

## ORIGINAL ARTICLE

IJPHY

## EFFECT OF DYNAMIC NEUROMUSCULAR STABILIZATION THERAPY VS PARACHUTE RESISTANCE TRAINING ON PERFORMANCE LEVEL IN RACE WALKERS: COMPARATIVE STUDY

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## ABSTRACT

**Background:** Race walking significantly places stress on the lower extremity joints affecting ADLs. The gait pattern of race walking is different than normal walking that causes biomechanical alterations leading to musculoskeletal disabilities. DNS (Dynamic Neuromuscular Stabilization) therapy is based on developmental kinesiology and the integration of neurophysiology and biomechanical principles in which each purposeful movement pattern is reinforced by the coordination between every segmented required for postural stability. Parachute Resistance training works on the principle of air resistance and terminal velocity, which helps in improving lower extremity muscle strength and power, decreasing the stress put on joints during physical activity.

**Methods:** The study was completed by using a stratified sampling technique among the race walkers between the age group of 18-29 years, a total of 40 race walkers (20 males and 20 females) were selected based on the inclusion and exclusion criteria by approaching various sports academies. Participants were divided into two groups, Group A and Group B. The groups consisted of 20 participants each. They were verbally interviewed regarding their demographics. Pre-treatment assessment of vo<sub>2</sub>max and speed was done using the Cooper test and sprint test, respectively. Participants in group A underwent Dynamic Neuromuscular Stabilization Technique, and group B underwent a Parachute resistance training program, and post-treatment assessment of all the parameters was done.

**Results:** DNS Therapy shows significant improvement in the performance level of race walkers in group A as compared to Group B with p-value 0.003 and 0.001.

**Conclusion:** The study concluded that DNS therapy and Parachute resistance training exercises are equally effective in improving the performance level in race walkers.

**Keywords:** DNS (Dynamic Neuromuscular Stabilization), Parachute resistance training Racewalkers, cooper test, vo<sub>2</sub> max, performance level.

Received 15<sup>th</sup> February 2020, accepted 17<sup>th</sup> May 2020, published 09<sup>th</sup> June 2020



www.ijphy.org

10.15621/ijphy/2020/v7i3/701

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## INTRODUCTION

Race walking is an endurance activity that quintessential needs technical ability to walk at a breakneck speed. It is the mid gait between normal walking and running. According to the International Association of the Athletic Federation (IAAF): Race Walking is an activity that requires the athlete to progression with steps taken in a way that the walker makes contact with the ground. The leading leg should be straightened until it attains a vertical upright position. Race walking creates positive effects on cardiovascular risk factors, types of injuries, and the biomechanical alterations are well known; however, race walking is not an activity without risk and has also been associated with musculoskeletal injuries [1-3].

According to the rules of race walking given by IAAF: A) during the toe-off phase, the toe must stay in contact with the ground until and unless the heel strike of other extremity occurs. B) The stance extremity should be straightened (knee hyperextension) from the initial contact and maintained until the acceleration occurs. These rules cause the hyperactivity of gluteus Maximus (hip extensor) to maintain the contact in the end phase, Gastrocnemius (maintains knee hyperextension). Along with this, to maintain the fast pace of walking, RW needs to perform increased knee flexion during the swing phase as compared to the knee flexion in normal walking so that the moment of inertia of leg decreases [4,5,6,7]. Norberg J. (2015), in one of his study, gave the brief description about the RW gait along with its kinematics and kinetics, according to this; during race walking, there is excessive hip adduction to assist walking in a straight line and control the speed of walking [8].

Racewalk training requires several physiological attributes for cardiovascular endurance, maximal oxygen uptake (VO<sub>2</sub> max), etc. Each of these components can be improved with training but at different workout intensities [9]. This study aimed to find the effect of DNS (Dynamic neuromuscular stabilization) therapy VS parachute resistance on the performance level of the national level race walkers. DNS (Dynamic Neuromuscular Stabilization) is a newer method of rehabilitation from locomotor to "Integrated stabilizing system" and achieve exciting levels of function [8,10]. This approach in which every movement is reinforced by the coordination activity each spinal segmental for postural stability [11]. Parachute Resistance training works on the reverse aerodynamic principle that helps in improving lower extremity muscle strength and increasing the stride length, decrease in ground contact time & potential increase in stride frequency that is the main three rules of race walking [8,12].

## METHODOLOGY

Total Forty race walkers (20 male and 20 female) between the age group of 18-29 years (mean: 20.38), athletes must be in RW since 1 years. The aim and method of the study were explained to the selected participants, and written consent was taken and was approved by the university's ethical

committee. The race walkers had a mean stature of 164.72 m and a weight of 20.25 kg. The study was completed using a stratified sampling technique with the experimental research-based study design. The athletes participating in the study should not have any fractures within a year. Participants were divided into two groups, Group A and Group B. The groups consisted of 20 participants each. They were verbally interviewed for demographic data, which included the height, weight, BMI, years of practicing, level of competition, etc. Subjects also answered questions regarding personal information and training volume, specifically, experience in RW, weekly training volume, and best time in RW. Pre-treatment assessment of vo<sub>2</sub>max and speed was done using the following outcome measures: Cooper test and sprint test, respectively. Participants in group A underwent Dynamic Neuromuscular stabilization Technique, and group B underwent a Parachute resistance training program for improving the endurance and performance level. 30 min session daily for four weeks for core stabilization and improving the performance level using DNS protocol and Parachute training was given, and post-treatment assessment of all the parameters was done [13].

### Exercise Program:

Warm-up: 5 minutes; spot jogging, push-ups, squatting, half crunches.

Conditioning program for DNS therapy [21]: 20 minutes

1) Supine position – Shavasana Pose, chin tuck in, palms open

Breathing exercise: breath in – breath out for three times, breath in – hold – breath out for two times, breath in – hold – hold – breath out for one time, breath in – hold – hold – hold – breath out for one time.

One leg up – hip flexed completely and externally rotated – knee flexed, breathing exercises. , repeat the same for 2<sup>nd</sup> leg and breathing exercises; both hands up with palms open, breathing exercises. Relax.

2) Prone position - Head up, chin tuck in, elbow flexed, palms open, fingers flexed (like catching a ball), breathing exercises, three times head rotation – breath in – turn around (breath out) – continue this with breathing exercises, head up and down – continue same as above and relax.

Conditioning program for Parachute resistance training: 20 min

Distance: 50 m; 5laps for 4 min each.

A parachute was used for resistance training in race walkers. Resistance has applied at the right to the posterior aspect of the athlete's body center of gravity and is caused by air.

**Cooldown:** 05 min.; stretching (30-sec hold. 3 reps.)

### STATISTICS

The data was statistically analyzed. The analysis showed normal distribution by the Shapiro Wilk test, and the parametric test was performed to analyze the data between

the group using Unpaired T-Test.

## RESULTS

The data was analyzed for 40 athletes who finished the prescribed exercises for four weeks. According to the result in Table1, demographic data in the form of age, height, body mass, body mass index, and years of practicing were usually distributed. The Result of the unpaired-T test showed that there was a significant improvement in the performance level of race walkers of both the groups. The obtained measurements related to the cooper test and sprint test in the two pre and post-intervention are shown in Table 2. A total of 40 athletes participated in this study. The mean age of the race walkers in this sample was 20.38 years (SD ± 0.86). The athletes who participated were having an average experience of 4years in race walking.

**Table 1:** Demographic Data

Variables	DNS (n=20)	Parachute (n=20)
Age (years)	18.9 ± 0.87	19.1 ± 0.87
Height(cm)	164.68 ± 5.9	164.26 ± 5.88
Body Mass(kg)	49.95 ± 2.49	51.01 ± 2.59
Body mass index	18 ± 1.61	18.9 ± 1.38
Years of practicing	4 ± 2.4	3.26 ± 1.79

**Table 2:** Cooper test and sprint test values pre and post-test in DNS & parachute intervention.

Variables	Group	Pre-test	Post-test	Sig. level
Distance (m)	DNS	2255 ± 401.9	2401.1 ± 417.7	P = 0.261
	Parachute	2422 ± 437.9	2844.21 ± 104.6	P = 0.41
VO2max (ml/kg/min)	DNS	39.15 ± 95	42.5 ± 2.5	p = 0.001
	Parachute	43.05 ± 9.7	52.27 ± 2.3	P = 0.3
Sprint test (sec)	DNS	10.72 ± 2.24	9.86 ± 2.16	P = 0.003
	Parachute	9.46 ± 1.28	9.43 ± 1.28	P = 0.001

## DISCUSSION

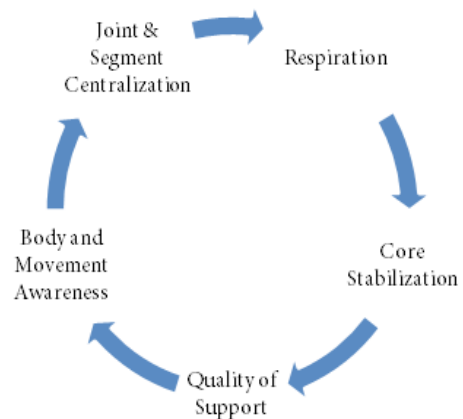
The Results in this revealed that both types of training could considerably improve distance, vo2 max, and speed of race walkers. The age criteria selected for the race walkers were the young- adult population because the peak age of athletes is 30 years [14]. The athletes in race walking need a minimum of 1year experience for getting properly trained in that field, so the chances of injuries are reduced. Cooper test is meant to measure the condition of the person, and therefore, he is supposed to run at a steady pace; it also measures the VO2max level before and after a treatment protocol so that the effect of the treatment can be studied in an athlete [15]. Sprint test helps in recording the acceleration, fastest running speed, and endurance related to speed depending upon the distance covered, so this outcome measures were used [16].

Clare Frank et al. (2013) in his study on DNS in sports rehabilitation stated that Dynamic neuromuscular (core) stability is necessary for maximal athletic performance and is not achieved purely by appropriate strength of abdominals, spinal extensors, gluteals; instead, core

stabilization is achieved through coordination of these muscles and thus maintains intra-abdominal pressure by the central nervous system to improve the performance [17]. The fundamental concept of the theories includes DK (Developmental Kinesiology), in which the development of human motor function in early childhood is genetically pre-determined and follows a predictable pattern. The motor programs are performed by the central nervous system (CNS)as it matures, enabling the infant to control posture, achieve erect posture against gravity, and also to move purposefully via muscular activity [17].

Developmental Kinesiology emphasizes the existence of central movement patterns that are inborn, and all these movement patterns or muscular synergy patterns occur automatically in a specific developmental sequence throughout CNS maturation. There is a consensus that an increase in IAP stabilizes the spine. The anterior lumbopelvic postural stability is provided by the diaphragm, pelvic floor, and transversus abdominis, and it also regulates the IAP. These intrinsic spinal stabilizing muscles provide spinal stiffness in coordination with IAP, which serves to provide dynamic stability of the spine [17].

## DNS PRINCIPLE



**Figure 1:** DNS Principal

**Factors affecting performance level [17,18]:**

- 1) Improve Neuromuscular control:
  - a) Abnormal postural development – developmental delay
  - b) Incorrect learning activity – poor coaching; wrong practice.
  - c) CNS Adapting to a pathological situation. – casting from a fractured limb.
- 2) Muscular insufficiency for joint stabilization.
  - a) Dyskinesia: muscle-strengthening in poor alignment. – corrected through exercise.
- 3) Ligament insufficiency & poor anatomy
  - a) CAM, Pincer, Alignment of the glenoid fossa, etc.
  - b) They are corrected through surgery.

The development of performance in competition is achieved through a training process that is designed to induce automation of motor skills and enhance structural

and metabolic functions [3,19,20].

Resistance training not only decreases resting heart rate but also its response to submaximal exercise; an increase in resting, stroke volume, and maximal cardiac output due to exercise can increase VO<sub>2</sub>max; and also increases arterio-venous oxygen difference. This study is supported by a study by Michael L. Pollock (2011) et al., who stated that resistance training improves cardiovascular and muscular endurance [6]. The effects and adaptation of nerve roots are responsible for the successful recruitment of motor units, thereby providing more muscle strength. Ae Rim Hong et al. (2011) supported this study, who concluded that a 90% increase in muscle strength by resistance training is due to neural adaptation [15]. In the present study, the distance and vo<sub>2</sub> max were the components of the cooper test, which showed maximum improvement post-treatment. Speed Parachutes built fast-twitch muscles. Fast-twitch muscle fibers are advantageous for short bursts of strength or speed of movement. For race walking, good cardiovascular endurance is required, which can be improved by using resistance training. Fast-twitch muscles also provide excessive speed and the ability to change direction fastly. The chute provides progressive resistance, meaning the faster you run, the more it drags the resistance that speed parachutes provide forces your glutes, quadriceps, hamstrings, and calves to contract with greater explosiveness [21].

As the lower extremity muscle strength improves, the stride length increases, decreasing the ground contact time & potentially increasing the stride frequency and thus improving the distance covered and endurance. This is supported by the study of klimentinimartinopoulou(2011) et al., who stated that resistance training improves running velocity and stride frequency [7,22]. There were several limitations to the research that should be noted. First, Both male and female race walkers were not studied separately. Secondly, their experience varied from at least one year and above. Last, the athletes were not enquired regarding how much time, if any, was missed from their training due to pain level.

## CONCLUSION

The study concluded that DNS therapy and Parachute resistance training are equally effective in improving the core stability and performance level in race walkers.

**Conflict of Interest:** None.

**Source of Funding:** No source of funding.

**Ethical Clearance:** Institutional ethical approval taken.

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