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Athletes Trunk Proprioceptive Ability Versus Non athletes

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ABSTRACT

Background: Intact proprioception is required to maintain motor trunk control and lumbopelvic stability. Impaired proprioception has an adverse effect on trunk motor control that increases the risk of injury particularly low back pain. Objective comparison between athletic and non-athletic population in trunk proprioception is needed. **Objective:** The current study was to investigate whether a significant variance in trunk proprioception can be observed between athletic and non-athletic subjects. **Patients and methods:** A cross sectional study conducted on 70 male and female volunteer subjects with age ranged from 18-37 years old. Participants were assigned into two groups; Group (A) with 35 athletic football players, and Group (B) control group with 35 age matched healthy non-athletic volunteers. Subjects in both groups were assessed for active repositioning error in the Army Rehabilitation Centre's Isokinetic Laboratory, Cairo. **Results:** Both groups did not differ significantly in terms of mean age, height, weight, and BMI (P<0.05), while a considerable difference in active repositioning error was found in Group (A) compared with Group (B) (P=0.006). **Conclusions:** The trunk proprioception differs significantly in athletes when compared to non-athletes. Athletes have better trunk proprioception than non-athletes.

Keywords: Trunk proprioception, Active repositioning error, Athletes.

INTRODUCTION

Trunk control and stability is strongly related to proprioception. Proprioception means literally to receive (-ception) one's own (propio-). It could be defined as sense of joint static position & sense of movement (kinesthesia) either acceleration or deceleration [(1)], it also includes sense of muscle force, tension, length and sense of pain as well [(2)].

Receptors that contribute to deep sensation are termed proprioceptors [(3)]. Those are found in various connective tissues throughout the body as skin, ligaments, joint capsules, tendons, fascia& muscle tissue (muscle spindle and golgi tendon organ). It is believed that the initial proprioceptive input comes from muscle spindles [(4)], as they are highly sensitive to detect minor changes in muscle length [(5)], while other proprioceptors provide additional sensory information about both position and movement senses [(1)]. Joint proprioceptors provide proprioceptive input throughout the entire joint's range of motion (ROM) and at the extremes or end ROM, those proprioceptors are essential in joints' stability [(6)].

Musculoskeletal disorders as ligamentous or tendon or muscular sprain, muscle weakness also chronic pain could result in impaired or altered proprioception [(7)]. Impaired proprioception has an adverse effect on trunk motor control that could in turn lead to balance disturbance, increasing risk of injury and falling [(8)]. These dysfunctions in motor control encompass decreased input to alpha motor neurons, disturbed reflex joint stability, The dysfunctions in motor control include reduced input to alpha motor neurons, disrupted reflexive joint stability, heightened postural instability, and greater inaccuracy in tasks related to visual movement acuity [(9)].

In order to investigate or assess proprioception wide varieties of tests have been developed. Specific tests of proprioception regarding both joint position sense (JPS) and movement sense are either passive or active [(2,5)]. JPS tests are used to assess the accuracy to reposition the joint to the predetermined angle [(10)], while threshold to detection of passive motion (TTDPM) is utilized to assess an individual's capacity to perceive joint movement [(11)], task tracking that measure movement acuity, or movement discrimination tests [(12)]. Force sense tests are used to assess the ability to detect and generate the previously pre-determined sub-maximal force [(13)].

It is thought that all types of exercise could stimulate proprioceptors and in turn can affect proprioception [(14)], regular daily exercise routine of a football player usually includes exercises that are specific to improve proprioception commonly involve JPS [(15)], kinesthesia or sense of force & exercises to train balance, co-ordination and dynamic stability [(16)]. Such exercise training may lead to morphological changes in proprioceptors either (joint or muscle) making them more sensitive to detect changes in length, tension or position. That in turn could lead to improve joints stability, balance, dynamic postural control and minimize risk of injuries [(17)].

The current study was to investigate whether a significant variance in trunk proprioception can be observed among athletic and non-athletic individuals.

PATIENTS AND METHODS

A cross sectional study conducted on 70 male and female volunteer subjects with age ranged from 18-37 years old. Participants were assigned into two

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groups; Group (A) with 35 athletic football players, and Group (B) control group with 35 age matched healthy non-athletic volunteers.

Purpose of the study was explained to all volunteers. All selected volunteers in Group (A) had proper physical fitness and regular daily training routine, while the volunteers in Group (B) are ordinary subjects with adequate physical fitness, both groups didn't have any previous musculoskeletal injury or surgical intervention as fractures or ligamentous injury, back pain or muscular strain.

The demographic information of the participants, including height in meter and weight in Kg, was entered into excel spreadsheet. Trunk proprioception was assessed via Cybex Isokinetic Trunk Extension Flexion Device (Model 6000; Cybex-Lumex Inc., Ronkonkoma, NY) to evaluate the trunk active repositioning error (ARE) inside the Army Rehabilitation Centre's Isokinetic laboratory, Cairo, Egypt.

Each participant positioned his foot into the heel cups and first stood on the foot support. The height of the foot plate was subsequently modified, and the rubber plate was placed opposing to the L5/S1 region. Additionally, the height of the thigh stabilizer was accustomed to become at a coincident level relative to the patella. Both belts of chest and waist were firmly drawn in order to ensure subject stability. Isolation of the eyes was performed via eye mask or band. Then, the starting position was as the following each volunteer was seated in a neutral position of the spine 0˚. The examined trunk flexion angle of was 30˚ [18]. At which the device was moved from neutral 0˚to the predetermined examined angle of trunk flexion 30˚ with velocity 30˚ per second, then each volunteer was instructed to remember & regenerate that trunk flexion angle 30˚. A familiarization trial was initially performed followed by three test trials. After conducting three trials, the average value was computed. The ARE was then determined through computing the difference among the target and reproduced angles [19].

Ethical Consideration:

This study was ethically approved by the Institutional Review Board of the Faculty of Physical Therapy, Cairo University (P.T.REC/012/004418). Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences ((IBM SPSS Inc, Chicago, IL, USA) version 20 for windows®. Qualitative data were defined as numbers and percentages. Chi-Square test, Fisher's exact test and Monte Carlo test were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Levene's test and Shapiro-Wilk test. Normal distribution of variables was described as mean and standard deviation (SD), and independent sample t-test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant.

RESULTS

Table 1 showed that the demographic data did not differ between Group (A) and Group (B).

Table (1): The demographic data of the two studied groups.

Variable	Group A	Group B		
	x̄±SD	x̄±SD	t-value	P-value
Age (years)	22.51 ± 2.31	23.25 ± 2	-1.43	0.15
Height (cm)	175.12 ± 6	172.4 ± 8.9	1.51	0.13
Weight (kg)	74.98 ± 10.4	76.94 ± 12.09	-0.72	0.47
BMI (kg/m²)	24.51 ± 3.75	25.96 ± 4.06	-1.54	0.12
Males/Females	32/3	30/5	(χ^2 = 0.56)	0.45

x̄, Mean; SD, Standard deviation; χ^2, Chi squared value; P value, Probability value.

Active repositioning error comparison between athletic and nonathletic groups:

Table (2) showed that the mean values of active repositioning error in both groups A and B were 3.5 (SD 1.5) and 4.6 (SD 1.75), respectively. The outcomes of the unpaired t-test reveal statistically significant differences among both groups (t value= -2.84, P=0.006), where the active repositioning error was considerably reduced in Group (A) than Group (B) (P=0.006).

Table (2): Mean active repositioning error in both groups.

Variable	Group (A)	Group (B)		
	x̄ ± SD	x̄ ± SD	t-value	P value
Active repositioning error (degrees)	3.5 ± 1.5	4.6 ± 1.75	-2.84	0.006*

x̄, mean; SD, standard deviation; P-value, level of significance; *Significant.

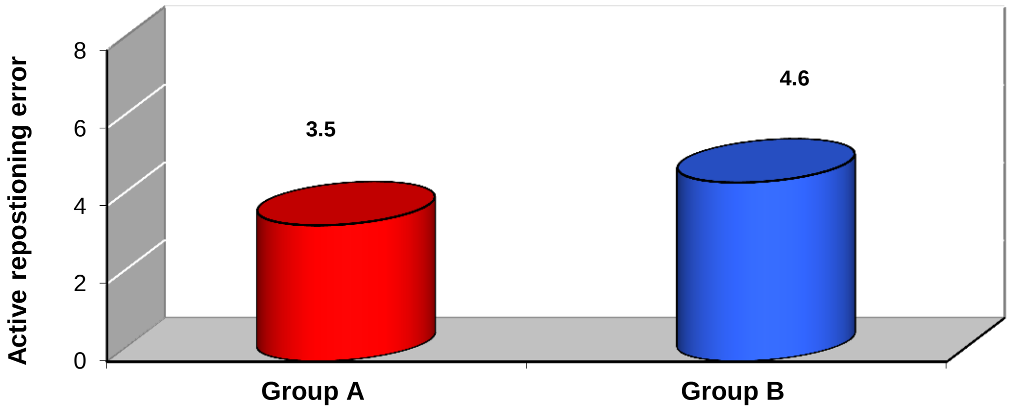

Figure (1): Mean active repositioning error in group (A) and group (B).

DISCUSSION

Intact proprioception is required in order to maintain adequate trunk control and lumbopelvic stability. Therefore, the current investigation is dedicated to evaluating whether there is any considerable variance in trunk proprioception in athletes when compared to non-athletes. In this study, the trunk active repositioning error exhibited a substantial decrease in Group (A) athletes than Group (B) non- athletes, with mean less proprioceptive ability in Group (A) athletes relative to the Group (B) non-athletes. Such results may be due to the effect of regular and repeated long term exercise training, proper physical fitness level, good muscle strength and flexibility in athletic population. Also this findings could be due to adaptive morphological changes in proprioceptors either (joint or muscle), which occurs after regular exercise training, so proprioceptors become more sensitive to detect changes in length, tension or position, faster muscle response and in turn better trunk control and stability especially in lumbopelvic region [17,20]. Regular exercise training especially balance and coordination may also lead to neural adaptations at either the spinal or supraspinal levels and consequently improve trunk control.

The finding of this study was supported by **Glofcheskie and Brown** [21] who also examined trunk proprioception in athletes from different sports compared by non-athletes, they demonstrated relatively better trunk postural control (less displaced center of pressure [COP]) when compared with non-athletes. They postulated significant statistical difference in the timing and amplitude of trunk muscle activation in athletes when compared by non-athletes. Also, there was less angular displacement of the lumbar spine because of abrupt perturbations relative to non-athletic individuals. That means better proprioception and neuromuscular control in athletes when compared to non-athletes.

In addition, **Davlin** [22] approved that athletes have better postural control either (static or dynamic) and better balance when compared with healthy non-athletes. **Silfies *et al.*** [23] suggested that athletes have greater proprioceptive abilities and better lumbar position sense when compared with non-athletes. **Hrysomallis** [24] suggested that participation in sport activity is essential as it could improve proprioception.

CONCLUSION

The ARE of the trunk differs significantly among athletes and non-athletes groups that means athletes have better trunk proprioception and better trunk control than non-athletes.

CLINICAL MESSAGE

As athletes and non-athletes groups differ significantly in ARE, the concept of regular exercise training within daily activities in non-athletes normal or to all general population should be considered to enhance proprioception and postural feedback, which can in turn minimize the risk of injuries in non-athletes population especially low back pain.

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