different sport athletes who are involved in regular training being selected to be the subjects.

REFERENCES:

Andres, R.O., & Anderson, D.J. (1980). Designing a better postural measurement system. *Am. J. Otolaryngol*, **4**, 197-206.

Lord, S.R., Ward, J. A., & Williams, P. (1996). Exercise effect on dynamic stability in older women: A randomized conteolled trial. *Arch Phys Med Rehabil*, **77**, 232-236.

Nashner, L.M., Woollacott, M., & Tuma, G. (1979). Organization of repaid responses to postural and locomotor-like perturbations of standing man. *Exp. Brain Res.*, **36**, 463-476.

Odenrick, P., Tropp, H., & Ortengren, R. (1987). A method for measurement of postural control in upright stance. *Biomechanics*, **10-A**, 437-443.