

The Relationship between Anthropometric and Physical Fitness Factors and Sport Injuries among Iran's National Team of Youth Freestyle Wrestling

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Abstract

Purpose: the aim of this study was to consider the number of prevalent traumas among the members of Iran's national team of youth freestyle wrestling and their relation with anthropometric factors and physical fitness.

Material and Methods: this was a descriptive- correlational study. after measuring some of the anthropometric and physical fitness factors, [Body Mass Index (BMI), Waist-Hip-Ratio (WHR), Percent of Body Fat (PBF), flexibility, aerobic and anaerobic power and strength] through standard tests, and acquiring the prevalent injuries of the team members from the team's physician, and applying descriptive statistics (mean $16 \pm 1/1$) and inferential statistics (Chi square), the relationship between the anthropometric measurements and physical fitness factors and the level of injuries were assessed.

Results: The results of this research showed that the muscular-tendinous injuries and articular-ligament injuries are the most frequent among the youth freestyle wrestling team. There was a relationship between muscle injuries and the level of flexibility, between joint injuries and (PBF) and (BMI) and also between bone injuries and isometric strength. There was also a relationship between the skin traumas and (WHR) ($P < 0.05$).

Discussion and Conclusion: results of this research revealed that there was a relationship between flexibility and muscle injuries. Reduction in BMI and PBF would also lead to less joint injuries. Furthermore low level of WHR had significant influence on reducing skin trauma, it seems that by improving the physical flexibility, the rate of skeletal and muscular-tendinous injuries, and by decreasing the body mass index, and fat percentage, the rate of articular-ligament injuries may decrease among the members of Iran's national team of youth freestyle wrestling.

Keywords: Anthropometric measurements, Physical fitness, Prevalent injuries, Iran's national wrestling team

Introduction

The physical education and sport in their development way have reached a stage whose important part in executive programs are apparent in the form of competitive and championship sports. This form of competitive and championship sports has several positive functions, but it also has side effects one of which is sport injuries [1]. Collegiate wrestling had a relatively high rate of injury at 9.6 injuries per 1000 athlete-exposures [2]. The danger of injuries may prevent adolescents and youths from performing the sports, especially championship sports. This may even

threaten their future health, which is in contrary to one of the main goals of physical education, which is providing the society with health and fitness [1].

Takedowns and sparring were the most common activities at the time of injury. Mechanism of injury was evaluated; rotation about a planted foot and contact with environmental objects were identified as areas in need of further attention. Illegal action accounted for only 4.6% of injuries in competition. Competition had a significantly higher injury rate than practice, but the injury profiles of these two areas showed both to be equally important [2].

Since nowadays the tendency to championship sport begins from adolescence, or even childhood, recognizing the common injuries in every field of sport, and the influencing factors on increasing the possibility of sport injuries may play a preventive

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and vital role in this regard. Undoubtedly wrestling is the first sport in Iran and is held in high esteem by its people, Wrestling in Iran is viewed as an honorable sport partly because it conveys a symbol of generosity and manliness, and partly because of its successes _sixty- three percent of Olympic, world and international medals for Iran have come from wrestling[3]. Wrestling has been referred to as the most intense and physically demanding sport in which the risk of injury is quite high. This risk has often been ranked only behind American football[4]. One scientific research in Iran reported that wrestling injuries were the reason for 44% of all overnight hospitalizations and one-third of them led to operations. The injury rates sustained by the subjects were 5.7 injuries/1000 wrestling exposures, or 42.3 injuries/100 wrestlers/year, or 31.4 injured wrestlers /100 wrestlers/year[5]. However, identifying physical features and the factors of physical fitness in order to discover talents and prevention from sport injuries in this field is overlooked. In this research, first we have studied the common injuries among the young wrestlers in youth freestyle wrestling team, and then determined the relationships between some anthropometric features and physical fitness factors on the one hand, and the rate of common sport injuries among the team on the other.

Zakani (1996) in a research under the title of the frequency of injuries among Iran's wrestling team, studied the sport injuries among 72 wrestlers who were invited to Iran's national team and stated that tendinous-muscle strain with 63.77% were the most common injury among them[6].

Akbarnejad(1999) examined the rate of common physical injuries among elite wrestlers in Iran, and found muscular and skeletal injuries, in respect, the most and least common injuries, and reported the most important reasons for them, to be exhaustion and previous injuries[7].

Aminian R.(2006) studied and compared the body composition and some physical factors of elite wrestlers with non-athletes, and found a meaningful difference between the indices of power, speed, and agility of athletes and non-athletes[8].

Richard(1982) examined common injuries among 1049 young wrestlers, among them the muscular injuries (knee and ankle strain) and articular injuries (dislocation in the wrist

and elbow joints) were the most common ones[9].

Comparing common injuries between young and adult wrestlers, Lorish (1992) found that the most common injury occurred in head and face in the young, and in neck and back in adult wrestlers[10].

In a research on student wrestlers, Jarret et al. (1998) found that high level of isometric strength in athletes was an important factor in increasing the injuries of lower limbs[2].

Pasque et al.(2000) studied the injuries among high school wrestlers in their research and stated that wrestlers with higher flexibility experience fewer injuries in their shoulder[11].

Agel (2007) in his research examined the common injuries among student wrestlers, and stated that skeletal injuries (with 35%) and muscles and ligament injuries (with 30%) had the highest frequency among the sport injuries in wrestlers[12].

Kordi et al.(2010) in their research investigated the very dangerous injuries among Iranian wrestlers since 1998 until 2005. They reported that 12 injuries led to death, 11 injuries resulted in physical handicap, and six severe injuries occurred during these years. They continued to mention that the main reasons of these injuries were weakness in injury management, lack of observation by coaches, and improper wrestling mat[13].

Babak Sh,(2010) in his research studied the sport injuries that occurred in Beijing Olympics (2008) in freestyle wrestling, greco-roman wrestling, and women wrestling, and reported that among 343 participants in those matches, 32 physical injuries occurred that was equivalent to 9.30% of the participants, and stated that 84% of injuries were trivial, and the rest (16%) were severe[14].

Richard (2010) compared the injuries among children and adolescent wrestlers in the United States. In this research he compared 7-12 and 12-17-year old wrestlers and reported that despite higher physical injuries among adolescent wrestlers, there was no significant differences between the two, and still the most frequent injuries were in muscles and joints[15].

In another research, Stanev et al.(2011) analyzed the frequent injuries among 18-26-year old wrestlers in the United States, and stated 45% of wrestlers had chronic injuries, and in freestyle wrestling the injuries of knee

and ankle articulators were the most frequent ones[16].

Analyzing the scientific databases, and the website for scientific documents, we found that most researches have been done in order to identify the most frequent injuries and their possible reasons in wrestling, and there was no specific research regarding the relationship between the physical fitness factors and anthropometric indices, and the most frequent injuries. Only two cases examined the relationship between physical fitness factors (flexibility and isometric strength) and several injuries in wrestling.

numerous studies reported that physical fitness and anthropometric traits play an important role in predicting the wrestlers' success [17,18,19,20,21,22,23,24,25], but the question about the relationship between physical fitness and anthropometric traits and prevalence of sport injuries among youth wrestlers is still in need of clarification.

Therefore, this research is different from the previous researches as it refers to this last mentioned problem.

Material and Methods

This was a descriptive-correlational research. The statistical population of this research included 25 wrestlers who were invited to the camp of Iranian youth freestyle wrestling team in order to participate in Asian cup 2009. The statistical sample of the research (with an average age of 16.2 ± 1.1) conforms to the statistical population..

As the technical staff and coach of the team agreed with our presence in the location of the camp of the wrestling team, we examined the anthropometric features and physical fitness of the participants there. And their injuries were acquired from the team's physician and were recorded in appropriate forms designed for this purpose. first we discussed the method and stages with each participant, then the related experiments were done. The athletes were at rest, and were wearing shorts but no shoes at the time of recording the anthropometric information. They were wearing shorts, shirt, and trainers for performing physical fitness tests.

In order to gather the information and measure the independent variables the following tools were used:

1. body mass index (BMI), waist-hip ratio(WHR), and percent of body fat (PBF), were determined applying Bioelectrical Impedance method, using InBody (720biospace, made in Korea).

2. To measure the flexibility of Hamstring and back muscles, the flexibility test (sit and reach) was applied[26].

3. To estimate the maximum consumed oxygen, the Bruce aerobic power test was applied[27-28].

4. To measure anaerobic power, 40-yard sprint was applied[26].

Statistical Method

Data were analyzed using SPSS, and applying descriptive and deductive methods in the following ways:

To compute the central indices (median and mean), and dispersal indices (standard deviation, maximum and minimum) descriptive statistics was used. Also in order to examine the relationship between physical fitness factors and anthropometric features, and common injuries, Chi square test was used, so that the samples were categorized according to standard norms (National institute of health-U.S. Department of Health & Human Services) for every independent variable, and the relationship between the independent and dependent variables were examined at a reliability of $P < 0.05$.

Table1: the statistics of central tendency and variability of anthropometric features and physical fitness factors among the Iranian youth freestyle wrestling team

Factor	mean	SD	MIN	MAX
Age	16.19	1.1	15	17
(BMI)	21.20	3.85	17.30	25.90
(W H R)	0.85	0.08	0.77	0.99
(P B F)	14.20	7.17	5.40	21.80
Strength	45.27	8.41	37.4	53.2
anaerobic power	7.59	1.16	6.30	8.88
(vo2 max/weight)	44.23	7.54	38	53
Flexibility	36.89	8.41	28	45

Table2: the statistics of central tendency and variability of injuries among the Iranian youth freestyle wrestling team

Injury	mean	SD	MIN	MAX
Skin injury	0.8	0.73	0	3
Muscular injury	3.9	1.09	0	8
Joint injury	2.8	2.01	0	6
Bone injury	1.4	0.8	0	4

As shown in table 2, muscular injuries with the mean of (3.9±1.09) were the most frequent, and Skin injuries with the mean of (0.8±0.73) were the least frequent injuries among the Iranian youth freestyle wrestling team.

Results

1. As we show in tables 3 and 4, results of Chi square test revealed that there was a significant relationship between categories of the body mass index and skin injuries (K=6.105; P=0.047) and joint injuries (K=6.287; P=0.045) among the Iranian youth freestyle wrestling team.

Table 3: the rate of frequent injuries among wrestlers in body mass index categories (BMI)

Categories of BMI	skin injury	Muscular injury	Joint injury	Bone injury
Under weight	2	2	2	2
Normal weight	2	2	3	3
Over weight	16	5	18	7

Table 4: the results of Chi square test showing the relationship between body mass index(BMI)and the rate of frequent injuries

Chi square test	Chi square values	df	sig
skin injury*BMI	6.105	2	0.047
Muscular injury* BMI	1.87	2	0.391
Joint injury* BMI	6.28	2	0.045
Bone injury * BMI	1.776	2	0.412

2. As we showed in tables 5 and 6, the results of Chi square test revealed that, there was a significant relationship between WHR and skin injuries (K=8.377; P=0.039).

Table 5: the rate for frequent injuries among wrestlers in WHR categories

Categories of WHR	skin injury	Muscular injury	Joint injury	Bone injury
Very low	4	7	8	3
Under	10	6	8	4
Normal	4	3	3	1
Over	1	2	1	0

Table 6: the results of Chi square test for identifying the relationship between WHR categories and the rate of frequent injuries

Chi square test	Chi square values	df	sig
skin injury*WHR	8.37	3	0.039
Muscular * WHR injury	0.571	3	0.903
Joint injury* WHR	2.476	3	0.480
Bone injury * WHR	2.520	3	0.472

3. As we showed in tables 7 and 8, the results of Chi square test revealed that there was a significant relationship between categories of the Percent Body Fat(PBF) and joint injuries (K=5.9; P=0.04).

Table 7: the rate of frequent injuries among wrestlers regarding PBF categories

Categories of PBF	skin injury	Muscular injury	Joint injury	Bone injury
Under	2	1	1	1
Normal	6	6	7	2
Over	11	4	12	5

Table 8: the results of Chi square test for identifying the relationship between PBF categories and the rate of frequent injuries

Chi square test	Chi square values	df	sig
skin injury* PBF	0.48	2	0.78
Muscular injury* PBF	4.54	2	0.10
Joint injury* PBF	5.99	2	0.04
Bone injury * PBF	0.25	2	0.88

4. As we have shown in tables 9 and 10, the results of Chi square test revealed that, there was a significant relationship between flexibility and Muscular injuries (K=7.89; P=0.04) and bone injuries(K=7.92; P=0.04) among the Iranian youth freestyle wrestling team.

Table 9: the rate for frequent injuries among wrestlers regarding their flexibility

Categories of flexibility	skin injury	Muscular injury	Joint injury	Bone injury
Low	4	8	8	7
Moderate	3	7	8	4
Good	4	2	3	2
Excellent	3	1	9	0

Table 10: the results of Chi square test showing the relationship between flexibility and the rate of frequent injuries among wrestlers

Chi square test	Chi square values	df	sig
Flexibility skin injury*	1.37	3	0.139
Flexibility Muscular injury*	7.89	3	0.04
Flexibility Joint injury*	2.47	3	0.48
Flexibility Bone injury *	7.92	3	0.04

5. As it is seen in tables 11 and 12, the results of Chi square test revealed that there was a significant relationship between the Isometric Strength and bone injuries ($K=7.92$; $P=0.04$) among the Iranian youth freestyle wrestling team.

Table 11: the rate for frequent injuries among wrestlers regarding their Isometric Strength

Categories of Isometric Strength	skin injury	Muscular injury	Joint injury	Bone injury
Low	1	3	4	8
Moderate	8	5	4	3
good	3	1	1	1
Excellent	3	3	2	0

Table 12: the results of Chi square test showing the relationship between Isometric Strength and the rate of frequent injuries among wrestlers

Chi square test	Chi square	df	sig
Isometric Strength skin injury*	4.97	3	0.17
Isometric Strength Muscular injury*	4.29	3	0.23
Isometric Strength Joint injury*	2.02	3	0.56
Isometric Strength Bone injury *	7.92	3	0.04

6. As we have shown in tables 13 and 14, the results of Chi square test revealed that, there was no significant relationship between injuries and Anaerobic power in the Iranian youth freestyle wrestling team ($P>0.05$).

Table 13: the rate for frequent injuries among wrestlers regarding their anaerobic power

categories of anaerobic power	skin injury	Muscular injury	Joint injury	Bone injury
Moderate	3	3	4	3
Good	4	3	4	3
Excellent	3	2	3	3

Table 14: the results of Chi square test showing the relationship between anaerobic power and the rate of frequent injuries among wrestlers

Chi square test	Chi square values	df	sig
anaerobic power skin injury*	1.142	2	0.285
anaerobic power Muscular injury*	0.382	2	0.536
anaerobic power Joint injury*	1.111	2	0.243
anaerobic power Bone injury *	1.141	2	0.285

7. As we have shown in tables 15 and 16, the results of Chi square test revealed that there was no significant relationship between Aerobic power and the frequency of injuries among the Iranian youth freestyle wrestling team ($P>0.05$).

Table 15: the rate for frequent injuries in Aerobic power categories

categories of Aerobic power	skin injury	Muscular injury	Joint injury	Bone injury
Moderate	5	4	4	5
Good	4	6	4	5
Excellent	6	2	3	6

Table 16: the results of Chi square test showing the relationship between Aerobic power and the rate of frequent injuries among wrestlers

Chi square test	Chi square values	df	sig
* Aerobic power skin injury	1.24	3	0.29
* Aerobic power Muscular injury	0.32	3	0.54
* Aerobic power Joint injury	1.12	3	0.29
* Aerobic power Bone injury	1.29	3	0.31

Discussion and Conclusion

Since all body limbs are involved in wrestling, it can be said that none of body limbs are immune against injuries; especially in high, national, and international levels of competition the injuries are

more probable[1]. The results of this research showed that the muscular and joint injuries were most frequent among the youth freestyle wrestling team, which were in line with those of the Zakani (1996), Akbarnejad (1999), Jarret (1998), Richard (2010), and Stanev (2011), but were in contrary with Agel 's(2007), which might be due to difference in age and athletic levels of the statistical population. Since during adolescence the length of bones grows faster, muscles would be under higher tension, and more prone to muscular injuries[29]. Also, the results of this research showed that there was a significant relationship between physical flexibility and the rate of physical injuries, which confirmed the results of Pasque[11].muscular flexibility is important in injury prevention. There are many situations in sports where a muscle is forced to stretch beyond its normal active limits, lithe muscle does not have enough elasticity to compensate for this additional stretch, injury might occur in the musculo-tendinous unit[30]. The mechanism underlying the relationship between flexibility and muscular injury is typically ascribed to an extension of the musculo-tendinous unit beyond its normal active limits, resulting in muscular trauma[31]. The musculo-tendinous unit represents the link between the skeletal system and the contractile component of muscles, and its stiffness, to some extent, determines how effectively external forces imposed on the skeletal system are transmitted through the muscles. Hence, the stiffness of the musculo-tendinous system also has the potential to modulate the probability of muscular injury[32].It seems that improving the level of flexibility significantly decreases, the tension stress of tendons on periostitis of human skeletal system decreasing the amount of strain in tendons[33].

results from the present study indicated that there was a significant relationship between the isometric strength and the rate of skeletal injuries, which strengthens the results of Jarret[2]. During a wrestling competition, fracture is a common occurrence[7]. Previous studies reported that resistance training increased the bones' mineral content and mass. Since an increase in bone density and therefore bone strength might be effective in preventing fractures[25], it seems that improving strength increases bones' mass and mineral content in athletes and may reduce the risk of fracture during competitions. Therefore, based on the results

of the present research, it seems that by decreasing the body mass index, and fat percentage, the rate of joint injuries decreases among the youth freestyle wrestling team. As obesity increases the stress imposed on weight bearing structures of the body, it is reasonable to hypothesize that degenerative joint disease will be more common among obese wrestlers[34]. The mechanical theory proposes that obesity causes joint injuries through increasing the load and impact on the joints, which in turn promotes cartilage degeneration[35].

However, further research is necessary in order to shed more light on the relationship between physical fitness and anthropometric features and sport injuries in elite wrestlers in different age groups.

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