Relationship between trunk muscle endurance with static balance among collegiate students with sedentary lifestyle; a correlation study

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ABSTRACT

Background: - The most important trunk stabilizers are the trunk flexor and extensors. The isometric endurance of the trunk muscle is on essential element for mechanical support of the spine in all positions. The study objectives were to find out the relationship between trunk muscle endurance with static balance among collegiate students with sedentary lifestyle.

Method: - In this correlation study, 35 subjects were selected by convenience sampling based on the basis of inclusion and exclusion criteria . Students of American international institute of medical sciences, Udaipur took voluntarily in the study. Sedentary behaviour questionnaire was utilized to find out subjects with sedentary lifestyle.

Results: - There were moderate positive correlation is seen between trunk extensor endurance and static balance (r= 0.44) and moderate strong positive correlation found between trunk flexor endurance and static balance (r=0.55).

Conclusion: - This study showed that static balance had moderate positive correlation with trunk extensor endurance and moderately strong positive correlation with trunk flexor endurance. The challenge in addressing trunk endurance is to apply our knowledge and skill to design exercise programs that improve endurance and subsequently balance as an integrated part in optimal performance of individuals.

Keywords:- Trunk Flexors Endurance (TFE) , Trunk Extensors Endurance (TEE), Kraus -Weber test, Sorenson test, Single Leg Stance test(SLS)

INTRODUCTION: - Muscle endurance is the ability to work for prolonged periods of time and the ability to resist fatigue [(1)]. The most important trunk stabilizers are the trunk flexors and extensors [(2)]. Balance is the ability to maintain COG of a body within the base of support with minimal postural sway. Maintaining balance is coordinated by three systems. The first input is from the vestibular system the second balance coordinator is the proprioceptive system originating from somatosensory receptors in muscles, tendons and joints for kinesthetic body posture and spatial awareness and finally. The visual system which sense visual signals about body's position. To keep the body's centre of gravity under control over the base of support, - postural stability depends on a complex interaction between the visual, vestibular, and semaphore systems. The capacity to maintain postural stability has a big impact on how well you perform in sports. Performing athletic moves that cause body oscillations away from the athletes' support surfaces requires optimal core stability as well. The pelvic floor is at the bottom, the transverses abdominals is in the anterior, the multifidus is in the posterior, and the diaphragm is on the upper side. The latissimus dorsi, gluteus maximus, and trapezius are minor core muscles The lumbar area is thought to be stabilized by core muscles. Particularly during vigorous physical activity, the core is crucial in lowering the risk of injury and stabilizing peripheral joints .The isometric endurance of the trunk muscle is an essential element for mechanical support of the spine in all positions [(3)]. The trunk consists of many different muscles that stabilize the spine pelvisand shoulder and provide a .foundation for movement in the extremities. The muscles of the trunk help control movements transfer energy, shift body weight and distribute the stresses of weight bearing. Imbalance in endurance between the trunk flexors and the extensors are mainreasons for acquiring postural defects, low back pain and various lumbar spine musculoskeletal injuries. Lacking. The imbalance between the trunk flexors and extensors endurance is more significant than isolated trunk muscle weakness. Prolonged sitting posture is the most important causative factor for the onset of non- specific pain in back and other postural abnormalities in student population. It is suggested that although trunk muscle strength is necessary for activity and sports, its endurance has a very important role in spinal stability during prolonged physical activity and protects from injury. The trunk flexor and extensors endurance can be easily evaluated by Kraus-Weber and Sorenson test respectively which are more reliable and valid easily available, clinically applicable and less expensive test. College or University is a critical period regarding unhealthy changes in energy related behavior in students. The transition from secondary school to university is often accompanied by unhealthy behavior changes such as decreasing physical activity and increasing sedentary behavior .According to Keating's review (28). 40-50% of college students are physically inactive. A more recent study in Czech university students reported that only 9% met the only I0.000 steps every day.

METHODOLOGY: - In this correlation study, 35 subjects were selected through convenience sampling based on the inclusion & exclusion criteria. Students of American international institute of medical sciences, Udaipur took part voluntarily in the study. The inclusion criteria comprised 18-25 years and Sedentary behaviour questionnaire was utilized to find out subjects with sedentary lifestyle (Dori E. Rosenberg, et al. 2010). Consent Forms were

distributed & overview of the research was given to the subjects. Informed consent form was obtained from the subjects. In the first phase, static balance was measured using a quantifiable clinical test called the single – leg stance test. Trunk muscle endurance was assessed using Sorenson test of trunk extensor endurance test, and Kraus-Weber test for assessing trunk flexor endurance.

INCLUSION CRITERIA: -

Age - 18 – 25 years

Gender – Male and Female both

BMI – Normal (18.5 – 24.9)

Sedentary behaviour questionnaire to assess sedentary behaviour

EXCLUSION CRITERIA: -

Balance problem / Low back pain / Thoracic Pain / Cervical Pain / Spinal cord Injury / Lower limb injury / Any fracture/ Metabolic Disorder / Recent fracture / surgery / Skin infection / Allergy / Neurological disorder / Mental Retardation / Malignancies

MATERIAL USED: –

Straps / Weight machine / Stadio meter / Goniometer / Stopwatch / Couch / Stool

PROCEDURE: -

TRUNK FLEXOR ENDURANCE TEST (KRAUS – WEBER TEST) - Each subject was in a sit-up position with arms crossed over the chest, hips and knees flexed 90 and trunk rested against the back support angled 60 from the couch. The feet were stabilized with straps. At the beginning of the test, the back support was drawn 10cm behind and the subject was instructed to maintain the position as long as possible. A stopwatch was used to count the holding duration fromthe time the back support was moved behind. The test ended when the subject's trunk touched the back support of the couch or reaches a maximum holding duration of 300 seconds.

TRUNK EXTENSORS MUSCLES ENDURANCE TEST (SORENSON TEST): - Each subject was instructed to lie prone with his/her Anterior Iliac Spine (ASIS) in the line with the edge of a couch. The lower body was stabilized on the couch using straps at the level of lower thighs and legs; while the upper body was notsupported by the surface of the couch by asking the subject to push his/her arms in extension position on a stool directly below him/her. At the beginning of the test, each subject was given instructions to lift the upper limbs from stool support and cross over the chest with hands resting on opposite shoulders and maintain the horizontal position as long as possible. A stopwatch was utilized to record the holding duration from the time the upper hands were crossed over the chest until the subject could no longer maintain the horizontal position or reaches a maximum duration of 300 seconds.

SINGLE – LEG STANCE TEST: - In this subjects were asked to stand on dominant foot by placing their handson the iliac crest with contra - lateral limb in hip flexion and knee flexion relying on medial side of the dominant knee. Subjects were told to; with observer command, liftthe stance foot heel and keep the stance position, motionless while time was then recorded. Errors include hands lifted off iliac crest and compensatory adjustment such as displacement of ball of non-dominant foot. The test was executed twice and the better result was recorded.

Figure (A): KRAUS - WEBER TEST

Figure (B): - SORENSON TEST

Figure (C) : - SINGLE-LEG STANCE TEST

RESULT: -

The study was 12 weeks structured. In this study 35 participants were selected through inclusion or exclusion criteria, students of American International Institute of Medical Sciences, Udaipur took part voluntarily. All participants underwent core endurance test (Trunk Flexor – Kraus Weber test, Trunk Extensor test – Sorenson's test) and static balance test by using single leg stance test.

There were positive correlations between static balance level and trunk flexor or extensor endurance measures (Karl Pearson Test, r=0.44 and r=0.55)

According to multiple regression analysis for variables predicting static balance, the linear combination of significant related to static balance.

DISCUSSION: -

The purpose of the study is to determine the relationship between the Trunk Muscle Endurance and the Static Balance. The main findings of our result were that Static Balance showed moderate strong positive correlation with Trunk Flexor Endurance and moderate positive correlation with Trunk Extensor Endurance.

In the posture and balance context, lower limb has been the main focus for study and therapeutic intervention; whereas the role of strength and endurance deficitof trunk has not been clear, so it is not surprising that core training was not the priority in training programs design. In 2009, Suri et al evaluated the association of trunk muscle attributes and balance and mobility in elderly and found an average correlation (41%) between balance and trunk muscle endurance (Suri P, et al, 2009).

The literature unanimously shows negative effects of trunk muscle fatigue on balance. In

2010, Helbostad et al demonstrated the consequences of lower extremity and trunk muscle fatigue on balance and functional tasks (Helbostad JL, et al, 2010).They showed that muscle extensor fatigue has been correlated with somatosensory process dysfunction that leads to poor balance and coordination, but it is not established that resistance against muscle fatigue or endurance could prove balance. Therefore it will be hypothetically sensible that muscle endurance as an opposite of fatigue could alleviate negative effect on balance.

Previous studies have shown that regular physical activities can contribute to improving muscle strength, minimizing existing balance disorders, besides reducing body sway due to its beneficial effect on the sensory and motor system (Lederman E,et al 2010, Bressel E, et al, 2007). Moreover, Torres et al (Leetun DT, et al, 2004) stated that regular physical activities help equalize the response of the posturalcontrol system of men in semi-static situations.

We assessed trunk muscle endurance through tests that elicited isometric muscle contraction of the trunk musculature during the time. The single leg stance test was used to measure static balance quantitatively and a moderate strong correlation was found between trunk muscle endurance and static balance. Due to thecorrelation type of study, we can't conclude that there is a cause and effect relationship between two variables but it can be inferred that with the improvement in one, we can expect the better result in another one. The fact that which variable is the priority to be worked on for improvement is not well known but regarding the core is where the centre of gravity is located and operates integrated functional units where the kinetic chain begins from, it deems trunk muscle as our primary issueto work on it.

From a performance perspective, specific training aimed at improving trunk muscle endurance must be incorporated in balance training design and vice- versa (Leetun DT, et al, 2004, Jacobson BH, et al, 2011, Sato K, et al, 2009). Additionally, in order to interpret the results of the trunk muscle endurance testing and assist in setting training targets, another study is required for female athletes to compare and evaluate the role of gender on trunk muscle endurance and staticbalance.

From an injury prevention perspective in athletes, further study forobservation of correlation between upper and lower limb injury rate and strength and endurance or trunk muscle is warranted. Since the relationship between the trunk muscle endurance and static balance may be sedentary behavior specific in university students, further studies of athletes from different sports are recommended.