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Weightlifting-related injuries

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ABSTRACT

Background: Each year, more and more athletes partake in weightlifting, aiming to outperform their predecessors and achieve new records of feats of strength. However, even despite the newer knowledge of biomechanics, and the safety precautions taken to prevent injury, such events still do take place.

Aim: The study aims to determine the sources of these injuries, as well as the more frequent parts of the body that get injured, those more prone to it.

Conclusion: The numerous injuries that can be sustained during weightlifting has been noted including its causes, as well as its effect on an individual and the incidence rate of the occurrence in professional weightlifters.

Keywords: heavy weight sports, athletes, biomechanics, muscle injury

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INTRODUCTION

Weightlifting has helped me a lot in my efforts to lose weight and start living a healthier life. Naturally, we began to take interest in the sport of weightlifting some point after learning about it. After watching numerous events, as well as other people training in the gym with me, we noticed that the injuries caused during weightlifting can be rather dangerous, and might affect an individual in the long run. However, we also know that we have come a long way in our understanding of biomechanics. If we know how the body should move, it shouldn't be too difficult to avoid injuries happening to it. Therefore, we decided to do research on this topic, to acquire knowledge on weightlifting, the injuries associated with it, and the biomechanics of the human body, to get an understanding on how to prevent such injuries.¹

Weightlifting is a sport that can be traced to more than 4000 years ago, with evidence found in the tomb of an ancient Egyptian prince, Baghdi, at 2040 BC. Detailed writings also show that weightlifting was practiced in china around the year 551 BC.²⁻⁴ It wasn't until 1500 years after its beginning that the feats of strength performed by weightlifters became popular enough to be showcased in the Olympic Games. Since then, the contests of strength and shows of power have carried on their popularity into the modern era. Each year, more and more athletes partake in weightlifting, aiming to outperform their predecessors and achieve new records of feats of strength.⁵⁻⁷

In their quests to become stronger, weightlifters have applied newer more advanced techniques, making use of the advancements

in biomechanics over the years. The results of integrating these new methods have resulting in even greater yields, and a steady improvement in weightlifting.⁸⁻¹⁰ However, even despite the newer knowledge of biomechanics, and the safety precautions taken to prevent injury, such events still do take place. The purpose of this project is to determine the sources of these injuries, as well as the more frequent parts of the body that get injured, those more prone to it.

REVIEW

Weightlifting and Weightlifters

To be more specific, weightlifting is actually known as resistance training, as the act of weightlifting involves the actual lifting of weights. Resistance training (RT) can be defined as the act of training with the added resistance, in the form or a load, either with free weights or machines.^{11,12} The performance of someone who does RT can be measured using 3 criteria: strength, rate of force development and power. RT can be divided into two categories competitively, the first of which is weightlifting, consisting of two events, the snatch, and the clean and the jerk. Elite weightlifters usually possess physiques similar to wrestlers or throwers in track and field events.¹³⁻¹⁵ They have a high lean body mass and a low fat total body fat percentage. The other competitive sport is powerlifting; it's divided into 3 different sports, in the following order during competition: the squat, the bench press and the deadlift. Aside from that, there is also body building and aesthetic fitness that can be achieved through RT.¹⁶

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The Biomechanics of Weightlifting

Weightlifters are arguably the most powerful of all athletes, and because of this, their training methods and modalities are often emulated by other athletes of different sports by integrating them into their workouts. Along with the mechanical and musculoskeletal adaptations; cardio respiratory, motor behaviour and psychological alteration also form as a product of RT.¹⁷ Just like with any other sport, RT can be associated with motor control improvements, particularly in the activation of muscle groups and motor units, specifically a quicker activation of fast twitch muscle groups during submaximal muscle contractions, when compared to non-weightlifters.¹⁹ RT produces patterns in muscle activity that contributes to generating maximal force and rate of force production with more optimal timing. An example of this is the elimination of the knee extensor motion and the actuation by the flexors of the knee when the barbell is lifted past the knee which leads to the double knee bend motion, in which the culminating joint movement, compared to the knee flexion, is as brief as the knee extensors reactivate to perform the second pull.²⁰⁻²² The information shows RT not only improves the force an individual produces, but also the alterations during near maximal force application, allowing the body to perform greater feats of strength for a longer period of time. Vertical jumping also correlates closely with these concepts, showing that time of force application might be more important rather than just simply peak force, for sports requiring a greater force output.²³⁻²⁵

There are 2 different events of weightlifting, firstly the snatch, which can be broken into 3 parts, the first pull, the second pull and receiving the bar, each having distinct adaptational benefits. The initial pull consists of hoisting the barbell from its stationary position on the ground up to the point it passes the lifter's knees.^{26,27} In this action the torso bend is more horizontal than vertical relative to the floor; thus, besides the primary knee movement, the gluteus maximus, hamstrings, the erector spinae, middle trapezius and rhomboids, latissimus dorsi, teres major and minor, and posterior deltoid muscles are also in participation. The erector spinae create hind shear force to resist hind shear gravitational force that, in addition to the compression force developed, increases spinal stability. The middle trapezius and rhomboids, and latissimus dorsi, teres major and minor, and posterior deltoid muscles retain the barbell close to the body. The lifter can administer great pressure in this position; nonetheless, heavy weights cannot be moved at great velocities. Lifting the bar off the ground thus assists in initial strength training, in which the

capacity to produce great force from the outset of muscle activation in a brief amount of time is the initial strength. Initial strength affects the initial defensive positions for games such as volleyball and football. As the barbell passes the knees, they shift forward, and the hips and barbell move towards one another. The aforementioned movement triggers a sequence of stretch-shortening and alters the lifter-barbell structure so that the lifter achieves joint positions along beneficial leverage directed towards conveying a great force towards the barbell quickly, in which a high power output is produced. Given that the aforementioned generation of power is regarded as the main gain of clean and snatch, programs on strength and conditioning usually incorporate exercises which separate that lift segment. Among those exercises are high-pulls, hang-clean, and lifting boxes. Although absolutely beneficial to athletes to make use of said exercises, the second pull is not the only essential aspect of snatch and clean movement.^{25,27-29}

Second comes the clean and snatch exercises, which are more safe, and maybe a better efficient approach of building yielding strength, in so much as the jerk exercise can be utilised for building reactive strength. The vertical ground reaction forces produced in receiving the bar in properly trained individuals are decreased in comparison to those formed when landing from leaping and during leaps in depth.²⁸ Significantly less research exists for the jerk exercise compared to the clean and jerk. The commencement of the jerk by the knees bending and then immediately followed by fast extension is comparable to the secondary knee bend and the second snatch and clean pull. When the barbell is driven from the shoulders into an overhead position for the jerk, an identical power is transferred to the barbell in the form of the secondary pull of the snatch and clean. Drawing the bar to an overhead position for the jerk is comparable to the snatch, with the exception of greater loads being able to be lifted in the clean and jerk exercise.^{29,30}

The Benefit of Weightlifting in General Fitness

There are numerous benefits to weightlifting, such as in rehabilitation as a way to retrain an injured muscle that hasn't been used during the course of recovery, in order to speed up the recovery of an individual's strength. Weightlifting can also be used in general fitness or recreations sports such as aesthetic fitness, or in competitive sports, such as weightlifting and powerlifting. In addition to that, weightlifting can also be used to supplement an athlete's performance in other sports, such as in swimming.^{1,2,5}

Injuries that might Occurs during Weightlifting

Just like in every human activity, there is always a risk of injury. There are specific injuries that are common to weightlifting.^{3,6} Weightlifters' Cephalgia – This uncommon variety of a headache caused by exertion, is a superficial condition that occurs when the individual is lifting weights. It has an abrupt onset and dissipates quickly as soon as the exercise ceases. Only 10% of cases are reportedly serious. Sinus headaches can also be provoked by the strain from weightlifting and the frequently used valsalva maneuvers by weightlifting athletes. In elite weightlifters, head injuries such as this are only present in 0.7% of cases of injuries; fractures – fractures often occur when mishandling weights, such as when an exercise is performed wrongly and the weight is dropped. The most frequent fractures that occur are in the distal arms of adolescent weightlifters, involving the ulna and radius, with the sudden forceful hyperextension of the wrists. In elite weightlifters, fractures account for 1.1% of the injuries occurred; lower back pain – Lower back pain may result as a result of improper form being used during bench presses and military presses, as the lumbar hyperextends. In a study, 29 out of 43 lower back injuries in sports were a result of poor form during weightlifting, and 30 of the 43 incidents were required to report for surgery. Although the majority of the injuries were exclusively due to poor form, few of the cases were simply due to an aggravated underlying cause.²⁰⁻²⁴

Lower back pain is the most common injury that occurs among elite weightlifters, which accounts for 23.1% of all cases reported; avulsion of the anterior-superior iliac spine (ASIS) – as noted by the same clinic, 6 out of 43 of juvenile cases are due to ASIS avulsion, related to back hyperextension exercises. Avulsions are fairly uncommon among elite weightlifters, with only 0.1% of injuries being reported; knee injuries – knee injuries are also fairly common, especially during leg training, particularly the squat, or knee extensions using the leg curl machines. Those who suffer from knee injuries often do not recognize the correlation between the pain and the exercise until it is pointed out to them. Due to the knee joint's mechanical benefit, there is a possibility of the patellar tendon to suffer an avulsion. When this happens, the tension to the patellar tendon can reach up to 18 times the lifter's weight, such as in the case of a former Olympic athlete, who's injury was captured on camera during a clean and jerk event.^{15,17,19,31}

As for the leg curl machine, it is very easy to hyperextend the joint, if it is stretched too far, a click sound can be heard followed by extreme pain. The pain, although transitional, may be the

prerequisite for future degeneration of the knee joint. The second most common injury among weightlifters, with 19.1% of injuries reported being of the knee; shoulder ache – intermittent shoulder ache is prevalent among weightlifting athletes, caused by mild muscle and joint strain, trauma and overuse, such as when bench presses are performed using butterfly machines. Acromioclavicular strain or the even more rare osteolysis of the distal clavicle can also be the causes of these aches. The onset of latter injury may be more dangerous, while the lifter is performing push-ups, dips and bench presses.^{32,33}

Shoulders follow knee injuries closely behind, with 17.7% of cases reported; ulna neuritis – a syndrome of ulnar hand weakening and aching as a result of prior or reoccurring trauma to the ulnar nerve, known as tardy ulnar palsy, is a well-known syndrome. Weightlifting athletes are not exempt from this syndrome, as compression of the ulnar nerve in between both heads of the carpi ulnari flexors in addition to friction over the medial epicondyle have been reported; additional injuries – there are numerous injuries could be possibly occur during resistance training. Another two injuries consists of a volar forearm compartment syndrome suffered by a person who exercised their formerly untrained pair of arms, and death. Throughout the years there have been near-deaths and deaths which were reported when bench presses or other heavy lifts have been botched to the extent of a bar being dropped across an athlete's neck or upper body, usually when someone attempts to lock out a maximal lift to secure a personal record. The need for a spotter is emphasized when attempting more high risk exercises as these accidents serve to prove.^{18,20-26,31}

Factors Influencing the Occurrence of Injuries in Weightlifting

Sex

The study included subjects aged between the ages of 14 and 30 years. The U.S. Consumer Product Safety Commission (CPSC) testing loads were used to determine nationwide estimates of 3,713 test subjects, which consisted of 3,102 men and 611 women, from the sample. Weighted Chi-square analysis is then used to compare between the type, location of injury, and mechanism between men and women. Men had considerably more strains and sprains ($p=0,004$), while women had more injury from accidents in comparison to men ($p<0,001$). The torso was the body part most frequently injured for men (36.9%) as well as women (27.4%). The men had injured their torsos more than the women ($p < 0.001$), however the women had more frequently injured their foot ($p < 0.001$) and leg ($p = 0.03$) when compared to the men ($p < 0.001$). The results suggest that men

are more likely to experience exertional injuries when performing RT (strains and sprains) when compared with women, especially at the torso. In comparison, women appear more susceptible to injuries of lower-extremity that are a result of accidents happening during RT.^{3,10}

Age

Previously, RT was thought to be ineffective, and more importantly, dangerous when practiced by children. Research was conducted to evaluate injuries related to RT presented to emergency rooms in the U.S.A. by mechanism of injury, age, and type. It is presumed that athletes who are older would have a higher percentage of muscle strains and joint sprains, while athletes who are younger would have higher percentages of injuries that are accidental in nature resulting in youths having a higher percentage of fractures. The CPSC National Electronic Injury Surveillance System had been requested to evaluate data from the year 2002 to the year 2005 using the “Weightlifting” code of the CPSC. Subjects among ages 8 and 30 years were divided into several categories which are; elementary / middle school age (8 to 13), high school age (14 to 18), college age (19 to 22) and adult age (23 to 30). The injuries are classified as “accidental,” if they happened due to improper use of equipment or weight being dropped. For comparing accidental accidents between age groups, multiple logistic regressions have been used. There were 4,111 patients in the sample. It was found that injuries from accidents decline ($p < 0.05$) as an individual grows older: elementary / middle school age > high school age > college age = 23 adult age (23 to 30). On the contrary, in each successive age group, sprain / strain injuries increased ($p < 0,05$). From the interpretation of non-accidental injuries ($n = 2,565$) alone, it is shown that the college (19-22) and adult age (23-30) categories displayed an increased percentage of strains and sprains in comparison to elementary / middle school age (8 to 13) and high school age (14 to 18) categories ($p < 0.001$). A majority of the injuries experienced by the elementary / middle school age group were to the foot and hand and were frequently caused by “pinching” and “dropping” in the detailed explanation of injury, in addition the fractures suffered in the elementary / middle school age group was a higher percentage in relation to other groups ($p < 0.001$). The verdict of the research indicates that there is a lower risk of RT-related muscle strains and joint sprains in children when compared to adults. A large amount of RT-related injuries in youths result from potentially preventable accidents if aided by stricter protocols and tighter supervision.^{7,9}

CONCLUSION

When talking about the biomechanics of weightlifting, it is shown that there are specific movements for each part of a lift, from the starting to the finish. The use of the entire body is vital to ensure safe lifts with a maximal output while simultaneously preventing injuries. Aside from that, the numerous injuries that can be sustained during weightlifting has been noted including its causes, as well as its effect on an individual and the incidence rate of the occurrence in professional weightlifters. With the information I have gathered, it is possible to avoid each and every injury by following the precautions placed. Lastly, age and sex have been analysed as causes of weightlifting injuries, and the results show which age and sex are more likely to get injured how, and the methods needed to avoid the injuries. Weightlifting is a great sport, as well as all its other benefits, and if precautions are taken to avoid injuries, much more progress can be made as a sport in its entirety.

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