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Characteristics of injury to weightlifting athletes in Indonesia
Características de las lesiones en deportistas de halterofilia en Indonesia

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Abstract. Weightlifting is requires maximum strength, speed, and explosive power in order to lift maximum weight. Weightlifting carries a risk of injury which can result in pain, damage and limitation of bodily functions. The aim of this study is to describe and characterize of injuries that occur in weightlifting sports. This retrospective cohort study using a questionnaire that valuated 111 male lifters who were currently had experienced injuries. The result that, characteristics of athletes are an average age of 16.4 ± 3.7, height 161.2 ± 8.9, body weight 60.7 ± 14.9, body mass index 23.2 ± 4.7, arm length 67.9 ± 8.8, and leg length 90.4 ± 8.8 who have chronic injuries (67%) occurred during exercise (87%) and most injuries occurred in the upper limb (62%). Locations of injuries are shoulders (57%), wrists (10%), back (33%), hip/groin (10%), hamstring (16%), and knees (35%) with the types of injury experienced athletes are muscle strains (33%), ligament sprains (32%), and impingement (35%). 87% of athletes are injured during practice while 13% are injured during competition**.** To sum up, this study shows that the characteristics of major injuries occur in the upper extremities, namely the shoulder and the incident injuries occur during exercise.
Keywords: Weightlifter, Performance, Injury, Training Programs

Resumen. El levantamiento de pesas requiere máxima fuerza, velocidad y potencia explosiva para poder levantar el máximo peso. El levantamiento de pesas conlleva un riesgo de lesiones que pueden provocar dolor, daños y limitación de las funciones corporales. El objetivo de este estudio es describir y caracterizar las lesiones que se producen en los deportes de halterofilia. Este estudio de cohorte retrospectivo utilizó un cuestionario que evaluó a 111 levantadores masculinos que actualmente habían experimentado lesiones. Se obtuvo como resultado que, las características de los atletas son una edad promedio de 16.4 ± 3.7, altura 161.2 ± 8.9, peso corporal 60.7 ± 14.9, índice de masa corporal 23.2 ± 4.7, longitud de brazos 67.9 ± 8.8 y longitud de piernas 90.4 ± 8.8 que presentan lesiones crónicas. (67%) ocurrieron durante el ejercicio (87%) y la mayoría de las lesiones ocurrieron en el miembro superior (62%). Las ubicaciones de las lesiones son hombros (57%), muñecas (10%), espalda (33%), cadera/ingle (10%), tendones de la corva (16%) y rodillas (35%) con los tipos de lesiones experimentadas. atletas son distensiones musculares (33%), esguinces de ligamentos (32%) y pinzamientos (35%). El 87% de los deportistas se lesiona durante la práctica mientras que el 13% se lesiona durante la competición. En resumen, este estudio muestra que las características de las lesiones mayores ocurren en las extremidades superiores, es decir, el hombro y las lesiones incidentales ocurren durante el ejercicio.
Palabras clave: Levantador de pesas, Actuación, Lesión, Programas de entrenamiento

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Introduction

Weightlifting is one of the sports competed in the Olympics. Indonesian weightlifters have consistently donated medals, since the 2000 Sydney Olympics. With such a reputation, it can be seen that weightlifting is very competitive (Hasan, Bahri, and Adnyana 2021), weightlifting sports are competed based on weight categories with two types of forces namely snatch and clean and jerk (International Weightlifting Federation 2020). Snatch is the movement of lifting the barbell from the floor to the top of the head along the thigh in one motion (Olaya-Mira et al. 2020), while clean and jerk lifting the barbell to the shoulders in one movement and continuing to push the barbell over the head in the second movement (Miller, Ventresca, and Bracken 2018). The goal of weightlifting is to lift the maximum weight (Neumann 2019)(Chavda et al. 2021). To achieve this goal, good balance, strength, speed, explosive power, and lower muscle strength are needed (Huebner et al. 2020)(DeWeese et al. 2016).

Weightlifting carries a risk of injury which can result in pain, damage and limitation of bodily functions that appear gradually and cause athletes to lose opportunities to practice or compete (Murphy, Connolly, and Beynnon 2003)(Timpka et al. 2014)(Felipe and Correia 2022). Factors that influence injury are intrinsic factors such as anthropometric structure, nutrition and psychology. In addition, extrinsic factors such as environment, weather, equipment, and fatigue while practicing can also increase the risk of injury (Jayanthi et al. 2018). However, there are also those who say that the cause of injury is the bad behaviour of athletes who keep repeating themselves (Colonna et al. 2021).

According to previous research, the incidence of injury in weightlifting occurs during 2.4 – 3.3/1000 hours of training (Aasa et al. 2017). Injuries that occurred in 80 Olympic weightlifting athletes amount 111 body parts, namely in the areas of the shoulders, knees, wrists, elbows, back, chin, hands, neck, hips, and ankles (Kulund et al. 2017). In the case of weightlifting masters it was reported that male athletes were more prone to injury than female

master athletes (Huebner and Ma 2022). Injury monitoring is very important for prevention and knowing the risks of injuries that will occur during matches and training (Solikah, Apriantono, and Nurhasan 2023)(Felipe and Correia 2022)(Camargo Rojas, Cañon, and Mendoza Romero 2023). In addition, if an injury is not treated immediately, it will result in a more serious injury.

Until now there has been no research that knows about the characteristics, risks and areas of injury experienced by weightlifters in Indonesia. The data collected will add to the literature on weightlifting, therefore, the purpose of this study is to identify and describe the characteristics of injuries experienced by weightlifters in Indonesia. So that researchers have the hope of being able to help athletes, coaches and medical staff to be able to develop and implement strategies for monitoring and preventing injuries to weightlifters in Indonesia.

Methods

This study uses a design retrospective cohort study by method survey to obtain an overview of the characteristics of injuries in weightlifting athletes. The time of the research was carried out in October-December 2022. This research received ethical approval with number 25/KEPK/EC/X/2022

Participants

The population of this study was male weightlifters in Indonesia (N=150). Sample selection was based on predetermined inclusion criteria, namely (1) weightlifters who have experienced or are currently experiencing injuries, and (2) athletes who at least have experience competing at the national level. The exclusion criteria were (1) athletes who had not been involved in systematic weightlifting training for the last 2 months. Sampling technique using purposive sampling. After selecting based on the exclusion criteria that the researchers had determined, it was found (n = 111) participants who met the inclusion criteria in this study.

Procedures

Questionnaires were distributed to participants directly at their respective practice sites. Then followed by an interview session to get additional information. The mechanism for this interview session is just a small talk with the athlete about their experiences in training, injuries, daily activities, and nutritional intake. While the focus of the question includes athlete injury data or injury reports. The question refers to research conducted by Fuller et al. (Fuller et al. 2006). Furthermore, there are also questions regarding the athletes' anthropometric data to find out their body composition. Body composition measurements were carried out using the Omron Karada Scan Body Composition Monitor HBF-375. Meanwhile, measurements of arms length and shortness are carried out using a measuring tape. Researchers visited participants and obtained data at weightlifting training centers in Bandung City, Surabaya City, and Bandar Lampung City, Indonesia. Quantitative descriptive methods are used to describe and summarize data using numerical and graphic techniques. The research design can be seen in Figure 1.

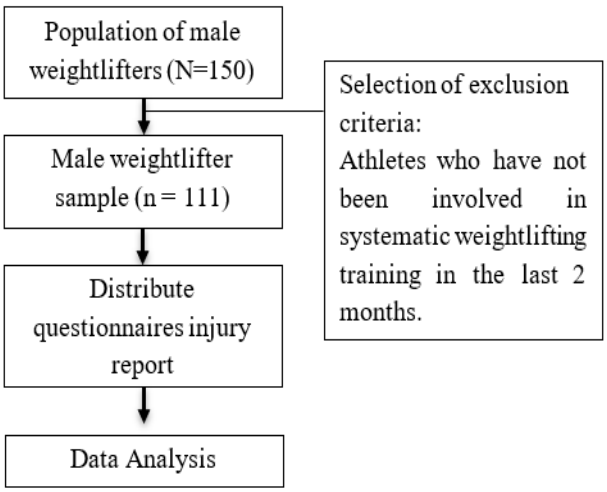

Figure 1. Research Design

Results

In this study there were N = 150, then selected based on inclusion and exclusion criteria. Then n = 111 weightlifters who have or are currently experiencing injuries. It can be seen in Table 1. The characteristics of the subjects were obtained which showed the average age, height, weight, body mass index (BMI), arm length, and leg length. Weightlifters average age 16.4 ± 3.7, height 161.2 ± 8.9, body weight 60.7 ± 14.9, body mass index 23.2 ± 4.7, arm length 67.9 ± 8.8, and leg length 90.4 ± 8.8. The injury time obtained by athletes was 87% during training and 13% during matches with a classification of 35% acute and 65% chronic injuries, besides that injuries to the upper extremities were greater, namely 62% while the lower extremities were 38%. This data can be seen in Table 2. In addition, in Table 3 showed, the location of injuries obtained by athletes in the upper extremities, namely the shoulders (57%), wrists (10%), and back (33%), in the lower extremities, namely hip/groin (10%), hamstring (16%), and knee (35%). While the types of injuries experienced by athletes were muscle strains (33%), ligament sprains (32%), and impingement (35%). The injuries experienced by these athletes were due to excessive training (50%), insufficient warm-up (15%), and technical errors (35%).

Table 1.
Characteristics of Research Subjects

Variable (n = 111)	Mean ± SD
Age	16.4 ± 3,7
Height (cm)	161.2 ± 8.9
Weight (Kg)	60.7 ± 14.9
BMI (Kg/m2)	23.2 ± 4.7
Arm length (cm)	67.9 ± 8.8
Leg length (cm)	90.4 ± 8.8

Note. SD: Standard Deviation

Table 2.
Injury Characteristics

Variable (n = 111)	no of injury	% injury	Injury incidence/1000 h
Injury Causes			
Match	14	13	7.3
Training	97	87	50.5
Injury Classification			
Acute	39	35	20.3
Chronic	72	65	37.5
Injury Type			
Upper Extremity	69	62	35.9
Lower Extremity	42	38	21.9

Table 3.
Injury Location

Variable (n = 111)	no of injury	% injury	Injury incidence per 1000 h
Upper Extremity			
Shoulder	39	35	20.3
Wrist	7	6	3.6
Back	23	21	12.0
Lower Extremity			
Hip/groin	7	6	3.6
Hamstring	11	10	5.7
Knee	24	22	12.5
Injury Type Specific			
Muscle Strain	37	33	19.3
Ligament Sprain	35	32	18.2
Impingement	39	35	20.3
Injury causes			
Over playing	55	50	28.6
Inadequate warm up	17	15	8.9
Inappropriate technique	39	35	20.3

In terms of subject characteristics, the average respondent who filled out this survey was an athlete in the "junior" age category according to International Weightlifting Federation regulations. In addition, they have normal BMI values with an average of 23.2 kg/m2 according to World Health Organization standards. The arms and legs of weightlifting athletes are relatively shorter than younger subjects in other sports in Indonesia (Bakti et al. 2024), This can provide an advantage for athletes because it reduces the amount of muscle work required to lift (Keogh et al. 2007). The data obtained is by previous studies that the comparison of arm and leg lengths with elite athletes shows smaller lengths for amateur athletes (Vidal Pérez et al. 2021).

Discussion

From the results of this study, researchers were able to reveal several facts about injuries to male weightlifters in Indonesia. Some of the facts obtained in this study are: (1) The injury time obtained by athletes is 87% during training and 13% during matches with an acute injury classification of 35% and 65% chronic, (2) injuries to the upper extremities are greater namely 62% while the lower extremities are 38%, (3) the location of the injuries obtained by athletes in the upper extremities are the shoulders (35%), wrists (6%), and back (21%), while in the lower extremities, namely the hip/groin (6%), hamstring (10%), and knee (22%), (4) types of injuries experienced by athletes, namely muscle strains (33%), ligament sprains (32%),and impingement (35%). (5) while the injuries experienced by athletes are due to excessive training (50%), lack of warm-up (15%), and technical errors (35%).

These results shown that weightlifter have a greater potential risk of injuries than the other athletes (Gimigliano et al. 2021). The part that has a great risk of injury is the upper extremity, especially the shoulder, previous research revealed that upper extremity injuries are common in strength sports athletes, especially weightlifting (Golshani et al. 2018). Coupled with other studies, injuries to the shoulder may caused by the rotation when transition from shoulder to overhead in the Jerk and the movement phase of the Snatch (Serrano and Serrano 2020). In addition to shoulder injuries, elbow, wrist, back and knee, and ankle injuries are also common in athletes caused by the loads lifted throughout the training and competition (Bukhary et al. 2023). This should receive more attention because injuries have a negative impact on training and reduction the performance and competitive results (Raya-González et al. 2022).

In terms of injury classification, the results of the study revealed that 50% of the injuries that occurred in weightlifters in Indonesia were caused by excessive training. Researchers identified that the cause of injury during exercise occurred due to excessive training which would have an impact on limited range of motion. As with baseball athletes, athletes who have injuries will also experience a decrease in range of motion (Bullock et al. 2018). In fact, in line with previous research, chronic injury in weightlifting can occur due to overtraining (Golshani et al. 2018). This can be related to the daily nutritional intake of athletes because low energy availability will affect recovery, muscle mass, and neuromuscular function, and increase the risk of injury (Melin et al. 2019). Besides that it is said that the selection of nutrients can also prevent acute injuries (Huebner and Ma 2022). In the results of the interviews conducted, researchers obtained additional information regarding daily activities and the nutritional intake they consumed every

day. In daily activities, there is no heavy physical activity other than a scheduled exercise program. Another routine activity is schooling, which has overall school subjects at the upper secondary level. The average nutritional intake is still not balanced and most of them only fulfill their carbohydrate needs, without any protein intake which can help regenerate cells in the body for better recovery (Puya-Braza and Sanchez-Oliver 2018).

While the number of chronic injuries is greater than acute injuries in this study, it is different from previous research which revealed that acute injury rates were greater than chronic injuries in elite weightlifters (Keogh and Winwood 2017) (Golshani et al. 2018). This could possibly happen because elite athletes have a larger weight force compared to athletes in Indonesia. The incidence of very large injuries occurred during training, namely 50.5/1000, this is supported by previous research conducted during the XXX Olympics held in London, with the result that injuries experienced by weight lifters were mostly experienced during training (Engebretsen et al. 2013).

Many injuries in training that occur are the result of acute fatigue (Pierce, Hornsby, and Stone 2022). These results are important to use as an evaluation of the incidence of injuries that occur in weightlifters and the incidence of injuries will also vary according to the research data obtained. Meanwhile, the most common types of injuries in weightlifters are strains and sprains (Golshani et al. 2018). These injury usual caused by an external factor such as not performing warm-ups and using inadequate facilities (Prieto-González et al. 2021), and to reduce the risk of injury, athletes should have good technique (Pierce, Hornsby, and Stone 2022). However, the risk of injury can be reduced by doing resistance training (Hurtado and Mayorga 2023). Meanwhile, intrinsic factors such as age, gender, and weight category have a relatively small effect on injury (Keogh and Winwood 2017). To reduce the risk of injury, an athlete should have to control their mindset and know the symptoms that have the potential to cause injury, then evaluate what the cause is (O'Brien et al. 2019).

Frequently injured athletes often show a symptom of triggering higher risk injury for instance being more careless, bungling and wimpier (Saragiotto, Di Pierro, and Lopes 2014). For a preventive action to minimize the risk of injury an athlete needs the right composition of nutrition (Saragiotto, Di Pierro, and Lopes 2014), good knowledge and test muscle measurements consistently to know the specifications of muscle strength that used continuously by monitoring by the coach (Fares et al. 2020).

This research is expected to help clarify and describe the characteristics of injuries in the sport of weightlifting and players and even coaches are expected to be able to evaluate training programs and develop appropriate training programs so that they can help reduce the risk of injury. The researcher realizes that there are some deficiencies in this study, such as (1) the researcher only measures the characteristics of injuries that occur in male athletes, (2) the researcher only uses a questionnaire instrument and does not measure directly to see the injuries experienced by weightlifters. Some of these limitations can be answered by several further studies, so that they can complement the findings obtained in this study.

Conclusion

From the results of the study, this study revealed that the most common location of injuries to weightlifters in Indonesia is the shoulder with a greater chronic injury classification and the incidence of injury occurs due to excessive training. Based on these findings, the researchers advise athletes to continue to maintain muscle strength, especially in the upper limbs so as to reduce the risk of injury. Meanwhile, coaches are expected to be able to evaluate optimal training programs and implement injury prevention programs, so that the risk of injury to weightlifters is easily well-controlled.

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