

## The Study on Sports Injury of Coaches in Boxing Training Environment

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### Abstract

The aim of this study was to investigate and analyze causes, times, regions, types, situations, first aid and treatment conditions of the injuries the boxing coaches. This study was conducted with a total of 80 subjects, who are currently active boxing coaches for middle school, high school, university, professional and national division. The tool used to investigate the nature of sports injuries of the boxing leaders based on the training environment was questionnaire, which is composed of 39 questions on age, sex, social background including leadership career, cause and time of injuries during training, type of region of injuries, injury regions based on type of training, first aid and treatment for injuries during training, and prevention of injuries. The questionnaire utilizes self-administered method. First, the form of training that exhibited highest injury rate during training was sparring, where attack type that most likely led to injuries was powerful hook. Second, the region of injury that exhibited highest injury rate during training was ligament injury, where upper limb area was more frequently observed than lower limb area. Third, most preferred emergency prevention method was ice packaging, and the most preferred hospital for treatment was western medicine based hospitals. Fourth, most of the coaches generally performed stretching before and after trainings. 16.25% of the coaches reported that they did not wear protection gears during training. In conclusion, this study that focused on causes, types, regions, first aid and treatment conditions of injuries for the coaches based on the training environment could aid in planning efficient measures for sports injuries of the boxing coaches and provide basic information to formulate treatment measures after injuries.

Key words: Injury, Boxing coach, Training Environment

### Introduction

Boxing has been popular for many centuries among spectators and boxers; however, injuries also accompanied the popularity from the beginning. Although critical neural damage resulted from boxing has not been discovered, the correlation in boxers has been reported through many studies (Heilbronner et al., 2009). King(2009) also commented that, though there does not exist any unique boxing

diseases, boxing is one of the sports that are best represented by high potential for injury evoked by training equipment, coaches, and boxers themselves. Especially, amateur boxing has high correlation with acute nerve cell damage. However, since researches on probability of nerve cell damage among amateur boxers are rarely carried out (Zetterberg et al., 2006), it is recommended that researches coming from various perspectives for the prevention of injuries among boxers be conducted. Sports injuries are caused from lack of skills, excessive training, mental and physical state of

tension, lack of attention, lack of warm-up exercises, and foul or aggressive actions during training or match, and the nature of the injury is related to physical activities and therefore unique injuries are observed for different sports. Among these sports injuries, injuries from martial arts sports account for 10.2% of all sports injuries (Tenvergert, 1992), and boxing is observed to have 23.6% injury rate (Zazryn et al., 2009). Similarly, since boxing requires consistent contact with opponents and high-intensity training, coaches as well as boxers themselves are also exposed to the danger of many injuries based on training environment. Because boxers cannot fight with their full capability and leadership of coaches are questioned when the boxers are injured, injury only results in damage of their careers regardless of outstanding state of facility and ability of boxers coaches. Bianco et al. (2007) showed that adequate amount of exercise and training is related to increasing expectancy of satisfactory life, and thus boxing may decrease expectancy of satisfactory life as it causes injuries from intentional, repetitive impacts.

Researches on the injuries of boxers due to the nature of boxing are continuously carried out (Ohhashi et al., 2002; Zazryn et al., 2009; Vent et al., 2010), but there is no research case where coaches, who are exposed to unexpected high probability of injury during training, were the subject of injury research in both domestic and international field.

The athletic performance of boxers can largely be affected not only by the conditions of boxers themselves but also by the state of health of coaches. Leaders greatly influence by facilitating communication, boosting morale, increasing win rate, enhancing teamwork, and improving athletic performance. Also, it is a critical factor to exercise technical, action influence in order to achieve the goals of the boxers.

From these perspectives, it is important to understand that sports injuries, which are perceived to be usually specific to athletes, can be observed in coaches as well. In the context of boxing, sports injuries of coaches occur more frequently compared to other sports as coaches

are more involved in actual training environment through mass boxing (a type of mutual shadow boxing in which boxers face each other without direct hits) and sparring. In addition, as coaches are engaged in training by taking direct punches from boxers during punching mitt training, a representative technical training in boxing, severe damages in wrists, elbows and shoulders could be resulted. Also, with excessive trainings, these damages can potentially be developed into chronic damages, and therefore there are frequently many cases where coaches end their careers due to such damages. Recently, there is an increasing attention being paid to stability of boxers, but the nature of typical sports injuries or severe damages from boxing matches is yet to be clearly investigated (Vent et al., 2010). Despite the fact that more attention should be paid to health and safety of boxing coaches, it is difficult to find any researches on the injuries of the coaches. Hence, this study aims to investigate and analyze causes, times, regions, types, situations, first aid and treatment conditions of the injuries the boxing coaches encounter in order to provide basic information utilized to create basis for sports injury prevention and treatment measures for future boxing coaches.

## Method

### Subjects

This study was conducted with a total of 80 subjects, who are currently active boxing coaches and supervisors that participated in the National Athletic Meet as leaders for middle school, high school, university, professional, national division representatives from respective cities and provinces. The subjects understood the objective and the procedure of this study and provided written consents, and instructions were provided to encourage the subjects to respond in full and prevent them from omitting information. The overall frequency of the subjects participated in this study is shown in <Table 1>.

**Table 1. Characteristics of the subjects**

Classification	Frequency	%
Middle school	26	32.5
High school	33	41.25
University	10	12.5
Business team	8	10.0
National team	3	3.75
Total	80	100

## Questionnaire Formulation and Collection

The tool used to investigate the nature of sports injuries of the boxing leaders based on the training environment was questionnaire, which is composed of 39 questions on age, sex, social background including leadership career, cause and time of injuries during training, type of region of injuries, injury regions based on type of training, first aid and treatment for injuries during training, and prevention of injuries. In order to formulate questions regarding sports injuries resulted from coaching boxers, The study of boxers injuries (Lee, J. D., 2004) and The study on the injuries of boxers in boxing matches (Lee, J. J., 2006) were referred to revise the questionnaire to suit the coaching environment for boxing coaches. Afterwards, to secure validity of the questionnaire, the questionnaire was finalized after being revised to suit the boxing coaches and their working environment and to reduce the level of difficulty in understanding by conferring with experts in boxing and fields relevant to sports injuries. Also, to verify reliability, after the first confirmation on the questionnaire, test-retest method was used over 3-week interval on 15 boxing coaches, who are not included in the test subject group but exhibit similar characteristics, in order to assess the reliability of obtained data from evaluation of understanding. The finalized questionnaire was distributed around the opening of the National Athletic Meet with cooperation and consent from the coaches after instructing them with the purpose and the filing method. The coaches of the national team were not participating in the Meet and

thus were visited in person to hand out the questionnaire. The questionnaire utilizes self-administered method. The filed questionnaires were retrieved afterwards.

## Data processing method

All data obtained in this study were analyzed by using statistical software called SPSS Ver 18.0 for Windows. To find characteristic of the questionnaire results on causes, time, region, type, first aid treatment, and prevention of damage of coaches during boxing training, multiple response and frequency analysis were used.

## Results and Discussion

### Causes and time of injuries from coaching boxers during training.

It is known that the causes of sports injury are excessive training, inappropriate training method, lack of flexibility, imbalance and over-tension of muscular strength, inattentiveness, and lack of training and technique (Ha, K. I., 1988). Furthermore, while social, psychological elements, such as personality and stress-inducing environment, are claimed to have effects on injuries (Nideffer, 1989; Kerr & Minden, 1988), this study focused on the cause and the time of injuries specific to boxing. Demonstrations with high injury rate during coaching are shown in <Table 2>. The demonstrations with high injury rate during coaching are, in order of highest to lowest, sparring, mitt, sand bag. Sparring is one of the most efficient training methods in boxing (Ghosh, 2010). While sparring has an advantage of showing unnecessary moves and quickly teaching techniques and strategies to the boxers, coaches can be have bruise or scratches as a result of the opponent's unpredictable punches and buttings, not to mention ligament

**Table 2.** The demonstration caused a lot of injuries in accordance with the training environment

Sand bag		Meet		Sparring		Total	
Frequency	%	Frequency	%	Frequency	%	Frequency	%
2	2.5	29	36.25	49	61.25	80	100

**Table 3.** The type of attack caused a lot of injuries in accordance with the training environment

Classification	Sand bag		Meet		Sparring		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Straight	19	23.8	13	16.2	17	21.2	49	20.4
Hook	49	61.2	56	70.0	51	63.8	156	65.0
Upper-cut	12	15.0	11	13.8	12	15.0	35	14.6
Total	80	100	80	100	80	100	240	100

**Table 4.** Offensive behavior caused a lot of injuries in accordance with the training environment

Classification	Meet		Sparring		Total	
	Frequency	%	Frequency	%	Frequency	%
Combination	33	41.2	33	41.2	66	82.4
Counter	26	32.5	26	32.5	52	65.0
Footwork	13	16.3	13	16.3	26	32.6
weaving, Ducking	8	10.0	8	10.0	16	20.0
Total	80	100	80	100	160	200

**Table 5.** Time caused a lot of injuries in accordance with the training environment

Dawn		Forenoon		Afternoon		Evening		Total	
Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
14	17.5	2	2.5	58	72.5	6	7.5	80	100

injuries on fingers and wrists as a consequence of an inappropriate moves. Recently, since the international trend in boxing is illustrated by the rise of the boxers with outstanding flexibility taking the initiative during the game through consistent infighting and power-boxing based on the basics of defensive boxing (Kim, K. J. et al, 2010), Korea's heavyweight boxers show gradual enhancement in their power. Thus, punches of the boxers from heavyweight or heavier division are tremendous in their impact and accidents in sparring demonstration can lead to a serious injury. Hence, coaches must be

aware of the strategies of their boxers, and construct a plan that accurately demonstrates tactics specific to each boxer. Next, it was observed that coaches are most injured during mitt training, where the impact is delivered through wrists, elbows and shoulders. The injury rate for the coaches can increase further when the boxers misuse techniques in their blow. Therefore, during the mitt training, it is important that the coaches wrap their wrists with bandages and participate in the training after sufficiently stretching their arms and bodies, and that the coaches educate their boxers in

order for them to demonstrate techniques accurately. In the study conducted by Zazryn et al.(2009) on rates and causes of injuries for boxers, it was reported that boxers exhibit 23.6% injury rate, and that it is important to be prepared with strategies that reflect on the characteristics of the boxers and the possibility of participating in a match.

<Table 3> shows punch types that result injuries during training. The punch type that resulted the most injuries is hook, followed by straight punch and then uppercut. Safet et al(2008), through a research that analyzed all matches of 80 boxers in international amateur boxing match, mentioned the importance of straight punches and hooks as left hand straight took 28.9%, left hand hook 23.2%, right hand hook 19.5%, right hand straight 15.5% of all attacks on facial area. Because hook is a close range punch and requires boxers to attempt to approach their opponents, it is technique with the most powerful damage. In a research that studied the effect of boxing techniques on the speed of punches and deliver (Piorkowski et al., 2011), hook exhibits greater speed than do other types of punches. During their use of hook, the boxers are under psychological influence to quickly strike and fall out. Thus, they tend to hit with great strength rather than precision, which results in decrease in accuracy and abnormal punch that seem to injure their coaches. Hence, it appears that it may be necessary for the coaches to instruct their boxers to put more emphasis on the accuracy of their hook and straight punches than the strength of their punches. Zhang & Kang(2011) reported in a research that analyzed electromyogram of upper arm and waist muscles of boxers, who were asked to hold 2.5kg dumb-bell and perform straight punch technique until exhaustion, that efforts to increase muscular strength in upper arm and waist areas are required because upper arm and waist are critically important for boxers to perform techniques. Therefore, the coaches need to focus on reinforcements on major muscles involved in primary techniques performed by their boxers. Also, they must focus on instructing their boxers with more weight on accuracy during their trainings because the international

boxing matches are becoming more inclined towards counting punches with accuracy.

The attacking actions that lead to injuries are shown in <Table 4>. In order of highest to lowest, it was shown that attack moves that led to injuries are combination, counter, footwork, weaving, ducking. As combination technique requires longer punches, there could be an injury when the opponent missed the mitt approaching him. Iide et al.(2008) reported that, through a study on the relationship on demonstrations of offensive and defensive techniques of boxers, the longest technique demonstrated during each round was combination technique with an average of  $2.1 \pm 1.0$  seconds. Providing that there is a unpredicted, misused combination attack that lasts for 2-3 seconds on the coaches by the boxers, there could be a serious, consequential injury. Therefore, it is important to practice combination attack tactics that reflects on the characteristics of each boxer when each boxer perfectly acquired such tactics in advance, and, for infighter boxers who utilize power-boxing, various forms of combination attacks must be consulted with the coaches upon training. Also, since single punch or combination attack progresses in a quick manner, boxers need strategies to avoid taking a hit faster than before and understand that the coaches as well as themselves should be aware of these characteristics during their preparations for training (Piorkowski et al. 2011)

The time of injuries happened during the training sessions was exhibited in the <Table 5>. As for the times of injuries, afternoon was highest among all, followed by dawn, night, and then morning in order. The reason why most of the injuries occurred during the afternoon training is that most of trainings involving techniques are taking place during the afternoon, and that mitt training and sparring usually take place during the afternoon. Also, as for trainings at dawn, injuries frequently occur due to the fact that the coaches participate in the trainings even when the muscles relaxed in sleep were not stretched enough. Therefore, warm-ups and stretching must be systematically done during the training in the afternoon or at dawn in order to prevent sudden injuries

**Table 6.** Type and area of injuries in accordance with the training environment

Classification	Abrasion		Fracture		Ligament Injury		Bruise		Dislocation		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Ankle	13	6.44	23	15.65	33	16.1	11	5.76	9	9.47	109	10.69
Knee	12	5.94	11	7.48	18	8.78	11	5.76	3	3.16	75	7.35
Waist	19	9.41	2	1.36	9	4.39	13	6.81	3	3.16	59	5.79
Neck	12	5.94	3	2.04	7	3.42	5	2.61	1	1.05	33	3.23
Shoulder	27	13.37	15	10.21	32	15.6	36	18.85	34	35.79	163	15.98
Wrist	36	17.82	35	23.81	41	20.0	25	13.09	13	13.69	189	18.53
Elbow	20	9.9	13	8.84	27	13.17	17	8.9	11	11.58	111	10.88
Finger	38	18.81	38	25.85	30	14.64	28	14.66	16	16.84	182	17.84
Head	3	1.49	1	0.68	2	0.98	6	3.14	1	1.05	15	1.47
Face	20	9.9	6	4.08	6	2.92	37	19.37	4	4.21	78	7.65
internal organs	1	0.49	0	0	0	0	0	0	0	0	2	0.2
Scrotum	1	0.49	0	0	0	0	2	1.05	0	0	4	0.39
Total	202	100	147	100	205	100	191	100	95	100	1020	100

**Table 7.** Area of injuries in accordance with the teaching methods

Classification	Sand bag		Meet		Sparring		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Ankle	6	5.09	3	1.87	9	5.38	18	4.04
Knee	3	2.54	1	0.63	5	3.00	9	2.02
Waist	3	2.54	5	3.12	11	6.59	19	4.26
Neck	0	0	2	1.25	9	5.39	11	2.47
Shoulder	16	13.56	30	18.76	22	13.18	68	15.29
Wrist	55	46.61	53	33.12	26	15.56	134	30.12
Elbow	7	5.93	20	12.50	10	5.99	37	8.32
Finger	28	23.73	40	25.00	30	17.97	98	22.03
Head	0	0	3	1.87	9	5.38	12	2.70
Face	0	0	2	1.25	29	17.36	31	6.97
internal organs	0	0	0	0	4	2.39	4	0.89
Scrotum	0	0	1	0.63	3	1.79	4	0.89
Total	118	100	160	100	167	100	445	100

from sports. Typically, in many cases, the coaches participate in the trainings without proper warm-ups. It is important not only to conduct warm-ups for boxers but also for the coaches themselves to do sufficient warm-ups and stretching over all parts of their body in order to train their boxers. Kittel et al.(2005) commented that an appropriate, compensative exercises must be included

in training programs in order to prevent injuries of boxers; but it is necessary for the coaches to participate in stamina exercises to prevent injuries. Together with such exercises, during trainings, it seems that it would be helpful for the boxers as well as the coaches to prevent injuries and increase effectiveness of the trainings when they participate with concentration. In

many sports, frequently used warm-up method is stretching. However, considering the results that show static stretching may decrease athletic performance level of athletes (Behm & Chaouachi, 2011), it appears that warm-ups that apply many forms of stretching, including static and passive stretching, should be used. Because stretching increases flexibility by actively or passively stretching muscles, joints and tendons and decreases the possibility of injuries to act as an important factor contributing to efficient performance of muscle and acquisition of high-degree techniques (Kim, M. Y. et al., 2005), the coaches also must consider warm-ups before dawn and afternoon trainings.

### Region and type of injuries that take place during trainings

The types and the regions in which the injuries take place are shown in <Table 6>. After looking at the data, the most frequent region of scratches for the coaches was fingers, followed by wrists and then shoulder; the most frequent region of bruise was face, followed by shoulder, finger and then wrist; and the most frequent region of dislocation was shoulder, followed by finger and then wrist.

There is a difference among the degrees of injuries, in sports of physical contact, edema and hematoma are developed as a result of direct and indirect kicks or hits, and there is damage dealt to muscles and tendons as the level of motions and coordination fall to apply indirect external force on muscles. In case of boxing, as attacking facial areas of opponents using punches is prevalent, injuries often take place in facial areas in upper body or in hands. During the training, the type of injuries most frequently observed is ligament injury, followed by stretches, bruise, fracture and then dislocation. In boxing, there are more injuries on upper body than there are in lower body because boxing utilizes upper body more and offense and defense take place in upper body. In a study on injury rate and cause for boxers (Zazryn et al., 2009), boxers demonstrated 23.6% injury

rate, but the fact that the boxers were mostly injured in the head and the facial area differs from the results of this study, where it was observed that the coaches are mostly injured in the wrists and the fingers. This is due to the fact that, while boxers powerful hits in their facial areas, the coaches defend themselves from inappropriate punches or endure continuous punches, as training counterpart, with upper arms using mitt.

As for injuries, injuries are classified into acute injuries, fracture and dislocation resulted from strong external force applied instantly on a body, and overuse injuries, where small external force is applied several times on a specific region (Yang et al., 2012) For the coaches, overuse injuries seem to be more prevalent. The main reason being is that they constantly need to face boxers from lightweight to heavyweight individually in mass boxing or with punching mitt in order to train them with techniques. In order to prevent such injuries, it is necessary for the coaches to efficiently plan training program to prevent concentrated impacts from being delivered to their bodies by breaking down the technical training into days, times, weight. Also, it recommended that they take sufficient break in between training sessions.

### Regions of injuries dependent on training type

Regions of injuries dependent on training type are shown in <Table 7>. It was observed that the coaches were injured most frequently in wrists, followed by fingers and then shoulders, during sand bag and mitt training; and the injury rate was highest in finger, followed by face and then wrists, during sparring. As said previously, there is a difference between injury regions observed in the boxers and those observed in the coaches. The boxers usually take great impacts in their head and body during sparring and matches, which lead to a noted increase in neurochemical index level such as increase in stress and parathyroid hormones (Graham et al., 2011). However, the coaches usually are injured in their upper arms due to the nature of training. Sand

bag injuries occur due to not wearing protection gears or the use of inappropriate punching; and mitt-training injuries occur as direct impacts are delivered to their hands. It seems that, due to the nature of boxing training, unpredictable attacks and defense, inappropriate punching or foul actions lead to injuries. Overall, the most frequent region of injury was wrists (30.12%), followed by fingers (22.03%), shoulders (15.29%), elbows (8.32%), face (6.70%), waist (4.26%), ankle (4.04%), head(2.70%), neck (2.47%), knee (2.02%) scrotum (0.89%), and then internal organs (0.89%). In a study conducted on 632 Japanese boxers, it was emphasized that scientific training and exercise is important to prevent injuries of the boxers (Ohhashi et al. 2002). Considering the nature of the boxing coaches, who train with their boxers, this result indicates the fact that the coaches also need efficient practice suitable for their training types. Therefore, rather than demonstrating abruptly or participate in mitt training, the coaches need to plan training program in which takes the form of gradually increasing strength and speed or transition from basic moves to application moves. Also, warm-ups on the regions of frequent injuries, such as wrists, fingers, shoulders and elbows, are important. As Torres et al.(2008) reported that static stretching which incorporates technical moves often seen in real situation is effective in enhancement of athletic performance and decrease in sports injury, the coaches need to develop and apply various static enhancement based on boxing techniques to prevent sports injury on frequently injured regions

### First aid and treatment for injuries during training

The first aid and the treatment for injuries during training is shown in <Table 8>. The first aid method most preferred by the coaches were ice packaging, followed by massage, taping, spray, M lotion, pressure method, hot-massage and then bandaging. It is important that these first aid methods must be applied to different sports injury types, and the coaches need to know accurately how to systematically apply first aid to different

types of injuries. The coaches need to be educated with proper ways of applying first aid because appropriate action taken by the coaches, as well as boxers in emergency is the first measure to prevent the injury from deteriorating. As seen in <Table 9>, preferred hospital for injury was 56.25% western medicine hospital and 43.75% oriental medicine hospital. In many cases, the subjective evaluation of the coaches leads to permanent injury due to the fact that the injury was not treated in systematic method. Therefore, systematic diagnosis and treatment based on accurate diagnosis procedure in a respected hospital is a principle to be upheld by both the boxers and the coaches.

Hospitalization and operation due to the injuries from the training are shown in <Table 10>. 33.75% of the subjects reported that they were hospitalized due to the injuries received from training, and 25% of them reported that they had operations. It can be seen that the experiences of serious injuries for the coaches are high as 43.75% of the coaches reported that they had put on casts due to the injuries from training. Thus, a method to secure safety of the coaches is urgently demanded. The possibility of retiring from the injuries is shown in <Table 11>. Among the coaches, 47 of them, which is 58.75% of the subjects, reported that they considered retirement due to the injuries. The career as a coach was affected by lack of systematic rehabilitation and management after the injuries.

### Injury prevention during training

The results regarding training before and after stretching are indicated in <Table 12>. As for prevention of injuries during training, 8.74% of the coaches reported that they do not spend time stretching before and after the training. Stretching is intended to prevent injuries and excessive activity of muscles when they are abruptly used. Stretching increases flexibility by passively and actively elongating muscles, joints and tendons, helps demonstrate muscular efficiency by reducing the possibility of injury outbreak, and is an important factor



**Table 8.** First aid methods in accordance with the training environment

Classification	Frequency	%
Massage	30	16.67
Ice therapy	51	28.33
Hot towel	9	5.0
Taping	25	13.89
Pressure	11	6.11
Bandage	6	3.33
M lotion	23	12.78
Spray	25	13.89
Total	180	100

**Table 9.** Preferred Hospital in accordance with the training environment

Oriental Medicine Clinic		Hospital		Total	
Frequency	%	Frequency	%	Frequency	%
35	43.75	45	56.25	80	100

**Table 10.** Hospitalization and operation in accordance with the injuries

Classification	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Hospitalization	27	33.75	53	66.25	80	100
Operation	20	25.0	60	75.0	80	100
Gibbs	35	43.75	45	56.25	80	100
Total	34.17		65.83			

**Table 11.** Considering retirement due to the injuries

Yes		No		Total	
Frequency	%	Frequency	%	Frequency	%
47	58.75	33	41.25	80	100

**Table 12.** Stretching conducted before and after training

Classification	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Before Training	74	92.5	6	7.5	80	100
After Training	72	90.0	8	10.0	80	100

**Table 13.** Use of protective equipment in accordance with the training environment

	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Sand bag	67	83.75	13	16.25	80	100
Meet(hand)	78	97.5	2	2.5	80	100
Meet(abdomen)	25	31.25	55	68.75	80	100
Sparring(face)	58	72.5	22	27.5	80	100
Sparring(hand)	68	85.0	12	15.0	80	100

**Table 14.** The need for injury prevention education

Yes		No		Total	
Frequency	%	Frequency	%	Frequency	%
75	93.75	5	6.25	80	100

that contributes to high-degree technique acquisition (Kim, M Y. et al, 2005). The cause of injury lies in inattentiveness and excessive desire for winning, and injuries can be prevented by thorough warm-ups and cool-downs (Daneshjoo et al. 2013). However, it is assumed that the fact that the injury rates on fingers and wrists are high despite the fact that 90% of the case reported they do stretching indicates the subjects only perform stretching on gross muscles. Also, since passive stretching, such as static stretching, can reduce characteristic performance capability in many areas (Gergley, 2009; Moran et al., 2009), and, especially, passive stretching may lead to decrease in isotonic muscle level (Fowles & Sale, 1997), various stretching methods, in consideration of the nature of boxing, must be formulated to complement typical stretching to include hand regions to upper body.

The use of protection gears is indicated in <Table 13>. During the sand bag training, 83.75% reported that they wear protection gears. During mitt training, 97.5% reported that they wear hand gears but only 68.75% reported that they do not wear body gears. The reason being is that the body gear is uncomfortable and not supplied sufficiently. Such seem to lead to injuries on internal organs and scrotum.

27.5% reported that they do not wear head gear during sparring, and 15% reported that they did not use

hand protection. Therefore, injuries on face and hand region occur, and it is necessary for the coaches to change their thoughts to wear all of protection gears in full.

The need for lectures on injury prevention is shown in <Table 14>. 93.75% of the coaches responded that lectures on injury prevention are necessary, which shows that lectures on systematic analysis of causes of injury and prevention are highly demanded.

As boxing is a sport involving physical contact, injury rates can only be high because the rules governing boxing requires boxers to directly hit certain areas of his opponent's body within a reasonable range (Lee, J. D., 2004). Furthermore, due to the nature of boxing, the possibility of injury for the coaches is greater than that of coaches in other sports because the coaches are more involved in training. King(2009) reported that, although there is no boxing-specific injury, the possibility of sport injury based on training facility, matches, leadership, athletic performance of boxers is evident and thus the capability of the coaches is an important cause for boxing injury. Hence, boxing coaches must be aware of the danger of injury, perform compensative exercises including warm-ups and stretching as the boxers do, and try their best to prevent injuries by participating in training with protection gears.

## Conclusion

This study is focused on analyzing causes for injuries of the coaches due to the boxing training environment, and to provide basis and basic information to come up with injury prevention and treatment measures for the coaches in the future. From this research, following conclusions were drawn.

First, the form of training that exhibited highest injury rate during training was sparring, where attack type that most likely led to injuries was powerful hook and combination moves that is composed of several, continual techniques. The most likely time of injury was in the afternoon, when boxing technique trainings often take place.

Second, the region of injury that exhibited highest injury rate during training was ligament injury, where upper limb area was more frequently observed than lower limb area. The region most prone to injury during demonstration, mitt training or sand bag training was wrists and fingers.

Third, most preferred emergency prevention method was ice packaging, and the most preferred hospital for treatment was western medicine based hospitals. 58.75% of the coaches reported that they considered retirement due to the injuries.

Fourth, most of the coaches generally performed stretching before and after trainings. 16.25% of the coaches reported that they did not wear protection gears during training. Also, 93.75% of the coaches expressed that the lecture on injury prevention is necessary.

In conclusion, this study that focused on causes, types, regions, first aid and treatment conditions of injuries for the coaches based on the training environment could aid in planning efficient measures for sports injuries of the boxing coaches and provide basic information to formulate treatment measures after injuries.

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