



## **Strength and Conditioning in Sri Lankan Sports; Fulfilling a high performance Need**

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### **ABSTRACT**

The purpose of this study is to determine the influence of strength and conditioning interventions on sports for high performance in Sri Lanka. Training for strength and conditioning is a standard occurrence in any sport that seeks to improve performance or prevent injuries. Studies on the impact of strength and conditioning on athletic results, however, are scarce; the effect of age, gender or level of competition is even scarcer. Existing studies conducted by Sri Lankan researchers do not include research on strength and conditioning which has resulted in a knowledge gap and a lack of qualified coaches, lack in knowledge of players and lack in knowledge of the sports management. Further it gives importance and prominence to sports specific skills and less importance to physical fitness area when it comes to team selection. Hence players and coaches give less emphasis to strength and conditioning in all levels of sport in Sri Lanka. Due to these reasons, strength and conditioning is in a very primitive stage in Sri Lankan sports. If Sri Lanka is to win another medal in the Olympic level or at world level, prominence should be given to strength and conditioning to achieve high performance.

**KEYWORDS:** High Performance, Strengthen and Conditioning, Sports, Prevent Injury

## INTRODUCTION

Strength and conditioning training and sports specific training should go hand in hand in order to achieve high performance in any sport. Further Performing concurrent training which is a combination of cardio and strength training, is a popular training strategy to develop various aspects of physiological capabilities in most sports (Balabinis, Psarakis, Moukas, Vassiliou, & Behrakis, 2003; Wong & Chaouachi, 2010). This training method has a huge impact on overall health, rather than performing individually (Häkkinen, Hannonen, Nyman, Lyyski, & Häkkinen, 2003; Sheikholeslami Vatan, Siahkhouhian, Hakimi, & Ali-Mohammadi, 2015; Takeshima et al., 2004). If a sportsman is looking to improve his/her athletic ability, strength and conditioning is the perfect training method one should follow. This training method will make you stronger, fitter and faster and at the same time it will improve the skill of the specific sport and most importantly it will help to prevent injury (Palmer, & Collins 2019). Over the last few decades, strength training has become such an important part of the training routine of an athlete that you can assume that it is widely recognized as a standard operating procedure. It still tends, however, to be a reasonably significant contingent of well-meaning coaches who are push-back beneficiaries with regard to the effectiveness and overall benefits of strength training (Mannie, 2014). Strength and Conditioning training is an integral aspect of team sports and individual disciplines (Gamble, 2013; Schelling and Torres-Rhonda, 2013; Martinez, 2017; Wagner et al., 2019). The main aim of the strength and conditioning program is to provide players with the physical abilities under competitive and training environments for the demonstration of sports skills on the sports field/court. Considering the role of strength and conditioning in more detail, we may outline its five basic tasks accordingly. According to Talpey and Siesma (2017) and O'Brien et al. studied (2019, as cited in Jukic et al., 2020), "ensure the availability of players through prevention and reduction of the number and severity of sports injuries", (p.15). Bompa and Haff (2009), Gamble (2013) and Jukic et al. (2018), (as cited in Jukic et al., 2020), "develop the morphological, neuro-muscular and energy capacities of players (p.15). "Postpone fatigue reactions in training and competition" (Weineck, 2007; Carriker, 2017, as cited in Jukic et al., 2020, p.15). Calleja-Gonzalez (2017, as cited in Jukic et al., 2020), "enhance the recovery process during and between training and competition", (p.15). "provide the physical conditions for optimal technical performance and decision-making on the sports field (Jukic et al., 2019, as cited in Jukic et al., 2020, p.15), "

## STRENGTH AND CONDITIONING IN SRI LANKAN CONTEXT

In 2019, the National Science Foundation (NSF) held a highly informative information sharing session for local sports managers, coaches and ground-level practitioners, sharing the eye-opening findings of a three-year report on exercise physiology. The findings show that the national athletes of Sri Lanka and their custodians lack adequate guidance and direction on how to apply scientific research findings and technology to enhance athletic performance and are expected to be the beginning of a steady revolution of physically advanced athletes displaying the right combination of *strength*, agility and endurance for the required sporting disciplines. With the intention of establishing a collaborative network between sports administrators and medical experts in the country, a knowledge sharing session organized by the NSF together with some of Sri Lanka's leading medical experts was held. This event illustrated the importance of exercise physiology, examined the current status of our national athletes, and, most significantly, applied these recent research results to the overall advancement of Sri Lankan *sports* and athletes. Dr. Upendra Wijayasiri, Head of the Sports and Exercise Medicine Unit, Colombo South Teaching Hospital, Kalubowila, conducted the study from 2015 to 2017 with the overall objective of evaluating cardiopulmonary (heart and lung) fitness among national athletes participating in running events Wijayasiri (2019).

**Sports classification on CVS demand**

	Low ( < 40% VO <sub>2</sub> max)	Moderate ( 40%- 70% VO <sub>2</sub> max)	High ( >70% VO <sub>2</sub> max)
Low (20% MVC)	Throwing events, gymnastics, martial arts, climbing	Body building, wrestling	Cycling, triathlon, decathlon, rowing, boxing
Moderate (20-50% MVC)	Archery, diving, auto sports	Sprint running, jumping, rugby, short distance swimming,	Middle distance running, basketball, middle distance swimming
High (> 50% MVC)	Cricket, billiards, golf, riflery	Table tennis, volley ball	Long distance running, race walking, racquet games, foot ball

Source: Sports and Exercise Medicine Unit Colombo South Teaching Hospital, Kalubowila

This is the first research study of its kind on the cardiopulmonary health of various running disciplines practiced by Sri Lankan athletes. For comparative purposes, the analysis evaluated top 100 national level athletes, top 100 university level athletes and a control group of university

students who are not involved in daily sports activities. The results and conclusion of the study showed that national-level athletes in Sri Lanka needed urgent attention and guidance to improve performance through the proper application of exercise physiology in areas such as peak oxygen intake, enhancement of endurance, and through sufficient and continuous training, the overall 'remodeling' of the cardiovascular system. This combination of science and sports in Sri Lanka is still in its infantile stage, but with proper guidance and nurturing, our talented national athletes will be ensured a safe future. However, no research has been done with regard to importance of strength and conditioning in Sri Lanka hence there is a gap in Sri Lankan sports to incorporate strength and conditioning for better sports performance.

In the international arena, Sri Lankan basketball and football teams receive relatively less recognition and achievements, and this is probably due to deficiencies in programmers for player training. With only a limited number of studies comparing fitness profiles of both sports (Gökdemir, Cigerci, 2012; Popovic, Akpinar, Jaksic, 2013; Srinet, 2014; Atan, Akyol, 2014; Dias, Ravindran 1978) and only one from Sri Lanka (Dias, Ravindran 1978;) we aimed to evaluate and compare the physical fitness characteristics of Sri Lankan national level basketball and football team players in terms of health and skills. It is quite evident that there are very less studies done in evaluating Sri Lankan *sports* and only one study in the above context. Hence it is understood that there is a gap in giving importance to physical fitness and *strength and conditioning*. In the study of Kariyawasam<sup>1</sup>, Ariyasinghe, Rajaratnam and Subasinghe, 2019, it is said that all components of physical fitness, including flexibility, balance, coordination and reaction time, which have not been extensively studied, have been assessed. It is also one of the few studies on national teams carried out. A current necessity in Sri Lanka is to improve the quality of players to internationally recognized standards with the limited resources available. The study aimed to evaluate and compare health and skill-related physical fitness profiles among the Sri Lankan national teams' healthy, male, basketball and football players.

### Statistical Analysis

According to (Kariyawasam et al., 2019) Statistical analysis performed using SPSS for Windows, version 20.0. Data were presented as mean  $\pm$  standard deviation (SD). Age adjusted analysis was done in both teams. Two tailed independent sample test was used for analyzing differences of means. A p value  $\leq 0.05$  was taken statistically significant. The mean age of basketball players was 24 years $\pm$ 4.5 years (range 18–34 years) and of football players was 23 $\pm$ 4.3 years (range 17–36 years). The mean heights of basketball and football players were

183.33±8.39 cm and 172.83±6.23 cm, respectively. The mean weights of basketball and football players were 79.33±12.87 kg and 63.67±8.31 kg, respectively. As shown in Table 1, mean fat percentage, upper body endurance and grip strength were significantly higher in basketball players compared to footballers (p<0.05). Although not significant upper body strength and flexibility were higher in footballers compared to basketball players (p>0.05). However, the difference in VO2 max between the two groups was negligible. As shown in Table 2, basketball players had significantly higher mean agility, muscle power coordination, balance compared to football players (p<0.05). In conclusion it was identified that basketball players had better upper body endurance, abdominal endurance isometric grip strength, lower body strength, running speed, explosive throwing power, vertical jumping power, balance and coordination. The football players had better VO2max, upper body strength, flexibility, reaction time, agility and lower fat percentage. The results have implications in tailoring appropriate training activities to improve relevant fitness characteristics. However, to date this information were not shared with relevant authorities to improve the weak points through strength and conditioning training. (Useful data which was never shared with the two *strength and conditioning* coaches for improvements is available in table 1)

**Table 1 Comparison of health related fitness parameters between basketball and football players**

Health related fitness variable	Basketball players (Mean ± SD)	Football players (Mean ± SD)	p value
Fat percentage	11.61 ± 5.48	8.59 ± 4.15	0.019*
Cardiorespiratory fitness (VO <sub>2</sub> max (ml/kg/min))	50.6 ± 4.0	52.0 ± 4.0	0.181
Muscular endurance (Sit-ups per 1 min)	49.63 ± 6.77	46.40 ± 7.69	0.089
Muscular endurance (Push-ups per 1 min)	47.03 ± 14.78	37.77 ± 8.08	0.004*
Grip strength—left hand (kg)	42.59 ± 7.39	38.03 ± 5.92	0.011*
Grip strength—right hand (kg)	46.08 ± 6.83	39.54 ± 6.49	<0.001*
Upper body muscle strength (kg) (1-RM bench press)	111.60 ± 64.09	119.10 ± 19.13	0.542
Lower body muscle strength (kg) (1-RM leg press)	219.46 ± 75.07	196.76 ± 30.03	0.13
Flexibility (cm) (Sit and reach test)	10.87 ± 5.31	12.73 ± 5.46	0.185

SD standard deviation

\* Statistically significant

A study was conducted to identify the incidence and nature of match injuries among Sri Lankan junior cricketers (Prasanna, Gamage, Lauren, Fortington, Kountouris, Caroline, .Finch, 2018)

## Results

From 59 school-teams, 573 players responded, with 404 players reporting 744 injuries in 648 matches. The match-IIR was 28.0 injuries/100 match-player-days (95% CI = 26.0–30.2). The highest match-IIR was reported among fielders (46.0% of all injuries sustained; match-IIR = 12.9) compared with batters (25.4%; match-IIR = 7.1) and bowlers (20.3%; match-IIR = 5.7). Abrasions and bruises to the knee or elbow were the most common injuries among fielders, with the majority being non-MTL injuries. Almost half (46.0%) of all injuries were to fielders, and more research into their severity and mechanisms is needed to identify the need for, and design of, preventive measures. Batsmen sustained a relatively large number of facial-organ injuries from being struck by the ball, presenting a need to evaluate the use and appropriateness of helmets by Sri Lankan junior cricketers. Similar to other junior cricket studies, the most common injuries among bowlers were strains and sprains, mainly affecting the lower limbs and lower back. The main reason for strains and sprains are due to lack of strength and conditioning.

A different study was done by (Ranasinghe, Gamage, Girard, Perera, Ranasinghe, Seneviratne, and De Silva, 2018) in order to develop a Sports Medicine Human Performance and Research Centre at the planned High Altitude Training Centre (HATC), Nuwara Eliya, Sri Lanka.

To boost the endurance performance of athletes, different kinds of altitude training have been used. Innovative approaches have been applied in recent developments in altitude training to expand the benefits of physiological adaptations to boost strength, power, facilitate injury recovery and athlete rehabilitation. Furthermore, altitude training has been shown to be a useful treatment in the prevention of chronic injuries and management of certain medical conditions. Ransinghe and others, et al. SLJSEM, 2018, 1: 1 In South Asia, there are no renowned HATCs and the planned Nuwara Eliya facility for altitude training is an ideal set-up as it has unique characteristics such as high elevation, ideal temperature and proximity within a short travel time for low elevation areas. However, it is noteworthy to understand that up to date no steps have been taken to implement the project, which shows that there is lack of knowledge in governing bodies for such requirement which is a sad story for the development of *sports* in Sri Lanka and specially in *strength and conditioning* area which is the foundation of any sport.

## EMPIRICAL REVIEW ON WHY STRENGTH AND CONDITIONING IS IMPORTANT IN SPORTS

In today's sports world strength and conditioning has become an essential area in order to achieve high performance (Lloyd, Cronin, Faigenbaum, Haff, Howard, Kraemer, Micheli, Myer, and Oliver, 2016 ;) The National Strength and Conditioning Association's position statement on long-term athletic development, *one* major reason is long-term athletic development (LTD) for young athletes. Children should always engage in proper exercises programs in order to enhance physical fitness level which in the interim helps them to carryout day to day activities as well as to prevent any injuries. Further it will help the child to engage in competitive sports for better performance. Modern day childhood is totally different to what was experienced few decades ago. According to global reports it is evident that children and adolescents are less active than they used to be. This shows that daily physical activity needed for a child is not fulfilled (Tremblay, Barnes, González, 2016; Farooq, Parkinson, Adamson, 2018 ;). Technological developments have decreased the need for travel, physical education is considered unessential, and many children have less exposure to "free play" due to safety concerns and access problems. Based on these findings, many question whether or not young athletes are sufficiently strong for the physical demands of *sports*.

Further research supports the argument that many of the biomotor qualities such as strength, endurance, speed, flexibility and coordination affect athleticism and sports performance (Suchomel, NimphiusS, Stone 2016; and Granacher, Lesinski, Büsch, 2016; and Faigenbaum, Lloyd, MacDonald , Myer 2016;), but very few young athletes engage in strength and conditioning during the year and reach a physical fitness standard that optimizes their ability to run faster, jump higher and be stronger (Faigenbaum, et al 2016;). To break through a "strength barrier" to allow weaker young athletes to catch up to their stronger teammates, prerequisite levels of muscular strength are required. If young athletes are not exposed to an atmosphere of occasional opportunities to strengthen their muscle strength, they would be less likely to acquire the skills and prerequisites. Further when it comes to muscle strength measurements that young people are not stronger than previous generations in modern times (Müllerová, Langmajerová, Sedláček, 2015; and Venckunas, Emeljanovas, Mieziene, Volbekiene, 2012; and Sandercock, Cohen, 2018; ). In the late 1980s, for example, in the United States, the 50th percentile for adjusted pull-ups for 6- to 9-year-olds ranged from 6 to 10 repetitions, but for this same

population, the actual 50th percentile is now 2 to 4 repetitions (Laurson , Saint-Maurice, Welk, Eisenmann, 2017;). This is only one illustration of a troubling increase in muscle strength deficiencies that predispose children and adolescents to even higher levels of physical inactivity and sedentary activities as a result. Team sports belong to dynamic sports areas, and their complexity is reflected in the challenging system of movements and circumstances and in many features that players need to have in order to be competitive during training and competition (Jukic, 2018; Marrier, 2018; Schneider, 2018;). In addition, all these features should be part of the integral preparedness of the players, who is responsible for competitive performance. Finally, in order for the team to be more successful on the field/court and to produce great results, all players in the team need to be aligned with each other. The method of sports training in team sports is highly complex and challenging for these key reasons.

In addition to specific motor skills, tactical qualities, playing style, seasonal time, individual and team motivation, team sports require psychological and physical well-being (Kumar, Kumar 2014;). Physical fitness may be the most important of the determinants affecting *sports* performance (Karthi, Krishnakanthan 2012 ;). Physical fitness is characterized as the ability, with vitality and sharpness, to perform everyday activity without excessive fatigue while being able to appreciate the interests of leisure time and to meet unexpected emergencies (Singh, Singh, 2014 ;). It is the combination of physical fitness elements related to health and skill that is imperative in shaping individuals in sports or games. As an example Basketball and football are two sports which need very high level of physical fitness in order to effectively execute the tactical plan. Over the last 40 years, as an applied science, *strength and conditioning* has experienced tremendous growth, as evidenced by the establishment of the largest professional body in the world, the National Strength and Conditioning Association (NSCA) from North America. With a membership of 76 since its establishment in 1978, The NSCA has risen to 30,000 members now. As strength and conditioning coaches usually have postgraduate training in exercise science and physiology, such a rapid expansion will continue, and they are known as having a role in promoting fitness and well-being and promoting sports success, since 2006, For example, strength and *conditioning* coaches with expertise in exercise physiology and who meet the requirements for accreditation of exercise physiologist from Exercise and Sport Science Australia is eligible to obtain public health funds for the delivery of exercise services within the health care system (McGuigan, Tatasciore, Newton, and Pettigrew, 2009;). The expanding research base that underpins practice also shows the tremendous progress of the area. There is a



body of information based on how the body adapts to different exercise regimes (McGuigan, et al 2009 ;) physiological adaptation mechanisms (Ahtiainen, Lehti, Hulmi, Kraemer, Alen, Nyman, Selañne, Pakarinen, Komulainen, Kovanen, Mero, 2011 ;). and variables that moderate body responses to physical activity (Greer, White, Arguello, and Haymes, 2011; Tod, Thatcher, McGuigan, and Thatcher, 2009 ;).

## **DISCUSSION**

The practical application of sports science is to improve movement efficiency which is called *strength and conditioning* at its simplest form. It's focused on evidence-based exercise and anatomy studies and physiology. Strength and fitness for athletes is not only a hardcore beast, nor is it a basic Olympic lift, prowler push or hill sprint drill. While we can equate these movements with strength and conditioning, they are instruments that encourage good *strength and conditioning*. Firstly, in order to enhance performance, we prefer to concentrate on movement efficiency, this could be in any given sport focusing on speed, strength and power, or it may also improve performance in real-life situations, such as standing up for elderly customers with ease. Secondly, it concentrates on injury prevention, creating improved patterns of movement helps to reduce injury in athletes and can help speed up their career. This may be an elderly client working on kinesthesia & balance in our real-life situation, to help them fall less often. Strength and conditioning, whether you are an athlete or an amateur, an expert or just starting out, is a perfect way to change your body and get great results. It requires so much more than just weight lifting and relies on a range of instruments to promote movement, wellbeing and physical fitness. Strength & Conditioning used to be a niche area considered to be just for athletes, but the strength and conditioning market is increasing as more individuals begin to realize the many advantages of movement-based fitness. Plyometrics, speed and agility, mobility, core stability, stamina and weight training are approaches, and so much more depending on the needs of individuals or teams.

### **Benefits of strength and Conditioning for Athletes**

The importance of strength and conditioning is growing its importance day by day in Sri Lanka. The key areas an athlete could benefit are as follows.

**Injury Prevention-** Injuries are inevitable in *sports*. However, with a well-organized exercise regime throughout will help to prevent injuries as it will improve the proprioception and balance. A good example is the Sri Lanka cricket team, over the past five years' injuries have plagued in to Sri Lanka cricket. This was very much evident at the recently concluded series with South Africa where five of the players got injured. Injuries are inevitable in sports but this kind of number of injuries is unacceptable at this level, countries such as England, South Africa, New Zealand and even Pakistan is well conditioned for their tours. Hence proper strength training program is the answer to this king of injuries.

**Enhance Performance-** A program of *strength and conditioning* will aim to maximize your performance over time. Using scientifically-backed training techniques, programming is performance specific. A *Strength & Conditioning* Coach is important to optimizing your *performance* enhancing skills, as they will be able to spot key areas of change and reliably and assess your results as well. It was evident in the South Asian Games in 2019 where Sri Lanka appointed a trainer for *strength and conditioning* for the first time in history of Sri Lankan Basketball. It was witnessed that some of the players was never exposed to weight training and the team ended up with a silver medal for the first time in the history. The last time Sri Lanka won a medal was way back in 1991 which was a bronze medal.

**Remedy for Recovery-** One of the *strength and conditioning* ideals is to minimize injury by better movement, but sadly, injuries can still occur. *Strength and conditioning* will aid the process of recovery and the muscles will be stronger and more adaptive. *Strength and conditioning* coach will spot which movement habits are out of bounds and how to use exercise to restore efficiency to your muscles. It was noted way back in 1980s one of the greatest fast bowlers of Australia Dennis Lillee with number of stress fractures in his back was able to continue his sporting career with strict regime of fitness training.

**Physiological Satisfaction-** Exercise becomes more fun when you move correctly and you note changes in your movement technique for better. This is not only because success is inspiring, but also because *strength and conditioning* by improving quality movement habits helps to reduce accidents. A decreased worry about the risk of *injury* also helps to make training more fun! Hence this gives the athlete the confidence needed for better performance.

**Bone Strength**-Strength training doesn't just improve our muscles' *strength*. In fact, there are numerous articles and research papers on the benefits of improving bone density with *strength* training. An article published on the impact of *strength* training on bone health by Harvard Medical School explains: Several studies have shown that strength training can play a role in slowing bone loss, and several studies have shown that strength training can also build bones. This is particularly beneficial in helping to offset age-related reductions in bone mass. This will give the opportunity for athlete to be in sports for a longer period of time.

Another area which affects the performance is that coaches are not given specific parameters to analyze the players. For instance, what is the beep test standard for a basketball player, VO2 max level for a specific sport etc. These are important parameters where a coach should have in order to increase the performance level of a sportsman. Further there are few researches conducted (Kariyawasam et al., 2019) of which results were never shared or discussed with the Sri Lanka basketball or football team strength and conditioning coaches. If it was discussed both coaches would have had the opportunity to share the experiences in order to strengthen the weak areas of each other's players. In Sri Lankan sports over the years we have seen political interference when it comes to team selections giving less importance to strength and conditioning. For instance, when a player is not selected due to failing of fitness test or injury there had been occasions where the inclusion of the said player took place due to political influence. This kind of scenarios have effected and questioned the importance of strength and conditioning in Sri Lanka.

## CONCLUSION

It was noted in Sri Lankan context that programs have taken place in isolation in strength and conditioning. Hence the sports ministry must take necessary actions to coordinate amongst the stakeholders and focus with a holistic approach. Without any question there has to be a personalized tailored approach for athletes based on specific profiles of each player in strength and conditioning in Sri Lanka for world class performance. In every single step of the strength and conditioning phase, this technique is about understanding the particularities of each athlete. A customized strength and conditioning program should be developed and given on the basis of each player's individual profile. This program includes: diagnostic techniques, preparation and

training load tracking, strength and conditioning of individual programs for precise and integral preparation, procedures for rehabilitation and a tailored psychological approach to the player. Modern research and monitoring techniques and methodological methods involving genetic, morphological, biomechanical, physiological and psychological tools are used for this purpose. In addition, to prevent duplication and conflict between concurrent programs, it is necessary to coordinate institutional (club, national team) and private strength and conditioning programs.

A big contribution from high technology and genetics to the design of customized strength and conditioning programs is anticipated in the near future. The expertise of the strength and conditioning coach will, however, continue to be a deciding factor in the sports development of top athletes in Sri Lanka. Hence the ministry of sports should come up with a national policy for strength and conditioning in Sri Lanka to uplift the sports performance to world class level.

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