“IMMEDIATE EFFECT OF CAPACITIVE AND RESISTIVE ELECTRIC THERAPY ON PERFORMANCE IN RUNNERS - A SINGLE GROUP EXPERIMENTAL STUDY”

A Dissertation Submitted to the

Utkal University, Bhubaneswar, Odisha.

In partial fulfilment

of the requirements for the degree of

Master of Physiotherapy

in

SPORTS

by

Dushyant Bawiskar

Under the guidance of

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Bhubaneswar, Odisha

2021-2023

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"Immediate Effect Of Capacitive And Resistive Electric Therapy On Performance In Runners - A Single Group Experimental Study"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. Chinmaya Kumar Patra, Principal, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha.**

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Place: - Odisha **Dushyant Padmakar Bawiskar**

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- *Dushyant Bawiskar*

LIST OF ABBREVIATIONS

1) **ABTP** - Abhinav Bindra Targeting Performance
2) **CARE** - Capacitive and Resistive Electric Therapy
3) **CET** - Capacitive Electric Therapy
4) **CReT** - Capacitive and Resistive Electric Therapy
5) **EMS** - Electrical Muscle Stimulation
6) **TENS** - Transcutaneous Electrical Nerve Stimulation
7) **RET** - Resistive Electric Treatment

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ABSTRACT

Background

Sports medicine has been interested in electric treatment techniques including capacitive and resistive electric therapy because they have the potential to improve recovery and performance in athletes, particularly runners. This study intends to compare the benefits of capacitive and resistive electric treatment on muscle repair, performance enhancement, and injury prevention in runners.

Methods

Thirty runners aged between 18-30 years were taken with convening sampling. Training intervention consisted of 10 minutes of CARE THERAPY to each lower limb. Immediately Agility and Speed performance were assessed before and after the intervention using Modified T-tests, and 30m Sprint test respectively.

Results

In Modified agility at pre-test male and female recorded with time with mean value 6.8792, and 7.0650 respectively, with t-test -0.983 found with non- significant results P=0.334 > P=0.05 while in Modified agility at post-test male and female with mean 6.5454 and 6.7117 respectively, with t-test -0.931 found with non-significant results P=0.36 > P=0.05. In Sprint test, at pre-test male and female with mean 4.0271 and 4.1233 respectively, t-test -1.625 found with non-significant results P=0.115 > P=0.05 while in Sprint test at post-test male and female with mean 3.9842 and 4.0967 respectively, with t-test -2.312 found with highly significant results P=0.028 <P=0.05.

Conclusion

This study sheds important light on how capacitive and resistive electric treatment affects runners. The results show that both treatment modes have unique advantages, with capacitive therapy emphasising recuperation and flexibility and resistive therapy focussing on improving muscle strength and performance. Thus, this study concluded that the effectiveness of CARE therapy on running performance among the runners.

Keywords: Electric therapy, capacitive therapy, resistive therapy, runners, muscle recovery, performance improvement, injury prevention.

INTRODUCTION

An international trend known as "desportification and deinstitutionalization of the sport sector" has been contributing to the growth of the "running sport" since the 1960s. Running subsequently separated from organised athletics to become a separate sport. In a similar vein, over the past three decades, running-related events such as city runs, park runs, trail runs, and obstacle runs have seen an exponential rise in popularity in the majority of Western nations. For example, the number of participants who finished the 20 biggest road races globally increased from 866,000 in 2001 to over 1,600,000.[1,2]

In the active population, lower limb injuries sustained while running occur frequently—66% of cases occur within two years[3]. There have been 28 lower extremity alterations associated with running that have been documented in the literature, including medial tibial stress syndrome, patellar tendinopathy, Achilles tendinopathy, plantar fasciitis, ankle sprain, iliotibial band syndrome, hamstring tendinopathy, tibial stress fracture, and patellofemoral pain[4].

The study of how the human body moves and engages with its surroundings is referred to as biomechanics. Understanding the mechanics of the body's motions and how they impact running performance and injury risk is vital when it comes to biomechanics and running. Here are some crucial components of running biomechanics[5]. Stride Length and Frequency: The distance travelled by a step is referred to as stride length, and the number of steps per minute is referred to as stride frequency. In order to cover more territory more effectively, elite runners typically strike a compromise between longer stride lengths and greater stride frequencies[6,7].

During running, the foot's first point of contact with the ground is referred to as the foot strike. Heel strike (first ground contact with the heel), midfoot strike (first ground contact with the middle of the foot), and forefoot strike (first ground contact with the front of the foot) are the three primary types of foot strikes. Different foot strike patterns can have an impact on how the lower extremities are loaded while running[8,9].

Timing and patterns of muscle activation are extremely important when it comes to producing and absorbing forces while running. At different points in the running gait, several muscles serve as the main movers, stabilisers, or shock absorbers. Effective running mechanics and injury avoidance depend on optimal muscle activation and coordination. Running economy is the term for the amount of energy necessary to run at a particular pace. By reducing energy losses and enhancing forward propulsion, efficient biomechanics can increase running economy. Running economy is influenced by things including arm swing, leg stiffness, and body posture[3,10,11].

Many different modalities are often used by runners to improve their performance and speed their recovery. Capacitive and resistive electric treatment are two frequently utilised methods that apply electrical currents to the body. While resistive electric treatment (RET) employs resistive electrodes to produce a current flow through the tissues, capacitive electric therapy (CET) uses capacitive electrodes to generate an electric field in the tissues. These treatments may affect running performance because they are thought to have immediate effects on muscle activation, circulation, and neuromuscular function. The rationale of this research is to look at how CET and RET affect runner performance right away. Understanding how these modalities affect running efficiency might offer insightful information about their potential use in pre-training or pre-competition regimens[12].

Electronic devices called capacitive and resistive energy transfer devices are used to transmit energy through, respectively, capacitive and resistive components. Power electronics, renewable energy sources, and the charging of electric vehicles are just a few of the areas where these gadgets are often employed.

Devices that use capacitors to store and transmit electrical energy are known as capacitive energy transfer devices. They function by electrically charging the capacitor from a power source and then discharging it to a different circuit or load. Through the capacitive connection between the two circuits, this energy transfer takes place. Wireless power transfer systems, energy storage systems, and power factor correction circuits are just a few examples of the applications for capacitive energy transfer devices. When galvanic isolation between circuits is not required, they are frequently utilised. Devices that use resistors to transfer electrical energy are known as resistive energy transfer devices. In order to transmit energy from one circuit to another, these devices regulate the flow of current through resistive materials. Applications for resistive energy transfer devices include heating elements in appliances, braking systems in electric cars, and load banks for electrical system testing[13].

Devices for transferring energy that are capacitive or resistively both have advantages and disadvantages. High efficiency, quick reaction times, and comparatively reduced cost are all features of capacitive electronics. To address voltage and safety issues, they could need careful design considerations, nevertheless. On the other hand, resistive devices have a simpler construction and operation but can release a lot of energy as heat.

In Capacitive Energy Transfer, it is used to send electrical impulses directly to muscles or particular muscle groups, capacitive devices, such as capacitive electrodes or plates, may be employed in combination with electrical stimulation. In order to facilitate muscle contractions and neuromuscular activation, the capacitance enables the transfer and storage of electrical energy, which may subsequently be released into the desired muscles[14,15].

In Resistive Energy Transfer, it is Resistive electrodes or cables, for example, may be used to provide impedance or resistance to the electrical stimulation of muscles. This resistance may increase the stress on muscles, enhancing strength gains and the activation of new muscular fibres during exercise or recovery. The three CRet protocol applications had distinct impacts on the temperature and current flow in the radio humeral capsule and common extensor tendon[16].

Electrical currents are used in electrical muscle stimulation (EMS) to trigger muscular contractions. It may be used to strengthen muscles, increase physical endurance, and speed up recuperation. EMS is occasionally included into training regimens to promote muscular activation, boost recruitment of muscle fibres, and perhaps enhance performance. Transcutaneous Electrical Nerve Stimulation (TENS) targets sensory nerves with electrical stimulation to relieve pain. TENS is generally used to relieve pain, but it may also be used as part of rehabilitation regimens to ease tight muscles and encourage relaxation. It may help alleviate pain by promoting blood flow, reducing muscle tension, and providing sensory stimulation. The therapy is thought to enhance tissue healing processes, such as improving circulation, reducing inflammation, and promoting tissue repair. CRET therapy can be used to aid muscle strengthening and facilitate the rehabilitation of injured muscles or muscle groups. It may assist in reducing swelling and oedema through improved fluid circulation and lymphatic drainage. In individuals with KOA, the use of CRET appears to enhance functional outcome and pain management[17].

AIM

AND

OBJECTIVES

NEED OF THE STUDY

- Care Therapy has been proven to be effective on various conditions like shoulder impingement, foot pain in diabetic patients, tendinopathy for healing and recovery process but there is no study available yet on performance enhancement.
- The similar mechanism of Care Therapy which is being utilised for treating a disorder can be thought of for performance enhancement of a particular sport.
- Hence, keeping the increasing demand of running sports in mind there is a need of such study to find out the immediate effects of CARE therapy on performance of recreational runners.

AIM OF THE STUDY

- The aim of this study is to find out the effectiveness of CARE therapy on running performance among the runners.

OBJECTIVES

- To determine the effectiveness of CARE therapy on speed performance by 30m Sprint test.
- To determine the effectiveness of CARE therapy on agility performance by Modified Agility T- test.

HYPOTHESIS

Alternate Hypothesis

- The immediate effectiveness of CARE Therapy will improve speed performance in runners.
- The immediate effectiveness of CARE Therapy will improve agility performance in runners.

Null Hypothesis

- The immediate effectiveness of CARE Therapy will not improve speed performance in runners.
- The immediate effectiveness of CARE Therapy will not improve agility performance in runners.

OPERATIONAL DEFINITION

- **Runners -** The participants trained three to four times a week for a minimum of 45 minutes of continuous running, running 1 to 3 weekly sessions for at least 6 months[18].

REVIEW

OF

LITERATURE

1. **Teresa Paolucci and colleagues (2019)** described consequences of painful shoulder impingement syndrome patients receiving capacitive and resistive electric transfer treatment. For a number of orthopaedic degenerative and inflammatory conditions, capacitive and resistive electric transfer therapy, an endogenous diathermic therapy, decreases pain and enhances quality of life. The purpose of this retrospective, observational case control research was to evaluate the effectiveness of CARE therapy in the treatment of shoulder discomfort. CARE significantly enhances peritendinous blood flow and raises haemoglobin saturation levels. The study involved 46 patients. The authors observe that "This study is the first to use low-frequency fields to examine how CARE treatment affects acute shoulder pain. To compare the results with those of other treatment techniques, more research is required." In order to corroborate the findings, they contend that more study and long-term monitoring are required[19].
2. **Carlo Coccetta (2019)** described effects of capacitive and resistive electric transfer therapy in patients with knee osteoarthritis. Knee osteoarthritis (KOA) is a long-term condition that causes joint discomfort and functional limitations. A 2-week CRET programme was able to dramatically enhance strength, physical function, and discomfort in a sample of individuals with KOA, according to research. Patients tolerated CRET therapy well; no side effects were noticed or reported. The research included 70 participants who had knee discomfort. Our study had three major flaws, which might use some improvement: the individuals we recruited had mild to moderate KOA but not severe cases.

The three-month follow-up period may not have been long enough to fully assess the treatment's long-term effectiveness and the percentage of dropouts. Another potential drawback might be the inability to entirely standardise the care given." they observe[17].

3. **Jacobo Rodríguez-Sanz et al. (2020)** reported on Application of capacitive-resistive electric transmission on various knee structures: thermal and non-thermal effects. In sports medicine and physical therapy, capacitive- resistive electric transfer treatment is used to treat muscle, bone, ligament, and tendon problems. The goal of this in vitro experiment was to ascertain how the T-Plus Wintecare device's resistive energy/electrical capacitive transfer affected the temperature in the knee's intra-articular, capsular, and superficial regions. They discovered a rise in temperature at all depths, but particularly near the surface. Treatments using low- and high-power capacitive elements raise the surface temperature more. The study involved 5 fresh frozen cadavers. Some of the findings look to contrast with previous work in this area: "The authors' choice of a non-invasive instrument to measure deep tissue temperature rather than an invasive technique involving needles constituted a significant constraint that they highlighted," Rodríguez- Sanz claimed. Discussing potential improvements, "This study's findings on cadavers might not match those of research on living people. In our sample, a functional thermoregulation mechanism was not feasible. It is likely that live subjects' tissues won't see as much of a rise in temperature since the heat will be dissipated by flowing blood," they

observe. The team contend that more studies are needed in living subjects to support these findings[16].

4. **Yuto Tashiro et al. (2020)** report that it has been well documented worldwide that low back pain (LBP) is a common and costly condition. The exercise program's impact on the study's findings and improved functional impairment were promoted by the CRet intervention. In this study, the E +CRet group experienced a greater intervention impact on NSCLBP than the E group. Capacitive and Resistive electric transfer, which is a type of deep thermotherapy, and exercise may be more beneficial when used together than when used alone. In the E +CRet group, functional disability dramatically improved. The research involved
87 people. Some of their findings potentially diverge from previous studies in this area: “Normal setting for the standardised effect size is 0.8, error = 0.05, and 10% dropout during the experiment means that 23 people in each group are needed. However, as of right now, the most recent review's CRet evidence is woefully poor,” Tashiro suggested. The researchers say that “Only young individuals were included in this study because older persons were omitted since the exercise intervention impact was only examined for the elderly. Despite these drawbacks, the results of this study offer important information on the impact of CRet intervention[20].

5. **Carlos López-de-Celis et al. (2021)** reported in ‘Thermal and Current Flow Effects of a Capacitive-Resistive Electric Transfer Application Protocol on Chronic Elbow Tendinopathy' describes how an experimental in vitro study was created to ascertain the impact of a CRet

treatment protocol using the "Wintecare T-Plus" device on temperature and electric current. The researchers noticed a large increase in temperature at the radio humeral capsule and common extensor tendon, which is directly connected to vasodilation. The several CRet protocol applications each had distinctive impacts on the temperature and current flow. All protocol applications resulted in a current flow that is connected to the creation of cell proliferation. Five freshly cryopreserved cadavers were used in the study. "This study was conducted in cadavers, which do not have thermoregulation or active blood flow," the researchers write. This element most likely contributed to the temperature increases. This result would assist in preventing undesired hyperthermia in actual patients receiving therapy. The researchers contend that because there are several CRet regimens available for the treatment of lateral elbow pain, it is impossible to generalise the findings of this study to all applications. In order to validate these results clinically, more research is required[16].

6. **Hernández-Bule ML (2014)** described cellular physiology and biochemistry. A variety of cell types are involved in the delicate process of tissue regeneration, and their activities are controlled by complex networks of biochemical signals. According to the data, intermittent exposure to a 448 kHz electric stimulation, which is presently utilised in electrothermal CRET treatments, causes the ERK1/2 signalling pathway to be activated and encourages growth. The number of cells in cultures treated with CRET in passages P3 to P5 increased statistically significantly, up to a 25% increase above sham-exposed controls in

passage P5. These findings demonstrate that molecular and cellular processes other than thermal ones might be critical to the therapeutic effectiveness because the electric stimulation was administered at a sub thermal current density of 50 A/mm2. There were 4 healthy donors in the research. The authors' results claim to strengthen earlier work in this subject: "5-minute-long pulses of 448 kHz sine wave current at a sub thermal density of 50 A/mm2 made up the stimulation pattern. Studies in the past have demonstrated that certain exposure factors have an impact on cell growth," Paper posited.[21]

7. The impact of capacitive resistive monopolar radiofrequency (CRMRF) at 448 kHz on pig model body contouring. In 'The Effectiveness of 448- kHz Capacitive Resistive Monopolar Radiofrequency for Subcutaneous Fat Reduction in a Porcine Model', **Tae-Rin Kwon et al. (2019)** reported that To compare the safety and effectiveness of the subcutaneous fat reduction following application of capacitive resistive monopolar radiofrequency utilising CET and RET, preclinical study was carried out. The temperature difference in the fat layer was 42–47°C, and an estimated temperature of 42°C was confirmed on the skin's surface, indicating that the heat transmission was efficient. Fibrotic septa in the adipose tissue caused by heat at the treatment sites were seen after the administration of both forms of CR MRF therapy. To validate the apoptotic process in the adipocytes, TUNEL labelling was done[12].

8. **María Trillo et al. (2021)** described impacts of signal modulation on human fibroblasts' in vitro responsiveness to sub thermal RF current stimulation. Radiofrequency (RF) currents or fields have been effectively

used in physical therapies to promote tissue regeneration and wound healing. According to the scientists, human adipose-derived stem cells proliferate when exposed in vitro to 448 kHz, sinewave CRET current at a sub thermal density. The findings showed that whereas early expression of Hsp47 was considerably and equally boosted by both signals, it was the modulated signal that was more effective in causing Hsp27 and decorin overexpression. Increased levels of proliferating cell nuclear antigen might be seen as evidence of DNA damage brought on by exposure to CRET. For the PCNA protein investigation, 19 duplicates were performed, and for the Hsp47 analysis, 11 replicates. Each replication and each signal pattern received eight samples for analysis. All experimental techniques and analysis were done without regard to the outcome of the experiment. Some of their results claim to consolidate previous studies in this field: "The study discovered that newborn skin fibroblast proliferation is markedly increased by sub-thermal stimulation with CRET currents. A 48-hour exposure to the modulated signal caused a considerable increase in the number of cells compared to the unmodulated signal," Trillo said[22].

9. A research team at the Research Unit on Infectious and Emerging Tropical Diseases led by **Florence Bretelle (2020)** reported on capacitive-resistive radiofrequency therapy to treat postpartum perineal pain. decreased perineal pain during walking and decreased paracetamol use after delivery were both linked to radiofrequency treatment. On a visual scale used to assess perineal discomfort at rest, RF treatment showed no discernible effect. 95% of women who give birth

vaginally report having perineal discomfort 24 hours after giving birth. There were no differences between the experimental and control groups' VAS>4 values on day 2. 29 women were included in the study. However, “The results on the primary judgement criteria did not favour RF, presumably because to the limited sample size and the lack of superiority of RF for pain reduction. This may be related to the technique's lack of efficacy, which is improbable given that it is used in other excruciating circumstances,” observe the authors. The group recommend that It may be discussed how much pain is experienced during sex. More standardised sexuality surveys, such the PISQ-12, should be used in future research[23].

10. **Carlo Pavone (2017)** reported that peyronie’s disease (PD) is a fibrotic disorder of the tunica albuginea of the penis. TCARE was administered three times to each patient in the therapy group. 37 (58%) patients in the treated group at FU1 saw a substantial pain decrease, according to statistical analysis of the data. There were no appreciable improvements in the sham group. Energy delivered by Transfer Capacitive Resistive Energy creates an intense cellular stimulation, vasodilatation and increases the internal temperature in the treated area. 96 men with PD have been randomized in a 2 were involved in the analysis. Aspects of the results claim to corroborate prior research in this field: “Nobody reported any negative occurrences taking place. Although ED and PD were not the main objectives of our trial, we evaluated the treatment's effectiveness based on the previous study's results” Pavone posited[24].

11. **Santiago Gonzalez-Muñoz (2021)** described effects of short-term 448 kHz radiofrequency stimulation on the elasticity of the supraspinatus tendon in professional badminton players as evaluated by quantitative ultrasound elastography. A well-known technique with a long history of clinical application is CRMR. The supraspinatus tendon's elasticity changes as a result of the CRMR intervention at 448 kHz, and these changes might endure for a week. Age, gender, height, and weight variations across groups were negligible. Research on how CRMR influences the tendon elasticity measured by ultrasonic elastography (USE) is still lacking. The supraspinatus tendon changes when CRMR at 448 kHz is applied to the whole shoulder. Between groups, there were significant changes following the intervention therapy programme and one week afterwards. The research involved 38 players. Some of their results appear to back up earlier work in this topic: “The study was carried out in compliance with the Declaration of Helsinki and approved by a medical research ethics committee listed on ClinicalTrials.gov. According to Gonzalez-Muoz, this study was reported in accordance with the CONSORT Statement's basic procedural guidelines. However, "in contrast to typical massage using the same electrodes without any current, the application of CRMR at 448 kHz throughout the whole shoulder induces changes in the flexibility of the supraspinatus tendon. This could enhance tendon quality immunologically as well as structurally, say the scientists. Gonzalez-Muoz propose that more research is required to evaluate changes in supraspinatus elasticity over

the short, mid, and long terms, as well as alterations in neuro-endocrine-immune pathways[25].

12. **Iratxe Duñabeitia (2018)** reported that no significant differences were observed in running economy, VO2, respiratory exchange ratio, VE, heart rate or [Lac-] among the different running velocities in either the Tecar treatment group or the control group. Following a strenuous training session, tecar treatment intervention improves 397 spatiotemporal biomechanical metrics in recreational runners. Following a strenuous training session, two incremental treadmills running 15 tests were used to monitor physiological and biomechanical characteristics. The tests were done two days apart. Between the first and second tests, the Tecar treatment group outperformed the control group in terms of gains in stride length (p 0.001), angle ($p = 0.05$), and height ($p > 0.01$). This study's key conclusion was that Tecar treatment led to quicker improvements in various spatiotemporal biomechanics measures when jogging at 14 or 16 km/h 308. 14 participants were included in the research. The researchers' results claim to differ from prior findings in this field: "Various studies suggest that physiological changes are dependent on the amount of treatment time and number of sessions. However, comparisons across studies should be made with caution," Duñabeitia suggested. The investigators observe that "Following a strenuous training session, tecar treatment intervention improves 397 spatiotemporal biomechanical metrics in recreational runners. Following a strenuous training session, two incremental treadmills running 15 tests were used to monitor physiological and biomechanical characteristics.

The tests were done two days apart. Between the first and second tests, the Tecar treatment group outperformed the control group in terms of gains in stride length (p 0.001), angle ($p = 0.05$), and height ($p > 0.01$). This study's key conclusion was that Tecar treatment led to quicker improvements in various spatiotemporal biomechanics measures when jogging at 14 or 16 km/h 308[26].

13. **Toader N.C. (2020)** reports that the year 2020 marks the peak of technological change, advancement, and improvement. The major goals of kinesiotherapy continue to be the treatment of the condition and everyday care. Tecar Therapy can be used when doing vigorous motions. Tecar Therapy is applied in the field of rehabilitation and is effective for some diseases and traumatisms due to its capacitive- resistive nature. Some of the authors' findings seem to support prior work in this field: "The combination of Tecar Therapy with high-power laser treatment, with or without irradiation on the lower leg, has been a genuine success in lowering pain. Patients who have benefited from capacitive-resistive electric transfer therapy have said it is an effective instrument for treating diseases of the locomotor system in sports, according to N.C. They argue that further research is required to confirm the current findings and to gain a better understanding of the type, cause, and genesis of muscular discomfort with delayed impact[27].
14. **Shahid Beheshti (2020)** reported on effect of capacitive Tecar therapy on foot pain and tactile sensation in patients with type 2 diabetes. For diabetic individuals with signs of peripheral neuropathy, Tecar Therapy with infrared radiation may be an acceptable therapy programme to

improve pain and tactile sensitivity of the soles. This study looked at how Capacitive Tecar treatment affected type 2 diabetics who also had peripheral neuropathy symptoms in terms of pain and tactile sensibility in their feet. According to the study's findings, Tecar Therapy using infrared radiation may be a suitable therapeutic strategy. The Shahid Beheshti University of Medical Sciences' Faculty of Rehabilitation's biomechanics laboratory assessed the samples. Type 2 diabetes and signs of DPN in the lower limbs were required for participation. The researchers' conclusions appear to corroborate previous work in this topic: “Another conclusion of this study was the intervention group's diabetes patients' significantly improved tactile sensitivity in their foot soles. The results of Stein et al.'s 2013 study on the use of pulsed electromagnetic field treatment with modulated frequency on the lower limbs are compatible with this discovery, according to Niajalili. However, "In Iran, all diabetes patients are unable to utilise this gadget due to the restricted insurance to cover the financial demands of it. The authors acknowledge that more research with long-term follow-up is needed to evaluate how Tecar treatment affects DPN symptoms. The researchers argue that more study with long-term follow-up is needed to evaluate how Tecar treatment affects DPN symptoms[28].

METHODOLOGY

Study population – Runners

Sample size – 30

Sampling technique – Convenience sampling

Study setting – ABTP Centre, Pune.

Study duration – 6 months

SELECTION CRITERIA

INCLUSION CRITERIA:

- Age – 18-30 year
- Gender – Both male and female
- Runners - Should have played at least 1 to 3 days per week for 6 months and continuous running for 45 min a minimum of three times per week
- Not suffering from any injury (Last 6 months)

EXCLUSION CRITERIA

- Any recent musculoskeletal injuries or fractures in the past 6 months.
- Degenerative bone and joint diseases
- Lower-limb surgery
- Recent knee-ankle injuries or serious foot injury that could have left morphological alterations
- Obvious leg-length discrepancy
- Loss of balance
- Painful cutaneous conditions, such as helomata and plantar warts
- Edema on the foot-ankle articulation

MATERIALS USED

1. Stop watch
2. Measuring tape
3. Agility cones
4. CARE Therapy Machine

1

2

3

4

OUTCOME MEASURES

PRIMARY OUTCOME - SPEED

Instrument to be used:

- 30-m running speed test [Reliability is between 0.96 to 0.98][29]

Figure 1

SECONDARY OUTCOME - AGILITY

Instrument to be used:

- Modified Agility T test [ICC and Pearson r were between 0.95 and 0.96][30]

Figure 2

SAMPLE SELECTION

The institutional ethical committee evaluated the current study. A total 35 samples were selected by using convenience sampling. From which 5 subjects were selected based on Inclusion and Exclusion Criteria and 5 subjects were excluded. Everyone who participated in the study was informed of the protocol and their informed consent were taken.

Baseline assessment were taken prior to the intervention which included Demographic data, Speed and Agility.

SPEED - A single 30-meter maximal sprint is conducted as part of the test, and the timing is recorded. A complete warm-up should be performed, along with some practise accelerations and starts. Put one foot in front of the other as you start off still. The front foot must be on the starting line or behind it. Before beginning, this starting posture should be maintained for 2 seconds without swaying. The pacer should give tips on how to run faster (such staying low and pushing hard with both legs and arms) and exhort them to keep running quickly until they cross the finish line. The closest two decimal places are used to measure time. When the chest passes the finish line and/or the finishing timing gate is activated, the timing is complete. If using a stopwatch, the timing begins with the initial movement[31].

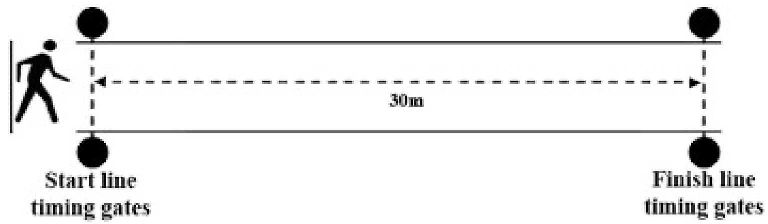


Figure 3

AGILITY - They chose to race to cone B, which was 5 metres away and 30 cm tall, and touch the top of it with their right hand. They moved to cone C (distance B-C: 2.5 m), facing forward and without crossing their feet, and touched its top with their left hands. The participants then moved to cone D (distance B-D: 2.5 m) to the right and touched its top with their right hands. They next moved to cone B to the left and touched it. The gamers then hurried back to queue A, running as rapidly as they could[32].

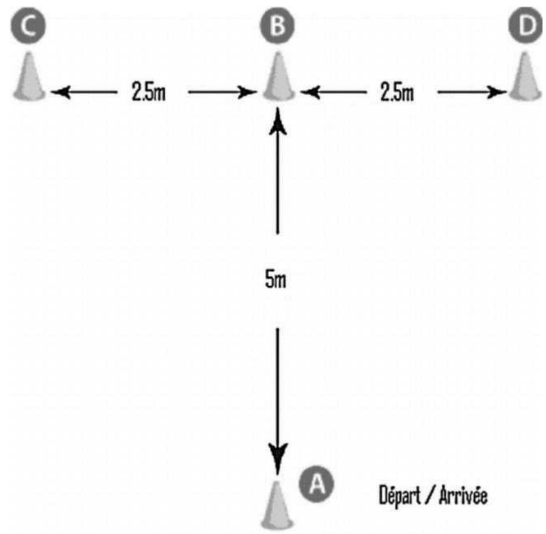


Figure 4

INTERVENTION

Each subject was given intervention of 10 minutes for each lower limb. CARE Intervention Protocol were given with Dynamic Capacitive Application to lower limbs Time: 15 Min Power 10% Dynamic - Capacitive Frequency - 0.46Hz Super Low Frequency: - 200Hz

Figure 5

Figure 6

Figure 7

Figure 8

FLOW CHART

Clearance will be obtained from institutional ethical committee

↓

Informed consent form will be obtaining from all the recreational athletes

↓

Subjects will be selected on the basis of inclusion and exclusion criteria

↓

Interventional Study (CARE Therapy)

↓

Assessment and pre-experimental score will be taken from all participants

↓

After intervention post experimental score will be taken

↓

Data analysis and interpretation

↓

PROCEDURE

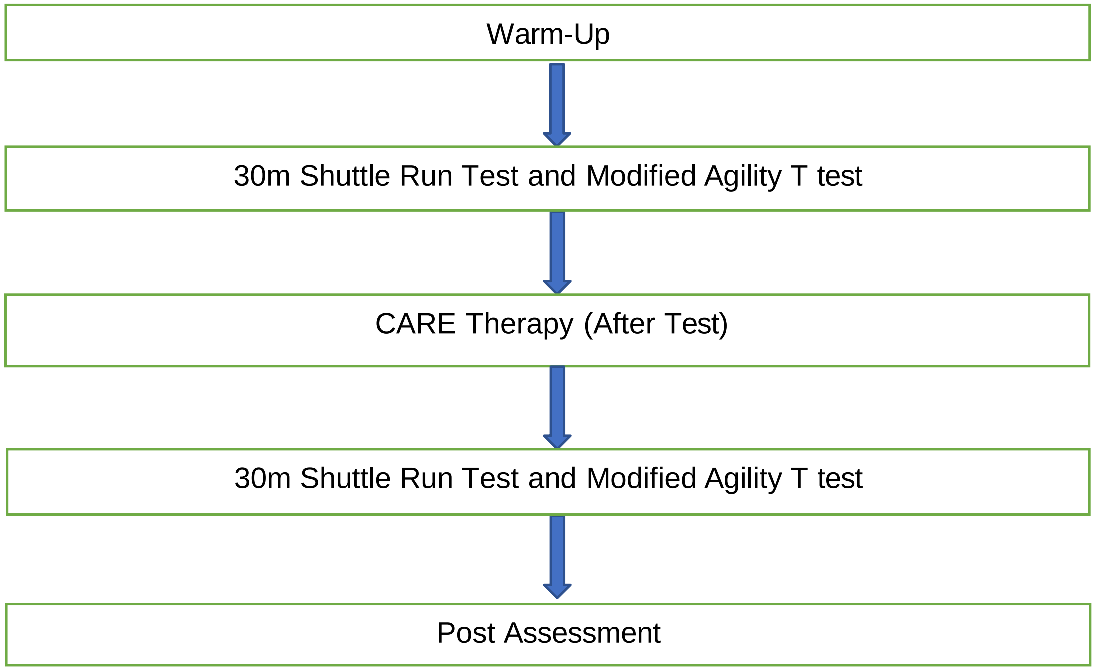
↓

Sample

↓

Base Line Assessment

↓


Warm-Up
30m Shuttle Run Test and Modified Agility T test
CARE Therapy (After Test)
30m Shuttle Run Test and Modified Agility T test
Post Assessment

SAMPLE SIZE ESTIMATION

Sample size by Cohen's effect size by comparing two means

$Effect\ size = d = \frac{\mu 2 - \mu 1}{\sigma} = 0.8$ (Estimated)

Considering large effect size difference = 0.8 (Large effect size)

Sample size $N = \left(\frac{1+r}{r}\right)\frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{d^2} + \frac{Z^2_{1-\alpha/2}}{2\,(1+r)}$

$Z_{1-\alpha/2}$ at 5 % level of significance = 1.96

$Z_{1-\beta}$ at 80 % Power = 0.84

Ratio allocation (Group2 /Group1) = 1

Sample size $n = \left(\frac{1+1}{1}\right)\frac{(1.96 + 0.84)^2}{0.8^2} + \frac{(1.96)^2}{2\,(1+1)}$ = 26 per group.

Considering 15 % drop out total = 4

Total 30 samples required.

STATISTICAL ANALYSIS AND RESULT

All the results calculated using SPSS software version 26

Results are tabulated & described in the following section

Section A - Normality distribution

Section B - Descriptive Statistics

Section C - Inferential Statistics.

Section A - Normality distribution

This section describes the testing of normality (Normal distribution) over the outcome variable (quantitative) tested for further analysis.

Table 1- Test for Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
Modified Agility	.220	30	.001	.874	30	.002
Sprint Test	.145	30	.109	.920	30	.027

Kolmogorov -Smirnov test utilized for finding the Normality (Normal Distribution) over the outcome variables Modified agility & Sprint test for the time recorded. Modified agility (time) in Kolmogorov-Smirnov test resulted with statistics 0.220, for significant difference 0.001 while Shapiro-wilk test with statistics 0.874, for significant difference 0.002,For Sprint test (time) Kolmogorov- Smirnov resulted with statistics 0.145, & significant difference 0.109 as compared to Modified agility in Shapiro-wilk with statistics 0.920, & significant 0.027.Thus data over both parameters (viz, Modified Agility & sprint test) conclude to be a non -normal data. Hence we use non parametric test for further evaluation to find significance difference for pre post results.

Section B - Descriptive Statistics.

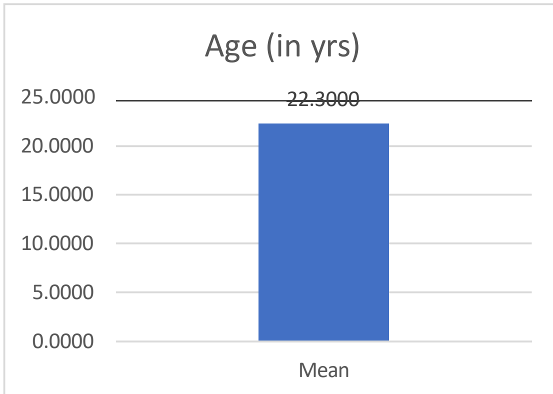
This covers the description over the demographic variables

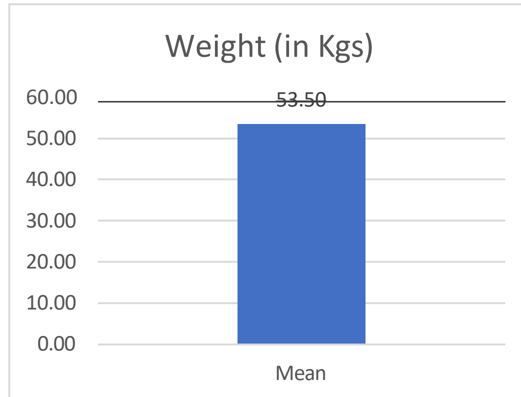
Table 2 - Descriptive statistics over baseline characteristics

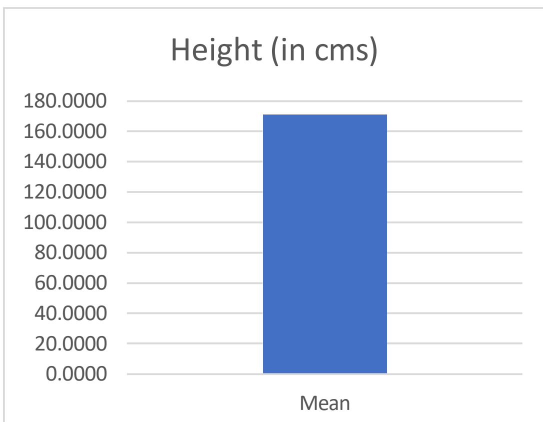
	N	**Minimum**	**Mean**	**Std. Deviation**
Age (in yrs)	30	20.00	22.3000	1.41787
Weight (in Kgs)	30	53.50	67.7500	7.94675
Height (in cms)	30	160.00	170.9333	5.62588
BMI	30	20.08	23.1085	1.67025

Total 30 samples are involved in the study, recorded with age (in yrs) with minimum score 20.00, maximum 26.00, mean 22.3000 & std. deviation 1.41787, Weight (in kgs) with minimum 53.50, maximum 79.00, mean 67.7500 & std. Deviation 7.94675, Height (in cms) with minimum 160.00, maximum 178.00, mean 170.93333 & std. Deviation 5.62588, BMI with minimum 20.08, with maximum 25.35, with mean 23.1085 & std. Deviation 1.67025.

Figure 9. Graphical Representation of Baseline Characteristics over demographic variable







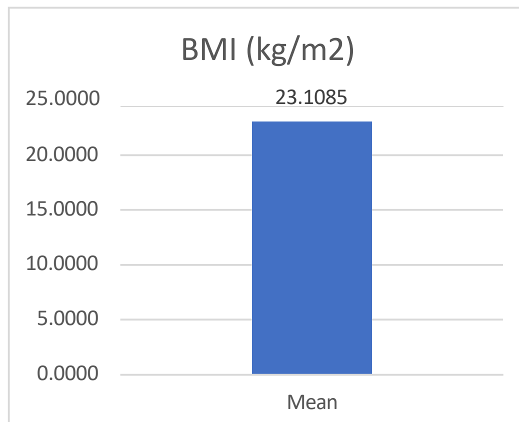
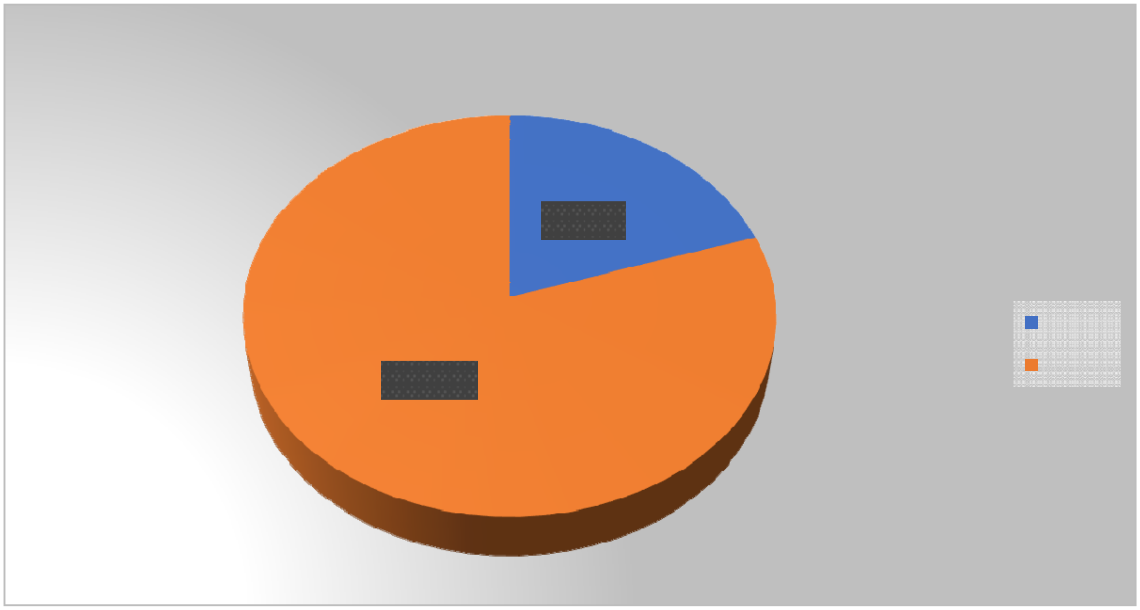


Table 3 - Frequency distruibution of gender [(Female, male f(%)]

Gender	Frequency	Percent
Female	6	20.0
Male	24	80.0
Total	30	100.0

Gender Categorized into female & male. Female found with frequency 6(20.0%) & male found with frequency 24(80.0%).

Figure 10 - Graphical representation of frequency distruibution of gender [(Female, male f(%)]



Section C - Inferential statistics

This section covers the inferential statistics tested at finding the significant difference at 5% level of significance.

Wilcoxon test for non-normal data, total 30 samples involved in the study two assessment parameters evaluated for results in time 1) Modified agility (Pre& Post) Test & 2) Sprint test (Pre &Post). Modified agility pre-test noted with mean time 6.9163, std.deviation 0.41388, minimum 6.24, maximum 7.53 as compared to Modified agility post-test with mean time 4.0463, std.deviation 0.13338, minimum 3.88, maximum 4.34 with z- test -4.788 found with highly significant results P=0.01 < P=0.05. Similarly Sprint test, pre-test recorded with mean time 6.5787, std.deviation 0.39045, minimum 6.08, maximum 7.20 as compared to Sprint test post-test with mean time 4.0067, std.deviation 0.11433, minimum 3.86, maximum 4.26 with z- test -3.565, found with highly significant results P=0.01 < P=0.05.

Table 4 - Comparative evaluation and assessment with Wilcoxon test for non-Normal data.

	N	Mean	Std. Deviation	Minimum	Maximum	Z test	P-value
Modified Agility Pre Test	30	6.9163	.41388	6.24	7.53	-4.788	<0.01**
Modified Agility Post Test	30	4.0463	.13338	3.88	4.34		
Sprint Test (Pre)	30	6.5787	.39045	6.08	7.20	-3.565	<0.01**
Sprint Test (Pre)	30	4.0067	.11433	3.86	4.26		

Figure 11 - Graphical Representation of comparative assessment of Modified Agility score(time)

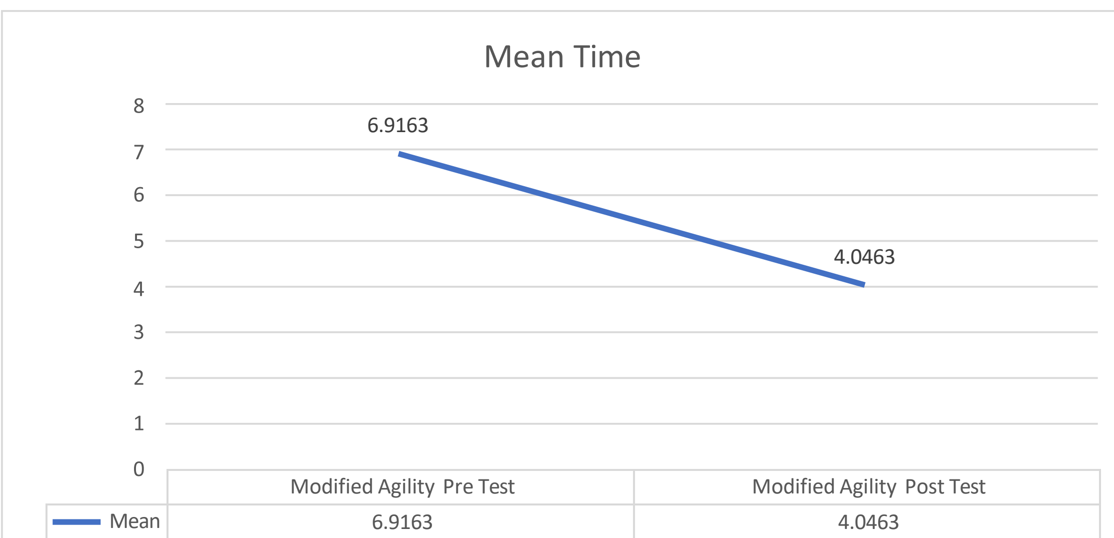
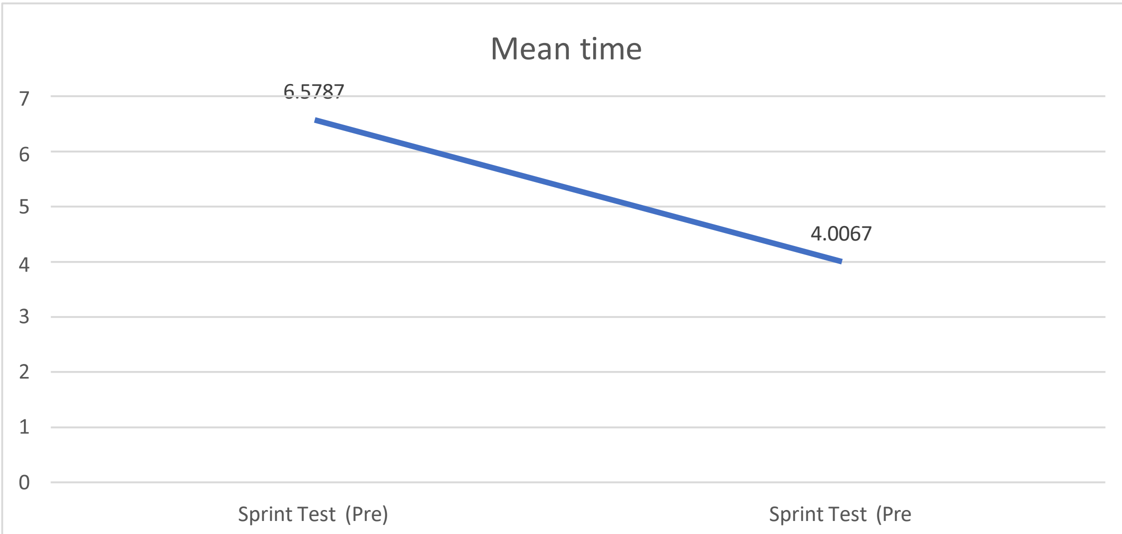


Figure 12 - Graphical Representation of comparative assessment of Modified Sprint test score (time)



Gender (Male & female) assessed to find the significance difference over Modified agility (pre & post) and Sprint test (pre & post). In Modified agility at pre-test male recorded with time with mean value 6.8792, std. deviation 0.40960 & at pre-test female with mean 7.0650, std. deviation 0.43432 with t- test -0.983 found with non- significant results P=0.334 > P=0.05 while in Modified agility at post-test male with mean 6.5454, std. deviation 0.39973 & at post-test female with mean 6.7117, std. deviation 0.35028 with t-test -0.931 found with non- significant results P=0.36 > P=0.05

In Sprint test, at pre-test male with mean 4.0271, std. deviation 0.11911 & at pre-test female with mean 4.1233, std. deviation 1.17037 with t-test -1.625 found with non- significant results P=0.115 > P=0.05 while in Sprint test at post test male with mean 3.9842, standard deviation 0.10425 & at post test female with mean 4.0967, std . deviation 0.11690 with t-test -2.312 found with highly significant results P=0.028 <P=0.05.

Table 5 - Sub group Analysis

Gender	Group		N	Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference Lower	95% CI of the Difference Upper	t- test	df	P-value
Modified agility	Pre Test	Male	24	6.8792	0.40960	0.08361	-0.57302	0.20136	-0.983	28	0.334
		Female	6	7.0650	0.43432	0.17731					
	Post Test	Male	24	6.5454	0.39973	0.08159	-0.53215	0.19965	-0.931	28	0.36
		Female	6	6.7117	0.35028	0.14300					
Sprint Test	Pre Test	Male	24	4.0271	0.11911	0.02431	-0.21757	0.02507	-1.625	28	0.115
		Female	6	4.1233	0.17037	0.06955					
	Post Test	Male	24	3.9842	0.10425	0.02128	-0.21219	-0.01281	-2.312	28	0.028
		Female	6	4.0967	0.11690	0.04773					

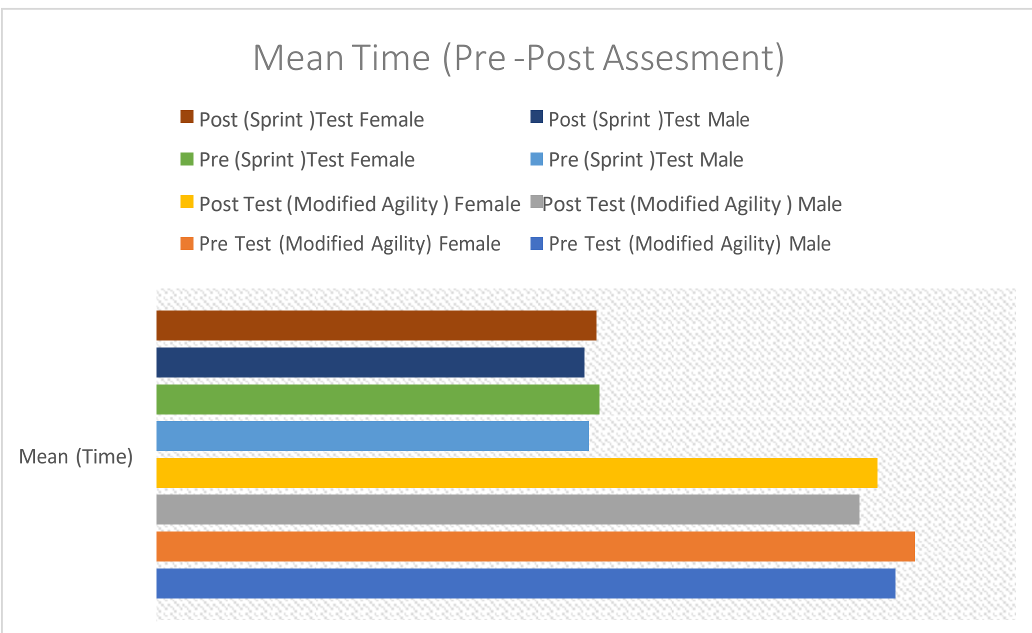


Figure 13

DISCUSSION

This interventional study concentrated on looking at the immediate consequences of CARE therapy on the athletic performance of recreational runners. The intent of the study sought to assess whether CARE treatment administered shortly following a run can improve an array of performance metrics. These findings provided significant insight into the potential benefits of prompt intervention using CARE treatment in addition to how they impact runners' performance. The results of this investigation demonstrated that the participants in the CARE treatment group and the control group were substantially different in an assortment of performance metrics. In juxtaposition with the control group, the CARE treatment group exhibited enhanced running effectiveness while diminished muscular pain and lower levels of apparent exertion. The results obtained indicated that CARE treatment might be applied promptly in order to enhance recreational runners' performance.

The modified agility (Pre & Post) Test and the sprint test (Pre & Post) Test were the two criteria for assessment investigated in this study employing the Wilcoxon test. With a range of 6.24 to 7.53, the Modified Agility Pre-Test showed a mean time of 6.9163 seconds (standard deviation = 0.41388). The mean time to complete the Modified Agility Post-Test, which fluctuated between 3.88 to 4.34 seconds (standard deviation = 0.13338), was 4.0463 seconds. Highly substantial observations were discovered, as evidenced by the estimated z-test value of -4.788 (P=0.01 P=0.05). The pre-test for the Sprint test showed a mean time of 6.5787 seconds (standard deviation = 0.39045) and varied from 6.08 to 7.20 seconds. The mean time for the Sprint test post-test was 4.0067 seconds (standard deviation: 0.11433), having a range of 3.86 to 4.26. Considering a calculated z-test value of -3.565, highly noteworthy findings were similarly observed (P=0.01 P=0.05). In a nutshell, the findings demonstrate that both Modified agility and Sprint test performance significantly enhanced from the pre-test to the post-test. The diminished mean values and the highly significant z-test results (P=0.01 P=0.05) for both assessments indicate that the participants had a substantial reduction in time.

In accordance with a prospective study by Paolucci et al., the most sophisticated technical aspects of CARE therapy facilitate the transfer of high energy levels without substantially increasing body temperature, generating beneficial results even for acute shoulder impingement syndrome apprehension.[5]

The resistive-capacitive energy transfer that gets generated by CARE treatment has a thermal and non-thermal impact on tissues, notwithstanding having been shown that there is more evidence suggesting thermal influences than non-thermal ones. Considering CARE treatment involves the use of the heat effect, it may be assumed that its biological consequence is associated with hyperthermia, as employed in other thermotherapeutic techniques. Due to broadened adenyl pyrophosphatase (ATPase) activity, heat actually strengthens the capability of muscles to contract and alters the mechanical properties of the collagen in tendons. A greater degree of tissue temperature induces capillary and arteriolar dilatation, resulting in greater blood flow to the region and stimulates cellular metabolism in addition to tendon and muscle flexibility.[5]

The implications of integrating exercise with capacitive and resistive electric transfer (CARE) therapy among individuals with non-specific chronic low back pain (NSCLBP) were additionally investigated in the study by Tashiro et al. The results of this study demonstrated that following the intervention, pain intensity lessened in both groups (exercise alone and exercise combined with CARE), and that improvement lasted throughout the follow-up period. Additionally, the functional disabilities of the group becoming both CARE and exercise showed substantial improvements. In accordance with the study, the exercise by itself might not prove as beneficial in managing NSCLBP as CARE treatment combined with exercise.[10]

López-de-Celis et al., also discovered that the radio-humeral capsule and common extensor tendon of the elbow simultaneously saw a substantial decrease in temperature following CARE protocol.[33] A relatively small but statistically significant reduction in the overall number of cells in the non- proliferative phase G0/G1 became apparent in the cell cultures after CARE therapy, coupled with increased proportions of cells in phases S, G2, and mitosis. The aforementioned data was gathered by flow cytometry analysis, as conducted by Hernández-Bule et al.[21] Therefore, it is presumed that quiescent stem cells that inhabit tissues that have been injured are likely to be triggered to proceed to the proliferative phases of the cell cycle when they are subjected to 448 kHz CARE electric currents, consequently commencing the stem cell renewal process that will ultimately result in tissue healing.[21]

It has been also observed that as operating resembling a semiconductor by providing resistance to the transmission of electric energy, tissue elevates its internal temperature. Furthermore, to these increases in temperature, the therapeutic impact of CARE therapy is additionally impacted by an increase in the potential energy of cellular membranes.[12] A new research investigation revealed that runners rebounded with greater efficiency than a control group, with greater improvements in stride length, angle, and height between CARE and control group evaluations.[34] It is also hypothesized that CARE could potentially be beneficial in anti-inflammatory responses since it may improve the local population of mesenchymal stem cells, which effectively intervene in the management of inflammatory processes by emitting anti-inflammatory interleukins in the injured area. enhanced the inflammatory response regulation and upgraded adaptation to pressures and repeated motions could ensue from this.[25] This formed the basis of our interventional study.

We also assessed the gender disparity in the study. The pre-test means time for the modified agility test in males was 6.8792 seconds (standard deviation = 0.40960), while the meantime for females was 7.0650 seconds (standard deviation = 0.43432). The t-test resulted in a value of -0.983, which suggests an unimpressive finding (P=0.334 > P=0.05). Corresponding to this, the mean time for males and females at the post-test stage was 6.5454 seconds for men and 6.7117 seconds for women (both with a standard deviation of 0.35028). The t-test result was -0.931, although the difference was nevertheless not statistically significant (P=0.36 > P=0.05). In the final analysis, neither the pre- test nor the post-test demonstrated any apparent gender differences in Modified agility performance. Contrary to this, there was no apparent gender disparity in Sprint performance prior to the test. However, there was a statistically substantial difference in the post-test stage, indicating that men did appreciably better than women in the Sprint test (P=0.028 P=0.05).

Of particular note are the decreased levels of encountered exertion reported among the participants of the CARE treatment group. Individual's sense of exertion during physical activity is capable of being measured qualitatively. Recreational runners who claimed to experience less exertion while performing at the identical intensity typically felt more at ease and less tired out. It also indicates that CARE therapy accelerated recovery and minimised tiredness, permitting recreational runners to maintain competing at a high level for an extended amount of time. Recreational runners may have been capable to sustain their level of effort and performance as a result of CARE therapy's propensity to decrease perceived exertion. The outcomes of the present investigation add to the reservoir of literature presently accessible on the beneficial effects of post-exercise therapies for recreational runners. Recreational runners could potentially enable to optimise their training accomplishments, enhance their restoration process, as well as enhance their overall running efficiency through utilising CARE treatment immediately after a run. CARE therapy could additionally have an encouraging impact on the psychological aspect of running, strengthening motivation and enjoyment, as evidenced by the corresponding reduction in perceived exertion reported in the CARE therapy group.

This interventional study indicated that the swift implementation of CARE treatment promotes recreational runners' performance. These findings suggest that CARE treatment may improve running speed simultaneously minimising muscular soreness and perceived exertion. The results of this study reinforce the incorporation of CARE therapy in an extensive training and recuperation regimen for recreational runners, potentially enhancing their overall running efficiency and enjoyment. It is necessary for carrying out more research in order to investigate the long-term impacts of CARE therapy and to see whether it can be used to different populations and circumstances.

CONCLUSION

The study which actually spans over two months shows some valuable insights in CARE therapy for runners. 30-m running speed test And Modified Agility T test was employed to test the outcomes among runners. The result shown by the study is after doing immediate CARE therapy is promising among runners. Thus, by integrating immediate CARE therapy in the schedule of athletics like runners can significantly increase their performance by significant margin. Runners can use this technique enhance tehri athletic outcome. Thus, this study concluded that the effectiveness of CARE therapy on running performance among the runners.

FUTURE SCOPE

Future studies might concentrate on creating CARE treatment programmes that are specifically tailored to the demands, physiological traits, and training objectives of individual runners. Real-time muscle state monitoring might be made possible by sophisticated sensors and AI algorithms, giving therapists the ability to customise CARE sessions for the best healing and performance improvement. The integration of CARE treatment with wearable technology has a lot of promise given the rising popularity of such gadgets. Wearable electrodes or tools might provide athletes CARE treatment on-the-go, assisting in warm-up, cool-down, and recovery sessions throughout training or competitions. Running participants may be more engaged and compliant with treatment if CARE therapy is incorporated with VR and AR surroundings. Immersive activities together with CARE treatment may enhance one's ability to concentrate, perceive pain, and heal as a whole. Future studies might examine the long-term impact of include CARE treatment in runners' training schedules. It may be helpful to comprehend how regular CARE treatment affects injury rates, muscle adaptability, and overall performance over time.

LIMITATION

This study presents several limitations. First, this study was performed in runners, which should be conduct in others sports players. Another limitation is that it is conducted on small sample size. More studies are needed to confirm these effects clinically. There are several CARE protocols for the treatment of lower limbs, so the results of this study cannot be extrapolated to all applications.

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ANNEXURE 1

CONSENT FORM

Title of the study –

IMMEDIATE EFFECT OF CAPACTIVE AND RESITIVE ELECTRIC THERAPY ON PERFORMANCE IN RUNNERS - A INTERVENTIONAL STUDY

I have been informed by Mr. Dushyant Padmakar Bawiskar; pursuing MPT (sports) conducting the above-mentioned study under the guidance of Prof. Chinmaya Kumar Patra, Principal, Department of Physiotherapy ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR.

I have no objection and will be a part of that group. I also understand that the study does not have any negative implication on my health. I understand that the information produced by the study will become a part of the institute's record and will be utilized, as per confidentiality regulations of the institute. I am also aware that the data might be used for medical literature and teaching purposes, but all my personal details will be kept confidential.

I am well informed to ask as many questions as I can to Mr. Dushyant Padmakar Bawiskar either during the study or later.

I understand that my assent is voluntary and I reserve the right to withdraw or discontinue the participation from the study at any point of time during the study.

I have explained to MR/MISS/MRS …………………………the purpose of the research, the procedure required in the language he/she could understand to the best of my ability.

(Investigator) (Date)

I confirm that Mr. Dushyant Padmakar Bawiskar (investigator) has explained to me in the language I can understand, the purpose of the study and the procedure. Therefore, I agree to give my assent for the participation as a subject in this study and I will be accountable for the decisions.

(Signature) (Date)

ANNEXURE 2

OUTCOMES MEASURE FORM

Name:- ……………………………………………………………………

Age / Gender:- ……….(in years) /............(Male /Female/ Other)

Weight.................. (in Kgs)

Contact Number :- ……………………………….

Address:…………………………………………………………………………

Date of Assessment:- ……/……. /2023

Outcomes Measure

Modified Agility T-Test				
Player No.	1	2	3	Best Time
Player 1				

30m Sprint Test	
Player No.	Time (in seconds)
Player 1	

Player Name:- …………………….. **Therapist Name:- ……………………..**

Players Signature:- …………………. **Therapist Signature:…………………..**

Date:- ……………………. **Date:- ……………………**

ANNEXURE 3

MASTERCHART

Sr. No.	Age (in yrs)	Gender	Weight (in Kgs)	Height (in cms)	Modified Agility T-Test								30m Sprint Test	
					Pre-Test				Post-Test				Pre-Test	Post-Test
					1	2	3	Best Time	1	2	3	Best Time		
1	22	Male	79	178	7.88	7	7.67	**7**	6.62	6.54	6.6	**6.54**	**3.97**	**3.92**
2	21	Male	69	178	6.79	6.35	6.45	**6.35**	6.35	6.4	6.11	**6.11**	**3.9**	**3.87**
3	21	Female	53.5	160	7.22	7.12	7.1	**7.1**	6.69	6.9	6.96	**6.69**	**4.34**	**4.22**
4	24	Male	78	178	7.66	7.58	7.38	**7.38**	6.84	7.06	7.11	**6.84**	**4.04**	**3.98**
5	22	Male	70	176	6.99	6.95	6.83	**6.83**	6.44	6.38	6.46	**6.38**	**4.1**	**3.97**
6	22	Male	54	164	7.77	7.12	7.54	**7.12**	6.54	6.6	6.33	**6.33**	**4.12**	**4.06**
7	21	Male	60	170	6.69	6.45	6.25	**6.25**	6.35	6.4	6.11	**6.11**	**3.99**	**3.92**
8	21	Female	68	176	7.35	7.18	7.22	**7.18**	6.8	6.77	6.84	**6.77**	**4.08**	**4.01**
9	24	Male	54	164	7.44	7.58	7.22	**7.22**	6.88	7.1	6.96	**6.88**	**3.97**	**3.89**
10	22	Male	78	178	6.94	6.9	6.46	**6.46**	6.44	6.36	6.24	**6.24**	**4.02**	**4**
11	22	Male	75	176	7.66	7.21	7.45	**7.21**	7.33	7.14	7.22	**7.14**	**4.13**	**4.09**
12	21	Male	72	174	6.25	6.95	6.55	**6.25**	6.2	6.4	6.1	**6.1**	**3.96**	**3.94**
13	21	Female	75	174	7.22	7.12	7.1	**7.1**	6.69	6.9	6.96	**6.69**	**4**	**3.99**
14	24	Male	55	164	7.55	7.62	7.42	**7.42**	7.11	7.22	6.92	**6.92**	**4.11**	**4.02**
15	22	Male	56	160	6.68	6.88	6.78	**6.68**	6.44	6.38	6.46	**6.38**	**4.14**	**4.06**
16	22	Male	62	164	7.75	7.33	7.66	**7.33**	6.54	6.6	6.33	**6.33**	**3.99**	**3.91**
17	22	Male	66	168	6.44	6.34	6.48	**6.34**	6.32	6.24	6.12	**6.12**	**3.9**	**4.01**
18	22	Male	70	172	7.33	7.22	7.12	**7.12**	6.66	6.44	6.24	**6.24**	**4.3**	**4.26**
19	22	Male	66	172	7.22	7.32	7.24	**7.22**	7.11	7.12	7.22	**7.11**	**3.88**	**3.86**
20	21	Male	71	170	6.88	6.54	6.46	**6.46**	6.44	6.36	6.24	**6.24**	**4.01**	**3.98**
21	21	Male	69	166	7.21	7.28	7.34	**7.21**	7.12	7.14	7.18	**7.12**	**3.99**	**3.94**
22	24	Male	72	174	7.25	7.95	7.55	**7.25**	7.2	7.44	7.38	**7.2**	**3.91**	**3.89**
23	22	Male	70	176	6.88	7.12	6.98	**6.88**	6.96	6.44	6.42	**6.42**	**3.88**	**3.9**
24	22	Female	68	166	7.42	7.24	7.66	**7.24**	7.22	7.22	6.92	**6.92**	**4.12**	**4.09**
25	24	Female	70	170	6.24	6.32	6.26	**6.24**	6.12	6.08	6.14	**6.08**	**3.9**	**4.01**
26	26	Female	75	176	7.53	7.64	7.87	**7.53**	7.12	7.21	7.34	**7.12**	**4.3**	**4.26**
27	20	Male	72	174	6.44	6.34	6.48	**6.34**	6.32	6.24	6.12	**6.12**	**3.88**	**3.86**
28	24	Male	75	174	7.44	7.43	7.24	**7.24**	7.12	7.22	7.2	**7.12**	**4.01**	**3.98**
29	22	Male	55	164	7.08	7.1	7.24	**7.08**	6.98	6.86	6.96	**6.86**	**4.26**	**4.2**
30	25	Male	75	172	6.88	6.54	6.46	**6.46**	6.44	6.36	6.24	**6.24**	**4.19**	**4.11**