THE COMPARISON OF STATIC BALANCE AND POSTURAL SWAY OF WATERPOLO PLAYERS, KARATE ATHLETES AND SEDENTARY PEOPLE

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Abstract

The aim of this study was to compare the postural control during static balance of Waterpolo players, Karate athletes and sedentary people. Turkish male and female waterpolo players and karate athletes who have been actively involved in sports at least for four years and sedentary people participated in this study. 10 waterpolo players between the age of 19-29 and 8 karate athletes between the age of 19-23 were included in the study. The control group consisted of 8 sedentary people of the same age group with similar characteristics.

The three groups were evaluated in their static balance. A static stabilometer was used for the evaluation of the static balance. The following tests were utilized: 1) Modified tests of sensory interaction on balance, 2) Unilateral stance tests, 3) Postural balance-limits of stability, 4) Rhytmic postural sway.

No difference was found for static balance tests between the three groups. There were significant differences between both sport groups on the postural sway tests; left-back reaction time of karate athletes were significantly shorter ($p<0.05$).The back movement velocity of waterpolo players were significantly higher than karate athletes($p<0.05$). These findings could be due to the players' training technics and game habits.

Keyword: static balance, center of pressure, postural sway

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ABSTRACT

The aim of this study was to compare postural control during static balance of waterpolo players, karate athletes and sedentary people. Turkish male and female waterpolo players and karate athletes who have been actively involved in sports at least for four years and sedentary people participated in this study. 10 waterpolo players between the age of 19-29 and 8 karate athletes between the age of 19-23 were included in the study. The control group consisted of 8 sedentary people of the same age group with similar characteristics. The three groups were evaluated in their static balance. A static stabilometer was used for the evaluation of the static balance. The following tests were utilized: 1) Modified tests of sensory interaction on balance, 2) Unilateral stance tests, 3) Postural balance-limits of stability, 4) Rhytmic postural sway.

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Topic: Sport Biomechanics

KeywordsI: balance

Keyword II: center of pressure

Keyword III: postural sway

INTRODUCTION

Postural control or balance can be defined statically as the ability to maintain a base of support with minimal movement and dynamically as the ability to perform a task while maintaining a stable position. Six factors that influence balance include sensory information obtained from the somatosensory, visual, and vestibular systems and motor responses that affect coordination, joint range of motion (ROM), and strenght (1). Postural control is known to result from the integration of visual, somesthetic and vestibular information (14) and is organized in hierarchic and stereotypic patterns (9).

Proper balance control in the achievement of motor skills is mainly based on muscular synergies that minimize displacements of the centre of the gravity while maintaining upright stance, proper orientation, adapted locomotion and adequate gestures, figures or techniques imparted to the sport practised (10,5).

Stabilometry has become A common technique to evaluate static postural changes in different sport fields in the last decades (12,16,3,2). Each sport requires different levels of sensorimotor processes to perform skills. Karete requires a unipedal posture to perform different technical movements (eg. kicking). On the other hand, water - polo requires postural control in the water without connection to the ground, especially while water - polo players are passing the ball.

Sport training enhances the ability to use somatosensory and otolithic information, which improves postural capabilities. Postural changes differ according to the sport practiced, but few authers have analyzed subject's postural performances to discriminate the expertise level among highly skilled athletes within a specific discipline (9). The purpose of this study, was to examine influences on the performance of a static balance task among athletes who differ in balance performance such as karete players and water polo players. Therefore,we compared the postural control on the static balance between waterpolo, karate athletes and sedentary people.

METHOD

Subject: Turkish male and female waterpolo players and karate athletes who have been actively involved in sports at least for four years and sedentary people participated in this study. 10 wateropolo players between the age of 19-29, 8 karate athletes between the age of 19-23 were included to the study. The control group consisted of 8 sedentary people in the same age group having similar characteristics. All subjects attended the study voluntarily and

gave informed consent prior to the study. Statistical Values of demographic data of subjects are presented in Table 1.

Table 1. The physical characteristics of karate athletes, water-polo players and sedantery people

Variables		Min.	Max.	Mean	SD.
KARATE ATHLETES N(8)	Gender	1	2	1,63	,518
	HEIGHT (cm)	18	23	20,50	1,604
	WEIGHT (kg)	50,00	80,00	62,375	9,664
	AGE (years)	150,00	182,00	168,125	9,891
WATER-POLO PLAYERS N (10)	Gender	1	2	1,70	,483
	HEIGHT (cm)	19	29	22,10	3,178
	WEIGHT (kg)	60	120	76,8	17,332
	AGE (years)	165,00	193,00	175,200	8,599
SEDANTERY PEOPLE N(8)	Gender	1	2	1,38	,518
	HEIGHT (cm)	19	23	20,63	1,408
	WEIGHT (kg)	55	75	63,75	7,796
	AGE (years)	160,00	186,00	170,125	9,701

Experimental Protocol:

The three groups were evaluated in their static balance a stabilometer was used for the evaluation of the static balance. The following tests were utilized as 1) Modified tests of sensory interaction on balance (MCTSB), 2) Unilateral stance (US) tests, 3) Postural balance-limits of stability, 4) Rhytmic postural sway (11)

1) Modified tests of sensory interaction on balance (MCTSIB) : The MCTSIB is a simplified derivative of the Sensory Organization Test (SOT). A modification of the original MCTSIB or " Foam and Dome", the MCTSIB eliminates the "dome" and adds objective (computerized) analysis of the patient's functional balance control to quantify postural sway velocity during the four sensory conditions:

1. Eyes open firm surface (Firm - EO)
2. Eyes closed firm firm surface (Firm - EC)
3. Eyes open unstable surface (Foam - EO)
4. Eyes closed unstable surface (Foam -EC)

The lenght of each trial is ten second. Each of test was performed two times the mean value was calculated. The Center of Gravity (COG) traces for each trial are shown as numerical values indicating the sway velocity in degrees per second and total duration (in seconds) of the trial.

2) Unilateral Stance (US) tests: The US quantifies postural sway velocity with the patient standing on both the right and left foot on the forceplate,with eyes open and with eyes closed. The lenght of each trial is ten seconds.

1) Left - Eyes Open (L-EO)

2) Left - Eyes Closed (L-EC)

3) Right - Eyes Open (L-EC)

4) Right - Eyes Closed (R-EC)

3) Postural Balance- Limits of Stability (LOS): The LOS quantifies the maxsimum distance a person can intentionally displace his Center of Gravity (COG). The measured parameters are reaction time, COG movement velocity, directional control, end point excursion, and maximum excursion.

For each of eight trials, the subject maintains their COG centered over the base of support as indicated by a cursor display of the COG position relative to a center target. On command, the patient moves the COG cursor as quickly and accurately as possible towards a second target located on the LOS perimeter (100 % of theoritical limits of stability) and then holds a position a close to the target as possible. The subject is allowed up to 8 seconds to complete each trial.

In our study, LOS comprehensive is composed of a) **Reaction Time (RT);** the time in seconds between the command to move and the subject's first movement, b) **Movement Velocity (MVL);** the average speed of COG movements in degrees per second, c) **Directional Control (DCL);** a ratio of the amount of movement in the intended direction (towards the target) to the amount of extraneous movement (away from the target).

4) Rhythmic Weight Shift (RWS): The RWS test quantifies the patient's ability to rhytmically move their Center of Gravity (COG) from left to right (lateral) and forward to backward (anterior/posterior) between two targets at three distinc speed: slow (3 second peak pacing), medium (2 second pacing), and fast (1 second pacing). The measured parameters are the on-axis (intentional) COG movement velocity and the directional control.

For each of three paces, the subject is instructed to rhytmically move the COG curser from side to side or front to back between two targets.

RESULTS

The three groups were evaluated in their static balance. Non-parametric Kruscal-Wallis H. Test was used to compare the three groups. As a result: There were no significant differences in postural sway velocity between the three groups on Modified Tests of Sensory Interaction on Balance (MCTSB) during the four sensory conditions (Firm - EO) (Firm - EC)

(Foam - EO) (Foam -EC) (p>0,05), Unilateral Stance postural sway velocity (US) tests: (L-EO) (L-EC) (L-EC) (R-EC) (p>0,05), Postural Balance- Limits of Stability (LOS) tests: The measured parameters were reaction time (RT), COG movement velocity (MVL), directional control (DCL), end point excursion, and maximum excursion (EPE&MXE) (p>0,05) and Rhythmic Weight Shift (RWS): The measured parameters are the on-axis (intentional) COG movement velocity and the directional control. (COG) (p>0,05).

The two sports group was evaluated in their static balance and postural sway. Non-parametric Wilcoxon Test was used to compare the two groups. As a result; There were no significant differences between two groups on Modified tests of sensory interaction on balance (MCTSB) control to postural sway velocity during the four sensory conditions (Firm - EO) (Firm - EC) , (Foam - EO) (Foam -EC) (p>0,05), Unilateral Stance postural sway velocity (US) tests: (L-EO) (L-EC) (L-EC) (R-EC) (p>0,05), Rhythmic Weight Shift (RWS): The measured parameters are the on-axis (intentional) COG movement velocity and the directional control (COG) (p>0,05) and There were no significant differences between two groups on Postural Balance- Limits of Stability (LOS) tests with exception of left back reaction time (RT 6) and back movement velocity (MVL 5) (p<0,05).

Table 2; Karate athletes and water-polo players differences and significance levels related to reaction time, movement velocity and directional control.

Variables	Karate players (n= 8) Mean and Std Deviation	Water-Polo players (n= 10) Mean and Std Deviation	Z	Significant (P)
Reaction time 1	0,735 ± 0,304	0,783 ± 0,293	-0,622	n.s.
Reaction time 2	0,712 ± 0,174	0,826 ± 0,404	-0,000	n.s
Reaction time 3	0,633 ± 0,144	0,900 ± 0,405	-0,890	n.s.
Reaction time 4	0,695 ± 0,217	0,852 ± 0,382	-0,756	n.s.
Reaction time 5	0,541 ± 0,201	0,647 ± 0,324	0,267	n.s.
Reaction time 6	0,730 ± 0,238	1,040 ± 0,345	-2,044	0,05
Reaction time 7	0,646 ± 0,222	0,821 ± 0,256	-1,600	n.s
Reaction time 8	0,621 ±0,210	0,594 ± 0,222	-0,356	n.s.
Movement velocity 1	5,262 ± 2,222	4,260 ± 2,210	-1,023	n.s.
Movement velocity 2	6,087 ± 2,251	5,500 ± 2,373	-0,756	n.s.
Movement velocity 3	5,400 ± 2,544	4,940 ± 2,331	-0,178	n.s
Movement velocity 4	4,937 ± 1,829	3,450 ± 1,346	-1,645	n.s.
Movement velocity 5	4,087 ± 1,427	2,830 ± 1,343	-2,001	0,05
Movement velocity 6	4,962 ± 1,680	3,720 ± 1,301	-1,734	n.s.
Movement velocity 7	7,650 ± 3,570	5,150 ± 1,381	-1,067	n.s.
Movement velocity 8	6,962 ± 3,258	5,240 ± 1,854	-1,156	n.s
Directional control 1	89,875 ± 4,257	89,400 ± 5,168	-0,180	n.s.
Directional control 2	89,250 ± 3,955	85,800 ± 6,124	-1,294	n.s.
Directional control 3	82,375 ± 6,255	84,900 ± 5,300	-0,802	n.s.
Directional control 4	74,125 ± 9,264	81,600 ± 11,137	-1,914	n.s.
Directional control 5	74,375 ± 25,528	74,800 ± 17,743	-0,713	n.s.
Directional control 6	63,625 ± 12,500	74,300 ± 10,562	-1,875	n.s
Directional control 7	86,375 ± 3,583	89,500 ± 3,778	-1,438	n.s.
Directional control 8	81,375 ± 9,590	85,700 ± 3,713	-1,114	n.s

DISCUSSION

In the literature, we couldn't find any research with stabilometric balance measurements of water polo players and karete players. However, there have been done balance asssesments to evaluate postural differences in other sports (such as, judo, soccer, dance, basketball, gymnastic, surfe, swimming, golf) (4,6,7,8,9,10,14,15).

Bressel E., et al. [2007] compared static and dynamic balance among collagiate athletes competing or training in soccer, basketball and gymnastics. They found that gymnasts and soccer players did not differ in terms of static and dynamic balance. In contrast, basketball players displayed inferior static balance compared with gymnasts and inferior dynamic balance compared with soccer players (1),

Hrysomallis C., et al. [2006] performed static and dynamic balance tests among elite Australian footballlers to determine the relationship between a static balance task on a firm surface with a stepping balance task on an unstable surface. They concluded that performance in the static balance test was not reflective of performance in the dynamic balance test (7).

Vehagen E.et all.(2005) showed that a 5,5 week balance traning programme by voleyball play did not lead to a reduction in center of pressure excursion (13)

In our study, no difference was found for static balance tests between the three groups. However, there were significant differences between both sport groups on the postural sway tests; left-back reaction time of karate athletes were significantly shorter ($p<0.05$) than water-polo players. This finding may result from enhanced defensive technique capacity of karate athletes, especially from sudden backward escape movements in the match. The back movement velocity of waterpolo players were significantly higher than karate athletes ($p<0.05$). We suggest that in water polo players, who are trained to raise above water level in order to block or attack, may have developed enhanced backward force production resulting in velocity increases. Thus, these findings could be due to the players' training technics and game habits.

REFERENCES

1. Adric Bressel, Joshua C Yonker, John Kras, Edward M Heath: Comparison of static and dynamic balanve in female collegiate soccer, basketball, and gymnastics athletes. Journal of Athletes Traning. Dallas: Jan-Mar 2007.Vol.42,Iss.1;pg 42,5 pgs

2. Carolyn A.Emery, J David Cassidy, Terry P Klassen, Rhonda J Rosychuk, Brain H Rower.: Development of Clinical static and Dynamic standing balance measurement tool appropriate for use in adolescents. Physical Therapy. Washington: June 2005. vol.85,Iss.6 pg.502,13 pgs

3. Chiari L., Rocchi L., Cappello A.: Stabilometric Parameters are affected by antropometry and foot placement. Clinical Biomechanics, 17: 666-677, 2002.

4. D.Leroy., D.Polin.,C.Tourny-Chollet.,J.Weber: Spatial and Temporal Gait variable differences between basketball, swimming and soccer players. Int J.Sports Med 2000;21:158-162

5. Davlin C.D. Dynamic Balance in High Level Athletes. Percept Mot Skills, 98: 1171-1176, 2004.

6. Grigorenko A.,Bjerkefors A.,Rosdahl H.,Hultling C.,Alm M.,Thorstensson A.: Sitting Balance and effects of kayak traning in paraplegics. J Rehabil. Med.2004 May;36(3):110-6.

7. Hrysomallis C., McLaughlin P., Gppdman C.: Relationship between static and dynamic balance tests among elite australian Footballers.J.Sci Med.Sport 2006 (Agust);9(4):275-6

8. Hugel F., Cadopi M., Kohler F., Perin P.: Postural Control of Balet Dancers: A Specific Use of Visual Input for Artistic Purposes. Internatinal of Sports Medicine. 20: 86-92, 1999.

9. Paillard T., Noe F., Riviere T., Marion V., Montoya R. And Philippe D.: Postural Performance and Strategy. Postural performance and Strategy in the Unipedal Stance of Soccer Players at Different Levels of Competition. J. Athl Train, 41(2): 172-176., 2006.

10. Perrin P., .Deviterne D., Hugel F., Perrot C.: Judo, beter than dance, develops Sensorimotor Adaptibilities İnvolved in Balance Control . Gait and Posture 15: 187-194, 2001.

11. Shaperd N. T.: Clinical Utility of the Motor Control Test (MCT) and Postural Evoked Responses (PER).A Neurocom Publication, rev.2000.

12. Trop H., Ekstrand J. And Gilquist J.: Factors Affecting Stabilometry Recordings of Single Limb Stance. American journal of Sport Medicine. 12 (3): 185-188, 1984.

13. Verhagen E., Bobbert M., Inklaar M., van Kalken M, van der Beek A.Bouter L, van Mechelen W.: The effect of a balance traning programme on center of pressure excursion in one-leg stance. Clin Biomech (Bristol, Avon). 2005 Dec; 20(10):1094-100, Epub 2005 Aug 29.

14. Vuillerme N., Danion F. Marin L.,Boyadjian A.,Prieur J.M., Weise I., Noujier V.: The effect of expertise in gymnastics on postural control. Neuroscience letters. Volume 303, Issue 2,4 May 2001 pages 83-86.

15. Vuillerme N., Nougier V.: Attentional Demand for Regulating Postural Sway: the Effect of Expertise in Gymnastics. Brain Research Bulletin 63: 161-165, 2004.

16. Winter D. A., Patla A.E., ıshac M. And Gage W.H.: Motor Mechanism of Balance during Quiet Standing. Journal of Electromyogr and Kinesiol. 13(1): 49-50, 2003

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