

THE CONTRIBUTIONS OF SPORTS SCIENCE IN THE PREVENTION AND REHABILITATION OF INJURIES SUSTAINED DURING SPORTS AND PHYSICAL ACTIVITY

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Abstract

This paper looked at the contributions of sports science in the prevention and rehabilitation of injuries sustained during sports and physical activity. Injuries sustained during the participation of sports and physical activity are termed sports injuries. Types of sports injuries are classified according to the type of tissue damaged i.e., soft-tissue and hard-tissue, while the soft-tissue injuries concerns the most common injuries in sports like, skin injuries, muscle injuries, as well as tendon and ligament injuries. Hard-tissue injuries involves damage to the bones of the skeleton. Causes of sports injuries were highlighted which range from, overuse, direct impact, poor flexibility, overtraining, improper warm-up and poor technique as well as horse play. Roles played by sport science in the prevention of sports injuries in this paper were viewed from the three E's of injury prevention strategies: education, engineering and enforcement. The education strategies focus on improving player, coach, and even parent understanding of a specific injury or injury prevention strategy. The engineering strategies involves the design of protective equipment in the development in an exercise training programme that can safeguard the athlete from injury. The enforcement strategies enforce rules, policies, and practices that have been put in place by governing bodies to prevent injuries and improve athlete's safety. Ways of avoiding sports injuries as expressed by this paper are: stay conditioned, do not forget to hydrate, make time for rest, always warm-up and stretch and the use of recommended safety equipment. This paper also address the rehabilitation of sports injuries by sports science, and they fall into five phases: protection and offloading, protected reloading and reconditioning, sports specific strength, conditioning and skill, and return to sports, as well as injury prevention.

Keywords: Sports- Is an activity involving physical exertion; prevention- Is the action of stopping something from happening; injury - Damage to the body. Sports Injury- Injury sustained during participation in sports/physical activity.

Introduction

Man as a roving entity since his existence, had been involved in different movement patterns in search of different satisfaction, in order to be comfortable. These movement patterns involved hunting, fishing, running, jumping, swimming, diving and farming, among others. The early men were unconsciously keeping themselves during their involvement in accomplishing these movement patterns (Smith, 2018). Over time men started consciously getting involved in physical activities. Throughout history, sports have played a variety of important functions in society as a form of recreation, preparation for war or the hunt; or later as a substitute for war. Sports have undergone many changes; some have stayed much the same, while others have adapted with the times (jamaica-gleaner.com).

With time men started getting involved in vigorous physical activity in form of sports participation, with intrinsic and extrinsic values as the case may be. This culminated into professional sports in modern time, where the global community had been involved one way or the other (Wilson, 2018). The more the involvement of athletes and sports practitioners, in

sports business, the more the intensity of training to make more money and fame, hence sports injury comes knocking. Sports injuries occur during exercise or while participating in a sport (Heitz, 2018). The term sports injury is used to refer to a variety of musculoskeletal damage caused by sports participation. However, ‘what is damage?’ may be interpreted and recorded in different ways”. There are general definitions; such as injuries are considered disorders of the musculoskeletal system or concussions, and specific definitions, such as injuries, requiring medical attention (i.e. any injury that leads to health care utilization) or injuries leading to time loss i.e. injuries that hamper the ability to fully participate in sports for at least one training session or competition (Hespanhol, Barbeza, Van, & Verhagen, 2015).

Sports science in the context of this paper is the combination of psychology, kinesiology, exercise physiology and biomechanics. By understanding how human perform, sports scientists can design, monitor and evaluate training programmes to help athletes and coaches to reach their maximum potential. Alternatively, they may study the physiological responses to exercise from a health perspective: the psychological benefits and barriers of exercise in sedentary people (www.bangor.ac.uk). Sports science is a discipline that studies how the healthy human body works during exercise, and how sports and physical activity promote health and performance from cellular to whole body perspectives.

Through the scientific study of sports, researchers have developed a greater understanding on how the human body reacts to exercise, training, different environments and many other stimuli (en.m.wikipedia.org). Therefore, the main focus of this paper is to highlight and discuss the contributions of sports science in the prevention, control and rehabilitation of injuries sustained during physical activity.

Types of Sports Injuries

Types of sports injuries are classified to the type of tissue damaged; soft-tissue and hard-tissue injury (lib.oup.com.au)

Soft-Tissue Injury: Soft-tissue injuries are the most common injuries resulting from participation in sports and they include

- skin Injuries – abrasions, lacerations and blisters
- muscle injuries – tears or strains of muscle fibres and contusions
- tendon injuries – tears – or strains of tendon fibres and inflammation (tendonitis).
- ligaments injuries – sprains and tears of ligament fibres.

Soft-tissue injuries can result in internal bleeding and swelling. Prompt and effective management of this bleeding aids recovery.

Hard-Tissue Injury: Hard-tissue injuries are those involving damage to the bones of the skeleton. They range from severe fractures and joint dislocations to bruising of the bone. A direct force can bruise a bone and cause bleeding between the outer layer of the bone and the underlying compact bone. This is common in a bone such as tibia (skin) where there is little muscle tissue over the bone to absorb the force (lib.oup.com.au). Bones have a blood supply and internal bleeding can result from a fracture. In major injuries, this internal bleeding in the bone, together with bleeding from surrounding damaged tissue, can lead to shock and serious circulatory complications (lib.oup.com.au).

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Abrasions Wound: This occurs when the outer layer of skin is removed, usually as a result of a scraping action. The open wound can contain dirt or gravel, which should be removed. More extensive, deeper abrasions require medical attention. When the skin is lacerated (cut), the depth and location of the laceration will determine whether suturing is required. Deep laceration are usually accompanied by significant bleeding (lib.oup.com.an).

Laceration Wound: This is wound that is produced by the tearing of soft body tissue, and this type of wound is often irregular and jagged. A laceration wound is often contaminated with bacteria and debris from whatever object caused the cut. Laceration may be caused by injury with a sharp object or by impact with a blunt objects or force. However, severe lacerations may extend through the full thickness of the skin and into subcutaneous tissues (<https://www.healthline.com>)

Blisters Wound: Blisters result from friction (rubbing). One layer of skin separates from another and a small pocket of fluid forms. Blisters can be caused by equipment, shoes, pressures from callous build-up, increased training loads or simply by the recommencement of training after an extended rest period (lib.oup.com.au).

Strain Wound: This type of wound is the stretching or tearing of a muscle or tissue connecting muscle to bone (tendon). It often occurs in the lower back and on the muscle in the back of the thigh. A muscle strain, or pulled muscle, occurs when muscle is overstretched or torn. This usually occurs as a result of fatigue, overuse, or improper use of a muscle. Strains cause great pains and may limit movement within the affected muscle group (<https://www.healthline.com>)

Sprain Wound: Sprain is the stretching of ligaments, the fibrous tissue that connects bones and joints. A sprain also known as a torn ligament is damage to one or more ligament in a joint often caused by trauma or the joint being taken beyond its functional range of motion (<https://en.m.wikipedia.org>). The severity of sprain ranges from a minor injury which resolves in a few days to a major rupture of one or more ligament requiring surgical fixation and a period of immobilization. Sprain can occur in any joint, but are most common at the ankle and wrist (Mayo Clinic, 2018).

Cramp Injury: Cramp is a painful, involuntary contraction of a muscle or group of muscle. Cramps can have caused that are not due to underlying disease. Examples include dehydration, strenuous exercise or lack of muscle use. Impaired blood circulation in muscle to when used in sudden vigorous manners can cause cramp. Cramp according to Layman is referred to as muscle pull. (Mayo Clinic, 2018).

Dislocation: This means disturbance from a proper, original, or usual place or state, and injury or disability caused when the normal position of a joint or other part of the body is disturbed. In sports injury dislocation is the displacement of one or more bones at a joint (Mayo Clinic, 2016). Dislocation can occur in contact sports, such as football, hockey,

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boxing and in sports in which falls are common, such as downhill skiing, gymnastics and volleyball.

Fainting: Fainting is loss of consciousness for a short period of time because of temporary insufficient supply of oxygen to the brain. Fainting is a particular problem for the elderly who may suffer serious injury from falls when they faint (<https://www.webmd.com>). Fainting could occur when there is a fight, freight, mental shock, bad news, or lack of fresh air resulting from sitting or standing in a hot stuffing atmosphere, illness, lack of food and fatigue (Wilson, 2018).

Puncture Wound: This is a deep wound that occurs due to something sharp and pointed such as a nail. The opening on the skin is small, and the puncture wound may not bleed much. Puncture wounds can easily become infected. Puncture wounds are one form of a deep wound that cuts deeper than ¼ of an inch beneath surface of the skin. A puncture wound may occur from stepping or piece from spike shoes, javelin implement (<https://advancedtissue.com>)

Fracture Wound: Fracture is when the continuity of a bone is broken. A fracture can range from a thin crack to a complete break. Bone can fracture crosswise, lengthwise, in several places, or into many pieces. Most fractures occur when a bone is impacted by more force or pressure than it can support. A fracture is a medical term for a broken bone. If a bone is broken in many places it becomes comminuted fracture (<https://www.healthline.com>)

Causes of Sport Injuries

Sports injuries are commonly caused by overuse, direct impact, or the application of force that is greater than the body part can structurally withstand (<https://www.better.health.vic.gov.au>). According to Health 24. Com (2016), everyone from well-conditioned to weakened warriors can suffer sports injury. Weakness in the muscles, ligaments and tendons following vigorous exercise is often caused by inadequate fitness and failure to warm-up properly as well as engaging in an activity one is not properly conditioned for yet.

The following are the causes of sports injuries

Poor flexibility: Flexibility is the free movement of joints in the body. Flexibility is important because it affects how the body moves and coordinates, and muscles work together to create smooth movement, so if there is tightness or inflexibility, it will limits movement greatly. Over time these muscles imbalances can affect posture and can cause injury (Wilson, 2018).

Overtraining: Simply put, is doing too much, too often with insufficient rest in-between. Lack of adequate recovery time coupled with amplified intensity of training symptoms overtraining. A physiological sign of overtraining is also an increased resting heart rate, and the best way to avoid overtraining is to ensure adequate rest between sessions (Mayo Clinic, 2018).

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Overuse: Repetitive strain injuries are caused by repeated actions which apply pressure to a certain group of muscles, joints or area of soft tissue. They usually worsen over time and include injuries as tennis elbow, golfers knee, thrower's shoulder (impingement syndrome), plantar fasciitis and jumper's knee (Patellar tendonitis) (Mayo Clinic, 2018).

Improper Warm-Up: Failure to perform a proper warm-up can put athlete at risk for injury, as the muscles and joints are not prepared for exercise. Warm-up is necessary to increase body temperature and circulation of blood to the working muscles. A 20 – 30 minute warm-up should include a combination of stretching and cardiovascular exercise to prepare the body for exercise, increases performance levels and helps to prevent injuries (Martins, 2019).

Poor Technique and Horse Play: An exercise or sports which is performed repetitively with bad form is a recipe for injury. Over exacerbated can either lead to a more serious condition or result in more acute injuries. Incorrect technique should quickly be corrected by the coach and trainer (Martins, 2019).

Impact: Perhaps the hardest to avoid is impact and sports, and injuries caused by impact are most common in contact sports such as football, rugby and boxing among others. The impact of coming into hard contact with another person/object can force unnatural or unexpected twisting and quick direction-change which can in turn cause damage to connective tissue or even joint dislocation. Common injuries here include cuts, bruising, head injuries, muscle pain and dislocated joints and spinal injuries among many others (Medline Plus Medical, 2014, Sports Medicine Information, 2009).

Sports Science Role in Injury Prevention and Rehabilitation Control

Injury prevention strategies are often classified into the “Three E’s of injury prevention”: education, engineering and enforcement (Scott & Emma, 2017).

Educational Strategies: Focus on improving player, coach, and even parent understanding of a specific injury or injury prevention strategy. A topical example of this in sports is in the area of concussion recognition and treatment. Current strategies in concussion prevention target improving coach, player, parent, and medical practitioner knowledge of the sign, symptoms, and recommended return to play guidelines after a concussion. According to Kerr, Yeargin, McLeod, Mensch, Harden & Dampier, (2015), a recent study demonstrated that a coach education programme in youth American football targeted at improving coaches’ knowledge of tackling techniques and strategies to reduce the number of collisions in a game resulted in significantly less head impacts when compared with a control group.

Engineering Strategies: Involves the design of protection equipment in the development of an exercise training programmes that can safeguard the athlete from the injury. An example of engineering strategy is the development of wearable technology to quantify and monitor the physical elements of training and competing, which can be used by coaches to inform the design of a training programme. Specifically, the use of GPS and accelerometer based technology is becoming increasingly popular in elite and sub-elite level of competition

(Halson, 2014). This technology is used to quantify the physical demands of the sports so that the stress associated with training and competing can be balanced with optimal, recovery to mitigate the risk of injury (Scott & Emma, 2017). In addition, the design and development of an exercise programme that may reduce the risk of injury through targeting a known risk factor can fall into the educational category.

Enforcement Strategies: Enforce rules, policies, and practices that have been put in place by governing bodies to prevent injuries and improve athlete safety. It is important to understand that to optimize the success of sports injury prevention strategies, they should incorporate a blend on all 3 approaches (Scott & Emma, 2019).

Bronsonhealth.com advocates six ways to avoid sports injuries, and they are as follows:

Stay Conditioned: keeping your body in shape over the summer is one of the best ways to avoid injury. Conditioning helps ensure that muscles stay strengthened that are used during play.

Don't Forget to Hydrate: Dehydration can easily be avoided by drinking water before and after exercise. Drinking fluids 30 minutes prior to participating in any activity should be encouraged. Water breaks should be taken every 15 – 20 minutes during activity. The more active one is the more fluid one consumes;

Make Time for Rest: Athletes should take one or two days off during the week to rest, for resting during practices and games is also essential, for this will help prevent overuse of muscle;

Warm-Up and Stretch: Set aside time before every practice to stretch. Starting with 10 minutes of jogging or any light activity is helpful. Then go onto stretching major muscles used during the activity because it releases muscle tension. Regular stretching not only helps to warm-up muscles, but it increases flexibility;

Use Recommended Safety Equipment: Wearing proper equipment will not guarantee that no injuries will occur but it lower the chances. Keep the neck, shoulder, elbow, chest, knee and shin areas protected by wearing proper gear;

Play Safe: Rules and regulations are set in place for a reason to help prevent injuries. Make sure athletes pay attention to what is being instructed by coaches, trainers and officiating officials to help them play more safely with teams and opponents.

Rehabilitation of Sports Injuries

According to Hedger (2020), there are 5 stages on injury rehabilitation in sports science:

Phase 1. Protection and Offloading: Adequate protection and offloading are vital for a few reasons. Firstly, it protects the affected area from experiencing any more damage. Secondly, protection not only avoids injury from getting worse, but it also promotes an internal

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environment to support healing, it is worth noting that for the first few days following injury, inflammation is progressively increased, associated with the breakdown and removal of damaged tissue and debris from the site of injury. Finally, and perhaps the most obvious is that injuries in this stage are often associated with significant pain. Offloading of the affected area is necessitated by the simple inability to continue to load the affected area;

Phase 2. Protected Reloading and Reconditioning: Following the initial phase of management, subacute management should be commenced. Put simply, some strain is applied to the affected area of injury. For muscle injuries, this may take the form of using light weights, in lower limb fractures it may take the form of increasing the amount of weight loading of the affected area at this stage can not only speed recovery, but also result in improved resilience of the repair. In addition to rehabilitation of the specific area of injury, it is critical to not lose sight of all other conditioning. Maintenance of strength and conditioning core muscle capacity mobility, cardiovascular capacity and mental rehearsal skill and practice skills, drills and technical aspects are often possible;

Phase 3: Sports Specific Strength, Conditioning and Skills: After injury has settled and maintenance of body rest, it is time to get serious. However, failure to address deficits in higher-level capacities can result in marked increases in the risk of reinjury. These include things such as:

- cardiovascular endurance
- muscular endurance
- muscular power
- rate of force development
- change of direction capacity
- agility
- balance.

Phase 4: Return to Sports: If an athlete has been physically and mentally prepared, this should be a smooth process. Even in instances where an athlete has met all objectives targets, ideally, they are eased back into playing loads;

Phase 5: Injury Prevention: The final and often overlooked phase of management in the prevention of re-injury. Injury prevention at its core, the process of identifying and managing risk factors with athletes during and following return to play. This difficulty is in navigating the completion of this prevention work, in what are often hectic athlete training and work schedules. This necessitates a careful balancing of work to promote incremental gains in performance, with that aimed at preventing injury.

According to morleyphysio.com, the four stages of complete rehabilitation are; rest and protect and the injury, recover motion, recover strength and recover bodily function. However, Heitz (2018) recommended the rest, ice, compression, and elevation method of rehabilitation of sports injuries.

Summary and Conclusion

Sports science are by nature involved in anything that involves sports and physical activity and is combination of science based aspect in human kinetics. In sports participation injuries are likely to occur due to several reasons, and these sustained injuries are referred to sports injuries. Sports injuries by nature hampers smooth participation in sports and physical activity and its devastating effects on sports persons and practitioners cannot be over emphasized. So consented efforts had bemade by medical experts and sport enthusiast to prevent, control and rehabilitate injuries during and after sports participation / physical activity. However, the contributions of sports science to the prevention and rehabilitation of injuries sustained during sports and physical activity is what this paper addressed. Sports injuries were classified according to the type of tissue damaged; soft—tissue and hard-tissue injury. Soft-tissue injuries are the most common, resulting from participation in sports and they include skin injuries, muscle injuries, tendons and ligament injuries. While hard-tissue injuries are those involving damage to the bone of the skeleton. Common causes of sports injuries are those factors that bring about sports injuries either directly or indirectly during participation in sports and physical activities. Injuries prevention was classified into three sections according to sports science and they are education, engineering and enforcement. Each of these three actions are every important to the prevention and rehabilitation of sports injuries, so as to get back affected athletes back to active competition.

Conclusively, sports science had done good work in the prevention and rehabilitation of sports in related injuries through scientific researches and method which have drastically reduced incidence of injuries during participation in sports and physical activity. Sport science had equally try to perfect the rehabilitation process of unfortunate athletes involved in various sports injuries, through modern means and methods together with medical doctors.

Recommendation

The following recommendations were made for this paper:

- Coaches and trainers should make sure that the conditioning seasons of training should be more thorough in order to avoid persistent injuries
- Present injuries should be rehabilitated and healed before training should commenced
- Training precaution and safety methods should be taught to every performing athletes and sports practitioner
- Protective gears should be worn during training and competition periods
- Broken down equipment and facilities should be repaired or replaced on time
- Warm-up exercises and drills should be done before training and warm-down done after training
- First aid boxes should be provided at training and competition venues
- Quality and durable equipment should be procured for training and competition
- Athletes should avoid horse play during training
- Overtraining should be avoided.

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