

8.0 DISCUSSIONS

8.1 DEMOGRAPHIC DATA

The data of 82 participants were available for final analysis including treatment and control group. Both the groups were matched on the status of their gender, age, height, weight and BMI.

8.2 PHYSICAL FITNESS OUTCOMES

8.2.1 Handgrip Muscle Strength

Summary

The handgrip strength was measured laterally and all most all subjects used right hand to measure muscle strength. The strength of the right hand increased significantly 63.56 to 66.68 in the treatment group and a slight increase from 56.71 to 57.41 in the control group. There is a significant change were found between Post Vs Post ($p < 0.001$).

Comparison

The large effect (Cohen $d = 1.11$) of our study, aligned with previous findings on high school junior soccer player where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.49, MITP=0.75, HITP=0.31) improvement in leg strength of all the three groups (Zakir Ahamed, Murugavel, 2011). Bikram yoga showed significant improvement in the leg strength of young adults (Hart and Tracy's, 2008).

The result of the present study reliable with previous findings on healthy children where yoga practices had a significant impact on minimum muscular fitness (Gharote, Ganguly, & Moorthy, 1974; Gharote, 1976; Moorthy, 1982). Evidence of significant improvement was also observed in muscle strength, endurance and

flexibility in different group of muscles through the practice of yoga (Madanmohan, Mahadevan, Balakrishnan, & Prakash, 2008; Chen et al., 2009, Telles, Sharma, Yadav, Singh, & Balkrishna, 2014). Earlier findings shown positive influence on Sūryanamaskāra (Bhutkar, Bhutkar, Taware, & Surdi, 2011) and Prānāyāma (Raghuraj, Nagarathna, Nagendra, & Telles, 1997) on muscle strength. Our study consisted similar components of practices along with Utthita Dvipadasana, Ushtrasana, Paschimottanasana and Dhanurāsana. Yoga poistures involve contraction on core muscles which may contributing factors for improvement in muscle strength.

Result of the Muscular Strength in the present study, supports the findings by the study of Madanmohan, Udupa, & Bhavanani, (2003) where the Hand Grip Strength was increased in both the hands among school children, aged between 12-15years after six months of yoga. Similarly, another study found significant improvement in children age 11-16 years after 3 month yoga intervention (Purohit, Pradhan, & Nagendra, 2016).

Comparison with other modes of intervention

A study was conducted comparing goal ball team players and non-players with varying degrees of blindness. After 6 hours per week training the goal ball groups had higher grip strength than control groups (Tuncay et al., 2004). Goal ball includes various physical movements which are likely to increase the strength within short duration of intervention.

Mechanism

The mechanism for the improvement in MS is due to the involvement of upper body muscles during Sūryanamaskāra (Bhutkar et al., 2011), increased in muscle length (Barnett, Holly, & Ashmore, 1980; Williams & Goldspink, 1971) might

have provided the possible reason of this result. One more possible reason for this encouraging outcome may be due to the yogic postures, which are involved in combination of isometric and isotonic contraction of muscular skeletal system during yoga sessions (Campbell, Crim, Young, & Evans, 1994) thus responsible to increase skeletal muscle strength (Sengupta, 2012), iso-kinetic muscle strength and isometric muscular endurance (Tran, Holly, Lashbrook, & Amsterdam, 2001).

8.2.2 Muscular Endurance

Summary

The Abdominal muscle endurance increased 27.61 to 30.76 in the treatment group and slight increase was observed in the control group. There is a significant changes were found between pre Vs pre ($p < 0.001$) and Post Vs Post ($p < 0.001$) whereas no significant changes were seen in group* time interaction ($p = 0.257$).

Comparison

Aligned with our result of Muscular Endurance, a study by Telles et al. (2013) with twelve weeks duration of intervention showed significant improvement in the treatment group. In accordance with previous study, the result showed significant improvement in muscle endurance after six weeks of intervention (Madanmohan et al., 2003). Another study was conducted on school girl, aged 7 to 10 years showed 26.53% increase in muscle endurance (Hashemi et al., 2012). This can be attributed to many factors, including differences between physical characteristics and interest of learning. As the control group of our study did not participate in any kind of intervention may the change in abdominal muscle endurance did not reach up to a significant level.

Mechanism

The mechanism for the improvement in muscle endurance is due to Specific yoga practices; Sūryanamaskāra and Prānāyāma have shown the positive effect on cardio-respiratory functions (Bhutkar et al., 2011; Bhavanani et al., 2011) may attribute to improve muscle endurance. Alternate relaxation and contraction of different muscle groups help to increase peripheral blood flow to contracting muscle. The effects may be attributed to increased oxidative capacity of muscle fibers or increased myoglobin content. Yogic practices activities Straight leg rising, Cycling, *Pavanamūktāsana*, *Navāsana*, *Utthita dvipadasana* and *Sūryanamaskāra* might have strengthened the abdominal muscles to achieve the significant result in this study. Another explanation may point out increased muscle endurance to decreased neuromuscular activity in antagonist muscles (Taran, Holly, Lashbrook, and Amsterdam, 2001). Since, our study included yogic practices involving relaxation and mindful movements, may have reduced antagonist muscle activity.

8.3.3 Cardio-vascular endurance

Summary

Cardiovascular endurance is one of the most important components for every sports person. The findings in the present study show significant improvement from 112.12 to 117.18 ($p < 0.001$) in the treatment group and very small change from 121.92 to 122.57 in the control group. There is a significant changes were found between Pre Vs Pre ($p < 0.05$) whereas no significant changes were seen in group* time interaction ($p = 0.199$) and in Post Vs Post ($p = 0.254$).

Comparison

The large effect (Cohen $d= 1.38$) of our study, allied with earlier results on junior football players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.47, MITP=0.61, HITP=0.30) improvement in cardiovascular endurance of all the three groups (Zakir Ahamed, Murugavel, 2011). Previous findings show that, yoga training program had positive effects on cardiovascular endurance (Santosh, 2016, Vinu, 2015), on post graduated female (Sangeetha, 2017). Sixty school students underwent yogic session for 10-week had a significant improvement in cardio vascular endurance (Kumaraswamy & Sanjeev, 2016). Yogic exercises and Pranayama are effective for cardio-vascular endurance (Rani & Malik, 2017).

Comparison with other mode of intervention

Circuit training sessions for 6-week on Hokey players found significant improvement in endurance (Ivin Jabakumar, 2012). Combination of different training such as circuit training, Yoga, physical exercise training had enhancing effect on endurance (Malathy, & Dean, 2016).

The previous findings states that, the influence of yoga shows statistically significant improvement on endurance and higher cardio-respiratory variables (Sovová et al., 2015). Lau, et al., (2015) studied the hatha yoga practices on 173 adult Chinese and found that, there is a significant improvement on cardiovascular endurance.

Another study was conducted on 9 soldiers to find the influence of Sūryanamaskāra, meditation and pranayama on cardiovascular endurance and physiological variables.

The results indicated that, the yogic training caused conditioning of cardio-respiratory parameters except breathing rates (Sinha, & Sinha, 2014).

Sinha et al., (2013) studied the influence of Sūryanamaskāra on 20 male adults and the same is compared with bicycle exercise. The results indicate that, cardio-respiratory stress was decreased in yoga group as compared with bicycle group.

Mechanism

Result of the cardio-vascular endurance in the present study, supports the findings by the study of K Jaychandran who investigated the effect of yoga on cardio respiratory system and body composition of school going children age ranging from 14 to 16 years which suggests that, yoga in long duration affects hypothalamus and brings about decrease in the systolic and diastolic blood pressure through its influence on vasomotor Centre (Bharshankar et al., 2003,; Ross, & Thomas, 2010) which leads to reduction in sympathetic tone and peripheral resistance. (Pramanik et al., 2009).

8.3.4 Body Mass Index

Summary

In the present study, Body mass index (BMI) among treatment group shows not much change in the pre and post test ($p < 0.041$) and also in the control group ($p = 0.182$). Whereas, group group*time interaction showed significant change ($p < 0.004$).

Comparison

Haldar (2017) studied BMI on high school athletes. The findings show that, there is a significant decrease in BMI by performing 10 weeks Sūryanamaskāra practice.

The previous findings revealed that there was a significant difference among treatment group as compare to its control group on BMI (Sukumar, 2017).

Mechanism

The yoga practices along with physical fitness training influenced for fat burning caused for the effect. (Oduniaya, Hamzat, Ajay, 2005). There is no much change in the BMI, since; the intervention was only for four months. In this short period, we could not find significant gain in height or in weight of the subjects.

8.3.5 Flexibility

Summary

The flexibility component in the present study shows significant improvement from 5.20 to 8.20 in the treatment group. Control group shows improvement from 5.37 to 5.98 which is not significant. The findings shows significant change in Post Vs Post ($p < 0.003$) and group*time interaction ($p = 0.291$) found insignificant.

Comparison

The results of flexibility in the present study is supported in accordance with previous research by Chen et al., (2009) found significantly higher performance in children. The results also agree with another study on school going children in which yoga group showed significant improvement on flexibility (Bal and Kaur's, 2009; Purohit et al., 2016).

The large effect (Cohen $d = 1.39$) of our study, aligned with earlier results on junior soccer players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.94, MITP=0.99, HITP=0.92) improvement in flexibility of all three groups (Zakir Ahamed, Murugavel, 2011).

Comparison with other modes of intervention

There was a significant improvement in flexibility among school children with 10 weeks rope jumping training (Chena & Linb, 2011). Another study was conducted with gymnastic skills training for 12 week intervention among school girls aged 7 to 10 years showed significant improvement in trunk and hamstring flexibility (Hashemi et al., 2012). In another study, greater flexibility was observed in goal ball players as compared to non-goal ball players (Tuncay et al., 2004).

Mechanism

The mechanism for the improvement of flexibility in the present study is due to regular practice of yogic postures increases range of motion which further loosens the joints, muscles and tissues (Kottke, Pauley, & Ptak, 1966). A yoga practice involves different joint movements on upper and lower extremities, Flexion and extension, Abduction and adduction of the limbs movements are the key factor in yoga posture. These factors may contribute to increase in the sit and reach scores are possible reason for the improvements observed in the present study.

8.3 BOBBY CHARLTON'S FOOTBALL SKILL TESTS

8.3.1 Dribbling

Summary

The importance was given on specific fitness training of particular fitness components and selected yogic practices. There is a significant improvement (decrease in time) in the treatment group of Dribbling from 37.34 sec. to 34.22 sec. ($p < 0.001$) whereas control group showed less gain from 40.00 sec. to 39.24 sec. ($p < 0.05$). The results shows that, Pre Vs Pre and Post Vs Post scores are also significant ($p < 0.001$) and group*time is insignificant.

Comparison

The dribbling and passing skill tests comprise of extensive amount of running.(Malina et al., 2005). The large effect (Cohen $d= 1.77$) of our study, associated with earlier results on junior soccer players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.87, MITP=0.92, HITP=0.83) enhancement in dribbling of all the groups (Zakir Ahamed, Murugavel, 2011).

The previous findings on 120 junior high school soccer players undergone low, moderate and high intensity plyometric training has influenced significant (Cohen $d=1.77$) improvement in dribbling skill of all the three groups (Zakir Ahamed, Murugavel, 2011).

The results agree with previous research findings that showed significant improvement of lower body muscle strength and back muscle strength in normal school children (Bhutkar et al., 2011). Another study has observed significant post intervention enhancement on calf muscle strength in a yoga group (D'souza and Avadhany, 2014).

Mechanism

Dribbling test associated with high frequency of foot and ball contact action, force applied on ball, guiding the ball in proper path. Previous study found that faster player have higher in higher foot-ball cadence, reduced CoM mediolateral, reduced hip and knee flexion RoMs, higher right stride cadence, with lower variability. (Zago, Piovan, Annoni, Ciprandi, Iaia, & Sforza, 2016). The results agree with previous research findings that showed significant improvement of lower body muscle strength and back muscle strength in normal school children (Bhutkar et al.,

2011). Another study has observed significant post intervention enhancement on calf muscle strength in a yoga group (D'souza and Avadhany, 2014). Yoga posture and practices had influence the CoM mediolateral, hip, knee and ankle RoMs, muscle resistance, improve the reparative motor activity. All these factors might have contributed for the enhancing the Dribbling score.

8.3.2 Lofted Pass

Summary

The findings in this study shows significant improvement from 165.12 to 204.63 in the treatment group ($p < 0.001$) as compared to control group improvement from 135.61 to 149.76 ($p = 0.004$). The results shows significant change in pre Vs pre (0.011) and post Vs post (0.001) whereas, group*time interaction is insignificant (0.148).

Comparison

The large effect (Cohen $d = 1.24$) of our study, associated with earlier results on junior soccer players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.99, MITP=0.98, HITP=0.83) enhancement in kicking (lofted pass) of all the groups (Zakir Ahamed, Murugavel, 2011).

Mechanism

A study showed significant change of soccer player's kick ((lofted pass) accuracy is due to muscle activation of biceps femurs, rectus femurs, Tibialis anterior, and gastronomies muscle (Athanasios Katis et al., 2013). Yoga posture has found the different core muscles activation (Ni, Mooney, Harriell, Balachandran, & Signorile, (2014). Vastus medialis and Vastus lateralis activates muscles during squat posture

in athletes (Nara, Kaur, Bhatia, & Shaw, 2016). Earlier findings indicated that, muscle activation of the kicking leg represents a significant mechanism which largely contributes to soccer kick (lofted pass) accuracy (Athanasios Katis et al., 2013). All above mentioned factors might have influenced for the possible enhancement for the present study.

8.3.3 Shooting

Summary

The results shooting skill in this study shows significant improvement from 106.10 to 120.24 in the treatment group ($p < 0.001$) and also control group improvement from 98.54 to 108.78 ($p = 0.001$). The results shows insignificant change in pre Vs pre (0.363) and post Vs post (0.077) whereas, group*time interaction showed significant (0.010).

Comparison

The large effect (Cohen $d = 0.81$) of our study, associated with earlier results on junior soccer players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.79, MITP=0.92, HITP=0.68) enhancement in shooting of all the groups (Zakir Ahamed, Murugavel, 2011).

Mechanism

The significant improvements in accuracy shooting by the treatment group may be due to increase in pelvic rotation. Kicking opens the hips, allowing the pelvis to move through a greater range of motion and prolonging ball contact time, which may have positive benefits for shooting accuracy (Barfield, 1998, Lees and Nolan, 2002). Yoga postures showed muscle activation on rectus femurs, Tibialis anterior,

biceps femurs and gastronomies (Kelley, Slattery, & Apollo, 2018) and hence, these may be the possible reason for the improvement of shooting variable.

8.3.4 Short passing

Summary

The findings in this study shows significant improvement in passing skill from 79.27 to 100.00 in the treatment group ($p < 0.006$) as compared to control group improvement from 76.83 to 81.71 ($p = 0.505$). The results shows insignificant change in pre Vs pre (0.824) and post Vs post (0.071) whereas, group*time interaction showed significant (0.029).

Comparison

Presently in our study, the short passing results shows near to moderate effect (Cohen $d = 0.48$), in align with earlier results on junior soccer players where low intensity plyometric training (LIPT), moderate intensity plyometric training (MIPT) and high intensity plyometric training (HIPT) had significant Cohen d (LITP=0.55, MITP=0.71, HITP=0.33) enhancement in dribbling of all the three groups (Zakir Ahamed, Murugavel, 2011).

Mechanism

Yoga postures have found the different core muscles activation (Ni, Mooney, Harriell, Balachandran, & Signorile, (2014) on both upper and lower extremity muscles. The activation of the muscle across the joint and its maintenance of stability supply resistance to rotation at joint and equally distribute the pressure at the articular surface (Nara, Kaur, Bhatia, & Shaw, 2016). This may be the possible cause for the enhancement of passing skill variable.

8.3.5 Juggling

Summary

The results in this study shows significant improvement in Juggling (sec.) from 12.68 to 17.98 in the treatment group ($p < 0.001$) as compared to control group improvement from 12.49 to 14.10 ($p = 0.055$). The results shows significant change in post Vs post (0.032) whereas, group*time interaction showed insignificant (0.111).

The findings also showed significant improvement in Juggling scores from 101.46 to 120.98 in the treatment group ($p < 0.001$) as compared to control group scores from 103.66 to 113.41 ($p = 0.028$) significant. Significant change was observed in group*time interaction (0.030) of Juggling scores.

Mechanism

Ali K (2015) demonstrated the effectiveness of progressive muscle relaxation to reduce the intensity of sports anxiety among elite football players. The mental training ability to concentrate is thought to increase cortical output signals, and drive muscles to higher levels of activation, increasing their strength (Ranganathan, Siemionow, Liu Sahgal, & Yue, 2004). Yogic practices helps to focus, improves calmness from stress-full situation and hence eye and leg co-ordination enhanced ball control in air (juggling). A high level of concentration, good reaction time, low level of competitive anxiety (Junge A et al., 2000) and increase in the coordination may be the reason for the possible improvement in juggling skill.