

ORIGINAL ARTICLE

Psychosocial Factors and Injury Risk in Taekwondo: An Exploratory Prospective Cohort Study

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Abstract

The purpose of this study was to examine the psychological profile of Taekwondo athletes competing at the 2011 Australian National Championships and to explore the potential relationship between psychosocial variables and injury risk. Forty-five athletes aged 16 years and older consented to complete a pre-tournament survey comprising demographic information and a battery of questionnaires designed to quantify four separate psychosocial factors (i.e., life-changing events, competition anxiety, coping skills, and social support). Older athletes had significantly lower competition anxiety ($p = 0.035$) and greater satisfaction with social support ($p = 0.019$) relative to younger athletes. Female athletes reported significantly fewer positive life events ($p = 0.039$) compared to their male counterparts. These findings indicate that younger or inexperienced athletes and females may be at greater risk from psychosocial stressors. Targeted programs to address these stressors may be beneficial; however, further research is needed to elucidate the relationships between injury risk and psychosocial factors in Taekwondo athletes.

Keywords: risk factors, psychological stress, competition anxiety, coping skills, social support, athletic injuries

Introduction

Taekwondo is a popular modern martial art and Olympic combat sport characterized by its emphasis on highly dynamic kicking techniques. As in any contact sport, there is an inherent risk of injury in full-contact Taekwondo. Indeed, previous literature reviews have identified that there is a substantial injury risk in competition Taekwondo (16, 22). While Pieter et al. reported injury rates between 20.6 and 139.5 per 1000 athlete-exposures, Lystad et al. used meta-regression to estimate an overall mean injury rate of 79.3 per 1000 athlete-exposures after adjusting for level of play, gender, and age (16, 22). Moreover, the reviews also reveal a distinct injury pattern in Taekwondo: the lower limb and head injuries are the predominant anatomical sites of injury, and contusion and joint sprain are the most common types of injury (16, 22). A distinct injury pattern suggests that the sport has a unique set of risk factors and mechanisms of injury.

Effective sports injury prevention depends on identifying the

factors that influence the risk of injury, in particular factors that may be amenable to preventive interventions (i.e., modifiable risk factors). A recent systematic review revealed a paucity of investigations attempting to identify risk factors for injury in Taekwondo (17). The available data indicate that athletes competing in heavier weight divisions are at a greater risk of injury, and adolescent athletes are at greater risk of concussion injuries (17). There is a clear need for further epidemiologic research to identify modifiable risk factors for injury in Taekwondo.

Over the past few decades, preventive sports medicine scientists have increasingly been investigating the influence of psychosocial factors on the incidence and severity of sporting injuries (1, 13). Based on stress theory adapted from earlier models, Junge proposed an integrative theoretical model of the influence of psychosocial stressors (e.g., life-changing events), coping resources (e.g., coping skills and social support), and emotional states (e.g., competition anxiety) on injury occurrence (13). According to this model, psychosocial stressors, coping

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resources, and emotional states may influence how athletes react to any particular situation with risk of injury (13).

Although several studies have investigated the relationship between various psychological factors and injury risk in a number of different sports (e.g., American football, gymnastics, and running), the authors are unaware of any peer-reviewed, published studies specifically pertaining to Taekwondo athletes. This paper consequently seeks to provide the first exploratory analysis of psychosocial factors in Taekwondo athletes, because the psychological profile of Taekwondo athletes may differ from that of athletes in other sports (e.g., less risk averse or more optimistic), and the athletic situations with risk of injury are, at least in some respects, different in Taekwondo compared to other sports. Specifically, the purpose of this study was to: (1) examine the psychological profile of Taekwondo athletes competing at the 2011 Australian National Championships using a battery of four psychological questionnaires, (2) identify potential relationships between psychosocial stress and coping resources with demographic characteristics to potentially aid in the identification of Taekwondo athletes most at risk for injury, and (3) explore potential relationships between psychosocial variables and injury incidence.

Methods

Study population

All athletes aged 16 years and older competing at the 2011 Australian National Taekwondo Championships (Canberra, Australia) were eligible to participate in this study. The tournament included both a full-contact sparring competition and a technical competition in which the athletes performed specific sequences of techniques called *poomsae*.

Procedure

Invitations to participate in this study were included in the tournament registration packs. The packs were distributed via email by the tournament organizer to head instructors and prospective tournament registrants. Eligible participants were asked to complete an online survey comprising a brief demographic information section and a battery of four psychosocial questionnaires prior to the commencement of the tournament. During the tournament, injury data were collected from athletes requesting medical assistance from the official sports medicine personnel (i.e., a trauma physician, a paramedic, sports physiotherapists, and sports chiropractors) covering the

event. The attending health professional would relay clinical diagnoses to a trained research assistant, who in turn recorded the information on a purpose-made injury form. Actual time-loss from full participation in training and match play was determined by conducting weekly follow-up telephone interviews with injured athletes for up to five weeks post-tournament.

Survey instrument

The demographic section included questions about age, gender, height, and weight. Body mass index (BMI) was subsequently calculated as weight (kg) divided by height squared (m^2). Individuals were categorized by BMI using the following standard guidelines: underweight (under $18.5\text{kg}/m^2$), normal (18.5 to $25\text{kg}/m^2$), overweight (25.0 to $30\text{kg}/m^2$), and obese ($30.0\text{kg}/m^2$ and over) (6).

The battery of psychosocial questionnaires was used to quantify four separate psychosocial variables: life stress, competition anxiety, coping skills, and social support. These variables were drawn from the aforementioned model of the influence of psychological factors on sports injury by Junge (13). All four psychosocial questionnaires have previously been validated (9, 18, 20, 21, 24, 25) and are routinely utilized for research purposes (5, 12, 19, 29, 30).

Major changes in the lives of participating athletes (i.e., life stresses) were quantified using the Life Event Survey for Collegiate Athletes (LESCA) (21). LESCA allows athletes to subjectively assess the impact of 69 possible life events on a scale from -4 (extremely negative) to 4 (extremely positive). The sum of all the negatively scored items gave rise to the negative subscale (LESCA-), and the sum of all the positive items constituted the positive subscale (LESCA+). The total LESCA score is the sum of the absolute value (modulus) of each item.

Competitive anxiety was quantified using the trait scale Sport Competition Anxiety Test (SCAT) (18). SCAT is comprised of 15 statements about how the athlete feels when competing in his or her sport. The 15 items were scored from 1 (rarely) to 3 (often), except for two items that were reverse scored and five items that scored zero regardless of the response. Hence, SCAT scores may range from 10 to 30 with levels of anxiety categorized as low (less than 17), average (17 to 24), and high (above 24).

Two different aspects of athletes' coping resources were measured. Firstly, sport specific psychological coping skills were quantified using the 28-item Athlete Coping Skills Inventory (ACSI-28) (26). Athletes rate the 28 statements on a 4-point scale, which in turn is scored from 0 (almost never) to 3 (almost always), except for six items which were reverse scored. Thus, the total ACSI-28 score may range from 0 to 84, where higher

scores imply better coping skills. Secondly, perceived availability and satisfaction with social support were quantified using the modified 6-item Social Support Questionnaire (SSQ-6), which was developed from a 27-item validated parent scale (24). Each of the six items has two parts. The first part of each item asks athletes to list all (maximum nine) the people they know, excluding themselves, whom they can count on for help or support. The perceived availability of social support (SSQ-N) is the average number of people listed in the first part of each item and may therefore range from 0 to 9. The second part of each item asks the athletes to rate their satisfaction with the overall support on a scale from 1 (very dissatisfied) to 6 (very satisfied). The perceived satisfaction with social support (SSQ-S) is the average score of the second part of each item and may therefore range from 1 to 6.

Injury definitions

This study adopted the operational injury definitions recommended by Lystad et al. (16). Thus, an injury was defined as any physical complaint for which an athlete would seek assistance from tournament medical personnel (medical attention injury). Recorded injuries were classified according to the Orchard Sports Injury Classification System, Version 10, which is a widely used, open access, and specific sports injury classification system (23). One athlete-exposure was defined as one athlete participating in one fight. Injury severity was defined in terms of the number of days that elapsed from the date of injury to the date of the athlete’s return to full participation in training and match play and categorized as: slight (0–1 day), minimal (2–3 days), mild (4–7 days), moderate (8–28 days), and severe (>28 days).

Data analysis

The four psychosocial questionnaires were scored according to their instructions. Descriptive statistics (mean ± standard error) were used to summarize demographic and psychosocial questionnaire scores. Two-sample student t-tests were used to check for differences between males and females and between sparring and *poomsae* athletes, while multivariate linear regression analyses were undertaken to look for relationships between psychosocial questionnaire scores and demographic variables. All statistical analyses were performed using R, version 2.14.2 (R Foundation for Statistical Computing, Vienna, Austria).

Ethical considerations

Informed consent was first obtained online when eligible participants completed the survey, and written consent was subsequently obtained on-site from athletes presenting with injury. This study was approved by the Macquarie University Human Research Ethics Committee.

Results

There were 1,513 entries to the various contests at the tournament; however, because many athletes entered multiple contests (e.g., sparring and *poomsae*, multiple sparring divisions, individual and team *poomsae*, or any other combination of the above), the total number of unique athletes participating at the championships is likely to be considerably lower than the total number of entries. Although the actual participation rate in this study is not known (because the total number of unique athletes is unknown), it is believed to be very low. Of the 45 athletes (38% females) who started the online survey, all completed the demographic section and the first psychosocial questionnaire (SCAT). Twenty-seven (60%) of these athletes were sparring

Table 1. Sample characteristics

	Total (N = 45)	Female (N = 17)	Male (N = 28)	p value ^a
Age (yr), mean ± SE	31.3 ± 2.1	28.8 ± 2.5	32.8 ± 2.9	0.294
Age range (yr)	16–70	16–44	16–70	-
Height (cm), mean ± SE	172.0 ± 1.2	166.2 ± 1.5	175.5 ± 1.4	< 0.001
Weight (kg), mean ± SE	71.6 ± 1.9	64.3 ± 2.4	76.1 ± 2.2	< 0.001
BMI (kg/m ²), mean ± SE	24.2 ± 0.6	23.2 ± 0.7	24.8 ± 0.8	0.161

BMI: body mass index; SE: standard error.
^a Comparison of means, female versus male athletes.

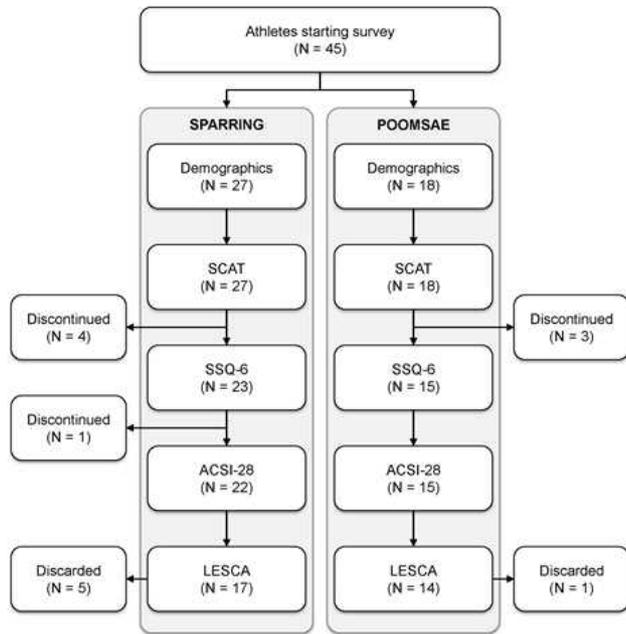


Figure 2. Flow diagram depicting the number of completed questionnaires in the online survey.

competitors and 18 (40%) were *poomsae* competitors. Table 1 provides an overview of the demographic characteristics of the respondents. Although there were significant differences between males and females in terms of height ($p < 0.001$) and weight ($p < 0.001$), there was no difference in BMI ($p = 0.161$). Eight athletes discontinued the online survey before completing the final questionnaire (LESCA), while six respondents did not complete LESCA correctly (i.e., they reported having experienced all life events in the LESCA questionnaire, including both female and male specific life events, which is impossible). Incomplete or incorrectly completed questionnaire responses

were omitted from further analyses. Figure 1 depicts a flow diagram of the number of completed questionnaires in the online survey.

Table 2 provides an overview of the psychosocial questionnaire scores. Overall, the participants reported experiencing slightly more positive than negative life event stress (mean LESCA+ score: 18.1 ± 2.6 ; mean LESCA- score: -14.2 ± 2.7) and feeling an “average” level of competition anxiety (mean SCAT score: 21.0 ± 0.7). The Taekwondo athletes were also found to possess good coping skills (mean ACSI-28 score: 50.9 ± 2.5). They reported having, on average, three people, excluding themselves, whom they can count on for help or support (mean SSQ-N score: 3.4 ± 0.3). The athletes also reported high levels of satisfaction with the overall social support they have at their disposal (mean SSQ-S score: 5.2 ± 0.2).

Table 3 shows the results of the multivariate linear regression analyses investigating the relationship between psychosocial questionnaire scores (competition anxiety, social support, coping skills, and life events), demographic variables (age, gender), and activity (sparring or *poomsae*) in Taekwondo athletes. Older age was found to be significantly associated with lower LESCA scores (coefficient: -0.56 [95% CI: $-1.07, -0.04$]; $p = 0.035$) and greater satisfaction with social support (coefficient: 0.03 [95% CI: $0.01, 0.05$]; $p = 0.019$). Males were found to report significantly greater LESCA+ scores compared to females (coefficient: 11.02 [95% CI: $0.58, 21.45$]; $p = 0.039$). In addition, the analyses suggested that older age might also be weakly associated with greater coping skills as determined on the ACSI-28 (coefficient: 0.34 [95% CI: $-0.02, 0.69$]; $p = 0.062$) and lower level of competition anxiety on the SCAT scale (coefficient: -0.10 [95% CI: $-0.20, 0.00$]; $p = 0.057$); however, these trends did not reach statistical significance.

Table 2. Mean psychosocial questionnaire scores with standard errors of Taekwondo athletes (sparring and *poomsae*).

Psychosocial questionnaire	N ^a	Mean ± SE	Range
SCAT	45	21.0 ± 0.7	13–30
SSQ-6			
SSQ-N	38	3.4 ± 0.3	0.3–8.2
SSQ-S	38	5.2 ± 0.2	1.3–6.0
ACSI-28	37	50.9 ± 2.5	14–81
LESCA	31	32.6 ± 3.2	0–62
LESCA-	31	-14.2 ± 2.3	-50–0
LESCA+	31	18.1 ± 2.6	0–47

ACSI-28: Athletic Coping Skills Inventory; LESCA: Life Events Scale for Collegiate Athletes; LESCA-: Life Events Scale for Collegiate Athletes, negative life events sub-scale; LESCA+: Life Events Scale for Collegiate Athletes, positive life events sub-scale; SCAT: Sport Competition Anxiety Test; SD: standard deviation; SSQ-6: Social Support Questionnaire (Short Form); SSQ-N: perceived availability subscale; SSQ-S: satisfaction subscale.

^a Number of completed questionnaires.

Table 3. Multiple linear regression analyses of relationships between psychosocial questionnaire scores and demographic variables in Taekwondo athletes (sparring and *poomsae*).

Questionnaire	Intercept	Coefficient (95% confidence interval)		
		Gender ^a	Activity ^b	Age ^c
SCAT	21.10 (18.56,23.63)	-1.18 (-4.04,1.67)	2.04 (-0.82,4.89)	-0.10 (-0.20,0.00)
SSQ-6				
SSQ-N	2.91 (1.85,3.97)	0.06 (-1.19, 1.30)	1.10 (-0.16,2.36)	-0.02 (-0.06, 0.03)
SSQ-S	5.34 (4.80, 5.88)	-0.07 (-0.71, 0.57)	-0.24 (-0.89, 0.40)	0.03 (0.01,0.05)*
ACSI-28	48.34 (40.29, 56.40)	7.09 (-2.52, 16.70)	-4.11 (-13.77,5.54)	0.34 (-0.02, 0.69)
LESCA	27.52 (16.20, 38.84)	5.37 (-7.40, 18.13)	4.62 (-8.11, 17.34)	-0.56 (-1.07, -0.04)*
LESCA-	-14.23 (-21.85, -6.61)	5.65 (-2.94, 14.24)	-7.08 (-15.64, 1.49)	0.28 (-0.06, 0.63)
LESCA+	13.29 (4.04, 22.55)	11.02 (0.58, 21.45)*	-2.46 (-12.86, 7.94)	-0.27 (-0.69, 0.15)

ACSI-28: Athletic Coping Skills Inventory; LESCA: Life Events Scale for Collegiate Athletes; LESCA-: Life Events Scale for Collegiate Athletes, negative life events sub-scale; LESCA+: Life Events Scale for Collegiate Athletes, positive life events sub-scale; SCAT: Sport Competition Anxiety Test; SSQ-6: Social Support Questionnaire (Short Form); SSQ-N: perceived availability subscale; SSQ-S: satisfaction subscale.

^a Reference group: female athletes.

^b Reference group: sparring athletes.

^c Age centered at 30; unit increase one year.

* Significant difference ($p < 0.05$).

The sparring athletes that participated in this study comprised a total of 45 athlete-exposures and 10 recorded injuries. The most commonly injured body region was the lower extremity (N = 2), followed by the upper extremity (N = 2) and trunk (N = 2). The most common type of injury was bruising/contusion (N = 5) followed by joint sprain (N = 3). The most common mechanisms of injury were receiving a blow (N = 4) and delivering a blow (N = 4). All the reported injuries were of minimal to mild severity (i.e., 2–7 days until the athlete returned to full participation in training).

Discussion

This study has examined the psychological profile of Taekwondo athletes and explored the potential influence of psychosocial factors for injury risk in Taekwondo. Whereas significant relationships were detected between psychosocial factors and demographic characteristics, any identification of significant relationships between injury incidence and psychosocial factors was precluded by the small sample of

recorded injuries and participating athletes.

Age, stress from life-changing events, and coping resources

This study revealed a significant negative relationship between LESCA scores and age, namely that older athletes experienced less stress from life-changing events during the 12 months preceding the tournament. The reason for this age difference is not entirely clear. However, it may simply reflect a transition from more turbulent years in puberty and adolescence to more stable years in early adulthood and into middle age. Alternatively, it may be that stress arising from life-changing events is mitigated by either better social support structures, which emerge during the transition from adolescence through young adulthood, or the adoption of more effective coping strategies which are accumulated through life experience itself.

In regard to better social support structures, there was no relationship between age and perceived availability of social support, but the results did reveal a significant, albeit small, positive relationship between age and satisfaction with social support. In regard to the adoption of more effective coping

strategies, the present results suggested a possible positive relationship between age and ACSI-28 scores; however, no statistically significant relationship could be demonstrated.

Coping is believed to be impacted by physical, cognitive, emotional, and social maturation. In a review of the literature, Hoar and Evans (11) concluded that as athletes progress through stages of maturation their coping strategies develop from that of primarily behavioral coping efforts to the combined use of both cognitive and behavioral coping efforts. Moreover, coping also continues to change throughout adulthood and into old age (7), and it is therefore important to avoid generalizing results across different age groups. As such, despite the lack of significant associations in the present study, younger athletes may nevertheless benefit from programs designed to enhance both their coping skills and the quality of their social support.

Gender, stress from life-changing events, and coping resources

Male Taekwondo athletes reported greater LESCA+ scores but lower LESCA- scores compared to their female counterparts; however, a statistically significant difference was detected only in the case of LESCA+ scores. Although disparate evidence of gender differences and stress from life-changing events has given rise to conflicting hypotheses, a meta-analysis found that females report both greater exposure to and appraisal of stressful events compared to males (4). It is suggested that gender role stereotypes may be a contributing factor. For example, promoting emotional expressiveness among females and stoicism among males may result in under-reporting of stressful experiences among males relative to females.

Although a substantial body of research has concluded that male and female athletes in general cope differently (10, 14), no statistically significant differences in coping skills were detected between genders in this study. The implications of the reported findings on gender, life stress, and coping suggest that it may be worthwhile to consider the potential utility of tailoring preventative psychosocial interventions by gender (e.g., problem-focused coping in females or attentional-focus strategies in males).

Competition anxiety

The considerable research efforts devoted to investigating the link between performance and anxiety, as well as the factors influencing the level of anxiety, have been detailed elsewhere (18). Although no statistically significant relationships between SCAT scores and demographic variables were detected in this

study, the literature suggests that there are some relationships between competition anxiety and demographic variables. For instance, competition anxiety increases slightly from childhood up until early adulthood (college years), at which time anxiety levels decrease (18). The absence of data from children and young adolescents in the present study precluded the identification of potentially confirmatory evidence of increasing levels of anxiety from adolescence into early adulthood. The present data, which were obtained from adult Taekwondo athletes (predominantly 20 to 40 years of age), correspond well with previous literature suggesting a continued decrease in levels of anxiety after leaving high school years (18). However, it may not be age in itself that is the crucial factor as years of experience (a factor that is also correlated with skill) has been reported to be a strong predictor of anxiety (2). This is not surprising considering that athletes eventually learn both the stratagems of the game and appropriate stress management techniques, which collectively serve to reduce the likelihood of encountering new and stressful events (8).

In regard to gender, the literature suggests that female athletes experience greater competitive anxiety than male athletes at the youth sport level, but the gender difference is reversed in older athletes (18). It is important to note, however, that significant gender effects may in fact not be determined by biological sex, but rather may be linked to gender roles or even competitiveness or perceived importance of the competition (18).

Targeted programs designed to alleviate competition anxiety and enhance coping skills may be worthwhile. One such educational intervention is coach effectiveness training, which provides coaches with specific behavioral guidelines for fostering positive coach-athlete relationships, reducing evaluation apprehension, and enhancing team cohesion (28). Although there is evidence to suggest that coach effectiveness training can significantly reduce children's trait anxiety (26, 27), there is uncertainty about how generalizable the evidence is (3, 15). Alternatively, the more recent intervention, the mastery approach to coaching, has similarly been demonstrated to affect motivational climate and reduce performance anxiety in athletes (27).

Injury incidence and psychosocial factors

Although other studies have identified significant relationships between injury occurrence and psychosocial factors, the small sample size in the present study precluded any such findings. This study nevertheless suggests that younger or inexperienced athletes and female athletes may experience more negative psychosocial influences, which subsequently may put these

athletes at greater risk of injury. Longitudinal studies with better power and compliance are necessary to further elucidate the potential influence of psychosocial factors on injury risk in Taekwondo.

Limitations

The low participation rate, small sample size, and voluntary nature of survey participation are major limitations of this study. For instance, it is likely that selection bias has resulted in a higher mean age and BMI of participants than expected for this population. The current sample may therefore not be representative of the target population, which consequently limits the generalizability of the findings. For pragmatic reasons, this study relied on the injury diagnoses provided by the tournament team of health personnel, whose credentials and level of experience may have varied considerably. This may give rise to inconsistencies and errors in injury diagnoses. Moreover, the lack of on-site advanced diagnostic technologies may have limited the accuracy of the injury diagnoses. The findings reported in this study should be interpreted in light of these limitations.

Conclusion

Older Taekwondo athletes had lower competition anxiety and greater satisfaction with social support relative to younger athletes. Female athletes reported fewer positive life events compared to their male counterparts. These preliminary findings suggest that younger, inexperienced, and female athletes may be at greater risk for injury due to psychosocial stressors. Targeted programs to address these stressors may be beneficial. While research elsewhere has indicated a relationship between psychosocial stressors and injury risk, further research is needed to elucidate these potential relationships in Taekwondo athletes.

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