BEING IN CONTEXT AND SIMILARITY IN FATIGUING PROTOCOLS TO MAIN ASPECTS OF WRESTLING DON'T ALTER THE BALANCE

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Abstract

The purpose of this study was to show that: being "in context" and "similarity" in fatiguing protocols to the main aspects of sport doesn't alter wrestlers balance. Twenty professional male wrestling athletes (age 26.2±1 yr, VO2max 62.3±3.1 ml kg min) participated in this study (10 in experimental and 10 subjects in control group) and completed a fatigue protocol. In this study, regular wrestling match used for metabolic fatigue protocol. Biodex balance system and lactometer used for evaluation of balance and blood lactate level (respectively). For statistical analysis, Pearson correlation coefficient, paired t-test, sample t and ANOVA tests were used. Based on these study results, the static balance alterations in experimental group (eye opened and eye closed positions) were respectively 0.16% and 3.17% that this wasn't statistically meaningful. Also, Dynamic balance alterations in experimental group (eye opened and eye closed positions) were 0.12% and 0.41% (respectively) that this weren't statistically meaningful. There wasn't significant relationship between lactate acid accumulation and variations of stability indices (r=-0/570, p<0.05). One of the best Justifications for no alteration in wrestlers balance is that: fatiguing protocol exerted in this study is "in context" and "similar" to wrestling main training and this can apply Anticipatory postural adjustment system for further maintaining postural stability. The probable mechanisms that through them neck fatigue did affect static and dynamic stability could be include of alteration in afferent sensory inputs, decreasing in postural adjustment, increase in COP displacement, increase in delay time and decease in muscular activity, alteration in proprioception and dysfunction of contractile units in anti gravity muscle following.

Keywords: *wrestlers; Metabolic Fatigue; Functional Stability, similarity, in context.*

INTRODUCTION

Wrestling is the most physically and psychologically grueling of sports. It is defined by effort, determined by mental and emotional discipline and unflinching in its feedback. The combative nature of the sport and the unavoidable exhaustion experienced during workout and competitive matches combine to shine the brightest of spotlights on personal character. Wrestling guarantees opportunity for personal victory, physical exertion, extreme fatigue and humility, yet thousands of athletes stay with it through high school, college and beyond. Because wrestlers find a deep significance in how the experience of wrestling defines them.

Historically, the potential factors involved in the fatigue development are divided in two categories: the central factors that should provoke the fatigue by a disorder in the neuromuscular transmission between the Central Nervous System (CNS) and the muscular membrane, and peripheral factors that would cause an alteration inside the muscle (Letafatkar et al., 2009). Another characteristic of the fatigue is the fact that it depends on the task, that is, its causes vary in a very wide way, and it behaves according to the way it is induced (Letafatkar et al., 2009). The muscular fatigue is considered as a predisposing factor to the appearance of injuries (Byars, 2006), such as the ankle sprain. Surenkok et al. (2006) showed that there was no correlation between lactic acid accumulation and stability changes. It can be concluded that knee muscle fatigue has an adverse effect on balance; however, this impairment was not correlated with the degree of lactic acid accumulation (Lederman et al., 2010).

Effects of fatigue on specific muscle groups and muscular performance e.g. strength has been investigated extensively in both young and older people (see Kent-Braun 2009 for review). Interestingly, despite typical loss in muscle strength with increasing age, studies have demonstrated that older people are more resistant to muscle fatigue than young people following isometric and dynamic lower extremity muscle work (Helbostad et al., 2010; Letafatkar et al., 2009). Possible mechanisms for this include lower maximal motor units discharge rates, slower contractile properties and greater reliance on oxidative metabolism in older people.

Excessive workloads can increase physical fatigue, resulting in diminished physical endurance and performance and, ultimately, a reduction in productivity. In addition, a combination of muscular fatigue and general subjective fatigue may also manifest itself by causing temporary interference with the functioning of the central nervous system (CNS) as well as the peripheral nervous system. As postural stability is maintained by the CNS as

well as the peripheral nervous system, modifications in its performance may diminish one's ability to sustain balance (Gribble et al., 2004; Letafatkar et al., 2009).

In recent years, a well publicized area in the literature is the relationship between postural control and fatigue. Specifically, postural control can be defined as either static (maintaining equilibrium with minimal movement), semi-dynamic (maintaining equilibrium while the base of support moves), or dynamic (maintaining a stable base of support while completing prescribed movement). Of the three, static and semi-dynamic have been used the most in past and present studies. For example, Gribble and Hertel (2004) looked at the effects of local muscle fatigue on static postural control when measured by a thirty second unilateral stance test (Gribble et al., 2004), and Camps et al. (2008) looked at the effects of upper body fatigue in static postural control measured by the Romberg test (Camps et al., 2008; Olmedo et al., 2009).

Letafatkar et al. (2009) showed that there aren't any significant main effects for time in the mean lateral deflection of the biodex platform. However, there was a significant main effect ($p=0.091$) in the mean anterior-posterior deflection. The mean deflection was significantly reduced, i.e., toward the anterior direction, at the end of each half relative to all other time points. Also there wasn't a significant relationship between lactate acid accumulation and variations of stability indices ($r=-0/661$, $p<0.05$). The balance index was significantly lower for standing with eyes open compared with eyes closed (Letafatkar et al., 2009; Letafatkar et al., 2009).

Several authors have been studying the effects of the muscular fatigue on the neuromuscular control (Chabran et al., 2002; Gefen et al., 2002; Lee et al., 2003), which is related to the proprioceptive afferents that are taken by the peripheral receptors to the upper centers, and to the efferent (motor) responses generated with the purpose to keep the dynamic muscular stability. Studies have shown that the muscular fatigue causes an adverse change in the proprioception (Letafatkar et al., 2009) a sensorial modality comprising the sensations of the joint movement and positioning (Kent-Braun, 2009), as well as the postural control (Lephart and Fu, 2000; Letafatkar et al., 2009). The purpose of this study was to show that: being "in context" and "similarity" in fatiguing protocols to the main aspects of sport doesn't alter wrestlers balance.

METHODS

Twenty elite male wrestlers (age 26.2±1 yr, VO2max 62.3±3.1 ml kg min) participated in this study (10 in experimental and 10 subjects in control group). VO2 max was determined by breath-by-breath analysis of a laboratory- based graded treadmill protocol to volitional failure. All participants provided written informed consent prior to beginning the study. Subjects were tested between 18:00 and 20:00 h, according to the regular training or competition times, and to account for the effects of circadian variation.

Participants attended the laboratory in a 3-h post-absorptive state, having performed no vigorous exercise in the 24 h prior to testing, and with diet standardized for 48 h proceeding in each test. Subjects were required to consume 500 ml of water 2 h prior to testing to ensure dehydration. Thereafter the subjects consumed no fluid so as to control for the possible influence of hydration status on performance. Subjects participated in the wrestling regular competition after having a standard breakfast and after having their blood lactate levels measured via the un-preferred hand mid-fingertip blood samples by a certificated lactometer. The stabilometer trial comprised a (20's eyes closed and 20's eyes opened respectively) double-legged balance task, where the subjects was instructed to keep the dynamic and unstable platform level to the best of their ability (Matt and Colin, 2007).

Dynamic postural stability

Participants stood barefoot on a biodex system (level 4). The biodex system measured any postural sway resulting from the focal movement by recording the displacement and velocity of the Center of Pressure (COP). To assess balance and neuromuscular control, this study used a commercially available balance device, the BSS (Biodex Medical Systems, Shirley, NY, USA), which consists of a movable balance platform that provides up to 20° of surface tilt in a 360° range of motion. The platform is interfaced with computer software (Biodex, Version 3.1, Biodex Medical Systems) that enables the device to serve as an objective assessment of balance. The measure of postural stability includes the Overall (OA), the Anterior/Posterior (AP) and the Medial/Lateral (ML) stability scores. A high score in the OA index indicates poor balance. The OA stability score is believed to be the best indicator of the overall ability of the subjects to balance the platform. We assessed bilateral stance at level 3 (more unstable) with the BSS over a period of (20's eyes closed and 20's eyes opened respectively). Following the recommendations of

the previous studies, level 4 is used as the unstable levels. Subjects were asked to step on the platform of the BSS and assume a comfortable position while maintaining slight flexion in the knees (15°), to look straight ahead and to place arms across the chest. Foot position coordinates were constant throughout the test session. Subjects were tested without footwear at all times (Byars et al., 2006; Letafatkar et al., 2009; Letafatkar et al., 2009; Reilly and Brooks, 1986).

Metabolic Fatiguing task

All subjects in experimental group were completed the regular wrestling match for creation of fatigue based on metabolic phases of lactate accumulation.

Blood samples were collected from unpreferred hand mid-fingertips two times 1) immediately prior to the fatiguing test (pre-lac), 2) five minutes after the fatiguing test (5lac)) for the purpose of estimating blood lactate using a lactate analyzer (Analox P-LM55, UK) found in an Analox lactate kit supplied by Analox (UK). It should be noted that, the analyzer had been calibrated with known lactate standards (5.0 and 15.0 mM). Since environmental conditions can affect blood lactate levels and performance, air temperature and relative humidity values for the track were recorded (22.6±4.3 and 22.7±2.4°C and 48.4±11.9 and 52.1±9.7%, for first and second sessions respectively) using an Arco device (Model TC14P; Germany) (Carvajal-Sancho and Moncada-Jimenez, 2005; Letafatkar et al., 2009).

One week before the data collection took place; the participants were instructed on how to perform the fatiguing test and underwent a familiarization session. In addition, they were asked to wear comfortable, loose-fitting clothing and get an adequate amount of sleep (6-8 h) the night before the test. The clothing, shoes, as well as all equipment used, were consistent for each subject and were recorded to establish controlled experimental conditions.

The subjects arrived at the stadium at 8:00 am in a fasted state and a standardized breakfast (approximately 380 kcal) was served and 30 min afterward they lactic and balance tests was taken. Then, the subjects were taken to a synthetic track (where the fatiguing test was performed). Since the fatiguing test is an all-out test, the subjects warmed up for at least 25 min. The warm-up was standardized for all of the participants. During the fatiguing test, the time of each repetition and the rest intervals was measured by an automatic timing photo-cell system. Before and 5 min after the fatiguing test, the balance tests were performed on Biodex system (Letafatkar et al., 2009; Vachon et al., 1999).

Statistical analysis

The pre and post-test data's were analyzed with a paired t-test and other data's analyzed by sample t-test, ANOVA and Pearson correlation coefficient an alpha level of (0.05) was used in determining statistical significance using the SPSS program for Windows, version 17.0.

RESULTS

Based on these study results, the static balance alterations in experimental group (eye opened and eye closed positions) were respectively 0.16% and 3.17% that this wasn't statistically meaningful. Also, Dynamic balance alterations in experimental group (eye opened and eye closed positions) were 0.12% and 0.41% (respectively) that this weren't statistically meaningful. The Repeated measure ANOVA test results revealed that there aren't any significant main effects for time in either score. There wasn't significant relationship between lactate acid accumulation and variations of stability indices ($r = -0/570$, $p<0.05$).

DISCUSSION

The Repeated measure ANOVA test results revealed that there aren't any significant main effects for time, such that single legged balance performance was maintained throughout the trial. Few studies have directly measured the effects of sport induced specific fatigue on functional stability. Greig et al (2007) indicated that sport specific fatigue couldn't affect stability index by times (Surenkok et al. 2006).

Schieppati (2003) completed a study in fatigue mechanisms; they found that fatigue can alter the stability indices (Zacharogiannis et al., 2004). According to this study results there wasn't significant relationship between lactate acid accumulation and variations of stability indices. In this study we found that lactate acid accumulation couldn't affect stability index. One reason for this result is that the elite wrestlers often training in the lactate threshold (based on energy systems), that this case can improved they body resistance for lactate acid accumulation and therefore the lactate acid accumulation couldn't affect stability index. Also Surenkok et al (2006) showed that there was no correlation between lactic acid accumulation and stability changes. It can be concluded that knee muscle fatigue has an adverse effect on balance; however, this impairment was not

correlated with the degree of lactic acid accumulation (Surenkok et al. 2006).

In the context of the multisensory control of balance, when the availability or the reliability of input from a particular body location decreases, it is conceivable the central nervous system to increase the weighting of input from other locations that provide reliable information for maintaining stable posture Camps et al., 2008; Letafatkar et al., 2009; Zacharogiannis et al., 2004).

Consideration of the directional stability indices reveals that stability was greater in the medio-lateral plane than in the anterior–posterior plane, until the post-exercise measure. This might reflect the anatomical configuration of boney and soft tissue structures (Surenkok et al. 2006; Letafatkar et al., 2009).

Instability in the medio-lateral plane is likely to pose a greater risk for joint injury, and the finding of no fatigue effect with exercise duration suggests that joint stability was not compromised. However, consideration of the mean deflection of the platform over the duration of the task indicates that a change of strategy might have been employed. In each trial the mean deflection was Lateral to the centre of the platform, as expected. However, at the end of each half the mean deflection in the anterior-posterior direction was seen to increase in the anterior direction. This toe down rotation of the platform is indicative of greater plantar flexion at the ankle. In a more functional setting plantar-flexion of the ankle reduces the base of support and increases the risk of ankle sprain injury due to the additional rotational and transverse movements allowed towards the more open packed position of the ankle joint (Hornery et al., 2007; Letafatkar et al., 2009).

The anterior deflection might also be achieved by increased knee or hip flexion to move the centre of mass forward. Injury risk might be increased when placing greater reliance on knee or hip strategies to maintain balance, due to changes in muscular recruitment patterns. These interpretations reported a post-fatigue change in postural control strategy, where the habitual strategy changed from ankle to hip following localized muscle fatigue of the calf. The modifications made in the postural control pattern produce compensatory corrections around the joints to maintain functional stability (Letafatkar et al., 2009).

However, whilst balance performance is maintained, the fatigue-induced alterations in strategy might make the player more susceptible to injury. The alteration in balance strategy during the latter stages of each half suggests that functional joint stability is impaired during the latter stages of each half. This finding supports epidemiological observations of temporal patterns in ankle sprain incidence during soccer match-play (Letafatkar et al., 2009; Torbjorn et al., 2006).

finally the probable mechanisms that through them neck fatigue did affect static and dynamic stability could be include of alteration in afferent sensory inputs, decreasing in postural adjustment, increase in COP displacement, increase in delay time and decease in muscular activity, alteration in proprioception and dysfunction of contractile units in anti gravity muscle following (Gribble and Hertel, 2004; Helbostad et al., 2010; Letafatkar et al., 2009; Letafatkar et al., 2009).

Lesser alteration of dynamic postural control after protocol probably could be related to increasing subject's concentration on body sway, alteration in lower limb neuromuscular function, appearances of visual system, high strength of plantar flexor muscles in athletes, alteration in postural control pattern, Anticipatory Postural Adjustment (APA) mechanism and increased activity in ligament- muscular reflex.

CONCLUSION

One of the best Justifications for no alteration in wrestlers balance is that: fatiguing protocol exerted in this study is "in context" and "similar" to wrestling main training and this can apply Anticipatory Postural Adjustment (APA) mechanism for further maintaining postural stability.

Based on below diagram and similar to the rehabilitations paradigms: it seems that for learning or recovering/learning particular movement patterns the practice should be both similar and within the context of the task. Practicing movements which is "similar" and with "in context" it is more likely to transfer to related daily activities. Transfer is the ability to take a motor experience from one situation and apply it to another. Similarly in the sport fields, when we want to increase the fatigue resistance in athletes we should create sever and multiple fatigue phases in athletes that this finally can positively affect their resistance to fatigue. Also with in context and similar training, athlete's movements highly transferred to them daily/functional sport situations (Lederman, 2010).

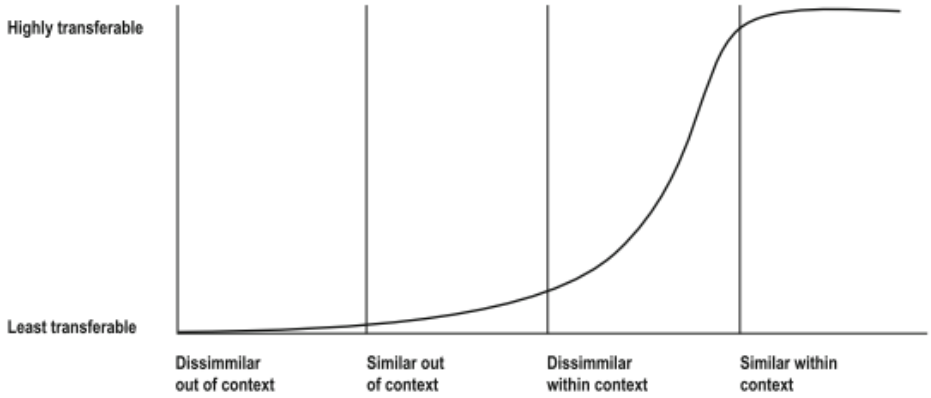

Fig1. Relationship between "similarity" and "in context" concepts and transfer rate.
With increasing similarity and in context the transfer and resistance to out coming situations can highly increase.

PRACTICAL IMPLICATIONS

This study can be used for evaluation and comparing fatigue & fitness in wrestling subjects via their coaches.

ADVICE FOR ATHLETES AND COACHES

The sensorimotor system normally uses inputs from three afferent systems: vestibular, somatosensory, and visual. When one of those systems (somatosensory) is impaired, the two intact systems compensate for the impaired one to some extent. Therefore, balance index in the eyes-closed situation becomes higher (lower balance) compared with eyes open. Balance was maintained and this shows that balance have a little decreases in one leg stance in professional wrestlers. Stability was maintained and this was seemingly achieved by a change in balance strategy during the latter stages of each half. These stages of the game are therefore when the player is most susceptible to injury. It is suggested that wrestling subjects perform proprioception drills both in the rested and exercised state.

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