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The Comparative Analysis on Balance Ability of Throwers between Excellent ATHLETES and Non Excellent ATHLETES

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Abstract

This study aimed to provide fundamental data contributing of throwers between excellent athletes and non excellent athletes by investigating the influence on balance ability. Forty voluntary throwers (20 Excellent Athletes, 20 Non Excellent Athletes) with an understanding toward the aims of this study were selected in 2017 Gim-Cheon athletic championship, and their balance abilities were measured. As for the static balance ability, excellent throwers group was higher than non excellent throwers group in Up(U), Right(R), Down(D), and Left(L) static balance ability of body balance variables. Especially, there is a significant difference in Up(U) and Left(L) static balance ability of the body balance variables statistically. As for the dynamic balance ability, excellent throwers group was higher than non excellent throwers group in Up(U), Right(R), Down(D), and Left(L) dynamic balance ability of exercise balance variables. Especially, there is a significant difference in Up(U), Right(R), Down(D), and Left(L) dynamic balance ability of the exercise balance variables statistically. The study results indicate that body balance and exercise balance of thrower effected the athletic ability.

[Keywords] ***Body Balance Ability, Exercise Balance Ability, Throwers, Excellent Athletes, Non Excellent Athletes***

1. Introduction

Athletics is one of the oldest competition in human competitions, with the most medals in the Olympic Games. These athletics are largely divided into track and field competition. Among them, throwing competitions belong to field competitions and are divided into discus, hammer throw, javelin throw, and shot throw[1]. Athletic throwing competitions are eccentric contraction before concentric contraction, so that the muscles are stretched rapidly to exert greater tension and apply the force to throwing tools to determine the game by flight distance. It is an athletic competition that requires strong muscular strength, power and high skill because the operation is completed in very short time[2].

Physical factors required for athletics require body balance and exercise balance in addition to behavioral fitness such as muscular strength, power, agility, speed, and flexibility. Exercise performance ability such as muscular strength, power, muscular endurance, and agility based on muscle contraction are considered to be essential part of athletic players performance[3]. In addition, the muscular nerve and muscle contraction type, which connects the power of the muscular function and the speed of exercise, is one of the important factors for improving the performance of the field throwing competition. Coordination of muscles and nerves is a stable factor for body center change, and body center change during the game plays is an important role in improving the performance of

a field-throwing competition[4]. In this way, the ability of muscular function in a field throwing competition is more important than other factors in performance. In particular, stabilization of muscular nerves based on stable muscle function and muscular function based on organic movement of the upper body and lower body was reported to help stabilize the body during the performance of the throwing competition and to help improve performance[5]. This causes the muscle to contract by transmitting a very strong force to the upper body through the thighs and the power zone of the core around the knee of the lower body. And the tension generated by the movement of the skeleton along the axis of the joint causes the acceleration at the movement part, which indicates the optimal kinetic energy[6].

As such, Athletic throwing competitions are extremely short time, so they need to be able to concentrate their maximum ability in a short time. Therefore, the best condition of throwing athletes in the competitions is a matter of concern to both throwers and leaders. However, it is not enough to study on the scientific basis of the physical factors necessary for the athletic throwing athletes, and the posture stabilization and balance ability to improve the performance and to prevent sports damage.

Therefore, this study aims to provide basic data that can help stabilize posture and improve performance of throwers by comparing the difference of body balance and exercise balance of throwers among three athletes in a round circle within a 2.5m of athletics, discus, hammer throw, shot-put.

2. Materils & Methods

2.1. Subject of study

This study was composed of participants in 2017 Kim-cheon Athletic Championship, and they were selected as athletes who have been registered as athletes in Korea Athletics Association for more than 5 years. Forty-two subjects who fully understood the purpose of the study and were willing to volunteer for the study were included. The participants were divided into two groups: Excellent Group(n=20 people) who were a prize winner and Non Excellent Group(n=20 people) who were not a prize winner. In order to facilitate the sampling of the subjects' data, the number of subjects per group was arbitrarily adjusted by the researcher and selected as 20 persons per group. The physical characteristics of the subjects are shown in <Table 1>.

Table 1. Physical characteristics of subjects.

Items	Age(yrs)	Height(Cm)	Weight(Kg)	Career(yrs)
Exercise group (N=20)	20.28±3.23	174.68±12.84	76.68±11.29	7.52±1.84
Non exercise group (N=20)	21.84±4.21	176.32±11.08	78.34±9.96	6.89±2.26

Note: M±SD.

2.2. Measure and method

Participants in this study were the athletes who were participating in 2017 Kim-cheon Athletic Championship and who finished pre-match warm-up. Before the measurement, the measurement equipment and the measurement method were fully explained. The body balance ability and the exercise balance measured in this study are the balance board system. This study was performed to evaluate the balance ability of the musculoskeletal system and the nervous system patients and the elderly. The subjects were not able to influence the measured values by artificial action and the preliminary measurement was performed 3 times before the measurement.

2.2.1. Physical characteristics

The height of the subjects was measured using an automatic extensometer BSM330 (Biospace Co., Seoul, Korea). The body composition was measured after removing the metal from the body, and taking a rest after 5 minutes of urination. The body composition was measured using the Inbody 720(Biospace Co., Seuol, Korea). The subjects were placed in an upright posture with their arms and legs slightly open. Body composition analysis was performed in the order of measuring the measurement manual.

2.2.2. Balance ability test

The balance ability test was performed using the Balance Board method using the Center of Pressure method and the Weight Bearing method of the Humac Norm Balance System(Computer Sports Medicine, Inc, Boston, USA). In order to maintain safety during measurement, a balance board with a width of 52cm, a length of 32cm and a height of 5.5cm was used to install a protection frame with a height of 86cm , width of 92cm and a length of 84cm. In addition, a flat mat was used to measure the static balance ability, and a balance mat was used to measure the dynamic balance ability.

The subject stood on the balance board and stared at the screen, and measured time which were keeping the balance in the center + shape of screen and keeping it constantly. After 3 exercises each before the test, this test was performed and a high value was selected after a total of 2 measurements.

2.3. Data process

For the data processing of the study, the mean and standard deviation of all collected data was caculated using SPSS 20.0(window statistical package), and independent sample t-test was performed for the experiment between the groups. The significance level was $p<.05$.

3. Results

3.1. Change in body balance

Changes in static balance ability as measured by body balance measuring instrument are shown in <Table 2>. As for the static balance ability, Up was higher in the EG group(1.88±0.84) than in the NEG group (0.92±0.90), and Down was higher in the EG group(1.62±0.68) than NEG group (1.43±0.76). Also, Left was higher in the EG group(1.36±0.92) than in the NEG group(0.02±0.78), and Right was higher in the EG group(-0.89±0.92), than in the NEG group(-1.19±0.88). However, statistically significant differences in the static balance ability changes between groups were only found in Up(p=.002) and Left(p=.000).

Table 2. The change of body balance ability.

Items＼Groups	EG(n=20)	NEG(n=20)	t	p
Up	1.88±0.84	0.92±0.90	2.886	.002**
Down	1.62±0.68	1.43±0.76	1.008	.264
Left	1.36±0.92	0.02±0.78	3.226	0.00***
Right	-0.89±0.92	-1.19±0.88	1.102	.322

Note: M±SD.

EG/Exercise group, NEG/Non Exercise group.

*, ** and *** mean $p<0.05$, $p<0.01$, and $p<0.001$, respectively.

3.2. Change in exercise balance

Changes in dynamic balance ability as measured by exercise balance measuring instrument are shown in <Table 3>. As for the dynamic balance ability, Up was higher in the EG group(11.28± 2.84) than in the NEG group(9.96±3.26). Down was higher in the EG group(13.82±4.94) than in the NEG group(8.08±2.66). Also, Left was higher in the EG group(12.08±2.64) than in the NEG group(10.82±2.96), and Right was higher in the EG group(8.68±2.68) than in the NEG group(7.92±1.94).

In addition, statistically significant differences in the dynamic balance ability changes between groups were found in all variables of Up(p=.000), Down(p=.000), Left(p=.002), Right(p=.032).

Table 3. The change of exercises balance ability.

Items＼Groups	EG(n=20)	NEG(n=20)	t	p
Up	11.28±2.84	9.96±3.26	3.864	.000***
Down	13.82±4.94	8.08±2.66	5.262	.000***
Left	12.08±2.64	10.82±2.96	2.886	.002**
Right	8.68±2.68	7.92±1.94	1.888	.032*

Note: M±SD.

EG/Exercise group, NEG/Non Exercise group.

*, ** and *** mean $p<0.05$, $p<0.01$, and $p<0.001$, respectively.

4. Discussion

As the result of analysis to compare body balance and exercise balance of 40 athletes throwers participating in 2017 Kim-cheon Athletic Champion ship(20 excellent athletes and 20 excellent athletes), the study discusses as below.

In athletics, throwing athletes require a great deal of anaerobic exercise ability to use their maximum capacity within a short period of time, and power, agility and maximum muscular strength are important factors in determining the performance of a throwing competition[7]. In addition, improvement of muscle coordination and muscle function is the most efficient training method of throwing athlete, and improvement of muscle nerve function by improvement of muscle function maintains stable body center change. Body-centered stability has been reported to have a direct impact on the prevention of sports injuries and improvement in performance of athletes[8]. Among such throwing athletic competitions, discus, hammer throwing, and shot-put to rotate trunk occupy a larger proportion in the movement of waist center than the javelin throwing to perform straightly. The misalignment of the center of gravity during exercise is the main cause of the decrease of performance and the risk of sports injury. Besides, wrong center movement during exercise is a major cause of decrease in performance and risk of sports injury[9]. In addition, the throwing technique of throwing competition uses driving force of lower limb and turning force of the torso to transmit to the upper limb and generates the maximum power by using the repulsive force of the whole body strength. However, it has been reported that the maximum power using propulsion force of lower limbs and torso's rotational force is the highest power when prevent loss of body-centered stability and balance ability[7].

This study investigated to compare the effect of physical balance on physical fitness of

throwing athletes between Excellent Athletes and Non Excellent Athletes. Also, it was confirmed that the body balance ability shows the stabilization of the body center and body balance ability of EG is higher than NEG. This is consistent with the results of Park Jung-min and Lee Jung-heon[8] who reported changes in balance ability for athletes on the track, and this study is similar to those of Kim[6] who reported about factor that improves the performance of athletes. In addition, in this study, it was confirmed that the difference of exercise performance equilibrium is influenced. As a result, performance of excellent athlete is higher than non excellent athlete. These results are consistent with Kim's[3] that the axis of the muscle moves around the joints during muscle contraction and stably maintains the movement of the skeleton. The tension generated during muscle contraction causes the acceleration of the moving part. The centrifugal force due to the rotation of the torso during the pitching operation shows the highest kinetic energy in combination with the kinetic energy of acceleration. And the maximum power of the kinetic energy during the pitching operation of throwing competition contributes to stabilize exercise balance through to stabilize body balance.

The above results show that the balance of body performance through the center of body stabilization and the exercise performance balance ability which contributes to stabilization of central axis during exercise performance help to improve athletic ability. It is expected that a good performance can be achieved by harmonizing transformation of technical ability and power through stabilized posture and balanced operation of field throwing game. In addition, in order to perform such a detailed and stabilized operation, it is necessary to develop suitable training with repeated training.

This study investigated that stable center of body balance ability and exercise balance during performance can contribute to athletic ability, and identified that Physical, and exercise performance balancing ability had a great effect on athletic ability of throwers.

5. Conclusion

The purpose of this study is to investigate the effect of body balance(static balance ability) and exercise balance(dynamic balance ability) on throwers' athletic ability. The subject of study was composed of participants in 2017 Kim-cheon Athletic Championship, and they were selected as 40 throwers who have been registered as athletes in Korea Athletics Association for more than 5 years. In order to achieve this purpose, 40 throwers divided into two groups: Excellent Group who were a prize winner and Non Excellent Group who were not a prize winner. and the following results were obtained as a result of observation of static balance ability which is body balance ability and dynamic balance ability which is exercise balance ability.

1. As for the static balance ability of throwers, excellent throwers group was higher than non excellent throwers group in Up(U), Right(R), Down(D), and Left(L). Especially, there is a significant difference in Up(U) and Left(L) static balance ability of the body balance variables statistically.

2. As for the dynamic balance ability of throwers, excellent throwers group was higher than non excellent throwers group in Up(U), Right(R), Down(D), and Left(L). Especially, there is a significant difference in Up(U), Right(R), Down(D), and Left(L) dynamic balance ability of the exercise balance variables statistically.

In conclusion of this study, body balance which stabilize body center and exercise balance which contributes to the stabilization of central axis during performance are helpful for improving athletic ability of throwers. In addition, in order to perform detailed and stabilized motion during throwing competition, it is necessary to develop suitable training for throwers with repeated training.

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