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Core stability training increases speed and agility in otherwise healthy individuals

Sergio Sarza Jr., PT, DPT, DRDM[a,b,c]*; Oscar Empleo, PT, BSc[a,c]; Thomas Bustalino, PT, BSc[a,c]

[a]College of Rehabilitative Sciences and [b]School of Medicine, Southwestern University PHINMA, Cebu City, Philippines; [c]Rehabilitation and Wellness Center, Southwestern University Medical Center, Cebu City, Philippines

This study investigated the effects of core stability training on the speed and agility of otherwise healthy individuals. Nineteen individuals (16 males), aged 16-44, were randomly divided into an experimental group, a conventional group, and a placebo group. Pre and post exercise speed and agility were tested through the 30-m sprint test and the t-drill test respectively. There was no significant difference between groups in the 30-m Sprint Test and the T-Drill Test. No significant interaction was also noted between time and groups for both sprint ($F(2, 15) = 1.35$, $p=0.29$) and drills ($F(2, 15) = 3.15$, $p=0.07$). Quantitatively, there were decreases in time among all groups in the sprint test, while decreases in both CON and PLA for the T-Drill. It was noted that in the T-Drills, there was an increase in the experimental group from the pre-test ($M=15.13$, $SD=0.76$) and post-test ($M=15.26$, $SD=0.83$). The results suggest that core stability improvement has little to no significant relationships to the speed and agility, and that age has little role to play in the improvements of time. Core training may be used as an aid for improving speed and agility but it may not be necessary.

Keywords: exercise, core stability, non-athletes

INTRODUCTION

The core plays an important role in human functional activities. It serves as a link between the upper and lower limbs of the body as well as maintaining posture and stability (3–5). Therefore, having a strong core is considered to improve biomechanical function of the human body (4,6,7). Core training has shown to be beneficial in different individuals. Although it is commonly associated with athletics and sport, it has also been used in other fields such as physical therapy and recreational exercise.

Two concepts have defined core training: core stability, and core strength. Both different concepts of core function but usually misunderstood as one is failed to be distinguished from the other. However, a study (5) has formulated clear definitions for the two. Core stability mainly concerns the spine and the vertebral column's ability to stabilize and maintain equilibrium during movement or in sudden perturbations. Core strength is more on the muscle contractions which results in the production and transfer of force. Another journal (3) suggests that until now there is still no universally accepted meaning for core stability (3,5) but most researchers have used the concept's recent meaning to define core stability in their studies (3,5,9).

Over the years, core training has been incorporated in athletic training (2,3,5,9). Many athletes in different sports, such as soccer, volleyball, basketball, and swimming, train their core to improve athletic performance, although several studies are still unsure about the significance of core training on sports as there have been mixed results in the improvement of athletic performance (5,11). Core stability training is also used in injury prevention programs. Exercises in these programs are geared towards enhancing the quality of global and the segmental muscles of the core. Global muscles act as guy wires that provide internal stability by resisting external movement and perturbation. The segmental muscles stabilize the spine through deep attachments in each vertebral segment to prevent the individual vertebra from falling apart (5). Moreover, functional movement is also included during training as injury prevention does not solely focus on a single component (5,10).

Among non-athletes, core stability training has shown to improve functional abilities (4,6). Studies that have been conducted in the elderly population have suggested that core stability training decreases the risk of falls (6,8). Since most of the elderly population has an increased risk of falling, core training has shown to be beneficial but rather than focusing more on core strength, exercises are geared toward core stability such that it is believed that an increase in strength compromises the stability of the core.

Core stability training has also shown to be more effective than routine physical therapy protocols for non-specific low back pain patients in terms of pain reduction (1). Though pain in non-specific low back pain can be treated with conventional physical therapy treatment, the application of core stability training relieves the symptom in a lesser amount of time. This is partly because that non-specific low back pain may be caused by a decline in the quality of the global and segmental muscles.

Several studies have been conducted for athletes and the elderly. A study has suggested that the effects of core stability training has no significant effects on athletes due to their improved muscular performance, but its effects could be more evident in healthy individuals although more studies are still needed to confirm this. Since most research was conducted to investigate among athletes and persons with medical conditions, this study aims to determine the effects of core stability training among otherwise healthy individuals.

METHODS

Experimental Approach to the Problem

A randomized comparative design was used in this study. Baseline measures for speed and agility were obtained through the 30-m sprint test and the t-drill test respectively. Subjects were then divided randomly into 1 of each intervention groups CON, EXP, and PLA. Each group were given a 3-week training plan. The program consisted of four exercises that were to be done five times a week. All groups performed each exercise for 3 sets of 10 repetitions. Ideally, training should have been done for about four or more weeks to allow detection of minimal changes in neuromuscular adaptation, but due to external factors the intervention period was cut short. Post testing was done ≤24 hours after the intervention period.

Subjects

Nineteen untrained individuals (16 males, between 16-44 years old), volunteered to participate in the study. All participants do recreational physical activity. Inclusion criteria did not include female participants due to potential effects of menstruation to training. Subject characteristics (weight and height) were not measured in this study. Informed Consent Forms were provided, verbally explained, and signed by the respondents prior to the start of involvement in the study. This research project subscribes to the ethical principles of the conduct of research involving human subjects mandated by the Philippine Health Research Ethics Board and relevant national and international organizations. It was approved by the Southwestern University PHINMA Research Integrity Board on December 7, 2019.

Procedures

Core Stability Training Intervention

Each intervention group was assigned with a different core training program (Table 1, 2, and 3). Subjects were taught how to perform the exercise properly before commencing the program. Each training program consists of four exercises which were done for 3 sets, and 10 repetitions, five times a week, for three weeks.

Table 1	Conventional Core Stability Exercises
Curl Ups	

Side Bridge	
Dead Bug	
Sit Ups	

Table 2	Experimental Core Stability Exercises
Bird Dog	

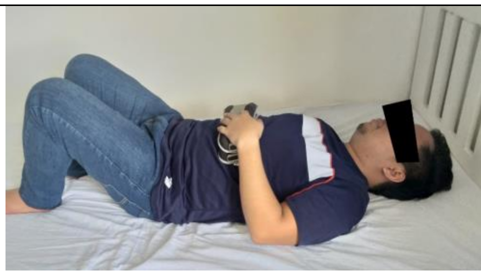
Supine Bridge	
Weighted Diaphragmatic Breathing	
Kegel Exercise Variation	

Table 3	Placebo Core Stability Exercises
Back Extensions	

Leg Lifts	
Superman	
Trunk Side Bends	

Assessment of Speed

The 30-m sprint test was used to test the subjects' speed. Two cones were placed 30-m apart, wherein the subject will sprint from one cone to another. The subjects will start in a stationary position (one foot in front of another, with front foot behind the starting cone) before sprinting at maximum speed when given the signal by the tester. Time taken to reach the end cone was recorded by a stopwatch. Before commencing the test, subjects performed a warm-up exercise. For standardization purposes, the FIFA 11+ Warm Up was done as warm up.

Assessment of Agility

The t-drill test was used to measure agility. Three cones were placed 5 yards apart, and a fourth cone was placed 10 yards from the middle to form a ‘T’ shape. Starting from the same stationary position at the base cone (bottom cone of the ‘T’ shape), the subject sprints to the middle cone at the tester’s signal. The subject sidesteps to the left cone, and sidesteps to the opposite far cone before sidestepping to the middle cone and running backwards to the base cone. Time to complete the test was recorded using a stopwatch. The FIFA 11+ Warm Up was performed before the test.

Statistical Analyses

All analyses were performed using SPSS software for Windows. Multivariate analyses of variance (MANOVA) were used to analyze effects between subjects and within subjects. Repeated measures ANOVA was measured to assess whether there is an interaction between age and group to the 30-m sprint test and the t-drill test. Alpha level of $\rho \leq 0.05$ was used in this study.

RESULTS

Comparison of Groups

Comparison of various core stability exercises are shown in Table 4. There was no significant difference between groups in the 30-m Sprint Test and the T-Drill Test. No significant interaction was also noted between time and groups for both sprint ($F(2, 15)=1.35$, $p=0.29$) and drills ($F(2, 15)=3.15$, $p=0.07$).

Table 4.

Measure	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence [a]... Lower Bound	95% Confidence Interval for [a]... Upper Bound
Sprint30M	Conventional	Experimental	.055	.433	1.000	-1.111	1.220
		Placebo	-.252	.428	1.000	-1.405	.901
	Experimental	Conventional	-.055	.433	1.000	-1.220	1.111
		Placebo	-.306	.439	1.000	-1.490	.877
	Placebo	Conventional	.252	.428	1.000	-.901	1.405
		Experimental	.306	.439	1.000	-.877	1.490
TDrill	Conventional	Experimental	-1.492	1.003	.473	-4.193	1.210
		Placebo	-1.367	.992	.565	-4.039	1.305
	Experimental	Conventional	1.492	1.003	.473	-1.210	4.193
		Placebo	.124	1.018	1.000	-2.618	2.867
	Placebo	Conventional	1.367	.992	.565	-1.305	4.039
		Experimental	-.124	1.018	1.000	-2.867	2.618

Changes in Speed and Agility

Quantitatively, there were decreases in time among all groups in the sprint test, while decreases in both CON and PLA for the T-Drill. It was noted that in the T-Drills, there was an increase in the experimental group from the pre-test (M=15.13, SD=0.76) and post-test (M=15.26, SD=0.83) as shown in Table 5, and Table 6.

Table 5.

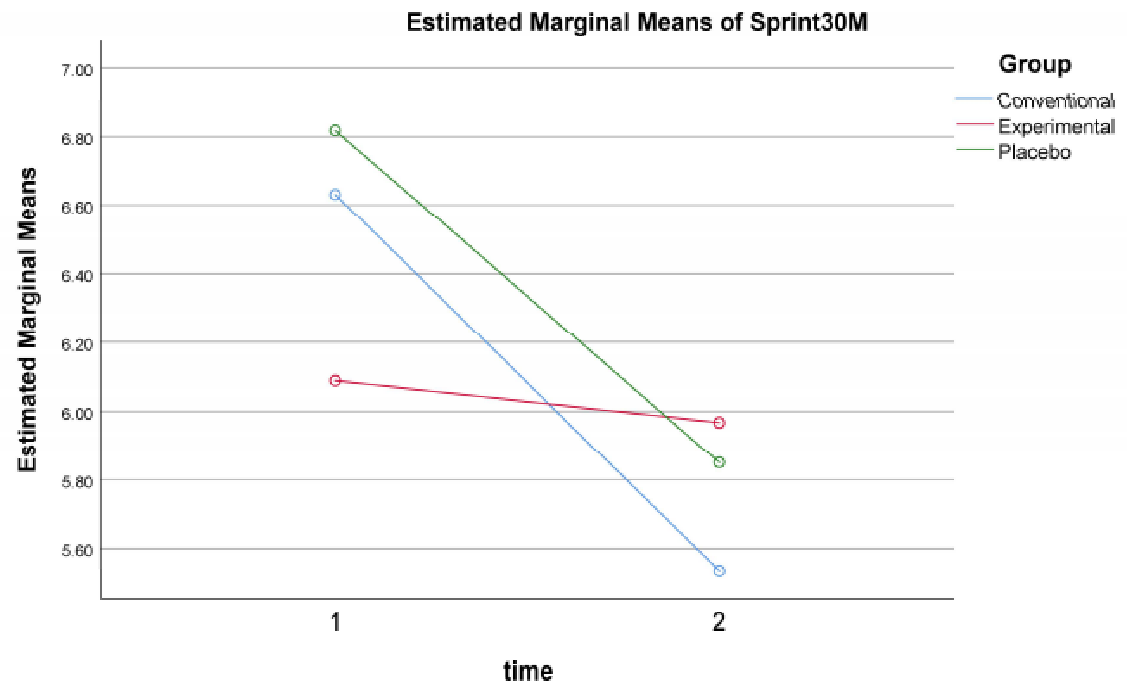
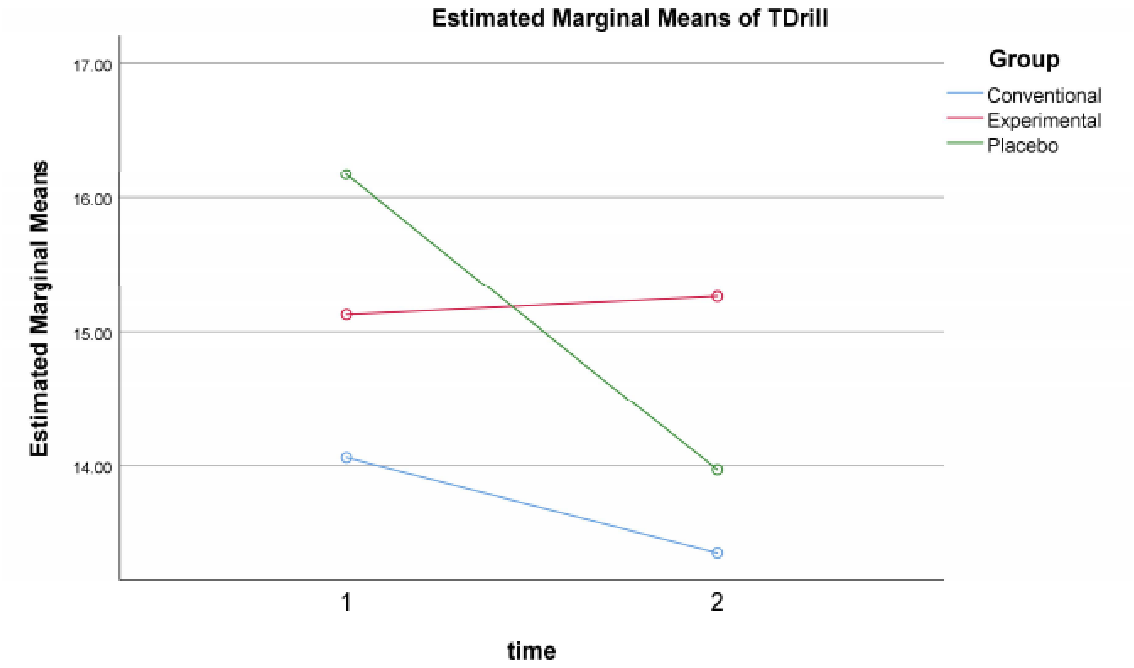


Table 6.



Effects in Different Age Groups

There was no significant interaction between time and age for both the sprint (F(1,15)=0.39, p=0.54) and drills (F(1,15)=1.91, p=0.19).

DISCUSSION

Theory suggests that core stability is improved by targeting muscles in the lumbopelvic-hip complex (5). Comparison of the groups included different training programs were done by each group that targeted different core muscles. The CON group did exercises to target global and segmental stabilizers. The EXP group included exercises for the muscles not usually targeted in core training (i.e. diaphragm, and the pelvic floor muscles). The PLA group focused more on exercises for the lower back muscles.

Previous studies suggest that by targeting all muscles of the core implies a greater improvement in stability (1,3,5), therefore improving biomechanical functions. However, results have shown that there was no significant difference between groups.

In athletes, it was expected that changes in speed and agility through core exercise is not entirely evident. Moreover, a previous study (2) has suggested that improvement is more evident in healthy individuals. In this research, it was observed that although there were improvements in both CON and PLA groups in terms of time, the EXP group showed increase in both tests after the exercises were performed. Results from the EXP group were unexpected as previous studies have not shown any increase in time after exercises were conducted.

It is widely believed that age plays a role in changes of fitness components of an individual. Books, and journals have also suggested theories of aging that could affect a person's decline in bodily functions that in turn affects their biomechanics. As such it was to be expected that there were significant differences in the age groups in terms of time, with the younger age group having lower than the older group. However, results showed otherwise.

PRACTICAL APPLICATIONS

Multiple factors may affect speed and agility. This can be done through resistance training and other sport-specific training protocols. Athletes, coaches, and other sports-related practitioners who would want to incorporate core stability exercises to their training program may do so. However, in the context of improving speed and agility, core training may be use as an aid but it may not be necessary to do so since direct relationship to core stability remains uncertain.

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