Dental and Jaw Injuries among Muay Thai Kickboxing Athletes

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Background: *It has been reported globally that boxing athletes suffer a high risk of injuries, predominantly dental and jaw injuries. While the popularity of Muay Thai kickboxing is increasing in Thailand, there has been very little research evidence regarding dental and jaw injuries among Thai boxing athletes.*
Objective: *This study aimed to evaluate the prevalence and severity, as well as factors associated with sport-related dental and jaw injuries in the northeastern Thai boxing athletes.*
Material and Method: *A survey was conducted on 260 samples of Thai boxing athletes residing in the northeast Thailand, using both questionnaire and oral health examination. Data were analyzed using descriptive, bivariate statistics and multivariable logistic regression.*
Results: *The results showed that 23.5% of the boxing athletes had dental and jaw injuries. Findings from the final logistic regression model revealed that weight, location of training camp (the upper part versus the lower part provinces) and location of boxing camp (rural versus urban districts) were significantly associated with dental and jaw injuries, with the adjusted odds ratios (95% CI) being 1.069 (1.040, 1.099), 2.422 (1.283, 4.571) and 4.525 (1.923, 10.638), respectively.*
Conclusion: *The Muay Thai boxing athletes sustain substantial dental and jaw injuries, and are at subjection to impending risk of such injuries. The findings of this research may be useful for prevention and planning to reduce dental and jaw injuries among Thai boxing athletes in the future.*

Keywords: *Dental jaw injuries, Thai boxing, Northeast*

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Muay Thai kickboxing is one of the most popular martial arts of Thailand, whereby punching, kicking and elbowing are permitted[1,2]. The popularity of Muay Thai kickboxing is rapidly increasing as its self-defense and physical fitness benefits are promoted[3-5]. It has been reported globally that boxing athletes are prone to high risk of injuries[6,7], particularly dental and jaw injuries are common in athletes engaged in boxing[8,10-15,26], as well as other contact sports[14-30]. In Thailand, the popularity of Muay Thai kickboxing has increased during recent years, but so far very little research evidence regarding the occurrence of dental and jaw injuries and factors related to dental and jaw injuries among Thai kickboxing athletes has been reported. Therefore, this study intended to evaluate the prevalence of dental and jaw injuries as well as factors associated with dental and jaw injuries among Muay Thai kickboxing athletes in the Northeast Thailand.

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Material and Method

A cross-sectional analytic study was conducted consisting of random selection of Muay Thai kickboxing athletes from randomly sampled boxing camps in the northeast Thailand. Firstly, two provinces in the upper part of northeast Thailand and two provinces in the lower part were randomly selected. Then, one urban together with four rural districts were randomly sampled from each of the four provinces. Altogether, 260 boxing athletes from 32 training camps located in 22 districts participated in the study.

The study protocol was approved by the Ethics committee at Khon Kaen University, Khon Kaen, Thailand (HE522167). The data were collected at every selected boxing camp during March 2009 to April 2010. After finishing the oral examination, the samples were interviewed using a structured, interviewer guided questionnaire by a well-trained interviewer. The questionnaire consisted of demographic and

background factors as well as dental trauma and jaw injuries experiences during Muay Thai kickboxing training or competition in the past five years. Double data entry was achieved to minimize errors in processing of the data. Data management and analysis were completed using SPSS for Windows version 15.0.

Results

A total of 260 boxing athletes from 32 training camps located in 22 districts of four provinces in northeast Thailand participated in the study. Table 1[9] shows that of all the 260 boxing athletes, 247 (95%) were males and 13 (5%) were females. Their ages ranged from 6.5 to 37.7 years (Mean 14.7 years). Around 60% of the athletes were under 15 years. The majority were single (98.8%) and had secondary education or less (90%). The participants had the average time of training and fighting around 4 years (Table 2). They practiced 18 hours per week and fought 18 matches per year on average. Most of the athletes (91.9%) did not use any protective device while training.

Table 1. Characteristics of the boxing athletes

Characteristics	Number (n = 260)	Percentage
Gender		
Males	247	95.0
Females	13	5.0
Age group (years)		
5.01-10.00	28	10.8
10.01-15.00	134	51.5
15.01-20.00	72	27.7
20.01-25.00	22	8.5
25.01-30.00	2	0.8
30 years and above	2	0.8
Marital status		
Single	257	98.8
Married	3	1.2
Education		
Attending primary school	56	21.5
Primary school	39	15.0
Attending secondary school	60	23.1
Lower secondary school	50	19.2
Upper secondary school	25	9.6
Vocational school	9	3.5
Bachelor degree or higher	13	5.0
Others	8	3.1
Income (Thai baht)		
0-1,000	130	50.0
1,001-5,000	105	40.4
5,001-10,000	19	7.3
10,000 or higher	6	2.3
Age (mean (SD) in years)	14.7 (0.3)	Range = 6.5-37.7
Weight (mean (SD) in kilograms)	41.3 (0.8)	Range = 15-79
Height (mean (SD) in centimeters)	150.1 (18.9)	Range = 95-193

In all, 61 boxing athletes (23.5%) reported that they had dental trauma or injuries while training or fighting during the previous five years. Most of them (52.5%) had only one injury, while 22.9% and 8.2% encountered two and five injuries, respectively. The highest number of injuries was 15 (48.4%). The injuries largely occurred from being punched, or kicked, or hit by the competitor (91.8%), and mostly (86.9%) occurred during competition (Table 3).

Table 3 also shows that most of the injuries affected the teeth (50.8%), followed by lower jaws (31.1%) and lips (29.5%). Upper incisors were the most affected teeth (48.4%), whereby the injuries were classified as tooth fracture not involving pulp (58.1%), tooth mobility (38.7%), and lateral luxation (3.2%).

Results from the bivariate analyses showed that several factors were primarily associated with dental and jaw injuries, including age (years), weight (kilograms), height (centimeters), income (Thai baht), weight on fighting (kilograms), time of fighting as a boxing athlete, numbers of matches, and location of training camps (Table 4).

Table 5 shows findings from the final multivariable logistic regression model having dental and jaw injuries as an outcome. The odds of getting dental and jaw injuries was 1.069 (95% CI: 1.040, 1.099) when the athletes' weight on fighting increased by 1 kg. The boxing athletes whose training camps were located in the upper northeast had higher chances of getting dental and jaw injuries compared to the lower northeast, with the odds ratio of 2.422 (95% CI 1.283, 4.571). In addition, the boxing athletes whose training camps were located in the rural areas had higher chances of getting dental and jaw injuries, with the adjusted odds ratio of 4.525 (95% CI 1.923, 10.638).

Discussion

The proportions of dental and jaw injuries among the boxing athletes in this present study (23.5%) were comparable to that found among Australian professional boxers[13], American mixed martial arts competitors[17], Malaysian athletes[20], and schoolboy rugby players in England and Australia[21]; but this percentage was much higher compared to several previous research[12,19,30-32]. However, the proportions

Table 2. Basic information of the boxing athletes

Characteristics	Number (n = 260)	Percentage
Time being boxing athletes (years)		
<1	29	11.2
1-5	160	61.5
5-10	56	21.5
10-15	14	5.4
>15	1	0.4
Frequency of training (hours/week)		
<10	73	28.1
10-20	55	21.1
20-30	109	41.9
>30	23	8.9
Frequency of fighting (matches/year)		
0-10	125	48.1
11-20	62	23.8
21-30	26	10.0
31-40	21	8.1
41-50	16	6.1
51-80	5	1.9
81-100	5	1.9
Weight upon fighting (kilograms)		
<45	142	54.6
47.5	40	15.4
49.0	13	5.0
51.0	11	4.2
52.5	8	3.1
54.0	11	4.2
55.5	8	3.1
57.5	6	2.3
59.5	4	1.5
61.5	6	2.3
64.0	5	1.9
67.0	3	1.1
70.0	1	0.4
73.0	2	0.8
Location of boxing camp		
Upper northeast Thailand	128	49.2
Lower northeast Thailand	130	50.8
Location of boxing camp		
Urban	67	25.8
Rural	193	74.2
Use of protective gear		
No	239	91.9
Yes	21	8.1
Time being boxing athletes (mean (SD) in years)	4.4 (0.2)	0.06-17.0
Frequency of training (mean (SD) hours/week)	18.2 (0.6)	2.0-49.0
Frequency of fighting (mean (SD) matches/year)	17.7 (1.2)	0-110

Table 3. Information regarding dental trauma and jaw injuries

Trauma/injuries	Number	Percentage
History of trauma/injuries		
Yes	61	23.5
No	199	76.5
Number of trauma/injuries		
1	32	52.5
2	14	22.9
3	3	4.9
5	5	8.2
6	1	1.6
10	4	6.6
12	1	1.6
15	1	1.64
Site of trauma/injuries		
Teeth	31	50.8
Lip	18	29.5
Upper jaw	12	19.7
Lower jaw	19	31.1
TMJ	12	19.7
Other	1	1.6
Causes of trauma/injuries		
Being attacked while fighting	56	91.8
Others	5	8.2
Times of trauma/injuries		
During competition	53	86.9
During training	8	13.1
Places where trauma/injuries occurred		
On the boxing ring	55	90.2
Others	6	9.8
First aid received after trauma/injuries		
No	38	62.3
Yes	23	37.7
Person attended to after trauma/injuries		
Coaches	22	36.1
None	22	36.1
Physicians/dentists	16	26.2
Others	1	1.6
Dental treatment received after trauma/injuries		
None	44	72.1
Extraction	8	13.1
Endodontic treatment (RCT)	6	9.8
Others	3	4.9
Type of tooth affected		
Upper anterior	15	48.4
Upper posterior	1	3.2
Lower anterior	9	29.0
Lower posterior	6	19.4
Severity of trauma/injuries		
Tooth fracture not involving pulp tissue	18	58.1
Tooth mobility	12	38.7
Tooth displacement	1	3.2

of dental and jaw injuries among these Thai boxing athletes were lower compared to the orofacial injuries among the basketball players in Nigeria[22], China[23], Croatia[24], Brazil[25] as well as among Japanese athletes[26]. Our findings are consistent with the evidence from prior research where high proportions of dental trauma existed among wrestling (83.3%), boxing (73.7%) athletes and basketball players (70.6%)[27]. It was found in this present study that tooth fracture was the most stated dental injury, which was in agreement with other reports[25,27,28,33-35]. The upper incisors were the most affected teeth (50.8%) in this present study, comparable to prior studies[8,16,18]. The reasons that upper central incisors were the most injurious teeth might be because of their location in the mouth and their size, which make them prone to any kind of trauma, impact, force, or accident. The finding that most of the injurious teeth were fractured without pulp exposure was also similar to prior studies[16-18]. Unfortunately, while several studies[12,20,22,23] have reported the injuries of soft tissues, including laceration of lips, tongue and gums as major frequent injuries, this present study did not assess the injuries of soft tissues.

Some previous researches among boxing athletes have reported occurrences of injuries to the body[6,7] as well as to oral cavity and jaw[8,10-15,26]. However, not many research studies among boxing athletes to date have assessed factors related to dental trauma and injuries and controlling for confounders. Among these, a previous study[13] reported that increasing age and number of fights were both significant predictors of dental trauma and injuries. However, this present study found that weight upon competing, location of boxing camps in the upper northeast of Thailand as well as boxing camps in rural area were directly related to dental trauma and injuries among these Thai boxing athletes in the final multivariable logistic regression model. Increased weight upon fighting corresponded to increased risk of getting dental trauma and jaw injuries, and may be explained partly by the reasons that heavier boxers also faced heavier forces from the opponents. Also, heavy weight made it more difficult for the boxers to avoid the attacks from the opponents. The boxing camps in the upper northeast regions as well as in the rural areas posed higher risk of dental and jaw injuries, which might have something to do with the fact that the boxers in those training camps may have different fighting experiences, or different boxing camps may have different standards, policies and regulations regarding use of protective gears, for which these require further exploration. However, in this present study, it was found that knowledge and attitudes regarding dental and jaw injuries did not relate to the

Table 4. Significance of the bivariate relationship between selected variables and dental trauma and jaw injuries

Variable	*p*-value
Gender (males vs. females)	0.561[b]
Age (years)	<0.001[a]
Age group (below 15 vs. 15+)	0.003[b]
Marital status (single vs. married)	0.236[b]
Weight (kilogram)	<0.001[a]
Height (centimeter)	<0.001[a]
Monthly income (Thai baht)	0.001[a]
Education (primary school/secondary school/ vocational school/bachelor degree or higher/others)	0.395[b]
Systemic diseases (no vs. yes)	0.657[b]
Weight upon fighting (kilogram)	<0.001[a]
Time being boxing athletes (year)	<0.001[a]
Hours of training per week (hour)	0.300[a]
Fighting matches per year (matches)	0.001[a]
Location of boxing camp (upper vs. lower northeast)	0.028[b]
Location of boxing camp (urban vs. rural)	0.029[b]

[a] Independent t-test; [b] Chi-square test

Table 5. Final multivariable logistic regression model of the relationship between dental trauma and jaw injuries and selected variables*

Variable	Adjusted odds ratio	95% confidence limit		*p*-value
		Lower	Upper	
1) Weight upon fighting (kilogram)	1.069	1.040	1.099	<0.001
2) Upper northeast Thailand	2.422	1.283	4.571	0.006
3) Boxing camps in rural area	4.525	1.923	10.638	0.001

* Nagelkerke R square = 20.3%

prevalence of dental and jaw injuries among these Thai boxing athletes (data not tabulated).

Dental trauma and injuries sustained by the athletes always have consequences, ranging from interruption of training and competition to disturbance of long-term activities of the athletes as well as the teams, causing financial burden as well as detrimental psychological or physical effects. Prior research has emphasized that dental trauma and injuries could be minimized if the athletes increase awareness and use of mouthguard regularly during training and competition[25,36-38]. Unfortunately, it was noted in this present study that regular use of mouth guards while training and competing among these Thai boxing athletes was rare. Previous research has also suggested that dentists, sport physicians and coaches should promote the use of mouth guards[25,38-40]. Therefore, sport authorities, dentists as well as other health personnel in Thailand should educate and encourage the use of mouth guards to reduce dental trauma and jaw injuries among Thai boxing athletes.

The importance of this present study lies in the fact that it is the first of its kind in Thailand. The study provides important information, which can be used for further research and subsequent comparisons. It also points out and documents the risks and danger involved in taking-up this sport and stresses the needs for safer rules and regulation, and also for better protective gear.

Limitations of the present study include the cross-sectional design whereby the cause-effect relationship between various factors with dental and jaw injuries cannot be confirmed. Moreover, future studies should assess a number of important issues such as complications or disabilities resulting from the injuries, loss of athletic performance, problems with occlusion, loss of jaw function, and other impacts on both physical and psychological effects of Thai boxing athletes.

Conclusion

Prevalence of dental and jaw injuries associated with Muay Thai kick boxing in this study was substantial, whereby tooth fracture was the most common dental injury. This high prevalence requires more attention with regard to prevention. The injuries were significantly higher among the athletes who were heavier and whose training camps located in the rural areas and the upper northeast regions of Thailand. Further studies are needed to evaluate the danger involved in Muay Thai kickboxing sport as well as the needs for safer rules and regulation, and also for better protective gear.

What is already known on this topic?

Boxing athletes suffer a high risk of dental and jaw injuries.

What this study adds?

The present study evaluated prevalence as well as factors related to dental and jaw injuries among Muay Thai kickboxing athletes in the northeast Thailand. The findings suggest that safer rules and regulation as well as better protective gear are needed in order to reduce dental and jaw injuries among Muay Thai kickboxing athletes.

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Potential conflicts of interest

None.

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การบาดเจ็บของฟันและกระดูกขากรรไกรในนักกีฬามวยไทย

สุภาภรณ์ ฉัตรชัยวิวัฒนา, ขนิษฐา ห้องสวัสดิ์, มุขดา ศิริเทพทวี, อมรรัตน์ รัตนสิริ

ภูมิหลัง: *เป็นที่ทราบกันดีว่านักกีฬามวยมีความเสี่ยงต่อการบาดเจ็บสูง โดยเฉพาะอย่างยิ่งการบาดเจ็บบริเวณฟันและกระดูกขากรรไกร ขณะที่กีฬามวยไทยได้รับความนิยมสูงขึ้นในประเทศไทยนี้ กลับยังมีหลักฐานการศึกษาน้อยมากเกี่ยวกับการบาดเจ็บบริเวณฟันและกระดูกขากรรไกรในนักกีฬามวยไทย*

วัตถุประสงค์: *ประเมินความชุกและความรุนแรง รวมทั้งปัจจัยที่เกี่ยวข้องกับการบาดเจ็บบริเวณฟันและกระดูกขากรรไกรในนักกีฬามวยไทย ในภาคตะวันออกเฉียงเหนือ*

วัสดุและวิธีการ: *ทำการสำรวจในนักกีฬามวยไทยที่อาศัยอยู่ในภาคตะวันออกเฉียงเหนือของประเทศไทยจำนวน 260 คน โดยทำการสอบถามและตรวจสุขภาพช่องปาก การวิเคราะห์ข้อมูลประกอบด้วยการวิเคราะห์ข้อมูลเชิงพรรณา วิเคราะห์ความสัมพันธ์ระหว่างสองตัวแปร และวิเคราะห์ความสัมพันธ์ในสมการถดถอยพหุคูณลอจิสติก*

ผลการศึกษา: *นักกีฬามวยไทย 23.5% มีการบาดเจ็บบริเวณฟันและกระดูกขากรรไกร ผลจากการวิเคราะห์ความสัมพันธ์ในสมการถดถอยพหุคูณลอจิสติกพบว่าน้ำหนักที่มากขึ้นของนักมวยจังหวัดที่ตั้งของค่ายมวย (ค่ายมวยในภาคตะวันออกเฉียงเหนือตอนบน) และค่ายมวยในเขตชนบท มีความสัมพันธ์กับการเกิดการบาดเจ็บบริเวณฟันและกระดูกขากรรไกร โดยมีค่าอัตราส่วนความเสี่ยงที่ปรับแล้ว (ช่วงเชื่อมั่น 95%) เป็น 1.069 (1.040, 1.099), 2.422 (1.283, 4.571) และ 4.525 (1.923, 10.638) ตามลำดับ*

สรุป: *นักกีฬามวยไทยประสบกับความเสี่ยงต่อการเกิดการบาดเจ็บบริเวณฟันและกระดูกขากรรไกร ผลจากการศึกษาครั้งนี้ควรนำไปสู่การหามาตรการป้องกันเพื่อลดการบาดเจ็บบริเวณฟันและกระดูกขากรรไกรในนักกีฬามวยไทยต่อไป*