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SPORTS INJURY PREVENTION EDUCATION: EXPANDING THE FRONTIER FOR SPORTS SCIENCE AND SAFE PERFORMANCE

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Abstract

Injury is an unwanted phenomenon whose occurrence lowers efficiency, and injuries from sports have reached almost epidemic proportion. This calls for the need to spend more time on the prevention and less time in the management of injury after they have already occurred. The best injury prevention system would only be developed after looking at the various causes of injury and the related risk factors. It is from this that measures will be taken to prevent injury through taking caution to control the causative and risk factors that can be controlled. This paper focused on the review of literature on variables that cause injury in sports with the aim of isolating them for prevention to promote safe participation in sports. It further Education on sports injury and its causes should be given to all athletes on regular basis. This is to enable consciousness and raise safe participation to a higher level.

Key Words: Sports Injury, Sportsman, Overuse Injury, Biomechanical Imbalance,

Introduction

Sport is a phenomenon that any society cannot ignore for its numerous benefits. A growing body of research literature shows that in addition to health benefits, sport plays significant role in the economy of any society that place high value on it. Priority is place on sports

development via education in such societies. Salami (2003) asserted that with good physical education and sports programmes in schools, solid foundation is laid for good sports development in our nation. Salami (2003) in addition, identified some contributions of physical education and school sports to sports of a nation. In line with this argument, Omolawon (2003) suggested that students need to be encouraged to identify themselves with sports which they will have to participate in on regular basis. The suggestion implies that sports programmes must give opportunity to students to participate in various sports. However, a major of concern for participation in sports at any level is injury.

Injury is inevitable in sports; therefore, a deep knowledge of the various sports injuries, the causes and the risk factors is useful [Adepoju, 2007]. According to Amarvi (2002) the word injury is derived from the French word "INJURIER" meaning wrong or faulty. In relation to this, Nclatchie (2004) defined injured joint as that which has been subjected to a wrongful treatment orientation leading to the damage of its structure framework partially or completely. Observation shows that this definition is incomplete in the sense that it is limited to joint only and the sources of irritation is not stated and the mechanism of injury is lacking too.

Adepoju [2007] stated that the skeletal and muscular systems that provide the primary support mechanism for man were not designed to meet all the demands of forces placed on these structures. The forces sometimes become too great for them to bear, therefore injury occurs. Adepoju [2007] therefore defined injury as the damage done to the body environmental energy which is beyond what the victims skeletal and muscular systems can support leading to temporary or permanent stoppage in doing what one is capable of doing or doing so below one's standard. Adepoju [2007] mentioned that the term sports injury, in the broadest sense, refers to the kinds of injury that most commonly occur during sporting activities. Although virtually any part of the body can be injured during sports or exercise, the term is usually reserved for injury that involves the musculoskeletal system which includes the muscles, bones, and associated tissue like cartilage.

Injury is an unwanted phenomenon whose occurrence lowers efficiency. The injury to extremities give rise to pain, muscle atrophy, loss of function and deformity. Ligamentous injury tends to reduce stability secondary to laxity of the ligaments (O'Donoghue, 2004). Immobilization leads to decreased strength ligaments and muscles. The overall result of this is reduction in the performance of the sportsman. So, before any competition, the sportsman is expected to have undergone a systemic rehabilitation in the form of physical conditioning (Kellett, 2003).

Injury from sports have reached almost epidemic proportion and this calls for the need to spend more time on the prevention and less time in the handling of injury after they have already occurred [Parkkari, Kujala & Kannus, 2001]. The best injury prevention system according to Adepoju [2007] would only be developed after looking at the various causes of injury and the related risk factors. It is from this that measures will be taken to prevent injury through taking caution to control the causative and risk factors that can be controlled. Considering these factors and taking appropriate action can help to prevent many injuries, or at least minimize their occurrence and severity. This paper focused on the review of literature on variables that cause injury in sports with the aim of isolating them for prevention of occurrence of injuries to promote safe participation in sports.

Sports Injury's Variables

A sport injury is the result of a complex interaction of various risk factors in the course of time. Sportsmen are at increased risk of sports-related injury [Jacobson, 2006]. Participation in competitive sports sets high demands on the sportsman's physical skills. As a result, the injury frequency is rather high among sportsmen (Ivarsson, 2008). Citing Dishman, Jackson, Hill and Morrow, Ivarsson [2008] stated that 17 million sportsmen in the United States of America suffer injury every year. Hagglund et al (2005) found that between 65 — 95 % of Swedish elite football players (male) reported at least one injury every year. Hagglund et al (2005) reported that international football players had an injury frequency that was 9 injury / 1000 hours of football practice. Similar results are found in many other sports. Several variables are responsible for these injuries; the following are among the variables.

Warm-up

The reduction in the risk of injury is just one of the benefits of a warm-up. The others include 'preparing the body for physical exertion, preparing the heart for the physical activity, rehearsal of the movements and skills needed and mental preparation for the event [Ivarsson, 2008; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997; Rosenbaum & Hennig, 1995]. A warm-up should be undertaken prior to any form of strenuous physical activity. According to Bird, Black & Newton [1997], it should normally consist of four stages:

- i. gentle loosening exercises;
- ii. some form of aerobic activity such as jogging;
- iii. static stretching; and
- iv. sport or activity-specific exercise.

Performing gentle loosening exercises in the initial stages of a warm-up is important, especially if the individual has been relatively sedentary for some time. These exercises, such as gentle rotations of the ankle, hip, wrist and shoulder joints, should be performed in a slow and controlled manner. Gentle jogging on the spot can also help to start warming up the leg muscles and Achilles tendons [Adepoju, 2007; Nclatchie, 2004; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997].

Bird, Black and Newton [1997] stated that the aerobic component of the warm-up should be related to the major activity and it should be commenced at a gentle pace, and gradually increased as the body responds to the physical demands placed upon it. This aspect of the warm-up enhances the flow of blood to the muscles by increasing the heart rate, the stroke volume of the heart and the circulation of blood to the muscles via the selective dilation and constriction of appropriate blood vessels [Ivarsson, 2008; Adepoju, 2007; Nclatchie, 2004; Booher & Thibodeau, 2000; Bird, Black & Newton, 1997]. Commencing strenuous exercise without such

a warm-up can put unwanted strain on the heart as well as the muscles [Bird, Black & Newton, 1997]. The aerobic Warm-up also help to increase the temperature of the muscles, which facilitates the transmission of nerve impulses, increases the speed of the chemical reactions used to release the energy needed by the muscles and enhances the overall process of muscle contraction [Adepoju, 2007; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Bird, Black & Newton., 1997]. Following the aerobic component-of the warm-up Bird, Black and Newton [1997] stated that a seriesof static stretching exercises should be completed. Those out running should pause for a few minutes to complete these before resuming at their full training pace. These should be used to stretch all the major muscle groups of the body but will tend to concentrate on those muscles most used in the activity. Hence the precise composition of the stretching routine will depend upon the sport or activity being prepared for. This component should last for at least 5-10 minutes, each stretch being held for a minimum of 10-15 seconds. In activities requiring a high level of flexibility, such as gymnastics, the martial arts and hurdling, the stretching component of the warm-up is likely-to take far more than 5-10 minutes, with each stretch being held for longer, possibly more than 60 seconds in some cases [Adepoju, 2007; Khan & Bruker, 1998; Bird, Black & Newton, 1997].

The content of the final stage of the warm up will depend upon the activity. In team or racquet games, it is likely to involve the practice of skills such as shooting, passing or hitting the ball. In other activities it may involve practice throws, hurdling, practice vaults or working through a routine. Bird, Black and Newton [1997] suggested that throughout the warm-up routine, appropriate clothing which helps to keep the body warm should be worn. A consistent warm-up routine will also help to prepare the individual mentally for the training or competition.

According to Bird, Black and Newton [1997], specific research into the benefits of warming up in reducing the risk of injury is difficult. One of the reasons for this is because of the ethics associated with getting individuals to exercise without warming up (with the expectation that they are more likely to suffer from an injury). Hence experimental evidence on the subject is scanty. Despite this, there is general agreement that an appropriate warm-up will greatly reduce the likelihood of injury. This is based upon the knowledge that cold muscles, tendons and

ligaments are less elastic than warm ones and hence are more likely to tear when stretched [Ivarsson, 2008; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Booher & Thibadeau, 2000; Bird, Black & Newton, 1997]. Conversely, the additional elasticity of warmed-up tissues reduces the risk of both traumatic and over use injury. It is important to note that it is not just the elite sportsmen and sportswomen who are prone to injury; a warm-up is important for all. In the game of football, Bird, Black and Newton[1997] suggested that warming up prior to a game is of key importance in the prevention of injury. This suggestion is based on the fact that many football teams fail to observe good and appropriate warm up requirement for training and matches; therefore considering that a 5-minute pre match 'kick about' is sufficient, which it is not.

Physical Fitness

If individuals are not fit enough for their chosen sport or activity then the physical stresses that they experience during it may cause injury [Ivarsson, 2008; Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. Bird, Black and Newton [1997] emphasized that lack of strength, speed, flexibility and/or endurance can all contribute towards injury. If a person tries to run a marathon with very little training then his/her body will not be used to the repeated movements and pounding experienced by the legs and this can cause injury. Conversely, a fit marathon runner will have a body that is well conditioned for the activity and should not experience such problems. In many sports, a lack of flexibility can cause injury, one of the most common injury being 'pulled' hamstring muscles due to short or 'tight' hamstrings. A lack of endurance can cause tiredness to players in the later stages of a football match; this may affect their coordination, reduce their level of skill and cause them to lose concentration and make mistakes. All of these may make them or their opponents more vulnerable to injury [Adepoju, 2007; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Khan & Bruker, 1998; Bird, Black & Newton, 1997].

Fitness is also specific to the sport itself and being fit for one activity does not necessarily make a person fit for another [Ivarsson, 2008; Adepoju, 2007; Bird, Black & Newton, 1997]. For

example a very fit volleyball player may be fit to play his game but not fit for marathon or a game of football; likewise a fit swimmer may not be fit to play squash. It should always be noted that each sport has its own fitness requirements, which must be trained for. If persons attempt sports for which they are not fit then they are at the risk of injury. This is exemplified by the commonly used adage: 'Get fit to play sport, don't play sport to get fit' [Bird, Black & Newton, 1997].

Training

The correct training and level of fitness will reduce the risk of injury by making the participant's body more able to withstand the physical demands of the activity. However, inappropriate training can cause injury [Adepoju, 2007; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Bird, Black & Newton, 1997]. When considering a person's training programme a number of factors need to be considered. These include the type, duration, intensity and frequency of the exercise they are doing along with their capacity to cope with the physical stress it places upon their body [Awopetu, 2000; Bird, Black & Newton, 1997]. If a person attempts to do too much, too often, of too high an intensity, then they are likely to suffer from overuse injury and their training must be modified. What is appropriate for one individual is not necessarily so for another, since it depends upon their physical capacity to train and their level of fitness.

In this context Bird, Black and Newton [1997] mentioned that it is also important to mention the aspect of progression. The body adapts gradually to appropriate training loads; therefore training should commence at a relatively easy level initially and progress with an increase in intensity, duration and frequency over a period of weeks. Attempting to progress too rapidly will not give the body time to adapt and overuse will occur. This is especially relevant to the beginner and the sports performer who has had to stop training through injury. Often these individuals are prone to try and get back into full training too soon without realizing that their bodies have lost a certain amount of fitness and cannot cope with the training loads they were using before the injury. Therefore gradual progression is essential in any rehabilitation

programme [Awopetu, 2000;Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997].

Undertaking the wrong type of exercise or using a poor technique can also cause injury. This is most obvious in areas such as weight training, where lifting weights with a poor technique can cause strain to areas such as the back [Bird, Black & Newton, 1997].

Recovery between Exercise Sessions

According to Bird, Black and Newton [1997], sport and physical activity in general places physical stresses upon the body. If given adequate time to recover these stresses will act as a stimulus and cause the body to adapt to the stresses in a positive manner, making it fitter. This is the training principle. However if adequate recovery time is not allowed between training sessions or matches then the body is unable to recover fully. This can result in any minor damage to tissues not being fully repaired and as a consequence of this it will be damaged further during subsequent exercise sessions; this is how overuse injury is caused. It is therefore important to ensure that adequate recovery time is included in any training programme and many top coaches advocate rest days for their sportsmen [Bird, Black & Newton, 1997]. These help to ensure that potentially vulnerable tissues are not overstrained and the body has the chance to make any minor repairs.

An additional consequence of hard training is a depletion of the muscles' glycogen stores. Muscle glycogen is an essential fuel during strenuous exercise, the depletion of which causes - fatigue and inhibits performance. Glycogen stores are replenished by eating adequate amount of carbohydrate in the form of bread, potatoes, rice and, where appropriate, energy replacement drinks [Adepoju, 2007; Hagglund, Walden, Bahr & Ekstrand, 2005; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. However, with prolonged or repeated hard training these stores may not fully recover despite eating the right things.

Bird, Black and Newton [1997] viewed the implication of this to mean that the individual may start the next session in a semi-depleted state, causing him/her to fatigue quickly, a factor that

may make him/her more vulnerable to injury. The same may also be true of dehydration and fluid replacement after exercise. Eating and drinking regimens must be considered as an integral part of a training programme at all times [Jacobson, 2006; Hagglund, Walden, Booher & Thibodeau, 2000; Bird, Black & Newton, 1997]. An alternative way of providing a means of recovery is to work alternately on hard and easy sessions or to work on different aspects of fitness on alternate days [Jacobson, 2006; Hagglund, Walden, Bahr & Ekstrand, 2005; Bird, Black & Newton, 1997]. For example those undertaking weight training will often train the muscles of their upper and lower body on alternate days [Bird, Black & Newton, 1997].

Biomechanical Imbalances and Anatomical Factors

Literature indicates that an imbalance between muscle groups or bone lengths, or the mobility at joints, can sometimes cause excessive stress to be placed on particular parts of the body, resulting in injury [Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. Furthermore, this can then cause the individual to compensate for a problem in one part of the body, such as the knee, which can then result in problems in other areas of the body [Jacobson, 2006]. In addition to this, aspects of the individual's basic anatomy may also cause him/her to be prone to particular injury [Bird, Black & Newton, 1997]. For example those who excessively pronate while running are vulnerable to knee injury, as are those who have relatively wide hips, since this can cause the patella to track across the knee at an angle, which causes it to rub and become inflamed [Bird, Black & Newton, 1997].

Skill and Technique

Lack of skill and technique can contribute in a significant way to sustenance of injury among sportsmen during training and competition. According to Jacobson [2006] and Bird, Black and Newton [1997], lack of skill can contribute to the risk of injury to the individual and his/her opponents. In the game of football, players who do not control their body movement are likely to run into their opponents. Likewise a player who lacks skill and makes clumsy tackles is more likely to cause injury. Even in sports like basketball, a lack of skill can contribute to injury.

Appropriate Footwear

Since different sports and forms of exercise place different stresses upon the body, the footwear worn in each activity must be appropriate [Ivarsson, 2008; Adepoju, 2007; Jacobson, 2006; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Khan & Bird, Black & Newton, 1997]. The physical demands of football, which requires a lot of rapid turning, abrupt stops and changes in direction, are very different to those of road running, in which the legs are repeatedly subjected to the stresses of the feet striking a hard surface. Jacobson [2006], Bird, Black and Newton [1997] were of the opinion that the footwear worn for sport must be comfortable, provide appropriate traction, cushion the impact of the foot striking the ground and be designed for specific movements such as changes in direction. So it would be inappropriate to wear a pair of running shoes for a game such as football, since they are not designed to protect the wearer from the stresses of rapid changes in direction or sideways movements.

Bird, Black and Newton [1997] mentioned that on certain occasions the practitioner or coach may be required to advise an individual on the choice of footwear and, if suitably qualified, the possibility may exist of modifying his/her footwear through the use of insoles and supports. In some sports the footwear should also provide specific support and include features that reduce the risk of injury. For example, some shoes are designed for specific running gaits with considerations for those who , experience excessive foot pronation or supination [Jacobson, 2006; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Bird, Black & Newton, 1997].

Conversely, poorly designed shoes can contribute to injury, causing blisters or the inflammation of tissues. Likewise, shoes with inadequate cushioning or those that are worn out can lead to injury of the foot, knee, hip and back [Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Bird, Black & Newton, 1997]. This is also true if the shoe becomes excessively worn in one place. When looking at a pair of worn sports shoes it is not just the amount of wear on the sole that is important. They should be viewed from the back to see if they still provide the relevant support or if they are misshapen and collapsing.

Appropriate Clothing

In some activities, there are rules governing the wearing of items of clothing in order to reduce the risk of injury. According to Bird, Black and Newton [1997], this includes items such as rings, earrings and necklaces, which are not permitted in games such as football, especially such materials that are excessively big. Loose clothing which may catch on apparatus and equipment is also of concern in some activities such as gymnastics. In orienteering full arm and leg cover is often insisted upon to reduce the number of cuts, scratches, stings and insect bites that may occur when running through rough undergrowth [Hagglund, Walden, Bahr & Ekstrand, 2005; Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Bird, Black & Newton, 1997]. In general terms, each sport has its own set of expectations of what is appropriate clothing and standards of dress may be specified. Often this is for the general safety and wellbeing of the participants.

Protective Clothing and Safety Equipment

Protective clothing and safety equipment are used to reduce the risk of injury [Jacobson, 2006; Hagglund, Walden, Bahr & Ekstrand, 2005; Booher & Thibodeau, 2000; Bird, Black & Newton, 1997]. In some sports their usage is compulsory; in others it may be recommended [Bird, Black & Newton, 1997]. For example, in sports such as American football padding and helmets must be worn, whereas in cricket their use is advised. Likewise, the use of safety goggles in badminton and squash is also advisable to prevent eye injury from the shuttlecock or ball. Shin pads are needed in sports such as hockey and football, with the goalkeeper in hockey and the goalminder in ice hockey requiring additional specific protection because of their vulnerability to certain forms of injury. A limited amount of protective clothing is permitted in football. According to Bird, Black and Newton [1997], the use of shin pads should be encouraged and in some cases is compulsory. Quilted tops may also be used by the goalkeeper, to reduce the risk of impact injury and abrasions when striking the ground. Specific goalkeeper's gloves are also available and are used by players to cushion the impact of the ball as well as to provide greater adhesion when catching.

The Environment

Literature shows that in some instances the environment can contribute to the incidence of injury [Ivarsson, 2008; Jacobson, 2006; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. In the game of football, Bird, Black and Newton [1997] were of the opinion that the pitch conditions are also a factor, with hard pitches that are either frozen in winter or baked hard in summer increasing the risk of injury when players hit the ground. Conversely, if the pitch is too wet and muddy, players may not be able to stop and change direction effectively, hence increasing the risk of collisions. Ensuring that the pitch is fit to use and free of debris and feces is also a consideration, and this can be a significant problem on public pitches, especially if dogs are exercised on them and other animals are allowed to graze.

Rough playing surfaces may increase the risk of sprained ankles or injury due to the unpredictable movement of a hard ball, as in hockey or cricket. In games such as rugby where collisions with the goal posts are possible, Bird, Black and Newton [1997] suggested that these should be padded to cushion any impact. In addition to this, any unnecessary equipment, such as unwanted benches or spare posts should be removed from the playing area to prevent collision and injury.

The Rules

In sports some of the rules are there to reduce the likelihood of injury to players. They include rules on tackling, the positioning of players and general conduct on the field of play [Ivarsson, 2008; Adepoju, 2007; Jacobson, 2006; Junge, & Dvorak, 2000; Bird, Black & Newton, 1997]. In addition, some rules also concern the age of the participants. For example there are rules governing the age at which children are permitted to run in races of certain distances [Bird, Black & Newton, 1997]. Similarly, children below the age of 10 years are not allowed to play competitive football [Jacobson, 2006]. This is set out to prevent young children, whose bodies are not yet fully matured, from getting overuse injury through running too far. The rules in some sports are also modified according to the age of the participants, again in order to reduce

the risk of injury. The prevention of injury in football requires good refereeing, to ensure adherence to the rules and the prevention of dangerous play. Violent challenges and reckless tackling are the main causes of severe preventable injury. Based on this, Bird, Black and Newton [1997] suggested that officials of games should ensure that any rules that apply to a particular sport should be strictly adhered to.

Inappropriate Opposition

In some cases, the risk of injury is increased if the opposition is inappropriate [Ivarsson, 2008; Hagglund, Walden, Bahr & Ekstrand, 2005; Nclatchie, 2004; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. This may be the case in sports that involve physical contact such as football or in the case of cricket, where an inexperienced batsman is unable to avoid a very fast ball or 'bouncer'. Problems with inappropriate opposition are even more likely to occur with children, where there is often a large difference in terms of physical size and maturity among children of the same age.

Implications of Prior Injury

With appropriate training and rehabilitation it is usually possible for sportsman to get back to full fitness [Booher & Thibodeau, 2000; Junge, & Dvorak, 2000; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. However the progression back to fitness needs to be carefully planned and gradual. A rehabilitation programme which does not do this is likely to leave the individual vulnerable to a repeat injury. A torn muscle must be gradually returned to its previous levels of flexibility and strength before it can be subjected to the full rigours of competitive sport. A muscle which is still weak, tight and contains the remnants of an injury is likely to tear again [Ivarsson, 2008; Jacobson, 2006; Khan & Bruker, 1998; Bird, Black & Newton, 1997]. In this context a good practitioner who is treating an injured sportsman will also seek to eradicate the cause of the initial injury, if possible. This may be through advising on equipment, clothing, footwear, training, warm-up and safety [Bird, Black & Newton, 1997]. Such advice is essential if the practitioner is to be fully effective and it forms the foundation of the practitioner's

reputation; differentiating between those who know how to treat the sportsman and sports injury and those who just treat the injury.

In football, fitness is a major factor in injury prevention, since tight, unfit muscles are more prone to damage, as well as players' recovery from previous injury. Bird, Black and Newton [1997] mention that in the professional football game this is of particular concern; cortisone injections may enable players to play in the short term but can result in long-term permanent damage that prematurely end their playing careers. The reason for this is that the injection can temporarily mask the sensation of pain, enabling players to play without realizing that they are sustaining further injury. Under normal conditions the sensation of pain would inform them of the worsening injury and cause them to stop, thereby preventing further damage.

Conclusion and Recommendations

An overview of sports injury revealed that its occurrence is inevitable, and it cut across a wide range of sporting activities meant for either recreation or competition, at amateur or professional levels. For prevention, general causes of sports injury are to be considered. This consideration and taking appropriate action can help to prevent many injuries, or at least minimize their occurrence and severity. Such factors include lack of warm-up, inadequate fitness and physical weakness, inappropriate training, inadequate skill/technique, inappropriate footwear and clothing. Others are inappropriate environment, breaking the rules, inappropriate opposition and prior injury.

It is recommended that prevention of occurrence of injury should be prioritised for sportsmen at all level of performance. Education on sports injury and its causes should be given to all athletes on a regular basis. This is to enable consciousness and raise safe participation to a higher level. Physical fitness of sportsmen should often be considered and appropriate facilities and equipment should be ensured at all levels of sports participation. Empirical studies should be made into sports injury across sports at various levels, investigating causes, frequency, severities and types of injuries.

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