

INVESTIGATION OF MANAGEMENT MODELS IN ELITE ATHLETE INJURIES

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This cross-sectional study investigated management models among elite athletes participating in sports including baseball, basketball, soccer, volleyball, tennis, softball, football, handball, track and field, swimming, judo, tae-kwon-do, gymnastics, archery, and weight lifting at the Tsoying National Sport Training Center. Data were collected by questionnaire. Of the 393 athletes investigated, 56% were male and 44% were female, with an average age of 20.9 years and average length of athletic experience of 9.8 years. At the time of the survey, 74.8% had sporting injuries and were being treated with Chinese and/or Western medicine. Among injured athletes, 14.5% chose Western treatment, 8.1% chose Chinese medicine, and 75.4% received combined treatment. There were various reasons for choosing the management model. Most athletes had ordinary self-recognition of sports injury prevention. Their qualified ability for sports injury prevention was 70%. This ability was significantly correlated with age, education, and sports experience. Within Taiwan's current medical and social environment, elite athletes prefer a combination of Eastern and Western treatments for sports injuries. Each of the medical approaches are widely accepted by elite athletes and their coaches. Doctors trained in Western medicine should learn these alternative treatment methods and apply them effectively in athletes, so that a better medical network can be established.

Key Words: sports injury, management model
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In Taiwan, there are two major methods of sports injury management, Western medicine and Chinese (traditional) remedies. Athletes usually select from the two different models when sports injuries occur. Chen asserts that, "In Taiwan, when the general public faces a sports injury, only 15% will seek Western medicine, while 34% receive Chinese treatments" [1]. Huang points out that previous surveys suggest that 40% of students and teachers who suffer from sports-related injuries prefer Chinese treatments, while only 20% prefer Western medicine [2]. In general, the

athlete's treatment preference largely depends on friends, family, coaches, and past experience.

This study examined elite athletes' behaviors when facing sports injuries and the reasons behind them. The database obtained may be used to understand athletes' behaviors and prolong their athletic careers.

MATERIALS AND METHODS

This study was based on a cross-sectional design using a general survey about sport-related injuries between March 2001 and June 2002 for athletes at Tsoying National Sport Training Center. The targeted athletes specialized in sports including baseball, basketball, soccer, volleyball, softball, handball, football, track and field, swimming, weight lifting, tae-kwan-do, judo, gymnastics, archery, and tennis. An

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injury was defined as any physical problem during practice or competition that resulted in an effect on or absence from the next practice or competition.

The survey was a paper-based questionnaire that athletes were required to complete. Individual interviews were conducted when incomplete surveys were returned. The questionnaire included information about the athletes (age, gender, height, and weight), history of sport-related injuries, sites of injuries, knowledge about sports injury prevention, medical history, and type of treatment preferred. Furthermore, the ability to prevent sports injuries was assessed using an eight-item scale with questions relating to an athlete's knowledge of sports injury prevention and treatments for acute injuries. A score of 60% or greater classified the athlete as "qualified" to prevent sport-related injuries whereas a score of lower than 60% classified an athlete as "unqualified".

Comparisons were performed using the Chi-squared test, Pearson's correlation, and the Spearman correlation to determine the relationships between different parameters. SPSS version 8.0 (SPSS Inc, Chicago, IL, USA) was used to analyze the data.

RESULTS

From the 500 questionnaires sent out, there was a valid questionnaire response rate of 78.6%. There were 393 athletes (220 males and 173 females) with an average age of 20.9 (± 3.3) years who specialized in 15 different activities (Tables 1 and 2). During the survey, 294 athletes (74.8%) were suffering from some sort of sport-related injury and 97.4% of the athletes had experienced such injuries in the past. Athletes experienced sports injuries during practice (95.4%) and at official games and competitions (76.6%). The most common sites of injuries were knees (58.8%), ankles (57.5%), shoulders (45.9%), waist (41.5%), and wrists (38.8%) (Figure).

Of all the athletes, 86.2% believed they had above-average knowledge and self-recognition of sports injury prevention. However, our data showed that only 68% of the athletes had a satisfactory general knowledge of sports injury prevention (Table 1). The survey suggested that 96.1% of athletes suffering from sports injuries sought Western treatment while 98.1% decided to seek Chinese remedies. Most athletes alternated between the two different treatments. The most popular type of Western treatment was physical therapy (73%) (Table 3) and only 16.7% of athletes had undergone surgery. The most popular

Table 1. Characteristics of athletes (independent)

Item	n (%)
Demographics	
Gender (n = 393)	
Male	220 (56.0)
Female	173 (44.0)
Occupation (n = 393)	
Student	281 (71.5)
Educator	36 (9.2)
Public servant	21 (5.3)
Business	16 (4.1)
Other	39 (9.9)
Education (n = 390)	
Junior school	13 (3.3)
High school	82 (21.0)
Junior college	10 (2.6)
College	269 (69.0)
Graduate	16 (4.1)
Injury	
Currently have sports injury (n = 393)	294 (74.8)
Past injury history (n = 385)	375 (97.4)
Injury occurred during practice (n = 393)	375 (95.4)
Injury occurred during competition (n = 393)	301 (76.6)
Treatment after injury	
Action after occurrence of sports injury (n = 384)	
Treat oneself	54 (14.1)
Ignore	5 (1.3)
Seek medical help immediately	129 (33.6)
Deal with it initially by oneself	196 (51.0)
Know the cause of injury (n = 383)	
Know	336 (87.7)
Do not know	47 (12.3)
Know the extent of injury (n = 383)	
Know	306 (79.9)
Do not know	77 (20.1)
Try to find the cause of injury (n = 381)	
Yes	293 (76.9)
No	88 (23.1)
Try to improve the condition (n = 381)	
Yes	339 (89.0)
No	42 (11.0)
Knowledge	
Knowledge and self-recognition of sports injury prevention (n = 376)	
Very sufficient	14 (3.8)
Sufficient	53 (14.1)
Ordinary	257 (68.3)
Insufficient	44 (11.7)
Very insufficient	8 (2.1)

traditional Chinese treatments were Chinese style applications, massage, and acupuncture.

Regarding actions taken by athletes after the occurrence of a sports injury, 51% of athletes attempted to treat the

Table 2. Characteristics of athletes (dependent)

	Mean ± SD	Min	Max
Age (yr)	20.9 ± 3.3	13	33
Athletic history (yr)	9.8 ± 3.3	2	21
Height (cm)			
Male	177 ± 8.5	157	202
Female	164 ± 6.9	143	185
Weight (kg)			
Male	77.2 ± 12.6	55	130
Female	59.8 ± 10.2	31	108
Training/day (hr)	5.2 ± 1.7	1.5	10
Length of warm-up (min)	24.6 ± 14.1	1	90

condition themselves and only consulted professional medical help if that proved ineffective, 33.6% sought medical attention immediately, 14.1% treated the condition themselves completely, and 1.3% ignored the injury (Table 1). When the injury produced significant long-term effects that did not seem to improve, 45% of athletes chose to suspend activity for a period of time.

When a sports injury occurred, 87.7% of athletes knew the cause of the injury, 79.9% knew the extent of the injury, 76.9% tried to find the cause of the injury if it was not known, and 89% tried to improve the condition. When asked about their knowledge of sports injury, 68.3% of the athletes believed their knowledge was "average", 17.9% believed they were "knowledgeable or very knowledgeable", and 13.8% believed they lacked sufficient knowledge.

Regarding the athletes' ability to prevent sports injury, 70% of athletes achieved passing scores. The pass rate was higher among males (75.5%) than females (64.3%), in those over 20 years of age, and in those involved in the sport for

Table 3. Medical treatments sought by athletes after sports injury

	n (%)
Had medical treatment (n = 393)	378 (96.1)
Western medicine (n = 378)	370 (97.9)
Surgery	63 (16.7)
Physical therapy	276 (73.0)
Take medicines	175 (46.3)
Other	9 (2.4)
Chinese medicine (n = 378)	371 (98.1)
Massage	242 (64.0)
Acupuncture	219 (57.9)
Chinese style application	246 (65.1)
Take Chinese herbal medicines	129 (34.1)
Other	7 (1.9)

a longer period of time (Table 4). Athletes involved in a sport for more than 10 years had the highest pass rate (74.5%). In terms of highest education received, with a college degree as a cut-off point, the pass rate was the same (Table 4).

DISCUSSION

From an athlete's perspective, any sport has the potential to cause injury, especially for high-achieving athletes who are involved in very active sports. According to Huang, physical education teachers and students are at a 90% risk of a sport-related injury [2]. This study found that, among 393 athletes, 97.4% had experienced a sports injury (Table 1). Moreover, as many as 100% of baseball, basketball, soccer, volleyball, judo, tae-kwan-do, weight lifting, football, and softball

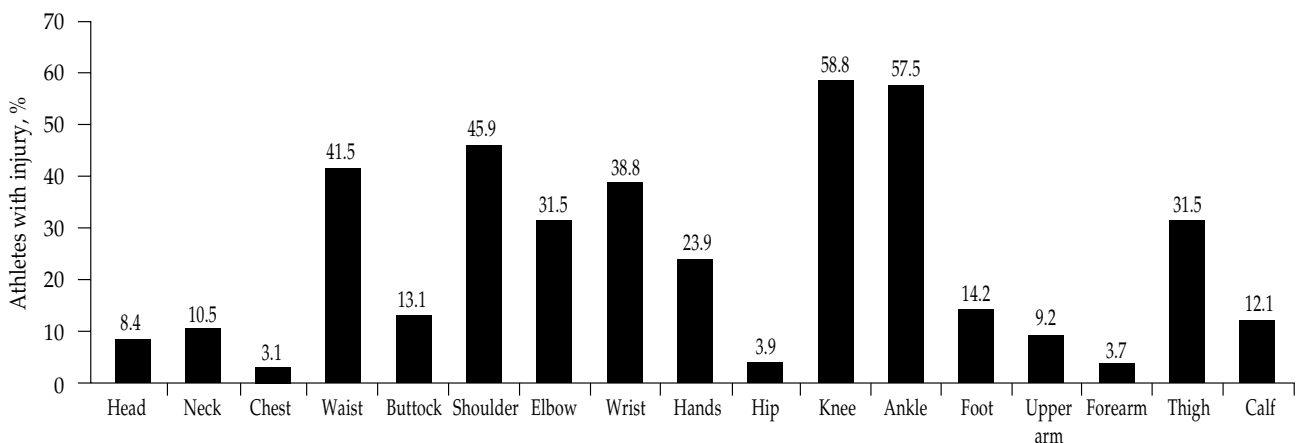


Figure. Locations of sports injury.

Table 4. Relationship between athlete characteristics and sports injury prevention ability

Score	N (%)	Gender, n (%)		Age, n (%)		Sport history, n (%)			Education, n (%)	
		Male	Female	≤ 20 yr	> 20 yr	< 5 yr	5-10 yr	> 10 yr	< University	University
4-8	115 (30.0)	54 (25.5)	61 (35.7)	54 (31.6)	61 (28.8)	10 (45.5)	69 (31.4)	36 (25.5)	30 (30.0)	85 (30.0)
9-14	268 (70.0)	158 (75.5)	110 (64.3)	117 (68.4)	151 (71.2)	12 (55.5)	151 (68.6)	105 (74.5)	70 (70.0)	198 (70.0)
Total	383	212 (55.4)	171 (44.6)	171 (44.6)	212 (55.4)	22 (5.7)	220 (57.4)	141 (36.8)	100 (26.1)	283 (73.9)

athletes reported suffering a sports injury (Table 5). These sports include contact sports (football, soccer, judo, and taekwan-do) and some semi-contact sports (basketball, volleyball, and softball). This shows that the inherent risk of sports injury is related to the degree of contact, speed, and player exposure.

Our study shows that athletes who suffered from sports injuries in the past were most likely to suffer again. Of the 393 athletes, 74.8% currently had a sports injury. A total of 785 incidents of sports injury were reported, giving an average of 2.5 episodes of injury per athlete. Of these, 28.9% were first-time injuries, while 71.1% were repeat injuries (Table 6), suggesting that sports injuries are often preceded by a prior injury. The nature of the sport and the athlete's medical history are important in predicting future episodes of injury. Walter et al's research also pointed out that only 50% of sports injuries are new, while the rest are repeat injuries [3].

This study found that, when a sports injury occurs, more than half (51%) of athletes will attempt to treat the condition themselves before seeking professional medical attention, while only 1.3% will ignore the injury. Among college football players in 1988, Wong found that most athletes treated sports injuries themselves without medical attention (38.3%), and as many as 18.5% ignored the injury [4]. This contrasts with the current study, which suggests an increasing awareness of sports injury prevention and treatment. As previously indicated, 87.7% of athletes knew the cause of the injury and 79.9% knew the extent of the injury. However, only 76.9% would seek the cause of the injury and the condition under which it happened (Table 1). It is reassuring that 89% of athletes were willing to take measures to prevent future repeat injury.

According to Chen [1], 5-34% of citizens who seek professional medical attention in Taiwan choose Western medicine; 40% of physical education teachers and students seek traditional Chinese medicine, while 20% seek Western medical help [2]. This study found that, among 393 national athletes, 96.1% sought professional medical attention to improve or treat the sports injury (Table 1). Of these athletes, 97.9% received Western medicine and 98.1% received traditional Chinese medical care. This study did not find any significant preference among athletes for Western or Eastern medicine. This indicates that many athletes believe that using both fields concurrently can achieve synergistic effects. For any injury, however, it is important to seek the most appropriate treatment or therapy as soon as possible to achieve the optimal therapeutic effect and to reduce the risk of sports injury-related illnesses.

Table 5. Correlation between sport and injury location

	N	Head n (%)	Neck n (%)	Chest n (%)	Waist n (%)	Buttock n (%)	Shoulder n (%)	Elbow n (%)	Wrist n (%)	Hands n (%)	Hip n (%)	Knee n (%)	Ankle n (%)	Foot n (%)	Upper arm n (%)	Forearm n (%)	Thigh n (%)	Calf n (%)	Total n (%)
Baseball	51	3 (5.9)	1 (2.0)	2 (3.9)	22 (43.1)	3 (5.9)	23 (45.1)	20 (39.2)	23 (45.1)	12 (23.5)	1 (2.0)	18 (35.3)	22 (43.1)	5 (9.8)	2 (3.9)	2 (3.9)	9 (17.6)	1 (2.0)	51 (100.0)
Basketball	12	2 (16.7)	1 (8.3)	1 (8.3)	4 (33.3)	1 (8.3)	7 (58.3)	6 (50.0)	5 (41.7)	4 (33.3)	0	7 (58.3)	10 (83.3)	2 (16.7)	1 (8.3)	1 (8.3)	6 (50.0)	3 (25.0)	10 (83.3)
Football	24	4 (16.7)	2 (8.3)	1 (4.2)	11 (45.8)	7 (29.2)	2 (8.3)	2 (8.3)	6 (25.0)	4 (16.7)	0	18 (75.0)	19 (79.2)	5 (20.8)	0	0	13 (54.2)	2 (8.3)	24 (100.0)
Volleyball	25	0	3 (12.0)	0	16 (64.0)	1 (4.0)	18 (72.0)	12 (48.0)	9 (36.0)	6 (24.0)	2 (8.0)	21 (84.0)	18 (72.0)	2 (8.0)	3 (12.0)	0	6 (24.0)	2 (8.0)	25 (86.2)
Track & field	16	0	1 (6.3)	0	7 (43.8)	1 (6.3)	3 (18.8)	1 (6.3)	2 (12.5)	4 (25.0)	0	8 (50.0)	8 (50.0)	2 (12.5)	1 (6.3)	0	9 (56.3)	5 (25.0)	15 (93.8)
Archery	24	1 (4.2)	4 (16.7)	0	8 (33.3)	3 (12.5)	15 (62.5)	2 (8.3)	15 (62.5)	5 (20.8)	1 (4.2)	9 (37.5)	2 (8.3)	3 (12.5)	5 (20.8)	0	4 (16.7)	3 (12.5)	23 (95.8)
Gymnastics	20	5 (25.0)	5 (25.0)	1 (5.0)	13 (65.0)	6 (30.0)	7 (35.0)	9 (45.0)	10 (50.0)	8 (40.0)	1 (5.0)	13 (65.0)	16 (80.0)	6 (30.0)	2 (10.0)	3 (15.0)	2 (10.0)	4 (20.0)	19 (95.0)
Judo	39	0	4 (10.3)	1 (2.6)	10 (25.6)	9 (23.1)	23 (59.0)	18 (46.2)	11 (28.2)	8 (20.5)	2 (5.1)	28 (71.8)	20 (51.3)	8 (20.5)	2 (5.1)	0	3 (7.7)	2 (5.1)	37 (94.9)
Tae-kwon-do	19	2 (10.5)	1 (5.3)	0	4 (21.1)	3 (15.8)	0	5 (26.3)	6 (31.6)	10 (52.6)	2 (10.5)	14 (73.7)	17 (89.5)	8 (42.1)	1 (5.3)	2 (10.5)	12 (63.2)	11 (57.9)	19 (100.0)
Weight lifting	23	0	2 (8.7)	2 (8.7)	16 (69.6)	7 (30.4)	14 (60.9)	12 (52.2)	17 (73.9)	4 (17.4)	5 (21.7)	19 (82.6)	9 (39.1)	2 (8.7)	2 (8.7)	3 (13.0)	10 (43.5)	2 (8.7)	23 (100.0)
Swimming	16	0	2 (12.5)	0	7 (43.8)	1 (6.3)	9 (56.3)	2 (12.5)	2 (12.5)	2 (12.5)	0	8 (50.0)	3 (18.8)	1 (6.3)	3 (18.8)	2 (12.5)	4 (25.0)	0	16 (80.0)
Handball	26	6 (23.1)	1 (3.8)	1 (3.8)	13 (50.0)	3 (11.5)	6 (23.1)	12 (46.2)	7 (26.9)	10 (38.5)	0	13 (50.0)	19 (73.1)	2 (7.7)	2 (7.7)	6 (23.1)	11 (42.3)	2 (7.7)	23 (88.5)
Tennis	29	0	0	0	4 (13.8)	0	9 (31.0)	11 (37.9)	13 (44.8)	4 (13.8)	0	6 (20.7)	14 (48.3)	2 (6.9)	6 (20.7)	2 (6.9)	11 (37.9)	2 (6.9)	27 (93.1)
Rugby	31	8 (25.8)	10 (32.3)	2 (6.5)	12 (38.7)	3 (9.7)	21 (67.7)	1 (3.2)	8 (25.8)	6 (19.4)	1 (3.2)	20 (64.5)	21 (67.7)	4 (12.9)	0	0	13 (41.9)	3 (9.7)	31 (88.6)
Softball	26	1 (3.8)	3 (11.5)	1 (3.8)	11 (42.3)	2 (7.7)	18 (69.2)	7 (26.9)	14 (53.8)	4 (15.4)	0	21 (80.8)	21 (80.8)	2 (7.7)	4 (15.4)	1 (3.8)	8 (30.8)	4 (15.4)	26 (100.0)
Total	381	32 (8.4)	40 (10.5)	12 (3.1)	158 (41.5)	50 (13.1)	175 (45.9)	120 (31.5)	148 (38.8)	91 (23.9)	15 (3.9)	223 (58.5)	219 (57.5)	54 (14.2)	35 (9.2)	14 (3.7)	120 (31.5)	46 (12.1)	369 (96.9)

Table 6. Distribution of new and repeated sports injuries

	Head n (%)	Neck n (%)	Chest n (%)	Waist n (%)	Buttock n (%)	Shoulder n (%)	Elbow n (%)	Wrist n (%)	Hands n (%)	Hip n (%)	Knee n (%)	Ankle n (%)	Foot n (%)	Upper arm n (%)	Forearm n (%)	Thigh n (%)	Calf n (%)	Total n (%)
New injury	5 (45.5)	8 (66.7)	2 (50.0)	20 (23.5)	12 (40.0)	31 (28.7)	20 (35.7)	14 (20.6)	14 (31.8)	4 (66.7)	40 (28.2)	18 (15.8)	9 (45.0)	6 (37.5)	0	16 (32.7)	8 (50.0)	227 (28.9)
Repeated injury	6 (54.5)	4 (33.3)	2 (50.0)	65 (76.5)	18 (60.0)	77 (71.3)	36 (64.3)	54 (79.4)	30 (68.1)	2 (33.3)	102 (71.8)	96 (84.2)	11 (55.0)	10 (62.5)	4 (100.0)	33 (67.3)	8 (50.0)	558 (71.1)
Total	11 (2.8)	12 (3.1)	4 (1.0)	85 (21.6)	30 (7.4)	108 (27.5)	56 (14.2)	68 (17.3)	44 (11.2)	6 (1.5)	142 (36.1)	114 (29.0)	20 (5.1)	16 (4.1)	4 (1.0)	49 (12.5)	16 (4.1)	785 (100.0)

Table 7. Correlation coefficient between prevention ability and athlete characteristic

	Correlation coefficient	p
Age*	0.211	0.001
Gender	0.181	0.532
Education level†	0.174	0.008
Athletic history*	0.196	0.005

*p < 0.01; †p < 0.05.

Of sports injury cases at the Iowa Junior Olympics in 1985, 34% required attention only from trainers, 46% were referred to local physicians, and 20% were referred to specialists [5]. This study found that, of patients who sought Western medical help, 17% required treatment from orthopedic surgeons to correct or treat the outstanding injury and 74.6% were treated by orthopedic doctors or physical therapists. More than half of the patients sought treatment from Eastern medicine, including traditional massage (64%), acupuncture (57.9%), and Chinese topical applications (65.1%) (Table 3).

This study found that most athletes' knowledge of sports injury was in the range of "average" to "knowledgeable or highly knowledgeable". Huang found that, of 238 athletes who participated in the 76th Taiwan athletics competition, 54.5% acknowledged that they knew "a thing or two" about sports injury [2]. The athletes were aged 10–30 years, similar to this study (13–33 years), but their educational background was unknown, while most subjects in this study completed college (73.1%). There has been increasing care regarding athlete's health, including public efforts to increase awareness of sports injury prevention. This, in addition to the athletes' advancing education, means that as many as 90% of today's athletes have significantly increased their knowledge and awareness of sports injury and its related prevention and treatment issues.

However, even though general awareness has increased, only 70% of athletes had passing scores for their ability to prevent sports injury. This deficit was due to the lack of active measures against sports injury. Athletes' ability to prevent sports injury increased significantly with age, experience, and education ($p < 0.05$) (Table 7). This shows that education is beneficial for the prevention of sport-related injuries. Related agencies can use educational materials to further educate and publicize this important information, so that athletes gain better knowledge in terms of sports injury prevention and treatment.

In our survey, 74.8% of athletes were suffering from sports injury and sought treatment. Most of the athletes who had experienced a sports injury in the past decided to use a combination of Eastern and Western treatments (96.1%). According to our survey, 14.5% of athletes would select Western treatment only, while 8.1% would choose traditional Chinese medicine only. Most athletes (75.6%) preferred combining Western and Eastern treatments.

It is apparent that elite athletes in Taiwan prefer a combination of Eastern and Western treatments for sports injuries. The completely different medical approaches of Eastern and Western medicine are widely accepted by elite athletes and coaches. Mainstream Western medicine doctors should not overlook traditional Eastern medicine, and they should learn from these alternative treatment methods and apply them effectively. If Western doctors can work together with Chinese traditional doctors, we can improve our medical

network and provide better medical care to athletes.

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精英選手運動傷害醫療模式的探討

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利用左營國家選手運動訓練中心，總共十六項運動項目包括 393 位選手，進行橫斷式問卷調查，探討國家級運動選手的運動傷害狀況，以及傷害後的就醫方式和選手運動傷害的防護能力。75.4% 的選手選擇中、西醫並用，而對運動傷害防護的認知有 70% 的選手屬於合格，又和選手的年齡、教育、年資呈顯著的正相關 ($p < 0.05$)。在台灣目前的醫療環境，由於選手偏好中西合併的治療模式，故接受西洋醫學的醫師更要學習和了解傳統中醫的治療理論和其應用，如果能在運動醫療體系，結合中西醫療之精萃，更能提供選手更完整和全方位的照護。

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