

Combat Sports Injuries in Well-Trained Athletes during African Games 2015 in Brazzaville, Congo

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Abstract

The aim of this study was to analyze the epidemiology and distribution of combat sports injuries during African Games 2015. A retrospective study was conducted from November 2016 to February 2017, including all adult patients aged consulted by doctor during combat or admitted to emergency medical sport unit of complex sporting of these Games. The data collected were sex, time and day of consulting or admission, injury risk, types, location and causes of injuries. During these African Games, an average injury frequency of about 78.6% has been observed. Contusions (n = 104), sprains and luxations (n = 43), fractures (n = 40) and wounds (n = 12) were the main injuries observed among 187 athletes. The lower extremities were more frequently affected than the upper extremities (150 cases *versus* 78 cases). In conclusion, the present study provides the latest knowledge on the frequency and characteristics injuries in combat sports. Injuries are different according to sport in their mechanisms and injury distribution. During African competition and training session, the evaluation and prevention of these factors could decrease the occurrence of such injuries.

Keywords

Combat Sports, African Games, Injuries

1. Introduction

Combat sports refer to a group of individual sports that are very relevant to the world sportive scenario. Altogether, the Olympic disciplines of combat sports (i.e. judo, wrestling, taekwondo and boxing) account for almost 25% of total medals disciplined in the Olympic Games (Gutiérrez-García, Pérez Gutiérrez, & Svinoh, 2010). Each specific combat sport has a unique combination of rules that confers singular characteristics to each one (e.g., grappling-based techniques or striking-based techniques; scoring system; number of rounds; recovery time between rounds; time duration of each round; distribution of gender; organization in weight divisions) (Poceco, Ruedl, Stankovic et al., 2013; Harmer, 2010). Despite those differences, studies have shown that most combat sports can be characterized as high-intensity, intermittent sports (Campos, Bertuzzi, Dourado, et al., 2012; Artioli, Gualano, Franchini et al., 2009; Franchini, Del Vecchio, Matsushige et al., 2011; Terbizan & Seliebold, 1996; Del Vecchio, Hirata, & Franchini, 2011). Consequently, injury risk had been consistently high in these athletes (Kobayashi, Kanamura, Koshida et al., 2010), even if the International Olympic Committee initiated and developed the injury and illness surveillance system during the 2008 Beijing and 2012 London Olympics (Junge, Engebretsen, Mountjoy et al., 2009; Engebretsen, Soligard, Steffen et al., 2013). In the literature, a few prospective and retrospective studies as well as case reports dealing with combat injuries are available (Souza, Monteiro, Del Vecchio et al., 2006; Green, Petrou, Fogarty-Hover et al., 2007; Pierantozzi & Muroi, 2009). In example, Souza, Monteiro, Del Vecchio et al. (2006) reported frequency of 12.5% of injuries in Brazilian Judo Championship 2005, whereas Pierantozzi and Muroi (2009) noted percent of 8.1% of injuries during Italian Judo Championship 2008. However, to our knowledge, no data is available in African Games since 1965 to nowadays and the distribution on combat sports injuries during African Games 2015. Therefore, the aim of this study was to analyze the epidemiology and the distribution on combat sport injuries during African Games 2015.

2. Methods

The retrospective study included all the sportsmen practising the sports of combat having taken part in the African Games 2015 of Brazzaville, among the 12 sporting disciplines selected. However, we focus on the judo, boxing, taekwondo and wrestling. Of the 336 combat sports athletes, 238 were recruited consulted by a sporting doctor appointed by the medical commission of the Games or admitted with the medico-sporting urgencies of the sporting complex of Kintélé (Brazzaville), following a traumatism between 4 and 19 September 2015. Inclusion/exclusion criteria for subjects were: to be competitive amateur combat sports (boxing, judo, taekwondo, wrestling) in these African Games 2015; to be injured during round competition; no history of orthopedic, cardiovascular or metabolic disorders that may affect the subjects' ability to perform a high-intensity work six months before African Games 2015. The other collected data in-

cluded/understood the mode of recourse (between or not addressed by the referee or the appointed doctor), nature, the seat and the type of assumption of responsibility of the lesions, and management of injuries in sporting medical emergencies.

According to Medical Subject Headings (MeSH), injuries are primarily defined as damage inflicted on the body as the direct or indirect result of an external force, with or without disruption of structural continuity. However, as a result of different designs of the reviewed literature, including prospective (Green, Petrou, Fogarty-Hover et al., 2007; Pierantozzi & Muroi, 2009), as well as retrospective studies (James & Pieter, 2003; Witkowski, Maslinski, Stefaniak et al., 2012), it was not possible to adopt a standardised definition, neither of injury, nor of the severity grade of injuries. In this study, an injury was defined as any physical complaint sustained by a competitor irrespective of the need for medical attention or time-loss from activities (Pierantozzi & Muroi, 2009), or which caused an exclusion from sports-related activities for at least 4 days (Witkowski, Maslinski, Stefaniak et al., 2012).

After anonymization, the data were seized on Epi information 3.5.3 and treated after quality control and checking of coherence of the data. The average for the age as well as the standard deviation was calculated. For the qualitative variables, the frequency of distribution of the various variables was given. Chi square was used for comparing categorical parameters. All statistical analyses were performed using the Statistical Package for the Social Sciences (version 17.0; SPSS, Chicago, IL) at the Statistics Laboratory, Department of Applied Mathematics, Faculty of Sciences, Marien NGOUABI University. P value ≤ 0.05 defined statistical significance.

3. Results

Among the 238 patients, 187 of them (78.6%) had been consulted by a doctor on the site of the combat (carpet of judo, taekwondo or fight; boxing ring for boxing). They were 81 judokas, 40 fighters, 25 boxers and 41 taekwondoists. The demographic data of all the patients are indicated in **Table 1**. The others traumatized had been taken along to the medico-surgical urgencies by a doctor. The means of transport was a vehicle of help. The distance between the sites of the sporting meetings and the urgencies varied from 1 km to 12 km. The majority of the consultations on the site took place Fridays, Saturdays and Sundays. As for the admissions with the urgencies, their office plurality reached finally week approximately 10.2% during the two weeks when the competitions related to the sports of combat proceeded.

The frequency of injuries associated to early production of lactate (cramps and muscular tiredness) rose with 73.3% ($n = 137$). For these subjects, massage with ozonised oils and oils enriched with bioperoxoil[®] was used. The distribution of the injuries was different according to the sport (**Table 2**). The circumstances of injuries were different as function as sport: muscular fatigue in judo for 80.4% of cases, 74.9% of cases in wrestling, 65.2% of cases in taekwondo; muscular

Table 1. Demographic characteristics of patients.

Variable	All patients (n = 238)	Judoists (n = 101)	Wrestlers (n = 50)	Boxers (n = 39)	Taekwondoists (n = 48)
Age, mean (SD)	24.6(1.8)	25.2(1.7)	24.8(2.3)	25.1(1.5)	23.4(1.8)
Sex, n (%)					
Male	173(72.7)	68(67.3)	32(64.0)	39(100)	34(70.8)
Female	65(27.3)	33(32.7)	18(36.0)	---	14(29.2)
Years of practice, mean (SD)					
5 - 7, n(%)	47(19.7)	13(12.9)	12(24.0)	6(15.4)	16(33.3)
8 - 10, n(%)	149(62.6)	71(70.3)	35(70.0)	21(53.8)	22(45.8)
≥11, n(%)	42(17.7)	27(16.8)	3(6.0)	12(30.8)	10(20.9)
Scholar status, n (%)					
Primary	52(21.8)	15(14.9)	19(38.0)	13(33.3)	5(10.4)
Secondary	165(69.3)	73(72.3)	24(48.0)	26(66.7)	42(87.5)
Student	21(8.9)	13(12.8)	7(14.0)	---	1(2.1)
Alcohol intake, n (%)					
Drinker	67(28.2)	15(14.9)	14(28.0)	13(33.3)	25(52.1)
Former drinker	73(30.7)	42(41.6)	8(16.0)	11(28.2)	12(25.0)
Nondrinker	98(41.1)	44(43.5)	28(56.0)	15(38.5)	11(22.9)
Smoker, n (%)					
Current smoker	21(8.8)	5(5.0)	2(4.0)	3(7.7)	11(22.9)
Ex-smoker	53(22.3)	31(30.7)	14(28.0)	4(10.3)	4(8.3)
No smoker	164(68.9)	65(64.3)	34(68.0)	32(82.0)	33(68.8)

Table 2. Distribution of injuries as function as sport and sex.

Injuries	Sex	Judo	Boxing	Wrestling	Taekwondo	Variation (%)
Contusions						
Male	61	13	17	14	17	+9.3
Female	43	17	--	16	10	+6.2
Fractures						
Male	31	4	11	5	11	+9.6
Female	9	2	--	1	6	+0.3
Sprains/Luxations						
Male	28	9	5	10	4	+2.0
Female	15	5	--	8	2	+0.8

elongations in wrestling (10.1% of cases); wounds (6.5% of cases) in boxing. The distribution of other injuries (n = 50) was by descending order: contusions (n = 61% - 32%), fractures (n = 43% - 26%), strains (n = 35% - 7%), wounds (n = 7% - 3%) and sprains (n = 5% - 3%). The distribution of these injuries according to the sex was homogeneous ($P = 0.25$) but, considering the risk of fracture compared with the other injuries, the men had a higher risk [OR = 2.18; CI 95% ranging (1.05 - 5.34); $P = 0.048$].

The seat of the injuries prevailed with the upper limbs in 54% of the case (n = 109) followed lower limbs (39.1% of the cases; n = 93). The other traumatism

sat on the level of the head and the neck.

The risk of attack of the upper limb was higher at men [OR = 9.51(3.82 - 25.34)]; $P < 0.0001$) the lesions related to the lower limbs (43% - 25%), the head and the neck (35% - 18%) including 15 cervical attacks, 13 cranial traumatism and wounds of the scalp, 4 traumatism of the jaw. The attacks affecting the rachis sat on the level of the thorax (7% - 4%), the back and the limbs (3% - 2%), with type of contusion. The abdominal traumatism, not very frequent ($n = 12$) were found on the level of the taekwondo, with type of simple contusion, without subjacent visceral lesion. A case of traumatism of the external genitals had been noted in a judoka man during a projection of the technique *uchi-mata*.

On the level of the upper limb (**Table 3**), the proximal injuries on the level of the shoulder (32%) prevailed and of the elbow (21%) the distal attacks of the upper limb were divided into: 18% of lesions of the front arm lever and the wrist ($n = 14$) and 18% of traumatism of the hand ($n = 14$). This distribution was comparable between the men and the ladies. Concerning the shoulder, the prevalent fractures were those of the clavicle (46% of the cases, found in the taekwondo) and in 18% of the cases of the fractures of the end of superior of the humerus (case of the taekwondo). The other lesions were represented by simple injuries ($n = 2$) and acromioclavicular distorsions ($n = 3$). No luxation of shoulder had been detected. On the level of the elbow and the front arm lever or wrist, the fractures respectively accounted for 44% of the cases ($n = 12$) and 37% ($n = 10$). With regard to the front arm lever and the wrist, the other attacks were distorsions.

On the level of the lower limbs (**Table 3**), in contrast to the upper limbs the distribution of the injuries concerned, the distal part of the member, starting from the knee where 29% of the lesions ($n = 10$) concentrated.

The attacks of the foot added up 55% of the cases ($n = 34$), of the knee (29% of

Table 3. Nature and distribution of injuries to a due level of upper limb and lower limb.

	Contusions	Fractures	Sprains/Luxations	Wounds
Upper limb				
Shoulder (n)	5	3	5	1
Elbow (n)	12	7	11	4
Wrist (n)	10	8	9	3
Total 1	27	18	25	8
Lower limb				
Hip (n)	3	--	--	1
Knee (n)	10	5	6	2
Leg (n)	8	8	4	1
Ankle (n)	13	3	8	1
Total 2	34	16	18	4
Total	61	34	43	12

the cases; $n = 10$) or of ankle (38%). Concerning the type of lesions of the lower limbs (Table 2), the contusions prevailed with 38% of the traumatism of ankle and ($n = 10$) and 29% of the traumatism of the knee. At the cranial level, the traumatism dominated. The wounds were rare ($n = 4$). The various types of fractures of the upper limb and the lower limb and their assumption of responsibility are indexed in Table 4. The assumption of responsibility of the patients was in the majority of the cases of the spontaneous type (93% of the cases). Two orthopedic reductions under Méopa® for fractures of the lower third of the two bones of the front armlever had been carried out with the urgencies, not allowing thus the resumption of the competition.

4. Discussion

The present study was initiated to identify the secondary traumatism with the practice of the combat sports to the African Games 2015 of Brazzaville. The number of the athletes of combat sports did not cease increasing by 1965 (1st African Games) to 2015 (11th African Games). This rise had consequences in terms of specific accidentology and dealt with between 1965 and 2015. The medical commissions of different Games recorded an increase of 8.3% of the traumatism related to the practice of the combat sports, varying from 7% in 1965 (judo and boxing) to 15.3% in 2015, bound mainly to the integration of the wrestling and the taekwondo and the participation of the ladies. Sprains, strains and contusions, usually of the knee, shoulder and fingers, were the most frequently reported injuries, whereas being thrown was the most common mechanism. The injury frequency during the two most recent Summer Olympic Games (SOG) of about 11.2% - 12.3% is well in accordance with the average injury frequency of 11% for all sport disciplines together in the 2012 SOG (Junge, Engebretsen, Mountjoy et al., 2009; Engebretsen, Soligard, Steffen et al., 2013). In comparison, taekwondo had the highest injury frequency with 39.1% during the London Games while in archery, canoe slalom and sprint, track cycling, rowing, shooting and equestrian sport less than 5% of athletes were injured

Table 4. Nature of the immobilization and the treatment of the fractures according to their location.

Location of fracture	Type of immobilization	Orthopedic reduction by General Méopa® anaesthesia	Osteosynthesis	Return urgencies
Upper limbs (n = 18)		0 0	0	
Clavicle	Clavicular rings	0 0	0	0
Higher end of the humerus	Dujarrier	--	--	0
	Plaster during BABP	0 7	2	
Lower end of the humerus	BABP	--	--	Pain under plaster
	Dujarrier	2 3	0	0
Front armlever, wrist	BABP, cuffs Syndactyly	0 0	0	0
Finger (inch)	Plastered gantelets	--	--	
		0 1		
Lower limbs (n = 16)		(Arthroscopy)		0
Inferior end of the femur	Cruro-pedal plaster Boots foundations of concrete, cruro-pedal plaster	0 0	0	Ablation of the plaster
Leg	Boots foundations of concrete,	--	0	0
Toe	Syndactylies	0 0	0	Repair of the plaster
		0 0		

(Engebresten, Soligard, Steffen et al., 2013). Our frequency of injuries in taekwondo, equal to 17.2%, is significantly higher ($p = 0.032$). Compared with other Olympic combat sports, judo time loss injury frequency of 6% - 9% during the last two SOGs was clearly lower than in taekwondo (16% - 18%) but slightly higher than in boxing (4% - 8%) and wrestling (5% - 6%), respectively (Junge, Engebretsen, Mountjoy et al., 2009; Engebresten, Soligard, Steffen et al., 2013). In this study, injuries' frequencies were higher, compared to other studies relating to judo (Barrault, Achou, & Sorel, 1983), wrestling (Cynarski & Kudlacz, 2008), boxing (Del Veccio & Gonçalves, 2012) and taekwondo (Del Veccio & Gonçalves, 2012). Many factors can explain these differences. Although nutrition, training level, hydration and weight cycling are considered important injury risk factors in combat sports (Boisseau, 2006; Agel, Ransone, Dick et al., 2007; Kordi, Maffulli, Wroble et al., 2009), specific research on martial arts is still very scarce (Kordi, Maffulli, Wroble et al., 2009). In example, a higher frequency of injuries and impairment of muscular function have been found in weight cycling judoists and among those undergoing rapid weight reductions before a competition compared with control groups of judo athletes (Poutreau, Ducher, Serbescu et al., 2007). Concerning massage, Brooks et al. (2005) found that manual massage to the forearm and hand after maximal exercise was associated with greater effect than non-massage on post-exercise power grip performances in healthy adults. Furthermore, Ogai et al. (2008) showed that sports massage was effective for decreasing perceived lower limb fatigue and muscle stiffness. Techniques like effleurage (stroking) and petrissage (kneading) are commonly used in sports massage to induce post-exercise intramuscular oedema resolution, by facilitating fluid movement and increasing circulation (Poutreau, et al., 2007). The ozonized oils have been widely studied in their chemical structure, in their pharmacology and toxicology and in their dermatologic compatibility (Travagli et al., 2011) giving guarantees on the perfect tolerability in dermatologic applications.

Moreover, even if bone injuries were not higher (14.3%; $n = 34$) in this study, the higher risk in bone injuries due changes in bone metabolism has been referred as a consequence of weight cycling in combat sports studied. Nevertheless, the strength requirements and technical characteristics of different sports' practice may also be preventive factors for bone loss and bone-related injuries (Poutreau, Pelle, Collomp et al., 2006). Furthermore, it has been reported (Rivera-Brown & De Felix-Davila, 2012) that the fluid restriction practiced by many combat sport athletes when involved in weight loss processes (Artioli, Gualano, Francini et al., 2010), in conjunction with intense training in these sport in hot environments, resulted in serious dehydration, which might provoke heat-related injuries. Despite the described risks, most judo and wrestling athletes reduce their weight a short time before competition (Fabrini, Brito, Mendes et al., 2010; Brito, Castro Martins Roas, Souza Brito et al., 2012). In addition, the research results of recent years reinforce the assumption that psychological factors are involved in the development of combat sports injuries (Andersen & Wil-

liams, 1988; Vago, Casola, Lovecchio et al., 2013). The perceived similarity and control seem to directly contribute to the perceived risk of injury (Deroche, Stephan, Woodman et al., 2012).

Our results indicate also that the nature of the injuries observed is comparable with those of the literature. With the exception of the contusions and distortions, they are not seemed different according to studied sports of combat. Indeed, according to Cunningham (1996) and other authors the contusions are the wounds most common during the practice of the judo, karate and the taekwondo (Table 5).

The fractures come then, except in the study of Yard and Knox (Yard & Knox, 2007), for which the fractures were prevalent. The distortions are described for the judo and the taekwondo, but are not noted for the wrestling, because of different organic mechanism. On the other hand, a study concerning the injuries which have occurred in the adults (on a troop of 93 judokas) at the time of a competition of judo in Sao Paolo (Souza & Monteiro, 2006), highlighted a majority of distortions, contusions, ligamentar injuries, luxation's, but did not find fracturar injuries. Sterkowicz (1999) reports similar results in adult judokas. These differences between the disciplines are explained by techniques of different combat and training level. Indeed, the injuries are in connection with direct injuries in boxing and wrestling; on the other hand, with the judo, they are in connection with the falls, the techniques of throttling and keys of arm (Sterkowicz, 1999). The fractures are more frequent in athletes whose experiment of practice varies from 5 to 7 years and old of less than 22 years, because probably of the mechanisms of fall and of a different, charged out of water and less resistant osseous structure.

Table 5. Studies published on the injuries related to the practice of combat sports.

Study	Present study	Sterkowicz	Souza and Monteiro	Cunningham
Year of publication	2017	2004	2006	1996
Population	Adult	Adult	Adult	Adult
Sport	Judo, lutte, boxing, taekwondo	Judo	Judo	Arts martiaux
Number	238	320	93	1177
Mean age (years)	24.6	Not paid	27.8	22.2
Standard Deviation (years)	1.8	Not paid	1.7	0.2
Sex-ratio	2.7	Not paid	Not paid	--
Contusions (%)	25.6	--	15.5	23.5
Sprains (%)	18.1	4.1	26.4	29.4
Wounds (%)	7-3	--	--	--
Musculotendinous injuries (%)	0	--	12.7	5.9
Luxations (%)	18.1	1.9	9	11.8
Concussion (%)	0	--	--	--

This phenomenon, found in our study, is also described by Birrer and Halbrook (1988) in the taekwondo where the principal injuries the candidates correspond to not blocked attacks, because of their lack of anticipation and experiment.

Moreover, the nature of the injuries varied according to the sex. The women presented contusions rather, without statistically significant difference ($P = 0.067$) and the men of the fractures significantly ($P = 0.041$). This tendency was found in the literature with, within the framework of injuries of sport in general, of the more significant of distortions and contusions, and less frequencies of fracture at the ladies (Pieter, 2005). In our study, the distribution of the injuries, according to parts' of the body injured, were comparable with that of Souza and Monteiro (2006) concerning the injuries of the judo. The organic attacks prevail on the upper limbs, but without significant difference compared to those found on the level of the lower limbs (32.8% versus 30.3%), indifferently of the sex. This fact can be explained for example to the judo through the mechanisms of the wounds (James & Pieter, 2003): majority of mechanisms of projection by the adversary or during work on the ground for the female sex; at the men, the agripments prevail causing more frequent digital injuries, projections of or by their adversary (James & Pieter, 2003). Lastly, according to Sterkowicz (1999), the proximal injuries of upper limb, in particular of the shoulder and the scapula are most frequent in the less tested and well-being trained judokas; they decrease at the candidate in combat sports according to the experiment and the type of practiced sport.

4. Conclusion

The present study provides the latest knowledge on the frequency and characteristics of injuries in combat sports during African Games 2015. The most found injuries are the contusions followed by the distortions. Their gravity remains weak. The factors of risk are represented by the training level, the nature of the sport and the sex. Consequently, comprehensive knowledge about the frequency of injury during combat sports and related risk factors represents an essential basis to develop effective strategies for injury prevention. Thus, the introduction of an ongoing injury surveillance system in different combat sports is of the utmost importance.

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