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ROLE OF EXERCISES IN INJURY PREVENTION PROGRAMME IN BADMINTON PLAYERS: A REVIEW

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Abstract

Multiple sport injury prevention programs designed to decrease acute and overuse injuries in athletes have been proven effective. Yet, the programs components, general or sports-specific, that led to these positive effects are uncertain. Despite not knowing about the superiority of sports-specific injury prevention programs, coaches and athletes alike prefer more specialized rather than generalized exercise. injuries in sports have been associated with intrinsic or extrinsic factors. To prevent injuries is extremely important given that a previous injury is a significant risk factor for sustaining another injury. establish some recommendations for coaches and physical fitness trainers that might reduce the overall number of injuries among badminton players.

In this study, we examine the effects of exercises in injury prevention program in games. We want to decrease the risk of injury in badminton games.

Material and Method: Google Scholar, Pub Med, the Physiotherapy Evidence Database, and the Cochrane Database were used to conduct a title and abstract search of an electronic database. Only full-text articles were used for the review, and everything was double-checked. To determine how well the effect of exercises in injury prevention program in badminton players.

Keywords: Prevention, Stretching, Balance, Low Injury.

Introduction

Competitive sports are dependent on multiple components of training and the development of strength, power, and endurance. Balance training is a relatively recent phenomenon in the fitness industry that has developed into a primary point of interest for consumers and fitness professionals. To maintain balance, it is necessary to have a functional awareness of the base of support (BOS) to better accommodate the changing centre of gravity (COG). The goal of balance training is to improve balance through perturbation of the musculoskeletal system that will facilitate neuromuscular capability readiness, and reaction. Traditionally, balance training has involved single limb stance activities on stable and unstable surfaces.[1]

Badminton is a racquet sport played using racquets to hit a shuttlecock across a net. There is high level skill required to play badminton at the elite level, though to be a successful player they also need good reflexes and be quick and agile around the court. The important factors for badminton players are muscle strength, muscular endurance, power, speed, agility, flexibility, balance and coordination. Functional movements are highly dependent on this part of the body, and lack of core muscular development can result in predisposition of injury. Core muscles includes transverse abdominal muscle, abdominal external oblique muscle, multifidus muscles, abdominal internal oblique, psoas major muscle. A core muscle is used to stabilize the thorax and the pelvis during

dynamic movement and it also provides internal pressure to expel substances. Static core functionally is the ability of ones core to align the skeleton to resist a force that does not change. The core strength training plays an important role in reducing and preventing lower and knee joint injuries. Badminton players need to conduct various movement patterns during the game including specialized twists, jumps, footwork, and swings to strike the shuttlecock and keep it moving back and forth on the court. Thus, the game is characterized by a changing actions of short period and high or intensity coupled with a short resting times. It appears that repeated activation of core musculature along with extremity movements helps to improve postural control. During performance of sports skills, a stable core provides a foundation upon which the muscles of the upper and lower extremities can accelerate body segments and transfer force between distal and proximal body segments. The core muscle strengthening may help to improve dynamic balance and muscle coordination between lower and upper extremities, as well as reducing injury risk and muscle imbalance. Thus, the purpose of this study to find out the effect of core strengthening on dynamic balance and agility in badminton players.

The sport with the highest incidence of Achilles tendon rupture is badminton. Stiff and contracted muscles may increase the risk of such injuries and stretching and elevated heels have been recommended to decrease the risk. There is, however, no evidence that badminton players in fact have short, contracted calf muscles or that stretching as a part of a training program could increase the length of the muscles or the range of dorsiflexion of the ankle.[9]

Badminton is a popular sport and one of the fastest racquet sports. The lunge step is one of the most frequently performed movements in badminton, accounting for approximately 15% of the total movements in a game. Performing a good lunge step is usually associated with high flexibility. In addition, badminton players must react by moving rapidly with powerful jumps and agile footwork throughout a game. Players must repeat actions quickly with high speed and intensity. Therefore, players need excellent joint range of motion, power, and agility. It improves performance and may avoid injury. Muscle strain injuries usually occur during movements that involve rapid acceleration/deceleration and sprinting. Dynamic stretching is the most commonly suggested warm-up protocol. The DS technique involves a stretch to lengthen the muscle, and it is performed by moving parts of the body and gradually increasing reach and speed of movement. It often mimics movement patterns performed during subsequent exercise. DS provides a more sport-specific warm-up exercise, and as a precursor, it increases body temperature, improves nerve conduction, and increases sports performance However, reports regarding the effect of DS on muscle stiffness are conflicting, indicating that DS may cause increased or reduced muscle stiffness. [8]

Sports performance is based on a complex variety of factors, which include physical, psychological, sociological and physical factors. Badminton is a complex physically enduring sport that requires an extensive amount of core strength as well as upper and lower body strength to produce powerful smashes, agility, good balance and coordination during rapid postural movement around. . It improves flexibility, tonicity, strengthens core muscle groups, enhances body awareness, prevents injury, developer posture and balance, and comfort of movement through daily life. Pilates gives equal importance to strengthening-body conditioning and the mind. Warm up, flexibility exercises, endurance exercises and sports specific exercises for badminton are included in conventional training of badminton players. Sports specific training is done for improving fitness and performance in sports.

Badminton is considered to be merely a slow and light game for children, a game that can be played outdoors and it is structurally unchallenging. It is appropriate for all ages, women and men and even disabled persons. Beginners can start playing badminton early since the basics are learned rapidly. It was stated that badminton requires jumping, changing directions, rapid arm movements and a broad range of body postures, and also requires extremely explosive movements to be carried out over a small court area. Changes in direction are necessary after most shots and all movements must be completed quickly with good technique and control. Vertical and lateral jumps are more usual in all aspects of the game. It was suggested that there are relations between power and movement speeds. Therefore, it is vital that programs of fitness assessment should reflect the very exact necessities of the sport.

Sports injury is one of the leading causes of injury in sports person. Injury can have both short- and long-term consequences. Not only may injury lead to temporary impairment of sports performance but also absence from sports. But it could also result in prolonged pain, higher risk of re-injury, early retirement from competitive sport, and lower future commitment to physical activity for health.

Sports injuries prevention includes static stretching, warm-up before and cool down after exercise, strength and conditioning, landing technique and correct application of protective equipment. Sports injury prevention programes are provided from prevention and reduce risk from sports injury.

Method

- Avi Saraswat,Deepak Malhotra,et,al.(2015),conducted a study on to improve the balance and thus reduce the risk of injury, for example ligament sprain is very common in basketball.various drills are being used to improve the performance parameters such as agility. Data analysis was done by independent test and paired t test for between group analysis and within group analysis respectively. There was significant reduction in T-test times in the experimental group as compared to the control group, while there was no significant improvement in the control group.1

- Towel K K Wong, Ada W W Ma,et al. (2019) conducted a study on Balance control, agility, eye-hand coordination, and sport performance of amateur badminton players in a cross-sectional study. Thirty young adult badminton players and 33 active controls participated in the study. Static single-leg standing balance (with eyes closed) was measured using a force platform, and dynamic balance was measured using the Y Balance Test (lower quarter). Agility was measured using a hexagon agility test, and eye—hand coordination was measured using a computerized finger-pointing task. Sports performance was quantified by the number of times a shuttlecock fell in a designated area following a badminton serve. Amateur badminton players had more favorable sports performance, but not balance performance, agility, or eye—hand coordination, than controls. 2

- Phil Page (2012) studied current concepts in muscle stretching for exercise and rehabilitation in which he described Stretching is a common activity used by athletes, older adults, rehabilitation patients, and anyone participating in a fitness program. While the benefits of stretching are known, controversy remains about the best type of stretching for a particular goal or outcome. The purpose of this clinical

commentary is to discuss the current concepts of muscle stretching interventions and summarize the evidence related to stretching as used in both exercise and rehabilitation.To increase range of motion (ROM), all types of stretching are effective, although PNF-type stretching may be more effective for immediate gains. To avoid decrease in strength and performance that may occur in athletes due to static stretching before competition or activity, dynamic stretching is recommended for warm-up. Older adults over 65 years old should incorporate static stretching into an exercise regimen. A variety of orthopedic patients can benefit from both static and pre-contraction stretching, although patients with joint contractures do not appear to benefit from stretching.3

- Amara PereraC. Perera, et al.(2015) conducted a study on Effectiveness of early stretching exercises for the quality of recovery of the upper limb in burnt patients. Pateints from 15-55 year of age with total burn injuy surface area of 10%- 45% involving the shoulder joint including axilla were eligible. The study demonstrated that a early sustained stretching exercise regime significantly improve the ROM and functional recovery of the shoulder joint.4

- Michael Williams, Lanisa Harveson et,al. (2013) examined the acute effects of upper extremity stretching on throwing velocity in baseball throwers.27 male throwers with adequate knowledge of demonstrable throwing mechanics. Study Design was randomized crossover trial with repeated measures. Subjects warmed up, threw 10 pitches at their maximum velocity, were randomly assigned to 1 of 3 stretching protocols,and then repeated their 10 pitches. Velocities were recorded after each pitch and average and peak velocities were recorded after each session. Data were analyzed using a 3 × 2 repeated measures ANOVA. No significant interaction between stretching and throwing velocity was observed. Main effects for time were not statistically significant. Main effects for the stretching groups were statistically significant. Results suggest that stretching of the shoulder internal rotators did not significantly affect throwing velocity immediately after stretching. This may be due to the complexity of the throwing task. Stretching may be included in a thrower's warm-up without any effects on throwing velocity.5

- Mehmet Fatih Yuksel, Asim Cengiz, Erdal Zorba et,al.(2015) studied theEffects of Badminton Training on Physical Parameters of Players, the study aimed to determine some physical parameters of badminton players in the ages of 10-12. Fifteen badminton players in 10-12 years old volunteered to participate. The players continued their badminton training for 8 weeks. After and before the 8 week training, their 15 m speed, vertical jump, standing broad jump, hand grip strength and flexibility tests were conducted. To analyses the data, paired t-test was used to compare the pre- and post-test tests. After the badminton training of the 8 weeks, subjects vertical jump, the hand grip strength (right hand) and flexibility performances increased significantly ($p<0.05$). There was no significant difference in standing broad jump, 15 m speed and left hand-grip strength between pre- and post-test ($p>0.05$). As a result, it can be said that the badminton training an 8-week might improve vertical jump, flexibility and hand grip strength in 10-12 years old badminton players. However, the training may not have any effect on their 15 m speed and standing broad jump performance.

- Rajiv Sighamoney, Raika Kad and Ujwal L Yeole. (2018) studied the Effect of core strengthening on dynamic balance and agility in badminton players, in which30 badminton players between the age 10-19years (mean age14+) were selected and informed consent was taken. Subjects filled Questionnaire, and modified star excursion tests for dynamic balance and core strengthening program were done, data was collected and analysed & treated. Total 4 weeks 5 times in week of exercise protocol given. Modified star excursion scale used for dynamic balance pre and post of training period. Illinois t-test test used for assess the agility pre and post of training period. The result of the study was there is significant effect of core strengthening on dynamic balance and agility. 7

- Wei-Cheng Lin, Chia-Lun Lee and Nai-Jen Chang.(2020) studied the acute effect of dynamic stretching follwed by vibration foam rolling on sports performance of badminton athele, They studies that Dynamic stretching (DS) is performed to increase sports per-formance and is also used primarily for transiently increasing range of motion (ROM). Recently, vibration foam rolling (VFR) has emerged. Forty badminton players performed DS or DS + VFR as warm-up exercises on two occasions in a randomized order. The target muscle groups were the bilateral shoulder, anterior and posterior thigh, posterior calf, and lower back. Main outcome measures: The primary outcome was knee range of motion (ROM), and the secondary outcomes were muscle stiffness, lower limb power (countermovement jump [CMJ]), and agility. Results indicated that the protocols improved performance.

- Anders henricson, Anniks Larsson, Ewa Olsson. Nils westlin,(1983), the investigated effect of stretching on the range of Motion (ROM) of the Ankle Joint in Badminton Players, The range of motion in the ankle joints were studied in two groups of badminton players during their training season. In one group, the exercise program consisted of tip-toe raising, whereas in the other group stretching exercise was added. The range of motion in the ankle joint in badminton players did not deviate from that of a control group. Both programs, stretching as well as regular exercise, increased the range of motion by approximatively 5° during a 12-week period. No lengthening of the gastrocnemius muscle could be measured under maximal dorsiflexion from 30—35°. Too short or too tight a calf muscle does not explain the high incidence of Achilles tendon rupture and Achilles tendon pain in badminton players. The ROM of the ankle joint in badminton player was slightly but not significantly less than in the controlled group. In fact ROM was same in both groups. 9

- Zhenxiang Guo, Yan Huang, Zhihui Zhou, Bo Leng, conducted a study on The Effect of 6-Week Combined Balance and Plyometric Training on Change of Direction Performance of Elite Badminton Players, The study aimed to investigate the effect of combined balance and plyometric training on the change of direction (COD) performance of badminton athletes. Sixteen elite male badminton players volunteered to participate and were randomly assigned to a balance-plyometric group (BP: $n = 8$) and plyometric group (PL: $n = 8$). All participants were tested to assess the COD ability before and after the training period: These findings suggest that combined training could further improve the COD

performance of badminton athletes than plyometric training alone and might provide fitness trainers a more efficient COD training alternative. 10

- Preeti, Sheetal Kalra, Joginder Yadav,et,al.(2019) conducted a study on pilates to evaluate the efficacy of pilates on lower limb strength, dynamic balance, agility and coordination skills in spiring state level badminton players., 40 male aspiring badminton players in the age group of 17-28 years were included in this experimental study and randomly divided into two groups. Experimental and control group with 20 players in each group. Both groups improved significantly at the end of 5th week but experimental group showed highly significant difference for lower limb strength, dynamic balance, agile and coordination as compared to control group. Pilates is effective method for improvement in lower limb strength, agility, dynamic balance and coordination skills in badminton players. 12

- Mehmet Yuksel, Asim Cengiz, (2015) conducted study to analyze 8 weeks of a basic technical badminton training program on some fitness parameters of beginner level badminton players. After two months of training it was determined that the vertical jumb increased for the experimental group. It was determined the standing road jump performance showed a significant improvement in performance for the experimental group. The results of the study could be of help to coaches and athletes to improve performance through selection and adjusting to a suitable training program. 13

- Xiaoxing Lai, Lin Bo, Hongwei Zhu, et, al.(2021) study was a randomized controlled trial of patients with pre-frailty. The control group received routine care, while the exercise group received a 12-week lower limb resistance exercise based on routine care. The muscle strength in the lower limbs, physical fitness, and energy metabolism of the patients was evaluated at admission and after 12 weeks of intervention. Results: The patients were divided into the exercise group and control group by random grouping. There were 17 men and 13 women aged in the exercise group, and 15 men and 15 women aged in the control groups. The results of repeated measurement ANOVA showed that there was statistically significant in crossover effect of group * time (all $p < 0.05$), that is, the differences of quadriceps femoris muscle strength, 6-min walking test, 30-s sit-to-stand test, 8-ft "up & go" test, daily activity energy expenditure and metabolic equivalent between the intervention group and the control group changed with time, The main effects of groups were statistically significant ($p < 0.05$), namely, femoris muscle strength, 6-min walking test, 30-s sit-to-stand test, daily activity energy expenditure and metabolic equivalent before and after intervention were significantly different between the intervention group and the control group, while there was no significant differences in 8-ft "up & go" test between groups. Conclusion: Lower limb resistance exercise used for the frailty intervention could improve muscle strength, physical fitness, and metabolism in pre-frail elderly. 14

- Byeong Mu Mun, Jin Park, Tae Ho Kim (2019) investigated the effect of strengthening exercise on balance and spasticity in chronic stroke patients and to suggest the basis of clinical treatment. Twenty subjects were divided into two groups: a lower-extremity strengthening group (experimental group) and

a general physical therapy group (control group). Balance and spasticity were measured before and after the training period. Balance ability was measured by the Berg balance scale, the Timed up and Go test and the weight distribution of the paralyzed muscles by the Space balance 3D. Spasticity was measured by the Biodex system. The experimental group showed a significant improvement in BBS, weight distribution of the paralyzed muscles, and decreased spasticity when compared to the control group ($p < 0.05$).This study supported the hypothesis that lower-extremity strengthening exercise improves the balance and decreases the spasticity of stroke patients.15

- Ran Wu, Yan Zhang, Jiao-Jiao Bai, (2020) study, patients were divided in two groups according to their lower limb muscle strength: those with declining muscle strength and those with normal muscle strength.Walking function was significantly abnormal in the patients with declining lower limb muscle strength. The gait trajectories were abnormal, mainly with respect to a shortage of driving force. The lower limb muscle strength can affect the static balance and dynamic balance in advanced-age patients with declining lower limb muscle strength. 16

- Hye Joo Jeon, Byong Yong Hwang, (2018) in this study found the effect of bilateral lower limb strengthening designed to improve balance and walking in stroke patients. Twenty hemiparetic stroke patients were divided into two groups: Assessment tools included the functional reach test (FRT), the Berg balance scale the timed up and go test, and a 10-meter walk test.In both groups, the lower limb strengthening exercise for balance and walking significantly improved the FRT, BBS, TUG, and 10MWT scores. Compared with UTG, the BTG attained significantly improved FRT and BBS scores. Bilateral therapy using this lower limb strengthening exercise effectively promotes balance in hemiparetic stroke patients.17

- Naoki Kato, Goichi Hashida, Mizuki Kobayashi and Noriaki Hattori, (2020) investigated whether patients with early-stage amyotrophic lateral sclerosis can improve their voluntary strength with a physical therapy program. This retrospective case series study at a single university hospital included 13 patients with amyotrophic lateral sclerosis (amyotrophic lateral sclerosis functional rating scale-revised ≥35, modified functional ambulation categories score ≥4). Physical therapy was performed for 3 weeks. Study investigated knee extension muscle strength and modified functional ambulation categories scores at the start and end of the therapy and calculated the improvement rate of knee extension muscle strength. We performed a regression analysis of the relationship between knee extension muscle strength at the start of the study and the improvement rate. Was seen the knee extension muscle strength improved significantly; however, the effect size was small (0.13). The modified functional ambulation categories scores did not improve significantly. The knee extension muscle strength at the start of the therapy was negatively correlated with the improvement rate (logarithmic transformed linear regression: adjusted R^2=0.27). [Conclusion] A short-duration exercise program improved lower limb muscle strength in patients with early-stage amyotrophic lateral sclerosis. Additionally, we found that patients with weaker lower limb muscle strength at the start of the therapy demonstrated greater improvement at the end of the therapy.18

- ·Paulo H. Marchetti, Fernando H. D. and de Oliveira Silva.(2014) study randomized between group experimental protocol consisted of a three trials of maximal concentric jump task, before and after a SS of the upper limb. A significant interaction for passive ROM of the shoulder joint revealed significant increases between pre- and post-SS protocol ($p < 0.001$). A significant interaction demonstrated decreased peak force and an increased peak propulsion duration between pre- and post-stretching only for stretch group ($p = 0.021$, and $p = 0.024$, respectively. There was a significant main effect between groups (stretch and control) for peak force for control group ($p = 0.045$). Regarding sEMG variables, there were no significant differences between groups (control versus stretched) or condition A significant interaction for passive ROM of the shoulder joint revealed significant increases between the measurements taken before and those taken after the SS protocol (mean±SD: 134.9 ± 12.4° to 141.9 ± 14.4°, $p < 0.001$, ES = 0.54, Δ% = 5.93%). There were no significant differences with pre- to post-SS measures for the control group (mean±SD: 135 ± 12° to 139 ± 14°, $p = 0.704$). There were no significant main effects between the groups for shoulder joint passive ROM.19

- Simran Narang, Pratik Phansopkar,et,al. (2022) study the Protocol was followed for 6weeks and difference was seen in agility speed and strength. The Ballistic Six upper extremity plyometric training program involves a series of functional exercises performed at high volumes to simulate the movements, positions and forces involved with the overhead throwing motion. In order to take advantage of the stretch reflex, plyometric training study conducted in a ballistic, high velocity manner to decrease the amortization phase of the stretch shortening cycle. 20

Result and Conclusion: This review also analyzed published literature from India to understand the effects of exercise in injury prevention program in badminton players. This exercises shows positive effects. The purpose of this study was to review the physical exercise training programs that have been effective in lowering the injury incidence. Expanding the availability and scope of these programs is a pressing concern for social support networks as well as global health and fitness providers.

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