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The Relationship between Ankle Propriosepsion and Dynamic Balance Performance in Wresters

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Abstract

The aim of this study is; to investigate the relationship between ankle proprioception and dynamic balance performance. 12 athletes from the wrestling team (age: 20.4 ± 1.6 year, height: 175.±4.24 cm, weight: 76.75 ± 10.1 kg) of Pamukkale University Faculty of Sport Sciences participated in this study voluntarily. Dynamic balance, height and weight measurements, leg lengths and dominant legs of the right and left legs of the subjects were recorded. Proprioception of wrestlers; 7º, 14º and 21º plantar flexion and 7º dorsi flexion positions were measured with universal goniometer. In the neutral position of the ankle at 90º, the eyes were taught in the open position while the foot was moved passively. Then he was asked to find the same angle and 3 attempts were made for each angle. YBT (Y- Balance Test) battery was applied to assess the wrestlers' dynamic balance measurementsThe measurements were taken in 3 different directions (anterior, posteromedial, posterolateral) for both legs and the mean of three measurements for each direction was averaged. Pearson correlation analysis was used to determine the relationship between the proprioception values and balance performance of the athletes There was a statistically significant relationship between right and left dynamic equilibrium performances of 7º and 14º plantar flexion and 7º dorsi flexion values of right and left ($p < 0.05$). There was no statistically significant relationship between right-left dynamic balance performance and 21º plantar flexion of the right-left foot ($p > 0.05$).

Keywords: Wrestlers, proprioception, dynamic balance.

Introduction

Proprioception has been defined as one's ability to integrate the sensory signals from various mechanoreceptors to thereby determine body position and movements in space (Han et al. 2015b) and it plays a crucial role in balance control (Clark et al. 2015).

Proprioception plays an requisite role in balance control, and ankle proprioception is arguably the most important (Han et al., 2015a). During the game activities, the ankle-foot complex is the only part of the body contacting the ground. Ankle proprioception provides essential information to enable adjustment of ankle positions and movements of the upper body, in order to successfully performthe complex motor tasks required in elite sport (Sasagawa et al., 2009).

Enhanced balance ability is necessary for athletes. and play a fundamental role in many sport activities. Becauce this ability can facilitate to achieve the highest performance level and prevent muscle injuries. Besides there is a limited relationship between balance and performance, it can contribute to high performance in athletes (Hrysomallis, 2011). There is a negatively relationship between the balance control and ankle proprioception in ankle injuries (Han et al., 2015a). Similar reports of the relationship between ankle proprioception and ankle injury risk are also noted in the literature. For example, Tropp et al. (1984) found that ankle injuries were almost 4 times more prevalent in soccer players with poor balance in comparison to those with normal balance ability. In addition, Watson (1999) reported that hurdling and Gaelic football players with poor balance ability had experience ankle injuries nearly twice relative to players with normal balance.

Wrestling is one of the oldest traditional sports in the world. A wrestling match is played at high intensity and requires regional power and whole body power (Zaccagnı, 2012). A good wrestler must have characteristics such as developed power, endurance, flexibility, balance and agility. As these characteristics are being exhibited, the skills enter into a systematic cycle, as successive and alike. During the match, this cycle is provided with conscious and unconscious feelings, awareness of movement, balance and postural control.This is reflected in the central nervous system as neural cumulative input and draws attention to the importance of proprioception in wrestling (Ribeiro and Oliveira, 2007).

The aim of this study is to examine the relationship between the dynamic balance performances of wrestlers at angles of 7º, 14º and 21º of plantar flexion and 7º of dorsi flexion.

Material and Methods

Participants

12 athletes from the wrestling team (age: 20.4 ± 1.6 year, height: 175.±4.24 cm, weight: 76.75 ± 10.1 kg) of Pamukkale University Faculty of Sport Sciences participated in this study voluntarily. Before the test, the right and left leg lengths of the participants were measured using a tape measure as the distance from the anterior superior of the spina iliaca to the inner malleole, and then the participants were warmed up for 5 minutes.

The approval for this study was obtained from the Clinical Research Ethical Committee of Pamukkale University (Decision no: E-60116787-020-119903, Date: 19.10.2021).

Data Collection Tools

Anthropometric Measurement Tools

Height and body weight measurements were taken with scales integrated with SECA brand stadiometer. The precision of the device is ±0.01 mm and ±0.1 kg.

Joint Position Sense Measurement

7º, 14º and 21º plantar flexion and 7º dorsiflexion joint angles of the ankle were accepted as reference using a universal goniometer for the determination of joint position sense. The reference angle was taught to the subject while the subject was lying down and the ankle was in a neutral position of 90º, eyes open and passively moving his foot.

Then, the participant was asked to find the same angle herself and 3 trials were made for each angle, the deviations from the target angle were averaged and the deviation amount was recorded in degrees. A rest period of 5 seconds was given between each trial. During the measurement, the eyes were closed and headphones were worn in order to disable the auditory and visual system.

Dynamic Balance Performance Measurement

The dynamic balance of the athletes was evaluated with YBT. The amount of reaching out on the dominant extremities of the athletes was measured. The athletes were asked to stand on one foot in the midpoint of the test set up and touch with the tip of the toe while maintaining the balance with the other foot in the anterior, posteromedial and posterolateral directions. The test was repeated 3 times in all directions, averaged, and recorded in cm.

The lower extremity lengths (sias-medial malleolus) of the athletes were calculated bilaterally in cm and the composite score was determined. (Plisky, 2009; Gribble, Hertel ve Plisky,2012).

Statistical Analysis

In the statistical analysis, Shapiro-Wilk test was used to examine whether the data show normal distribution or not. Since the data showed a normal distribution, Pearson correlation analysis was used to determine the relationship between the proprioception values and balance performance of the athletes. The level of significance for all statistical analysis was set at a p value of < 0.05.

Results

Table 1: The characteristic of participants

	N=12	**Mean. ± Sd**
Age (year)		20.4 ± 1.6
Height (cm)		175.±4.24

Body weight (kg)	76.75 ± 10.1
BMI (kg/m2)	25.08± 2.32

Table 2. The table of joint position sense of the ankle and Y balance composite scores of the participants.

Y balance composite scores (Mean. ± Sd)			**Deviation values from target angle (Mean. ± Sd)**	
Dynamic balance in left foot(sec)	123.66±7,42	Left ankle (cm)	7°Dorsiflexion	1.5 ±2.06
			7°Plantarflexion	1.5±1.40
			14°Plantarflexion	1.07±1.94
			21°Plantarflexion	2.42±2.27
Dynamic balance in right foot(sec)	120.66±10,29	Right ankle(cm)	7°Dorsiflexion	1.42 ±1.22
			7°Plantarflexion	1.78±1.84
			14°Plantarflexion	1.02±1.41
			21°Plantarflexion	2.42±1.82

Table 3. The relationship table between dynamic balance performances and ankle joint position senses of the participants

	RF 7° DF	**RF 7° PF**	**RF 14° PF**	**RF 21° PF**	**LF 7° DF**	**LF 7° PF**	**LF 14° PF**	**LF 21° PF**
Y Balance with Right Foot	0.03*	0.04*	0.00**	0.72	0.02*	0.03*	0.00**	0.94
Y Balance with Left Foot	0.04*	0.04*	0.01*	0.46	0.03*	0.02*	0.00**	0.47

*p<0.05, **p<0.01 Right Foot (RF), Left Foot (LF), Dorsi Flexion (DF), Plantar Flexion (PF)

A statistically significant correlation was found between right-left dynamic balance performances and dorsi and plantar flexion values of 7º and plantar flexion values of 14º in the right and left foot ($p<0.05$).

There was no statistically significant relationship between the dynamic balance performances and the plantar flexion values of 21º in the right and left foot ($p>0.05$).

Discussion

In this study, a statistically significant correlation was found between right-left dynamic balance performances and dorsi and plantar flexion values of 7º and plantar flexion values of 14º in the right and left foot ($p<0.05$). However, there was no statistically significant relationship between the dynamic balance performances and the plantar flexion values of 21º in the right and left foot ($p>0.05$).
The reason why there was no significant relationship here can be explained as the stabilizing effect of the bones forming the ankle decreases when the ankle is in the plantar flexion position, and the load is placed on the peroneal muscles and the lareral ligament of the ankle.
Ankle proprioception and sports performance are related. Han et al. measured ankle proprioception of 100 elite athletes from 5 different sports aerobic gymnastics, soccer, swimming, badminton, and sports dancing and found that ankle proprioception scores were significantly predictive of sport performance level (Han et al. 2014).
Han et al (2015) stated in their study that proprioception ability plays an important role in balance control and that ankle proprioceptive information functions centrally, providing integration for postural and balance control, as well as other sensory information.
Similarly, a recent study investigating balance ability of a group of athletes from soccer, handball, basketball, and volleyball found that the balance ability of male athletes was significantly correlated with their agility performance (Sekulic, 2013). This evidence suggests that balance control is fundamental to sports performance.
In a systematic review on the subject, it was reported that poor balance ability is an intrinsic factor associated with an increased risk of ankle injury (Witchalls, 2012).
Studies by Eils (2001) and Martínez- et al (2013) reported that specially designed exercise programs improve ankle proprioception and balance control in athletes, university students, and the elderly.
In another study examining the effects of ankle proprioception exercises on dynamic balance and static balance, no significant difference was observed between the static balance scores of the participants ($p>0.05$), but a significant difference was found in the dynamic balance scores ($p<0.05$). In the same study, it is suggested that ankle proprioception has an effect on body harmony as well as joint stability, and the increase in joint stability resulting from proprioceptive exercise may affect dynamic balance (Yong and Lee, 2017).
These findings reveal that ankle proprioception is closely related to balance control in sports injuries. Therefore, impaired ankle proprioception after injuries can significantly affect balance performance.

Conclusion

It was determined that the participants had better dynamic balance scores in case of less deviation angle in the joint position sense evaluations. It was found that proprioception values

decreased towards the midpoint of the range of motion and increased again from the midpoint towards the end of the range of motion.

Conflict of Interest

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

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