COMPARISON OF CORE STABILITY BETWEEN INDIVIDUALS IN SITTING AND STANDING OCCUPATIONS

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ABSTRACT

Background of the study: Core muscle dysfunction serves as a risk factor for future musculoskeletal dysfunctions considering the high percentages of adults employed in mainly sedentary occupations. There is a need to study core stability for populations who adapts to sitting and standing position at work.

Objective: To compare the core stability between individuals in sitting and standing occupations.

Methodology: This study utilized a quantitative approach and descriptive design. A total number of 60 individuals with sitting and standing occupations in Skudai, Johor were studied in 2 groups, sitting occupations (n=30) and standing occupations (n=30). The core endurance is measured using the Plank test.

Results: Independent t-test was used, and individuals in the standing occupation group had a statistically significant higher core endurance $p = .003$ ($P<0.05$) compared to the individuals in sitting occupations.

Keywords: *Core stability; Plank test; Sitting & Standing Occupations*

INTRODUCTION

Core resembles a muscular box, consisting of the diaphragm, the abdominals, the paraspinal, the gluteal as well as pelvis floor and hip girdle musculatures in all directions. They are all inserted onto the wide thoracolumbar fascia and the vertebral column. (Bliss and Teeple, 2005) Core provides a corset-like stabilization effect on the trunk and spine. A strong and efficient core is necessary for maintaining muscle balance throughout the human kinetic system. (Willson JD, 2005) Core stability is defined as "the ability to control the position and

motion of the trunk over the pelvis and legs to allow optimum production, transfer, control of force and motion to the terminal segment in integrated kinetic chain activities". (Kibler, Press and Sciascia, 2006).

Core muscle dysfunction serves as a risk factor for future musculoskeletal dysfunctions considering the high percentage of adults employed in sedentary occupations. (Haddadi. Esfahani., 2021). Prevalence of nonspecific low back pain is high among the collegiate young females and they are associated with the weakness of core muscles, namely the trunk flexors (rectus abdominis as well as the trunk rotators (oblique internus and externus). (Parashar, Arunmozhi and Kapoor, 2014) Overuse of lumbar multifidus muscle may lead to secondary low back pain owing to circulatory difficulties within the muscles. Among the occupational standing subjects, individuals with low back pain are more prone to experience trunk muscle fatigue compared to the asymptomatic controls. (Embaby and Abdallah, 2014) Reduction in core muscle stabilization could potentially expose individuals to an increased risk of spinal injury (Granata, Slota and Wilson, 2004).

A prolonged standing position can be related to back muscle fatigue as compared to a relaxed sitting position as it involves more lumbar lordosis. (Claus, Hides, Moseley and Hodges, 2016) On the contrary, the prevalence of low back pain among occupational sitting individuals is higher than in the general population. (Spyropoulous et al., 2008) The cause of low back pain is associated with the reduced viscoelasticity of passive structures in sitting. (Morl and Bradl, 2013). Prolonged sitting can result in less core muscle activation and more force onto the passive structure of the spine whereas prolonged standing increases the core muscle activity which can result in muscle fatigue. Srinivasan and Mathiassen (2012) reveal that even with the same constraint task, each individual executes movement differently which demonstrates the motor variability and differences in the susceptibility to musculoskeletal disorder (MSD).

The core muscle activation in sitting and standing positions is widely discussed and proven scientifically that the results are superior in standing. However, the adaptation of the core muscles by taking these factors based on the nature of work is yet to be proven. Therefore, the main purpose of this study is to determine the core stability of individuals with occupational sitting and occupational standing. By comparison of these two populations, this study is used to prove if there is any significant difference in core stability between them.

METHODOLOGY

This study utilized a quantitative approach and descriptive design to identify the characteristics as well as the correlations between two populations. (Lambert and Lambert, 2012) This research design is suitable to determine the characteristics, namely the core stability of populations of sitting occupations as well as the standing occupations and correlate them by the characteristics. The targeted populations are both genders, working adults aged between 20 -59 (Hunter, Pereira and Keenan, 2016), with at least 12-month employment at work (Jin, Sorock and Courtney, 2004) and individuals with sitting or standing occupations for more than half of the working hours (Lis et al., 2006). Usual working hours: 8-10 hours (Lee, McCann and Messenger, 2007). Exclusion criteria for subjects who are pregnant or post-partum for less than 8 weeks (Lederman, 2010, recent abdominal surgery (Strigård et al., 2016, history of recent strength training for abdominal muscles (Aggarwal, Kumar and Kumar, 2010), body Mass Index (BMI) more than 30 (Mayer et al., 2012) any neurological/ cardiorespiratory conditions and specific LBP red flag (eg: significant trauma, radicular syndrome, thoracic pain, widespread neurologic changes, malignancy, infection and fracture) (Almeida, Saragiotto and Maher, 2018) (Koes et al., 2001).

Subjects who fit the inclusion and exclusion criteria of the study will be selected using convenient sampling. (Etikan, 2016). A number of total populations of the Skudai area are obtained from the Department of Survey and Mapping Malaysia workers (60,000 in total), the factory workers in Skudai, Johor as the standing occupation and office workers in Skudai, Johor as the sitting occupations. The sample size is determined by using a sample size calculator powered by Calculator.net with a confidence level of 95% and a population proportion of 50%. The final sample size of 60 samples reached 30 samples for each category, sitting occupations (n=30) and standing occupations (n=30). An informed consent form is provided to each subject stating their willingness to participate in the study. The Plank Test was conducted as the outcome measure to determine the core muscle stability in the prone bridge position with high reliability of intra-class coefficient (ICC) of 0.97. (Tong, Wu and Nie, 2014).

Ethical considerations

This study was reviewed by the Faculty of Health Sciences Research Review Committee, MAHSA University (FRRC). All procedures and assessment tools used in this study have been approved by the FRRC.

RESULTS

All the data and statistics are analyzed by using Statistical Package for Social Sciences (SPSS) software version 25.0 with a confidence interval (CI) of 95% and a significance level of 5%. (Ibm.com, 2019).

The core stability in individuals in sitting occupation and standing occupation is presented in Table 1 by including the number (N) of participants, mean (M) and standard deviation (SD) from the results of The Plank Test in terms of seconds (s).

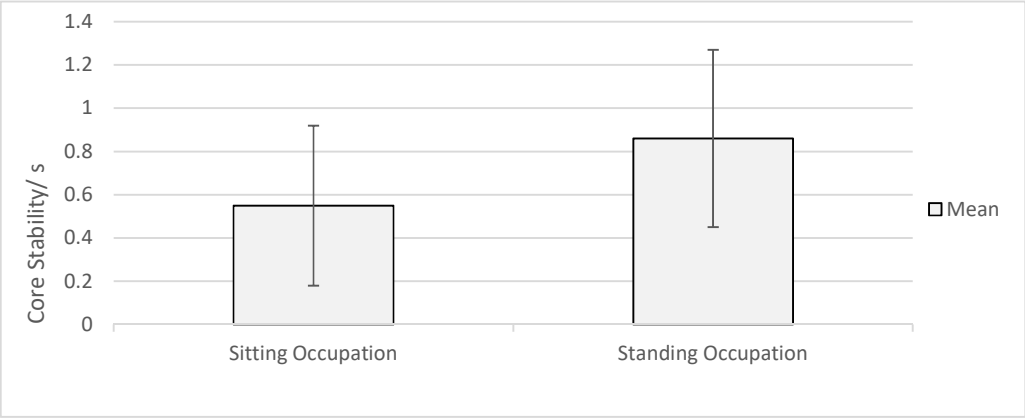
Table 1: Descriptive Statistics of Core Stability

	N	Mean/s	Std. Deviation/s
Sitting Occupation	30	0.55	0.37
Standing Occupation	30	0.86	0.41

The group with sitting occupation (N=30) is associated with core stability M=0.55s (SD=0.37s). In contrast, the group with standing occupation (N=30) is associated with numerically higher results in core stability M=0.86s (SD=0.41s).

The bar graph represents the means and standard deviation of core stability in sitting and standing occupations with a 95% confidence interval as shown in Figure 1.

Figure 1: Core Stability Bar Graph



Prior to the unrelated t-test, the assumption of equal variances is tested and fulfilled via Levene's F test, F (56) = 1.14, p = .290 (p>.05). The unrelated t-test is associated with a statistically significant difference in core stability between both groups, t (56) = 3.09, p = .003 (p<.05). There is a significant difference between the core stability of individuals in sitting occupations and standing occupations as the core stability of those with standing occupations is significantly higher than the other.

DISCUSSION

The purpose of the study was to compare the core stability in the sitting and standing occupation and to determine whether there is a significant difference between individuals in these two occupations. The findings indicate that individuals with occupational standing have superior core stability compared to those with occupational standing. The standing workers, also commonly known as 'blue-collar workers' are highly associated with occupational physical activity. (Smith et al., 2016). Blue-collar workers who are mostly standing at work also involve most of the lifting work during a full working day when compared to other job groups. The higher core stability directly exposes them to high low back muscle activities. (Jakobsen et al., 2018). Research has shown the association between the core muscle endurance and the upper extremity muscle strength owing to the anatomical and physiological properties of core muscles. (Kocahan and Akınoğlu, 2018) The core stability is required for optimal control and transfer of forces across upper and lower extremities. (Silfies, Ebaugh, Pontillo and Butowicz, 2015) The standing workers in the production line who performs their work with upper and lower extremities have superior core stability than the occupational sitting individuals.

A study further proves that high occupational physical activity and leisure-time physical activity (LTPA) have a positive association with muscular endurance as well as other physical fitness, namely power, motor coordination and cardiorespiratory endurance. (Vaara et al., 2014) Thus, the higher physical activity level among the factory workers, representing the occupational standing workers could be one of the contributing factors to the better core stability when compared to the occupational sitting workers. In the sitting position, the sagittal lumbar curve is less lordotic with less extension of lumbar vertebrae in each level, especially L4/L5 and L5/S1 levels when compared with the standing position. This implies the deactivation of lumbar stabilizing muscles as a result of the relaxation of the lumbar erector spinae and multifidus muscles in a sitting position. (Bae, Jang, Lee and Kim, 2012) Mörl and

Bradl (2013) also reveal that a kyphotic lumbar spine recruits very little or even near-zero muscle activation which supports the flexion-relaxation phenomenon in prolonged sitting among office workers. The possible reasons for weaker core stability in occupational sitting workers are attributed to the less lumbar muscle activation.

The weakness of core muscles can compromise core stability and it is proven to be highly associated with low back pain. (Parashar et al., 2014). Sitting position with less core muscle activation could cause strain on the passive structures along the spine, it is crucial to improve the core stability among sitting workers since they are more prone to having weaker core stability (Mörl and Bradl, 2013).

CONCLUSION

Dynamic balance is important for Taekwondo practitioners and although the results displayed a weak correlation the negative linear relationship between navicular drop with regards to dynamic balance performance gives insight that there may be a possible relationship between these variables. Through the research explored above, there is reason to believe that the deformity present in people with excess navicular drop is a valid point that should be looked at when looking at balance performance as it is crucial that the martial artist is able to perform kicks on both sides instead of only the dominant side to be a more well-rounded practitioner through suggestions on short foot exercise, proprioceptive balance training and hip strength training to be done on the dominant leg as well to not limit themselves with only one leg for kicking. This gives an insight for physiotherapists to investigate the balance performance of such martial artists and their ability to balance on their dominant side should be looked into should they have difficulty in executing kicks efficiently on their non-dominant side which requires balancing on their non-dominant leg.

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