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Corresponding author*
E-mail: tee89@naver.com

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A Survey of Injuries and a Comparative Study of Characteristics for Each Detailed Sport of TAEKWONDO

Youngnam Cha¹

Kosin University, Busan, Republic of Korea

Deuksu Park^{2*}

Korea National Sports University, Seoul, Republic of Korea

Abstract

Purpose: This study was conducted to examine the status of injuries by each detailed sport of Taekwondo and provide the basic data for developing an injuries prevention program appropriate for the characteristics of each sport.

Method: A total of 110 college and university Taekwondo athletes were targeted, including 35 for competition, 33 for poomsae, and 42 for demonstration, respectively, and the status of injuries and treatment methods were surveyed and analyzed. The results are as follows.

Results: First, as for the injuries related experiences, 82.4% of those for competition, 69.7% of those for poomsae, and 78% of those for demonstration turned out to have had relevant experiences, and as for the surgery related experiences by each sport, those for competition were 44.1%, those for poomsae were 15.2%, and those for demonstration were 21.4%, respectively. Second, as a result of analyzing the their recovery period, those for sparing were 28.6% and those for demonstration were 42.9% responding with less than 4 weeks at the most. Meanwhile, those for poomsae demonstrated the highest rate of 36.4% for over 6 months. Third, as a result of analyzing the situation of injuries, those for competition were 80%, those for poomsae were 78.8%, and those for demonstration were 63.4%, responding that they have suffered most injuries during this sport. Fourth, as a result of analyzing the causes of injuries, 24% of those for competition responded with collision or fall the most. 21.7% of those for poomsae and 25% of those for demonstration responded fatigue and overwork as the causes of injuries the most. Fifth, as a result of analyzing the timing of injuries, 36.8% of those for competition, 42.6% of those for poomsae, and 38.4% of those for demonstration responded that they have suffered the most injuries during the winter. Sixth, as a result of analyzing the types of injuries, sprains and fractures accounted for the most with 17.7%, respectively, while 18.9% of those for poomsae and 25.2% of those for demonstration responded the most with sprain. Seventh, as a result of analyzing the parts of injuries, 28.8% of those for competition, 34.5% of those for poomsae, and 34.5% of those for demonstration responded the most with lower body injuries. Lastly, as a result of analyzing the method of handling injuries, 24.7% of those for competition, 19.6% of those for poomsae, and 19.9% of those for demonstration responded the most with treatment after visiting an oriental medicine clinic.

Conclusion: Gathering which, given the high frequency of sports injuries for the athletes, conditioning is needed, and it is also determined that the measures for maintaining body temperature and preventing injuries are required during the winter exercises. Furthermore, given the characteristics of Taekwondo, the frequency of use of the lower body is quite high, and as it is evident that the lower body injuries are prevalent, and since there are many sprains and fractures, in line with the causes and types of such injuries, systematic training methods for improving the athletes' performance and preventing injuries, and such preventive methods as taping, braces, and warm-up exercises would likely be required.

[Keywords] Taekwondo, Demonstration, Poomsae, Competition, Injury

1. Introduction

Taekwondo is a sport for which the Republic of Korea is its origin, and the detailed sports are classified into competition, poomsae, and demonstration, respectively. Taekwondo's competition sport was adopted as a demonstration sport for and at the 1988 Seoul Summer Olympics, and has been maintained as an official sport since the 2000 Sydney Summer Olympics until the 2020 Tokyo Summer Olympics. Competition performs various actions including hand and foot work, directional change, and steps against the opponent during the game, and there is a high risk of injuries since strong contact and collisions occur much given the characteristics of the sport. Given such reason, the types of injuries are diverse, while the frequency of injuries is also high relative to other sports, and the methods and systems for preventing injuries are required.

Poomsae is a technical system which has been structured as a framework to ensure that trainees may train themselves with attack and defense techniques against virtual opponents[1][2]. Unlike other sports, Taekwondo poomsae games are not classified by weight class, but by age[3], while as a non-contact sport, its accuracy and expressiveness of techniques are evaluated on a scale of 10 points[4][5]. Most of the movements of poomsae require a maximum mobility of the joints, which cause injuries by causing problems including joint instability and muscular imbalance[6].

Taekwondo demonstration is a performance activity of Korean and foreign demonstration groups, which plays the role of promoting Taekwondo widely and the globalization and revitalization of Taekwondo[7]. Taekwondo demonstration is not a form of confrontation with the opponent like competition, but is consisted of sophisticated breaking, self-defense, and jumping kicks via brilliance and various changes[8][9], and has been acclaimed as a gaming sport which represents Taekwondo in tandem with competition and poomsae[10]. However, as the demonstration has developed beyond the context of sports and the means of publicity, the extent of sophistication has increased for the brilliant technical demonstration, while the members of the demonstration group are exposed to the risks of injuries[11].

In the field of sports, it is common to be unable to demonstrate the best performance or even give up on the career as athlete given unexpected injuries[12]. Due to such problems, athletes suffer from anxiety due to the injuries they sustain during the games and trainings, which negatively affects the overall athlete life. In a previous study, it was claimed that the pain caused by injuries was associated with a reduction of the training time[13], and since it has a negative effect on the performance, correct and immediate treatment is required[14]. However, according to the characteristics of the detailed sport of Taekwondo, there are differences in the movement and form of sport, while training methods and competition methods vary, and injuries, too, will be different.

Claimed that sports and injuries are inseparable, and identifying the causes and mechanisms of injuries is essential for the prevention and treatment of injuries, and for the rapid recovery of athletes, and to this end, the collection of basic data must be carried out in advance[15].

Most of the studies conducted to date on the Taekwondo sport related injuries and prevention Jung Hong-yong and Jeong Goo-yeol and Park Ik-yeol, Nam Jeong-soo and Lee Jae-hoon and, Jung Jin-ho and Jeon Jeong-woo[16][17][18] pertain to each sport, and the studies on competition account for the mainstream, and hence, it is quite difficult to apply them for the modern Taekwondo athletes who are diverse and further classified. Hence, it is intended to examine and understand the factors of injuries for each sport of Taekwondo, and provide them as the basic data for developing an injuries prevention program for the safe athlete life.

2. Research Method

2.1. Research tools and procedures

In this study, the questionnaire developed by the Korea Institute of Sports Science [19] was referred to examine and understand the injuries for each sport of Taekwondo, which were revised and supplemented in line with the purposes of the study along with its characteristics.

The structure of the questionnaire has been limited to the injuries which have arisen during the past year, consisted of 3 questions for personal characteristics (gender, age, and experience), 7 questions related to sports related injuries (timing of injuries, situation of injuries, and main causes of injuries), 2 questions related to the method of handling the injuries arisen (treatment method, etc.), while the detailed structure of the questionnaire is as illustrated in the following <Table 1>.

Table 1. Research tools and procedures.

Contents of questions	Detailed questions	No. of questions
Personal characteristics	Gender, age, taekwondo career	3
Characteristics of injuries	Injuries related experiences, time, parts, causes, forms	7
Response to injuries	Recovery period, treatment method	2

2.2. Research subject

The subjects of this study were only the athletes who understood the purpose of this study and voluntarily agreed among the Taekwondo athletes of University K in Busan, and a total of 110 people participated. Examining the demographic characteristics of each detailed sport, 35 people for competition, 33 for poomsae, and 42 for demonstration participated, of whom were 80 men and 30 women, respectively. The relevant details as illustrated in the following <Table 2>.

Table 2. Research subject.

Group	Classification	Competition	Poomsae	Demonstration
Gender	Men	28(80%)	19(57.6%)	33(78.6%)
	Women	7(20%)	14(42.4%)	9(21.4%)
Age	M±SD	21.26±1.27	21.61±1.06	21.55±1.23
Career	M±SD	10±3.77	10±4.24	9.31±3.79

2.3. Data processing and the statistical method

Among the data acquired in this study, the cases where the response details of the questionnaire were determined to be insincere or unreliable were excluded, and a total of 110 copies of the questionnaire were analyzed for the descriptive statistics and frequency by factor by using the Window SPSS 25.0 statistical program.

The multiple response frequency analysis was performed for the questions with multiple responses. The cross analysis was performed to examine and understand the variables for the injuries by each detailed sport, while all statistical significance level for each group was $\alpha=.05$, respectively.

3. Results

3.1. Injuries and surgery related experiences

As a result of the survey conducted on the injuries and surgery related experiences for each detailed sport of Taekwondo, it turned out that 82.4% of those for competition, 69.7% for poomsae, and 78% for demonstrations out of a total of 110 people sustained injuries, while 44.1% of those for competition, 15.2% for poomsae, and 21.4% for demonstration turned out to have sustained the surgeries for each sport, respectively. As for the surgery related experiences, it turned out that there was a difference for each sport($p<.05$).

Table 3. Injuries and surgery related experiences.

	Competition	Poomsae	Demonstration	χ^2
Injuries related experiences n(%)	28(82.4%)	23(69.7%)	32(78%)	.458
Surgery related experiences n(%)	15(44.1%)	5(15.2%)	9(21.4%)	.017

3.2. Recovery period following injuries

As a result of the cross analysis performed on the recovery period following injuries by a detailed sport of Taekwondo, competition turned out to be the highest with 10 people(28.6%) for less than 4 weeks, while demonstration also turned out to be high with 18 people(42.9%) for less than 4 weeks. Meanwhile, poomsae turned out to be the highest with 12 people(36.4%) over 6 months or longer, respectively. There were no differences between the sports.

Table 4. Recovery period following injuries.

Recovery period	Competition	Poomsae	Demonstration	χ^2
Less than 2 weeks	6(17.1%)	5(15.2%)	6(14.3%)	.153
Less than 4 weeks	10(28.6%)	4(12.1%)	18(42.9%)	
Less than 3 months	7(20%)	6(18.2%)	5(11.9%)	
4-6 months	3(8.6%)	6(18.2%)	7(16.7%)	
6 months or longer	9(25.7%)	12(36.4%)	6(14.3%)	

3.3. Situations in which injuries arise

As a result of the cross analysis performed on the injuries by a detailed sport of Taekwondo, 28 people for competition(80%), 26 people for poomsae(78.8%), and 26 people for demonstration(63.4%) responded that they have sustained the most injuries during this sport. There were no differences between the sports.

Table 5. Situations in which injuries arise.

Recovery period	Competition	Poomsae	Demonstration	χ^2
While practicing this sport	28(80%)	26(78.8%)	26(63.4%)	.176
While practicing personal sport	3(8.6%)	4(12.1%)	12(29.3%)	
While practicing physical strength sport	4(11.4%)	2(6.1%)	2(4.9%)	
While practicing warm-up	0(0%)	1(3%)	0(0%)	
While practicing warm-down	0(0%)	0(0%)	1(2.4%)	

3.4. Parts of injuries

As for the parts of injuries by each detailed sport of Taekwondo, it was allowed for the respondents to respond with multiple responses, and as a result of the survey conducted, the lower body injuries were most frequently responded to, with competition accounting for 28.8%, poomsae for 34.5%, and demonstration for 36.4%, respectively.

Table 6. Parts of injuries.

Name	Competition	Poomsae	Demonstration
Shoulder	25(24.%)	14(16%)	22(20%)
Shoulder and arm	32(30.7%)	21(24.2%)	25(22.7%)
Waist trunk	17(16.3%)	22(25.3%)	23(20.9%)
Pelvis and lower body	30(28.8%)	30(34.5%)	40(36.4%)

3.5. Forms of injuries

As for the form of injuries for each detailed sport of Taekwondo, multiple responses were allowed, and as a result of the survey conducted, sprains and fractures accounted for the most at 17.7%, respectively, while poomsae accounted for 18.9%, and demonstration responded the most with 25.2% for sprain.

Table 7. Forms of injuries.

Name	Competition	Poomsae	Demonstration
Bruise	17(15.9%)	14(14.7%)	27(21.9%)
Sprain	19(17.7%)	18(18.9%)	31(25.2%)
Contusion	11(10.3%)	17(17.9%)	12(9.7%)
Fracture	19(17.7%)	8(8.4%)	14(11.4%)
Dislocation	3(2.8%)	5(5.3%)	2(1.6%)
Laceration	3(2.8%)	3(3.2%)	6(4.9%)
Skin abrasion	5(4.7%)	5(5.3%)	6(4.9%)
Intervertebral disk	5(4.7%)	3(3.2%)	4(3.3%)
Ligaments, tendonitis	5(4.7%)	9(9.5%)	9(7.3%)
Meniscus cartilage damages	6(5.6%)	7(7.4%)	3(1.6%)
Miscellaneous	14(13.1%)	6(6.3%)	9(7.3%)

3.6. Time of injuries

Multiple responses were allowed for the questions pertaining to the time of injuries for each detailed sport of Taekwondo, and as a result, the most injuries arose during the winter for which 36.8% of competition, 42.6% of poomsae, and 38.4% of demonstration responded.

Table 8. Time of injuries.

Time of injuries		Competition	Poomsae	Demonstration
Season	Spring	9(13.2%)	10(16.4%)	7(10.8%)
	Summer	20(29.4%)	16(26.2%)	24(37%)
	Fall	14(20.6%)	9(14.8%)	9(13.8%)
	Winter	25(36.8%)	26(42.6%)	25(38.4%)

3.7. Causes of injuries

Multiple responses were allowed for the questions pertaining to the causes of injuries for each detailed sport of Taekwondo. As for competition, 24% responded collision or fall the most. As for poomsae, 21.7% responded fatigue and overwork, while 25% for demonstration responded fatigue and overwork as the causes of injuries the most.

Table 9. Causes of injuries.

Cause of injuries	Competition	Poomsae	Demonstration
Overtraining	13(16.4%)	10(10.9%)	8(7.1%)
Physical strength issue	2(2.5%)	4(4.3%)	7(6.3%)
Collision or fall	19(24%)	15(16.3%)	16(14.3%)
Lack of warm-up	7(8.9%)	10(10.9%)	11(9.8%)
Issues of equipments and facilities	3(3.8%)	4(4.3%)	2(1.8%)
Issue with opponent or partner	2(2.5%)	6(6.5%)	5(4.4%)
Mental problem	4(5.1%)	9(9.8%)	15(13.4%)
Excessive winning spirit	8(10.1%)	9(9.8%)	12(10.7%)
Physical problems(injuries, pain)	6(7.6%)	5(5.4%)	8(7.1%)
Fatigue and overwork	15(19%)	20(21.7%)	28(25%)

3.8. Method of handling injuries(treatment)

Multiple responses were allowed for the questions on the method of handling the injuries for each detailed sport of Taekwondo. As for competition, 24.7% responded that they underwent treatment at an oriental medicine clinic the most, while 19.6% for poomsae also responded with their undergoing treatment at an oriental medicine clinic. Furthermore, 19.9% of those for demonstration responded with their undergoing treatment an oriental medicine clinic, and consequently, the most responses for the treatment at oriental medicine clinic were evident for each detailed sport.

Table 10. Method of handling injuries(treatment).

Name	Competition	Poomsae	Demonstration
Oriental medicine clinic	26(24.7)	22(19.6)	31(19.9)
First aid	3(2.9)	7(6.3)	9(5.8)
Medicines(anti-inflammatory analgesics)	6(5.7)	13(11.6)	11(7.1)
Ointment	4(3.8)	11(9.8)	7(4.5)
Hot pack massage	9(8.6)	9(8.1)	16(10.2)
Cold pack massage	16(15.2)	19(17)	22(14.1)
Pain relief patch, spray	13(12.4)	12(10.7)	23(14.7)
Taping, bandage	17(16.2)	8(7.1)	22(14.1)
Break(no treatment)	11(10.5)	11(9.8)	15(9.6)

4. Discussion

This study was conducted to examine and understand the status of injuries of the athletes by each detailed sport of college and university Taekwondo and also provide the basic data for developing

the injuries prevention program in line with the characteristics of each specific sport. The discussion based on the results of this study is as follows.

Taekwondo is very much more easily exposed to the risks of injuries since it is a martial art. Furthermore, the athletes commit to excessive training to improve their performance, and suffer from unexpected accidents or injuries due to such problems as the psychological pressure[20]. In the previous studies, it was claimed that even the athletes with excellent performance would fall into slump due to the athletic injuries, and hence, alternatives to prevent and manage the injuries are required[21].

As a result of surveying the injuries sustained by each sport among a total of 110 college and university Taekwondo athletes, it turned out that 82.4% of those for competition, 69.7% of those for poomsae, and 78% of those for demonstration have sustained injuries, among whom those who have experienced surgeries turned out to be 44.1% for competition, 15.2% for poomsae, and 21.4% for demonstration for each sport, respectively. Such results mean that they are very easily exposed to the risks of injuries regardless of the whichever sport they are engaged in, and in the case of competition and demonstration, they will need a systematic preventive method given that the rate of surgical experiences following injuries is quite high.

As for the parts of injuries by each detailed sport of Taekwondo, the most responses demonstrated their concentration on the lower extremities regardless of the sport. Such results are determined to have a high rate of injuries given the high frequency of kicking given the nature of the Taekwondo movements[22]. Examining the previous studies, as for competition, the athletes do their best to decide victory and defeat, and there is a high risk of injury given direct strikes and blows, physical fights, and falls due to jumping and rotational movements[12][23]. As for poomsae, it is determined that it is a form which exceeds the mobility of the joints in the expression of kicking movements[22], and in the case of demonstration, the proportion of aerial movements using the lower body is very high, and hence, the proportion of injuries to the knee joints during jumping and landing is reported to be very large[8]. Even in the studies of Song Gil-seob and Kim Joon-taek and Kim Nam-taek[24], the lower extremity injuries were reported for the knee joints(43%) and lower extremities(34%), and in a study by Jung Hyeon-do[25], the results of this study were supported based on the report that the ratio of the injuries of the knees(37.4%) and shins(35.4%) was very large. Additionally, examining the study of Jung Kook-hyeon[26], who surveyed the techniques causing the injuries of Taekwondo athletes, it was claimed that poomsae and competition sport players have sustained injuries while performing kicking techniques, yet in the case of demonstration, it was claimed that the injuries were caused by the aerial movements and the extent of sophistication intended to dramatically express the excellence, if not the superiority, of the techniques.

As a result of surveying the types of injuries, for competition, sprains and fractures each accounted for the most with 17.7%, while poomsae for 18.9% and demonstration for 25.2% represented the most responses with sprains. Sprains are among the common injuries which arise amidst the sports injuries, and even in the study of Jung Goo-yeol and Jeon Byeong-oh and Lee Dong-joon[27], it was reported that the frequency of injuries was very high in the order of sprains and fractures. In the case of competition, the impact is caused by strike, which is a characteristic of the sport, and it is also determined that the rate of fracture is quite high given the physical contact.

Examining the results of injuries, competition, poomsae, and demonstration all have responded with the most damages during this sport, and examining the previous studies, 38.4% of the Taekwondo athletes reported that they have experienced injuries while participating in this sport [28], and hence, it is supportive of the results of this study. Such results demonstrate that this sport has the longest duration of time, and the athletes' injuries turned out to be of high frequency as they focus on practical training relative to other trainings.

As a result of analyzing the causes of injuries, 24% of competition responded the most for collision or fall, 21.7% of poomsae and 25% of demonstration responded with fatigue and overwork as for the causes of injuries the most. As for competition, fatigue and overwork represented the second most responses, while for poomsae and demonstration, collision or fall represented the second most, re-

spectively. Gathering which, regardless of the Taekwondo sport, it is determined that the injuries were experienced due to collisions or falls given the fatigue and overwork during this sport.

Regardless of the Taekwondo sport at the time of injuries, injuries were responded with the most in the winter. It is determined that such results were obtained since the adequate physical preparation is difficult to achieve in the winter when the temperature is low, and given the characteristics of Taekwondo, the rate of injuries turned out to be high since it is practiced while the athletes are wearing a very thin uniform. In the study of [22], it was also reported that the occurrence of injuries turned out to be 49% for the winter, 25% for the spring, 11.5% for the summer, and 10.4% for the fall, respectively. To maintain the body temperature and keep the athletes warm, proper heating and warm-up exercises would be a means to prevent injuries in the winter. Furthermore, injuries during the summer turned out to be the second highest regardless of the sport, and hence, it is determined that the temperature is relevant for the injuries.

As a result of the survey conducted on the recovery period following injuries, competition and demonstration sports reported less than 4 weeks of the recovery, whereas in the case of poomsae, the recovery turned out to entail 6 months or longer. Such results demonstrate the fact that competition has such a high rate of damages such as simple bruises and sprains given the impact of striking the opponent [23][29], and in the case of demonstration, too, the forms of injuries which arise while performing each demonstration movement are caused by the damages while landing after jumping [18], and hence, it is determined that the ratio of simple sprains is quite high. However, in the case of poomsae, excessive joint mobility is required for expressing movements given the nature of the sport, and it is also determined that chronic injuries are induced thereby. Examining the fact that the recovery period for each sport is varied, it will be necessary to conduct surveys which classify acute injuries from the chronic injuries.

As a result of the survey conducted on the method of handling injuries, the most responses represented treatment via oriental medicine regardless of the detailed sport, which is determined to be treatments performed at oriental medicine clinics for acupuncture or hot pack treatment since sprain is the most common form of injury.

Gathering which, there are merely differences in the causes of injuries for each detailed sport of Taekwondo, and the problems experienced during the injuries include the characteristics of Taekwondo as they are. Given the high frequency of use of the lower body, including feet, and while practicing this sport during the winter wearing a very thin uniform, it is very easy to be exposed to injuries as the ability to focus is exercised and participation is made very competitively. Furthermore, given that the frequent causes of injuries for the athletes are fatigue and overwork, it is determined that adequate prevention would be possible through the physical strength management [30]. Hence, the development of sport programs for the prevention and treatment of injuries of the athletes, improvement of perception of the athletes and coaches, and the detailed and systematic management by coaches will be required in combination.

5. Conclusion

This study was conducted to examine and understand the status of injuries by each detailed sport of Taekwondo and also provide the basic data for developing the injuries prevention program in line with the characteristics of each sport. The conclusions based on the results of this study are as follows.

First, as for the injuries related experiences by each detailed sport of Taekwondo, it turned out that 82.4% of those for competition had experiences, 69.7% of those for poomsae, and 78% of those for demonstration, respectively, among whom it turned out that 44.1% of those for competition, 15.2% of those for poomsae, and 21.4% of those for demonstration have had surgery related experiences by each sport, respectively.

Second, as a result of analyzing the recovery period, sparing with 28.6% and demonstration with 42.9% gathered the most responses for less than 4 weeks, respectively. Meanwhile, poomsae

demonstrated the highest rate of 36.4% for 6 months or longer, suggesting that there is a possibility of relative chronic injuries.

Third, as a result of analyzing the situation of injuries, 80% of those for competition, 78.8% of those for poomsae, and 63.4% of those for demonstration responded that they have sustained the most injuries while practicing this sport.

Fourth, as a result of analyzing the causes of injuries, 24% of those for competition responded with collision or fall the most. 21.7% of those for poomsae and 25% of those for demonstration responded with fatigue and overwork for the causes of injuries the most.

Fifth, as a result of analyzing the time of injuries, 36.8% of those for competition, 42.6% of those for poomsae, and 38.4% of those for demonstration responded that they have sustained the most injuries in the winter.

Sixth, as a result of analyzing the forms of injuries, sprains and fractures accounted for the most at 17.7%, respectively, while poomsae accounted for 18.9%, and demonstration for 25.2% with sprain the most, respectively.

Seventh, as a result of analyzing the parts of injuries, competition accounted for 28.8%, poomsae accounted for 34.5%, and demonstration accounted for 36.4% responding with the lower body injuries the most, respectively.

Lastly, as a result of analyzing the method of handling the injuries, 24.7% of those for competition, 19.6% of those for poomsae, and 19.9% of those for demonstration responded the most with treatment following their visits to oriental medicine clinics, respectively.

Gathering which, it is determined that the athletes need to regulate their physical conditions, and will also need the measures to maintain their body temperature and prevent injuries while practicing this sport during the winter. Furthermore, given the unique characteristics of Taekwondo, the frequency of use of the lower body is very high, and since it is evident that the lower body injuries are frequent, as well as the fact that there are many sprains and fractures, the systematic training methods for elevating the athletes' performance and preventing their injuries, and the preventive methods including taping, braces, and warm-up exercises will be needed in line with the causes and forms of such injuries.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	YC	-Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/>
Corresponding Author*	DP	-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Relationship Between TAEKWONDO Demonstrators' Athletic Commitment and the Psychological Happiness and Athletic Sustainability

Hochul Shin¹

Kyungmin University, Uijeongbu, Republic of Korea

Jongsoo Kim^{2*}

Keimyung University, Daegu, Republic of Korea

Abstract

Purpose: Prior studies related to athletic commitment have been conducted on various sports players, but studies on Taekwondo demonstrators are insufficient. Thus, it is deemed that measures should be prepared to expand the qualitative area of Taekwondo demonstration by exploring the appropriate level of athletic commitment. Accordingly, the purpose of this study is to identify the effect of Taekwondo demonstration team members' athletic commitment on psychological happiness and athletic sustainability and provide basic data for psychological research related to Taekwondo demonstration.

Method: The data collection of this study was conducted for a total of seven days from 07/05/2021 to 07/11/2021. The research team fully explained the purpose and intent of the study to the leaders of college Taekwondo demonstration teams, sought their cooperation, and visited the training place or classroom to conduct the survey. The research team explained the purpose of the study and required the subjects to participate in the survey.

Results: A correlation analysis was conducted to find out the correlation among factors such as athletic commitment, psychological happiness, and athletic sustainability of members of college Taekwondo demonstration teams. The Pearson correlation coefficient shows that the lowest correlation was found between cognitive commitment and reinforcement ($r=.439, p<.01$) and the highest correlation emerged between behavioral commitment and tendency ($r=.708, p<.01$).

Conclusion: First, the Taekwondo demonstration team's athletic commitment did not affect their psychological happiness. Second, multiple regression analyses were conducted on the effects of athletic commitment on the tendency of Taekwondo demonstrators, and the results showed that cognitive commitment and behavioral commitment had a positive impact on tendency on a statistically significant level. In addition, multiple regression analyses were conducted on the effects of reinforcement, and the results showed that cognitive commitment and behavioral commitment had a positive effect on reinforcement at a statistically significant level. Furthermore, multiple regression analyses of the effects on possibility have shown that cognitive commitment, behavioral commitment have statistically significant levels and positive effects on athletic sustainability. Third, the psychological happiness of the Taekwondo demonstration team did not affect athletic sustainability.

[Keywords] Relationship, Taekwondo, Athletic Commitment, Psychological Happiness, Athletic Sustainability

1. Introduction

Taekwondo demonstration is an event that expresses one's skills of basic movements, poomsae, sparring, and breaking and is considered to have contributed greatly to the development of Taekwondo through domestic and overseas demonstration activities, creating new demonstration culture, contents for demonstration performances, and improving Taekwondo techniques[1][2].

Taekwondo has built a global infrastructure in which more than 10,000 people, including the members of the international sports development cooperation, from 210 countries are training[3]. The Taekwondo demonstrations consist of combined movements created based on basic movements, and breaking targets, promoting excellence in taekwondo techniques and continuing to develop into an active sports event[4][5][6].

Taekwondo is largely divided into sparring, poomsae, and breaking. In 1962, the Korea Tae-soodo Association(the former entity of the Korea Taekwondo Association) joined the Korea Olympic Committee[7]. The technical system of Taekwondo breaking demonstration has evolved day by day, and various forms are being created, including breaking with hand and foot with large rotation angles, multi-way breaking in the air, acrobatic and tricking techniques, and other high-level techniques such as breaking targets after jumping off the chest of assistants[8][9]. The demonstrator experiences various negative emotions, such as stress, anxiety, and dissatisfaction related to the perfect performance of the breaking technique, and athletic commitment is proposed as a way to effectively cope with them[10].

The athletic commitment represents psychological emotions such as faith, belief, and hope gained from participating in sports and includes the meaning of inner motivation such as involvement and commitment to continuous participation in sports[11]. This is divided into the desire to exercise, the degree of awareness of exercise, the cognitive commitment, and the degree of interest in imaginative actions regarding information and methods related to exercise, behavioral commitment[12].

In addition, the number of members of the World Taekwondo Federation is 209 countries as of 2019, more than 206 Olympic countries and 84 percent of 249 countries by the International Organization for Standardization[13]. The athletic commitment is a psychological factor that creates the best athletic performance, and it also refers to a subjective psychological state that maximizes enjoyment and represents the best experiences one experiences[14][15]. It is also reported that it determines positive emotional conditions and whether sports activities can continue[16][17][18].

With the founding of the Kukkiwon Demonstration Team in 1974, taekwondo demonstration played a significant role in promoting and disseminating taekwondo not only in Korea but also around the world[19]. Psychological happiness, which incorporates a variety of positive emotions, can be defined as hedonic pleasures and emotional improvement that occur repeatedly after exercising[20]. It is reported that people who exercise continuously have a more positive attitude and condition in their lives and that the higher their experience in the athletic commitment, the stronger their desire for athletic sustainability[21][22][23]. Athletic sustainability refers to the degree to which an individual accepts regular exercise habits as a part of his or her life, and there are three psychological factors: the tendency to make exercise in everyday life, the possibility to plan and perform it, and the reinforcement to engage regularly[24]. These factors are reported to be predictors that evaluate the duration of the exercise and provide important information on inducing participation in exercise[25].

Taekwondo demonstrations were carried out as a means to promote taekwondo as an official Olympic event[26]. Previous studies on athletic commitment have shown that it affects the highest level of happiness and satisfaction and that higher athletic commitment has a positive effect on psychological happiness, which includes pleasure, confidence, etc[27][28]. In addition, it is reported that athletic sustainability becomes clear through athletic commitment, and it plays an important role in athletic sustainability by positively affecting the three factors of tendency, possibility, and reinforcement[29][30].

Prior studies related to athletic commitment have been conducted on various sports players, but studies on Taekwondo demonstrators are insufficient. Thus, it is deemed that measures should be prepared to expand the qualitative area of Taekwondo demonstration by exploring the appropriate level of athletic commitment. Accordingly, the purpose of this study is to identify the effect of Taekwondo demonstration team members' athletic commitment on

psychological happiness and athletic sustainability and provide basic data for psychological research related to Taekwondo demonstration.

2. Research Method

2.1. Subject to research

The subjects of this study are members of Taekwondo demonstration team at universities nationwide, and 390 questionnaires were collected using the convenience sampling method after selecting them as populations. Of these, 360 copies of the data were used for analysis, except for 30 that lacked consistency or answered insincerely. The general characteristics of the study subjects are as follows: In terms of gender, there were more men than women, with 279 men(77.5 %) and 81 women(22.5 %). The survey was conducted from freshmen to seniors of college Taekwondo demonstration teams. They are 147 freshmen(40.8 %), 123 sophomores(34.2 %), 66 juniors(18.3 %), and 24 seniors(6.7 %). The length of Taekwondo training for them was: 19(5.3 %) for more than a year to less than two years, 59(16.4 %) for more than two years to less than four years, 65(18.1 %) for more than four years to less than seven years, and 217(60.3 %) for more than seven years. The general characteristics of the study subjects are shown in <Table 1>.

Table 1. General characteristics of study participants.

Description		Number	Percentage
Gender	Male	279	77.5
	Female	81	22.5
Year	Freshman	147	40.8
	Sophomore	123	34.2
	Junior	66	18.3
	Senior	24	6.7
Length of training	1~2 years	19	5.3
	2~4 years	59	16.4
	4~7 years	65	18.1
	Longer than 7 years	217	60.3

2.2. Measuring tool

2.2.1. Athletic commitment scale

The questionnaire for athletic commitment was prepared by modifying and supplementing to suit this study based on one developed by Scanlan, Carpenter, Schmidt, and Keeler[15]. It consisted of a total of 12 questions, measured on the Likert 5-point scale from "not at all"(1 point) to "very much so"(5 points). As shown in <Table 2>, the subfactors were shown as two groups of factors, and Cronbach's alpha coefficient was 0.945 for cognitive commitment and 0.823 for behavioral commitment.

Table 2. Feasibility and reliability analysis of athletic commitment.

Factor	Question	Factor1	Factor3	Cronbach' α
Cognitive commitment	Cog. cmt 6	.858	.307	.945

	Cog. cmt2	.852	.245	
	Cog. cmt3	.827	.317	
	Cog. cmt4	.823	.346	
	Cog. cmt1	.819	.193	
	Cog. cmt5	.780	.395	
	Cog. cmt7	.719	.370	
Behavioral commitment	Beh. comt. 4	.337	.788	.823
	Beh. comt.1	.298	.784	
	Beh. comt.2	.220	.769	
	Beh. comt.3	.258	.716	
Eigenvalue		4.937	3.045	
Variance		44.884	27.677	
Cumulative		44.884	72.561	

2.2.2. Psychological happiness scale

The psychological happiness questionnaire was first developed by Yang Myung-hwan and used by Kim Hyun-kyun and was modified to meet the purpose of this study[20][31]. It consisted of a total of 18 questions, with a Likert 5-point scale, indicating that one point is 'not at all' and five points are 'very much so'. As shown in <Table 3>, the reliability coefficient(Cronbach' alpha coefficient) of the subfactor was 0.966.

Table 3. Feasibility and reliability analysis of psychological happiness.

Factor	Question	Factor1	Cronbach' α
Psychological happiness	Psychological happiness8	.848	.966
	Psychological happiness2	.845	
	Psychological happiness12	.842	
	Psychological happiness3	.835	
	Psychological happiness9	.830	
	Psychological happiness14	.827	
	Psychological happiness15	.826	
	Psychological happiness11	.822	
	Psychological happiness7	.814	
	Psychological happiness1	.810	
	Psychological happiness5	.809	
	Psychological happiness6	.808	
	Psychological happiness13	.800	

	Psychological happiness4	.795	
	Psychological happiness7	.790	
	Psychological happiness10	.788	
Eigenvalue		10.609	
Variance		66.307	
Cumulative		66.307	

2.2.3. Athletic sustainability

The athletic sustainability questionnaire used in this study was developed by Corbin and Lindsey, then developed by Oh Soo-hak, Song Yoon-kyung, Kim Hyun-jung, Heo Mi-yang, and Jo Jung-hwan through construct verification[24][25]. It consisted of a total of 18 questions, with a Likert 5-point scale, indicating that one point is 'not at all' and five points are 'very much so'. As shown in <Table 3>, for Cronbach' alpha coefficient of the subfactors, the tendency was 0.886, the reinforcement was 0.851, and the possibility was 0.805.

Table 4. Analysis of feasibility and reliability of athletic sustainability.

Factor	Question	Factor1	Factor2	Factor3	Cronbach' α
Tendency	Tendency2	.823	.256	.199	.886
	Tendency3	.814	.271	.217	
	Tendency4	.775	.251	.181	
	Tendency1	.762	.288	.197	
Reinforcement	Reinforcement4	.268	.817	.091	.851
	Reinforcement1	.134	.805	.236	
	Reinforcement2	.426	.716	.041	
	Reinforcement3	.392	.692	.250	
Possibility	Possibility2	.185	.038	.881	.805
	Possibility1	.158	.205	.857	
	Possibility3	.386	.351	.610	
Eigenvalue		3.154	2.759	2.169	
Variance		28.674	25.079	19.718	
Cumulative		28.674	53.753	73.471	

2.3. Data collection

The data collection of this study was conducted for a total of seven days from 07/05/2021 to 07/11/2021. The research team fully explained the purpose and intent of the study to the leaders of college Taekwondo demonstration teams, sought their cooperation, and visited the training place or classroom to conduct the survey. The research team explained the purpose of the study and required the subjects to participate in the survey.

2.4. Data processing

The collected data were analyzed using SPSS 21.0. Frequency analysis was conducted to identify the general characteristics of participants, and exploratory factor analysis was conducted to verify the validity and reliability of measurement tools. For each factor, Cronbach's alpha coefficient was used. In order to determine the effects among factors of athletic commitment, psychological happiness, and athletic sustainability, correlation analysis and multiple regression analysis were performed, with the significance level set to 0.05.

3. Results

3.1. Correlation analysis

A correlation analysis was conducted to find out the correlation among factors such as athletic commitment, psychological happiness, and athletic sustainability of members of college Taekwondo demonstration teams. The Pearson correlation coefficient shows that the lowest correlation was found between cognitive commitment and reinforcement ($r=.439$, $p<.01$) and the highest correlation emerged between behavioral commitment and tendency ($r=.708$, $p<.01$). The results of the correlation analysis are shown in <Table 5> below.

Table 5. Results of analysis of the correlation among variables.

Description	1	2	3	4	5	6
1. Cognitive commitment	1					
2. Behavioral commitment	.654**	1				
3. Psychological happiness	-.019	-.004	1			
4. Tendency	.690**	.708**	-.058	1		
5. Possibility	.488**	.550**	-.075	.651**	1	
6. Reinforcement	.439**	.483**	-.072	.528**	.468**	1

Note: ** $p<.01$.

3.2. Effects of athletic commitment on psychological happiness

Multiple regression analyses were conducted on the effects of athletic commitment on psychological happiness, and the results are shown in <Table 6>: it did not statistically affect psychological happiness.

Table 6. Effects of athletic commitment on psychological happiness.

	Psychological happiness		
	<i>B</i>	<i>Beta</i>	<i>t</i>
(Constant)	.226		17.734***
Cognitive commitment	.062	-.028	-.396
Behavioral commitment	.068	.014	.196
	$R^2=.000$, $F=.082$		

Note: * $p<.05$, ** $p<.01$, *** $p<.001$.

3.3. Effects of athletic commitment on athletic sustainability

Multiple regression analyses were conducted on the effects of athletic commitment on athletic sustainability (tendency, reinforcement, and possibility), and the results are shown in <Table 7>.

As a result of conducting multiple regression analysis on the effect of athletic commitment on tendency, cognitive commitment ($p=.000$), behavioral commitment ($p=.000$) was shown to have a positive effect on tendency at a statistically significant level, in the order of behavioral commitment (.448) and cognitive commitment (.397). In addition, in tendency, the regression model has an F value of 257.766 at $p<.001$, and $R^2=.589$ for the regression equation, showing 58.9% explanatory power of the total variations.

As a result of conducting multiple regression analysis on the effect of athletic commitment on possibility, cognitive commitment ($p=.000$), behavioral commitment ($p=.000$) was shown to have a positive effect on possibility at a statistically significant level, in the order of behavioral commitment (.342) and cognitive commitment (.215). In addition, in tendency, the regression model has an F value of 62.570 at $p<.001$, and $R^2=.260$ for the regression equation, showing 26.0% explanatory power of the total variations.

Table 7. Effects of athletic commitment on athletic sustainability.

	Tendency			Reinforcement			Possibility		
	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>B</i>	<i>Beta</i>	<i>t</i>
(Constant)	.142		7.206***	.193		8.253***	.221		6.239***
Cognitive commitment	.039	.397	8.866***	.052	.224	3.924***	.060	.215	3.575***
Behavioral commitment	.043	.448	10.023***	.058	.403	7.044***	.067	.342	5.685***
	$R^2=.589$, $F=257.766$ ***			$R^2=.331$ $F=88.303$ ***			$R^2=.260$ $F=62.570$ ***		

Note: *= $p<.05$, **= $p<.01$, ***= $p<.001$.

3.4. Effects of psychological happiness on athletic sustainability

Multiple regression analyses were conducted on the effects of psychological happiness on athletic sustainability, and the results are shown in <Table 8>: it did not statistically affect athletic sustainability.

Table 8. Effects of psychological happiness on athletic sustainability.

	Tendency			Reinforcement			Possibility		
	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>B</i>	<i>Beta</i>	<i>t</i>
(Constant)	.208		21.184***	.221		20.030***	.241		17.179
Psychological happiness	.052	-.058	-1.100	.055	-.075	-1.429	.060	-.072	-1.361
	$R^2=.003$, $F=1.210$			$R^2=.003$ $F=2.041$			$R^2=.005$ $F=1.853$		

Note: *= $p<.05$, **= $p<.01$, ***= $p<.001$.

4. Discussion

The purpose of this study was to identify the effect of Taekwondo demonstration team members' athletic commitment on psychological happiness and athletic sustainability and to provide basic data for psychological research related to Taekwondo demonstration. In order to achieve the purpose of this study, correlation analysis and multiple regression analysis were conducted among the variables, and the results are to be discussed as follows.

4.1. Effects of taekwondo demonstrators' athletic commitment on psychological happiness

The study showed that Taekwondo demonstrators' athletic commitment did not affect their psychological happiness, statistically. In their study, Cho Sun-ha and Kim Geun-guk said that athletic commitment significantly affected psychological happiness[28]. However, the study found that the pleasure factor had a greater impact than the confidence factor. They supported this result because of the anxiety and burden caused by the competitiveness in the elite sports environment.

4.2. Effects of taekwondo demonstrators' athletic commitment on athletic sustainability

Multiple regression analyses were conducted on the effect of Taekwondo demonstrators' athletic commitment on athletic sustainability, and the results showed that athletic commitment has a positive impact on athletic sustainability. These results support the findings of Kim Young-gap and Kim Sang-beom[32]. In addition, this supports research by Gam Kyung-dong and Kim Jong-eon, who say that athletic commitment is related to improving the solidarity of sports participants and continuing participation in sports[33]. The results of this study are also similar to those of Nam In-soo, Noh Mi-ra, and Yeo Ji-eun, who said that the higher the athletic commitment, the stronger the intention of athletic sustainability[34]. In other words, this can be interpreted as indicative of the significant effect of Taekwondo demonstrators' athletic commitment on athletic sustainability.

4.3. Effects of taekwondo demonstrators' psychological happiness on athletic sustainability

Psychological happiness did not affect athletic sustainability. According to a study by Kang Soo-taek and Jung Cheol-gyu, confidence, a subfactor of psychological happiness, has no statistical impact on athletic sustainability[35]. One of these reasons is, for Taekwondo demonstrators, psychological happiness and athletic sustainability may be irrelevant because of the high level of technical completeness and burden of success. According to Kim Jong-soo, most Taekwondo demonstrators perform demonstration techniques through psychological skills such as relieving tension and anxiety, concentration, and image training versus positive thoughts such as psychological happiness[36].

5. Conclusions and Suggestions

The purpose of this study is to determine the effect of Taekwondo demonstration team members' athletic commitment on psychological happiness and athletic sustainability, which led to the following conclusions.

First, the Taekwondo demonstration team's athletic commitment did not affect their psychological happiness.

Second, multiple regression analyses were conducted on the effects of athletic commitment on the tendency of Taekwondo demonstrators, and the results showed that cognitive commitment and behavioral commitment had a positive impact on tendency on a statistically significant level. In addition, multiple regression analyses were conducted on the effects of reinforcement, and the results showed that cognitive commitment and behavioral commitment had a positive effect on reinforcement at a statistically significant level. Furthermore, multiple regression analyses of the effects on possibility

have shown that cognitive commitment, behavioral commitment have statistically significant levels and positive effects on athletic sustainability.

Third, the psychological happiness of the Taekwondo demonstration team did not affect athletic sustainability.

To sum up these results, Taekwondo demonstrators' athletic commitment is an important factor in athletic sustainability, but psychological happiness does not affect their athletic commitment or adherence.

Therefore, in this study, these conclusions are intended to provide suggestions for further research.

First, it is believed that there is a limit to generalizing the research results to the entire Taekwondo demonstration teams as the subject of this study was limited to those attending universities. Therefore, it is believed that further research will be able to provide more accurate and broader data if the scope of the research is expanded.

Second, in this study, the participation rate of freshmen and sophomores was higher than that of juniors and seniors. In addition, proportionately, the factors associated with psychological happiness have shown insignificant results. Due to the nature of the athletic department, it is possible that the freshmen and sophomores showed more negative results because some of their behavior might be restricted due to the unique system and discipline of the athletic department. Therefore, it is believed that further in-depth data can be provided if the study is conducted in line with the proportion of the school year of the participants.

Third, the survey was measured to find out about athletic commitment, psychological happiness, and athletic sustainability of Taekwondo demonstrators. Since quantitative research is limited in identifying specific phenomena, it is believed that it will be a study that can understand more specific factors if qualitative research methods are conducted through interviews and in-depth consultation.

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6.1. Journal articles

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	HS	-Set of concepts <input checked="" type="checkbox"/>
		-Design <input checked="" type="checkbox"/>
		-Getting results <input checked="" type="checkbox"/>
		-Analysis <input checked="" type="checkbox"/>
		-Make a significant contribution to collection <input checked="" type="checkbox"/>
		-Final approval of the paper <input checked="" type="checkbox"/>
Corresponding Author*	JK	-Corresponding <input checked="" type="checkbox"/>
		-Play a decisive role in modification <input checked="" type="checkbox"/>
		-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
		-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
		-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Corresponding author*
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The Effect of the Youth's Generativity Following Their Participation in MARTIAL ARTS Training on Social Adaptation and Social Happiness

Hwansuk Choi¹

Jeonju University, Jeonju, Republic of Korea

Byeongchan Kim^{2*}

Kyungwoon University, Gumi, Republic of Korea

Sunggu Jo³

Kyungwoon University, Gumi, Republic of Korea

Abstract

Purpose: For youth, in such a time where physical activities and self-concept development are vigorous, and at the same time, where physical activities are suppressed due to the stress of entrance exam related academic preparations, the negative impact of self-concept is an obstacle to their holistic development, and hence, it is important for them to develop a positive self-concept, which requires an effective method. Hence, in order to spread the participation in sports activities for leading a healthy and sound life through the self-realization of youth and correct physical self-concept, by examining the effects of youth generativity through participation in the martial arts training on social adaptation and social happiness, it would be meaningful in helping to develop the regular education programs for youth.

Method: In this study, by using the youth participating in martial arts training as the population as of 2021, the sampling method was used to survey 300 people by using the convenience sampling method, and the survey was conducted by using the self-administration method, and among the recovered survey questionnaires, the questionnaire was used as a valid sample except for the data in which the response contents were insincere or some of the contents were omitted. The data processing of this study was frequency analysis, Cronbach's α coefficient calculation, factor analysis, and correlation analysis by using the SPSS 25.0 Program, a statistical package program. The multiple regression was used.

Results: As a result of the factor analysis performed on generativity, social adaptation, and social happiness, it was consisted of 2 factors for generativity, 4 factors for social adaptation, and 4 factors for social happiness, and all factors turned out to be .05 or higher, respectively. As a result of the reliability validation performed, the Cronbach's α coefficient turned out to be between .952 and .673, and as a result of the correlation analysis performed, it turned out that there was a positive(+) relationship between all of the factors. It turned out that generativity influences social adaptation and social happiness.

Conclusion: To achieve the purpose of the study, a conclusion was reached that generativity influences social adaptation and social happiness through the results of the questionnaire. It is necessary to maintain and improve optimism through the mental and physical health by continuously participating in physical activities including the martial arts training for youth, and there is also a need for an environment where the youth may freely participate in sports activities without any restrictions and the method or policy supported by policy. Furthermore, since the positive image of athletes by sport, including Taekwondo, is continuously used as a communication tool in the modern society, it ought to be used to promote and help improve the image of sports through advertisements for many sports athletes.

[Keywords] Martial Arts Training, Youth, Generativity, Social Adaptation, Social Happiness

1. Introduction

1.1. The needs and purpose of the study

Adolescence demonstrates a rapid physical and mental growth, and various maladaptive problems are viewed as a normal developmental process, and the future of youth may change depending on how various problems are solved which appear across the development process. Problem behaviors that occur in youth are not limited to that period, but can negatively influence the social adaptation and personality development in the latter part of the adulthood. If a youth does not adapt to school, he or she cannot receive school education at the most important stage of growth and development, cannot learn about the correct socialization process, cannot receive school education at an important period, and cannot acquire the correct socialization process. This is because there is a possibility of causing various kinds of social maladjustment problems even during the adulthood[1]. It is most important to promote the holistic development of youth, prevent psychological and social maladjustment that is an obstacle to normal life at school, and help them to adapt well by early detection, and in order to promote development, beyond addressing the youth's issues and prevention, a method to prevent and solve youth problems is required as a matter of reality[2][3].

Considering that most of the youth's life is in school, maladaptation to school life can have a significant impact on the youth's personality formation. Schools should not only improve their intellectual abilities, but also play a role in improving the students' quality of life by improving their psychological and social functions[4][5][6]. In the case of physical activities, they help physical and mental well-being, and at the same time, influence the social adaptation and ultimately improve the quality of life, and beyond which they lead others to live safely from against the various dangers of daily life, while helping to develop the capacity to contribute to the development of local communities and countries[7][8].

Among such physical activities, the martial arts training such as Judo and Kendo, including Taekwondo, has a positive effect on development in some items of the youth's physical self-concept. and the martial arts training is effective for the improvement and development of physical strength and physical self-concept[8], and since it is helpful for the physical health and mental cultivation, it is also helpful for the youth generativity, social adaptation, and the formation and improvement of social happiness[9]. That is, martial arts may be said to be a great sport that develops both the physical and mental aspects, and it is a sport which can help develop a strong physical strength, morality, and social skills through persistence and self-denial in the training process. In particular, during the adolescence, sports activities influence the physical, mental, social and psychological growth and personality development, and youth physical activities are not just a game, but provide for valuable learning and development opportunities[10].

At such a time as the current where egoism and individualism prevailed due to family decline due to declining fertility rates, excessive parental overprotection, Internet and computer addiction, etc., it is a time to break away from the self-centered thinking and understand and cooperate with other people's point of view[11], and for youth, it is necessary to secure an effective method for the development of positive self-concept since the negative influence of self-concept is an obstacle to their holistic development at a time where physical activities and self-concept development are vigorous for youth, and at the same time, physical activities are restricted due to the stress of entrance exam related academic preparations. Hence, in order to spread participation across sports activities for leading a healthy and sound life through the self-realization of youth and correct physical self-concept, by examining the effects of youth generativity through the participation in martial arts training on social adaptation and social happiness, it would be meaningful in helping them develop regular educational programs for youth.

2. Research Methods

2.1. Subjects and sampling technique

In this study, by using the youth participating in martial arts training as the population as of 2021, the sampling method was used to survey 300 people by using the convenience sampling method, and the survey was conducted by using the self-administration method, and among the recovered survey questionnaires, the questionnaire of 284 people was used as a valid sample except for the data in which the response contents were insincere or some of the contents were omitted.

2.2. Measurement method

First, the generativity factor was structured by revising and supplementing the questionnaire used for the study of Hyang-hee Hwang(2017), Il-soon Lee, Yong-eun Kim, Sol-bi Min, Yoo-chan Park, and Joon Kim(2019) in line with the purposes of this study[12][13]. The Cronbach's α coefficient, which represents the reliability of the questionnaire, turned out to be between .920 and .815 in the study of Hwang-hee Hwang(2017), representing that the reliability of most factors was adequate.

Second, the social adaptation factor was structured by revising and supplementing the questionnaire used in the study of Beon-jang Yim, Kyeong-shik Kim, Bo-hyeon Park, Mi-kyeong Hwang, Seung-baek Hahn, Soon-yong Kwon(2006), Han-shik Moon and Hyeon-mi Huh(2015) in line with the purposes of this study[14][15]. The Cronbach's α coefficient, which represents the reliability of the questionnaire, turned out to be between .78 and .74 in the study of Han-shik Moon and Hyeon-mi Huh(2015), representing that the reliability of most factors was adequate.

Third, the social happiness factor was structured by revising and supplementing the questionnaire used for the study of Seong-ae Choi(2011), Geun-baek Park, Geun-mo Lee, Joon Kim(2014), Dong-in Noh, Ji-won Cha, Dong-gyu Moon(2012) in line with the purposes of this study[16][17][18]. The Cronbach's α coefficient, which represents the reliability of the questionnaire, turned out to be between .891 and .808 in the study of Geun-baek Park, Geun-mo Lee, Joon Kim(2014), Dong-in Noh, Ji-won Cha, Dong-gyu Moon(2012), representing that the reliability of most factors was adequate.

2.3. Analysis of data

After distributing and recovering the questionnaire, the data processing for this study was conducted by excluding the data determined to lack reliability in terms of the response contents, inputting data which may be analyzed individually into the computer, and performed the statistical validation as follows in line with the research hypothesis and purpose of the data analysis with the SPSS 25.0 Program, a statistical package program.

First, the frequency analysis was performed to identify the general characteristics of the research subjects.

Second, the Cronbach's α coefficient was calculated to validate the reliability of the questionnaire used for the study.

Third, the factor analysis was performed to classify professionalism factors, ethical belief factors, and educational belief factors.

Fourth, the correlation analysis was performed to examine and understand the relationship between each variable.

Fifth, the multiple regression was used to examine and understand the effect of professionalism factors on ethical belief factors and educational belief factors, and the statistical significance level was validated at .05 level.

3. Results

3.1. Validity and reliability of the questionnaire, correlation

In this study, the validity of the content validity of the questionnaire was secured via the consultation with experts in the relevant fields, and the exploratory factor analysis was performed to validate the validity of the questionnaire. As for the principal components analysis and factor rotation, the varimax method, which is an orthogonal rotation among orthogonal rotation methods, was used. As

for the factor extraction, only the factors with an eigenvalue of 1.0 or higher were selected, and the factor loading representing the extent of correlation between the variables and factors was limited to the questions with an eigenvalue of 0.5 or higher. As a result, the eigenvalue of the community factor of generativity turned out to be 6.037 and the eigenvalue of the individual factor turned out to be 2.649, respectively.

The ratio of the 2 factors explaining all variables turned out to be 54.228%, respectively. Furthermore, as a result of the reliability validation performed, the reliability between the questions of each variable turned out to be a community factor with $\alpha=.907$ and generativity factor with $\alpha=.779$, respectively. Social adaptation was classified into depression and anxiety, delinquency, aggression, and atrophy factors, and the eigenvalue of the depression and anxiety factor turned out to be 8.447, eigenvalue of the delinquent factor turned out to be 6.826, eigenvalue of the aggression factor turned out to be 4.706, and the eigenvalue of the atrophy factor turned out to be 3.070, respectively. The ratio of the 4 factors explaining all of the variables turned out to be 54.878%, respectively. Furthermore, as a result of the reliability validation performed, the inter-question reliability of each variable turned out to be $\alpha=.940$ for the depression and anxiety factor, $\alpha=.906$ for the delinquent factor, $\alpha=.843$ for the aggression factor, and $\alpha=.673$ for the atrophy factor, respectively.

Social happiness was classified into interpersonal relationship, achievement, challenge, and pleasure factors. The eigenvalue of the interpersonal factor turned out to be 6.101, eigenvalue of the sense of achievement factor turned out to be 6.019, eigenvalue of the challenge factor turned out to be 3.556, and the eigenvalue of the pleasure factor turned out to be 3.420, respectively. The ratio of the 4 factors explaining all of the variables turned out to be 79.569%, respectively. Furthermore, as a result of the reliability validation performed, the reliability between the questions of each variable turned out to be interpersonal factor with $\alpha=.952$, achievement factor with $\alpha=.946$, challenge factor with $\alpha=.910$, and pleasure factor with $\alpha=.931$, respectively.

Furthermore, in this study, the correlation analysis was performed to examine and understand the relationship between each variable, and hence, based on such results, the regression analysis was performed to examine and understand the influence on and among the variables.

3.2. Effect of generativity on social adaptation

Table 1. Effect of generativity on depression and anxiety.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	<i>β</i>	
Constant	1.471	.435		3.384
Collective	-.052	.104	-.041	-.502
Personal	.416	.084	.402	4.94***
<i>R</i> ²	.170			
<i>F</i>	13.306***			

Note: *** $p<.001$.

<Table 1> illustrates that the personal factor of generativity($\beta=.402$) has a significant effect on depression and anxiety, and has an explanatory power of 17.0% with a coefficient of determination $R^2=.170$, respectively.

Table 2. Effect of generativity on misconduct.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	β	
Constant	.744	.306		2.431
Collective	.025	.073	.028	.732
Personal	.284	.059	.394	4.793***
R^2	.152			
F	11.661**			

Note: ***p<.001.

<Table 2> illustrates that the individual factor of generativity($\beta=.394$) has a significant effect on misconduct, and has an explanatory power of 15.2% with a coefficient of determination $R^2=.152$, respectively.

Table 3. Effect of generativity on aggression.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	β	
Constant	.880	.445		1.978
Collective	.323	.106	.259	3.051**
Personal	.233	.086	.229	2.699**
R^2	.197			
F	16.965**			

Note: **p<.01.

<Table 3> illustrates that the community factor($\beta=.259$) and individual factor($\beta=.229$) of generativity have a significant effect on aggression, with the coefficient of determination $R^2=.197$, representing 19.7% of explanatory power, respectively.

Table 4. Effect of generativity on atrophy.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	β	
Constant	1.047	.432		2.422
Collective	.144	.103	.119	1.401
Personal	.316	.084	.320	3.776***

R^2	.102
F	16.365**

Note: *** $p < .001$, ** $p < .01$.

<Table 4> illustrates that the individual factor of generativity($\beta = .320$) has a significant effect on atrophy, and has an explanatory power of 10.2%, with the coefficient of determination $R^2 = .102$, respectively.

3.3. Effect of generativity on social happiness

Table 5. Effect of generativity on interpersonal relationships.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	b	$Std.E$	β	
Constant	2.844	.480		5.925
Collective	.348	.114	.253	3.040**
Personal	-.237	.093	-.212	-2.544*
R^2	.130			
F	9.712***			

Note: *** $p < .001$, ** $p < .01$, * $p < .05$.

<Table 5> illustrates that community factors($\beta = .253$) and individual factors($\beta = -.212$) of generativity have a significant effect on interpersonal relationships. It turned out to have an explanatory power of 13.0%, with the coefficient of determination $R^2 = .130$, respectively.

Table 6. Effect of generativity on sense of achievement.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	b	$Std.E$	β	
Constant	3.338	.490		6.813
Collective	.335	.117	.235	2.868**
Personal	-.324	.095	-.280	-3.415**
R^2	.159			
F	12.290***			

Note: *** $p < .001$, ** $p < .01$.

<Table 6> illustrates that the community factor($\beta = .235$) and individual factor($\beta = -.280$) of generativity have a significant effect on the sense of achievement, with a coefficient of determination $R^2 = .159$, having 15.9% of the explanatory power, respectively.

Table 7. Effect of generativity on challenge.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	<i>β</i>	
Constant	3.278	.527		6.221
Collective	.303	.126	.202	2.417*
Personal	-.302	.102	-.248	-2.959**
<i>R</i> ²	.122			
<i>F</i>	19.014***			

Note: ****p*<.001, ***p*<.01, **p*<.05.

<Table 7> illustrates that the community factor($\beta=.202$) and individual factor($\beta=-.248$) of generativity have a significant effect on the sense of challenge, with the coefficient of determination $R^2=.122$, having 12.2% of the explanatory power, respectively.

Table 8. Effect of generativity on joy.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	<i>β</i>	
Constant	2.799	.503		5.565
Collective	.308	.120	.219	2.568*
Personal	-.199	.097	-.174	-2.042*
<i>R</i> ²	.183			
<i>F</i>	15.643**			

Note: ***p*<.01, **p*<.05.

<Table 8> illustrates that community factors($\beta=.219$) and individual factors($\beta=-.174$) of generativity have a significant effect on enjoyment, with the coefficient of determination $R^2=.183$, having 18.3% of the explanatory power, respectively.

3.4. Effects of social adaptation on social happiness

Table 9. Effect of social adaptation on interpersonal relationship.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	<i>b</i>	<i>Std.E</i>	<i>β</i>	
Constant	4.230	.282		14.992
Depression and anxiety	-.361	.123	-.335	-2.928**

Misconduct	-.192	.183	-.118	-1.050
Aggression	.065	.113	.060	.570
Atrophy	.066	.119	.059	.559
R^2	.123			
F	14.501**			

Note: ** $p < .01$.

<Table 9> illustrates that the depressive and anxiety factor of social adaptation($\beta = -.335$) has a significant effect on interpersonal relationships, with a coefficient of determination $R^2 = .123$, with 12.3% of the explanatory power, respectively.

Table 10. Effect of social adaptation on sense of achievement.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	b	$Std.E$	β	
Constant	4.121	.297		13.875
Depression and anxiety	-.259	.130	-.231	-1.994*
Misconduct	-.464	.193	-.274	-2.411*
Aggression	.222	.119	.197	1.858
Atrophy	.133	.125	.113	1.060
R^2	.103			
F	13.684**			

Note: ** $p < .01$, * $p < .05$.

<Table 10> illustrates that the depression and anxiety factors($\beta = -.231$) and delinquency factors($\beta = -.274$) of social adaptation have a significant effect on the sense of achievement, with the coefficient of determination $R^2 = .103$, having 10.3% of the explanatory power, respectively.

Table 11. Effect of social adaptation on challenge.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	b	$Std.E$	β	
Constant	4.099	.314		13.058
Depression and anxiety	-.314	.137	-.267	-2.290*
Misconduct	-.340	.204	-.191	-1.670

Aggression	.196	.126	.166	1.556
Atrophy	.101	.132	.082	.766
R^2	.089			
F	9.137*			

Note: * $p < .05$.

<Table 11> illustrates that the depression and anxiety factor of social adaptation($\beta = -.267$) has a significant effect on the sense of challenge, with a coefficient of determination $R^2 = .089$, having 8.9% of the explanatory power, respectively.

Table 12. Effect of social adaptation on joy.

	Standardized regression coefficient		Non-standardized regression coefficient	t-value
	b	$Std.E$	β	
Constant	4.099	.314		13.058
Depression and anxiety	-.314	.137	-.267	-2.290*
Misconduct	-.340	.204	-.191	-1.670
Aggression	.196	.126	.166	1.556
Atrophy	.101	.132	.082	.766
R^2	.089			
F	9.137*			

Note: * $p < .05$.

<Table 12> illustrates that all factors of social adaptation do not have a significant effect on joy.

4. Discussion

In regards to the effects of youth generativity following their participation in the martial arts training on social adaptation and social happiness, and through the study of Young-mi Kim, Seon-hee Hyun, Hyung-sam Song(2008), Seung-hee Lee(2010), Mi-young Moon, and Mi-yeon Kim(2017). it turned out that through physical activities, changes in the physical or mental health have demonstrated to influence the quality of life and self-actualization, which is evident to have relevant for the results of this study[19][20][21], Bo-ram Kim, Hwang-hee Hwang, So-ra Baek(2017) claimed that the generativity formed through the leisure education generally has a positive effect on the overall life, and it may be evident that it has sufficient explanatory power for the results of this study since it has improved the ability to solve problems in such events of problems[22]. In the study of Ki-Hoon Kim(2017), participation in martial arts training turned out to influence self-management, social adaptation, and social community consciousness, which are partially supportive of the results of this study[23].

Furthermore, in the study of Seok-min Yoon and Kyeong-Jin Kim(2020), it turned out that the youth exercise participation has a positive effect on the maintenance and development of a healthy body, as well as the improvement of psychological and social health, and it was also claimed that it is

necessary to spread the program, and it is necessary to continuously promote the development of physical activities programs for the youth and the improvement of the participation environment[24].

Even in the studies of Soon-beom Hong, Kwang-bong Suh, Ji-yeol Lee(2019), Min-hee Lee and Koo-myeong Kwon(2018), Seong-mi Jeon, Jeong-woo Jeon, Cheon Choi(2010), You-young Seonwoo, Yang-seob Ryu, Yong-jae Hahn(2015), Ok-joo Kim and Hong-nam Kim(2012), Ki-nam Kwon, Jeong-rae Lee, Yoon-soo Hahn(2011), etc., it turned out that the sports participation influences social adaptation, stress, and happiness[25][26][27][28][29][30].

During the growth process, forming relationships with peers including teachers and school life during the adolescence influences daily life through the complex operation of such personal internal factors as self-esteem and happiness and such personal external factors as social adaptation[31][32], and through the study which claimed that active participation in sports has a positive effect on the satisfaction of life structured of psychological and social factors including self-esteem, exercise participation has a complex effect on the youth's self-esteem, social adaptation, and improvement of happiness[33].

The participants' generativity following the physical activities and sports participation may be said to be satisfied by contributing to society and being considerate of others, and the participants' generativity was found to be very helpful for their daily lives. It is evident that the physical activities and participation in sports not only reduce the likelihood of disability or disease by maintaining physical health, but also increase the quality of life and influence satisfaction and happiness[34][35].

Since it would be difficult to improve the social adaptation and social happiness with generativity only through the martial arts training, it is considered desirable to continuously participate in various physical activities, sports, and leisure as well as the martial arts training.

Hence, it is necessary to maintain and improve optimism through the mental and physical health by continuously participating in physical activities including the martial arts training for youth, and an environment for participation and a method or policy supported by policy are required.

5. Conclusion

In order to spread participation in the sports activities to lead a healthy and sound life through the self-realization of youth and correct physical self-concept, by examining the effect of youth generativity through the participation in the martial arts training on social adaptation and social happiness, this study would be meaningful in helping to develop the regular educational programs for the youth.

To achieve such purpose of the study, as of 2021, the sampling method was used to survey 300 people by using the convenience sampling method, and the survey was conducted by using the self-administration method, and among the recovered survey questionnaires, the questionnaire of 284 people was used as a valid sample except for the data in which the response contents were insincere or some of the contents were omitted.

As for the data processing of this study, using the SPSS 25.0 Program, a statistical package program, the statistical validation was performed in line with the purposes of the data analysis as follows, and the results of the factor analysis and the reliability analysis were consisted of the 2 factors of generativity, 4 factors of social adaptation, and the 4 factors of social happiness, respectively, with all factors representing .05 or greater. As a result of the reliability validation performed, the Cronbach's α coefficient turned out to be between .952 and .673, and as a result of the correlation analysis performed, it turned out that there was a positive(+) relationship between all of the factors. Lastly, it turned out that generativity influences social adaptation and social happiness.

Gathering which, it is considered that it is necessary to maintain and improve optimism through the mental and physical health by continuously participating in the physical activities including the martial arts training for youth, and an environment where the youth may freely participate in the sports activities without any restrictions is necessary, and the method or policy supported by policy is required. Furthermore, since the positive images of athletes by sport, including Taekwondo, are continuously

used as the communication tools in the modern society, many sports athletes ought to use them to promote the sports and improve their images via advertisements of their promotion.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	HC	-Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/>
Corresponding Author*	BK	-Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/>
Co-Author	SJ	-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Corresponding author*
E-mail: masterlee72@naver.com

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Exploring the Possibilities of Be-Coming Sports Events of Traditional MARTIAL ARTS of Chinese Ethnic Minorities

Ziyan Wang¹

Tianshui Normal University, Gansu, China

Sukkyung Lee^{2*}

Jeonju University, Jeonju, Republic of Korea

Abstract

Purpose: This study aims to explore the possibility as a sports event by analyzing the competition environment of traditional martial arts sports competitions of ethnic minorities in Gansu Province, China.

Method: Based on literature research, competition events, performance, and participation status, we are going to explore the development and succession of traditional martial arts of Chinese ethnic minorities and the possibility of becoming competition sports in Gansu Province.

Results: First, the development stages of the traditional martial arts competitions were distinguished by considering prior studies centered on the traditional martial arts sports competitions of Chinese ethnic minorities in Gansu province. Second, through the competition status of the traditional martial arts sports competition, the competition environment was analyzed and the cause of the events that entered the national martial arts competition was analyzed. Third, it is reported that it can be developed with regional festivals by expanding the Gansu martial arts sports festivals and the regional festivals. Lastly, through the major educational channels of schools, excellent national traditional martial arts programs will be transferred and developed to create synergies between traditional martial arts programs and school physical education, as well as well as promote and develop Chinese traditional martial arts culture.

Conclusion: In order to explore the possibility of traditional Chinese martial arts sports competitions as national sports and further becoming school sports and sports events, educational and competitive support as a top priority should be based on Chinese physical education subjects. Various studies should be conducted to explore the possibility of Chinese physical education intangible cultural heritage as a global sport through the discovery, organization, distribution and promotion.

[Keywords] Chinese Ethnic, Traditional Martial Arts, Sports Competitions, Analysis on Competition Environment, Possibility

1. Introduction

China is a multi-ethnic country composed of 56 ethnic groups, and the sports culture of each ethnic group is an important part of Chinese sports culture. Physical education is a cultural phenomenon that has traditionally united the human body and the mental world, conceived in civilization to promote civilization's progress, competition is one of the important objective ways of testing the development of physical culture[1][2][3]. The ethnic minority athletic competitions played a significant role in the overall development of the ethnic minority sports projects as the best form to reflect the development of the traditional martial arts of ethnic minorities[1][4][5]. Traditional martial arts are part of human social life and the fertile ground that spawns modern sports. According to the world's sports history, many sports that have swept the world have developed in national sports. Various sports activities that are now in vogue around the world were initially limited to ethnic group or minorities in a region, but eventually

became a cultural asset as they were accepted by the people of each country and shared by all mankind. Researchers from advanced countries outside of China conducted long-term research and dissemination of national physical education, converting it into the recreational life of the public. So national sports were the mother of international sports that was popular in the world at the time. Not only should it be inherited as a precious cultural heritage of the Chinese people, but it should also shine more brightly to make it stand out. Since the establishment of the new China, the party and the government have used the development of traditional martial arts as an important way to realize national policies and have been widely loved by the people of each nation as a symbol of prosperity and wellness[3][6]. Among the 9th successful national traditional martial arts competitions, one held in Tianjin City in 1953 and the 1982 national traditional martial arts competition were officially adopted as the 1st and 2nd National Traditional Martial Arts Competitions in 1984[3][7]. Institutionalization has been taking place almost every four years since the second time in 1982. The National Sports Competition visited five ethnic minorities[8][9]. The Ethnic Minority Sports Competition is a guide to the cultural community of ethnic minorities, a bridge between ethnic Chinese and global sports, an exhibition of the culture ethnic minorities, and a focal point of interest in ethnic sports throughout the world, being a fertile ground for growing athletic talents[10][11]. The 9th Ethnic Minority Sports Competition, which was already held in China, not only promoted ethnic unity, but also promoted the development of the ethnic sports tourism market by competing for art and understanding each other under the eternal theme of "exchange, joy, and harmony[9][12][13]." As China's traditional martial arts development and economic and cultural standards continue to rise, each traditional martial arts event is welcomed by many people, has a wide range of popular foundations and wide-ranging developments, and national martial arts will also make great progress[1][8][14]. Whether it's technology or competition rules, it's going to be constantly perfect and science-rich. In the near future, outstanding traditional national sports should be listed as national competitions, and furthermore, national, policy, and physical education should be encouraged to be adopted as an international Olympic event[4][15].

Many ethnic groups have lived in Gansu Province since ancient times. In the midst of the continuous evolution of history, each group has formed its own structure of ethnic groups, including 10 major minorities, including Hui, Tibet, Donghyang, Yugo, Boan, Mongol, Kazakh, Sara, To, and Man throughout the region. Among them, Donghyang, Boan, and Yugo received the second prize in the performance category of the National Sports Festival, which ended in Guizhou Province in 2011 with sword taking of Boan, club pulling of Donghyang, and iron bar support of Yugo[1][4][16].

2. Literature Review

Ethnic minority martial arts originated from the daily lives of the people, has unique ethnic characteristics and a wide public base, and is not only a component of the national sports industry, but also a treasure of China's superior traditional culture. Traditional martial arts, as a phenomenon of traditional culture, has an important influence on the people concerned, and even on the whole country. Competitions are one of the most direct ways of showing the development of sports, and the hosting of the national traditional martial arts competition not only demonstrated the traditional culture, spirit and physical education of each ethnic group, but also on this broad foundation of national unity and friendship[5][17][18].

Since the first ethnic sports competition was held in Tianjin in 1953, it has been successful nine times, co-hosted by the national people's commission and the national sports commission and entrusted to local governments. The scale of ethnic minority sports competitions is increasing, along with an increase in the number of events that surpass the elimination, as well as a stadium for national sports competitions where single ethnic traditional martial arts are moving forward with exchanges with other ethnic groups. Thus, the following steps are taken through

the competition events and the competition environment of the minority ethnic traditional martial arts competition, which was held until the 9th anniversary, focusing on prior research related to the minority traditional martial art[19][20][21][22][23][24][25][26].

Table 1. Preceding studies on traditional martial arts of Chinese ethnic minorities.

	Preceding studies
Prior to the 2000s	Woo Hak-ryeong(1998), Oh Ji-pyeong(1996), Mak Seo-yong(1996), Dam Hwa(1992), Kang Sang-san(1997), Roh Mun-cho(1995), Jang Seon-gun(1999), Juck Bo(1986), Jong Nyeong(1996), Jin Cheong(1998), Ho Yu-gan(1994)
Since the 2000s	Yo Do(2002), Wang Chun-mae(2004), Bang Li-yong (2003), Baek Jin-sang(2004), Noh Pyeong-saeng(2001), Ga Jo-bin(2010), Dan Hui-do(2004), Yo Won & Jang Un-gang (2003), Woo Chong-chong & Jeok Suk-gwa(2010), Yu Mu-chang, Na Wi-dong, Dan Heung-ryang & Dan Heung-gun(2006), Yi Ji-cheong (2001), Yi Hyo-hwa(2001), Jang Ryeo(2006), Jang Jung(2005), Jo Guk(2007), Jo Chang-ui(2000)
Books	Noh Pyeong-saeng & Yang Nan-saeng(2002), Noh Pyeong-saeng & Jin Kang-woong(2009), Cheong Jin & Bong Nyeon-maeng(2002), Ho So-myeong(1999), So Myeong(2000), and Hwak Hong(2007)

2.1. History of ethnic minority martial arts competitions

2.1.1. Birth stage

Since the early days of the establishment of the New China, the Central People's Government has put great importance on the development of minority sports projects. In October 1949, comrade Zhu Deok, then vice president of the People's Republic of China, proposed at the founding convention of the National Sports Council of China that "many of the original forms of sports in the private sector need to be adopted extensively." The National Sports Festival, held in Tianjin on November 8, 1953, was six years earlier than the National Sports Festival in Beijing in September 1959. They came from nine organizations, including Hwabuk-gu, Northeast-gu, Westnorth-gu, Centralsouth-gu, Southwestern-gu(including Tibet), Neymung-gu Autonomous District, Liberation Army, and Railway System. At the opening ceremony held at Tianjin Civil Service Stadium, Guo Moruo, deputy prime minister of the Central People's Government, and head of the Culture and Education Committee, and Li Deo-quan, the director of hygiene, attended and gave speeches. Sports events are divided into three parts: competition, performance, and special invited performances. There are weightlifting, boxing, wrestling, and bosa. The performance includes martial arts(22 categories: stone parting, stone breaking, archery, tanhwan, post climbing, board jumping, pijo, sandbag, jiwi, vaulting, geundu, tumbling, wushu, oho bar hitting, jumping, jump rope, vicha acrobatics, acrobatics, etc. and 9 horse riding skills. Special invited performances include polo, Mongolian wrestling, lion dance, and acrobatics. Minority events such as Mongolian wrestling, ethnic Korean board jump, hui martial arts, and horse riding of Inner Mongolian cavalry left a strong impression. There were 120,000 visitors from all over the country and Tianjin City. After the closing of the competition, 90 outstanding athletes were selected, and 31 consecutive performances were held in Beijing, which was warmly welcomed by the audience[12][18].

The first ethnic minority sports competition is a sports competition in which the nation combined the sports movement with the development of traditional culture to serve as a guide to traditional Chinese martial arts. There is a significance in the history of Chinese sports that it has an important influence on strengthening national unity by following the party's national policies and promoting the development of national sports projects. It has a monumental effect on the development of Chinese physical education.

2.1.2. Growth stage

In the 1980s, ethnic minority martial arts gained the attention of the party and the government after going through various political hardships represented by the Cultural Revolution. The National Subcommittee convened a meeting of ethnic minorities' sports affairs in a timely manner and put national traditional martial arts back on the agenda. In 1982, experts and scholars in the relevant fields selected relatively strong cultural significance and popular-based national sports events as competitions and performances at the 2nd National Minority Sports Competition hosted by Huhe Haot. The competition lasted seven days, with 863 athletes and coaches from 29 ethnic groups across the country, including 593 ethnic minority athletes. Physical activities are divided into two categories: competition and performance. There are archery invitations and Chinese wrestling. More than 800 athletes from 46 ethnic minorities from 26 provinces, municipalities and local governments would perform a total of 68 times. These traditional ethnic performance programs have been developed in the production and life of each people, each with a distinctive and colorful audience of more than 800,000 people. During the competition, they held a "photo exhibition of traditional martial arts events of ethnic minorities nationwide" and held a big social party with 12,000 participants[6][11].

The first Chinese National Sports Festival played an important role in restoring and developing China's traditional national sports culture. The National Sports Festival, which was confirmed through the State Council's approval in 1984, was held once every four years, and the National Sports Festival was recorded as the first national minority sports competition held in Tianjin in 1953.

2.1.3. Development stage

The third Chinese National Sports Competition, which was held in Urumqi in 1986, was a competition that was put on track and distributed and developed. 1,097 athletes from 55 ethnic minorities and leaders and executives from 29 provinces, autonomous districts and direct cities across the country participated. The total number of observers in 29 provinces, autonomous districts, and direct cities is 2,000, including guest representatives, domestic and foreign journalists, those from Hong Kong and Macau, and foreign acquaintances, totaling 3,704. The insignia, national flag, and emblem of the competition were first introduced as symbolic events to announce that ethnic minorities' traditional martial arts competitions are gradually becoming regular. In addition to traditional wrestling and archery in previous competitions, competitions were held in seven events and 115 events, and one or more ethnic minorities including archery, shepherding, swing, and horse racing were established. For the first time, the competition supplemented the rules and raised the level of athletic skills with scientific rules. A study was conducted on the transition and development of ethnic Chinese physical education, and good theoretical support was provided for the development of ethnic minority martial arts competitions. By raising awareness and interest in the work of ethnic minorities among workers, local minorities sports have developed rapidly[8][10].

The 4th Chinese National Sports Festival was held for eight days in Guangxi Nanning in 1991, with a total of 3,000 athletes from 30 provinces, autonomous districts, and direct cities, and also directors, observers, representatives of advanced ethnic sports and international journalists. In this competition, two events were held: competition and performance. A total of 114 prizes, including 34 gold medals and 120 prizes, were at stake in nine events, exceeding the number of the first and second events and put the competition on the track of normalization once again by suggesting relatively scientific and systematic general regulations and methods of evaluating performing events. For the first time, minority traditional dance arts groups participated in the competition's games and performances, truly realizing the great unity of minorities across the country at the Chinese national sports festival[27].

The 5th Chinese National Sports Competition, which was held in Kunming for 8 days, was bigger than ever and had more games. A total of 9,000 people participated, including 55 ethnic minority athletes from each province, autonomous districts, and direct cities, coaches from each ethnic group, judges, officials, observers, leading representatives of minority sports, and newspaper reporters. The People's Liberation Army of China and the Xinjiang Production and Construction Corps joined for the first time. Minorities from Taiwan gathered to participate in rowing competition, and some compatriots from Hong Kong, Australia, and Taiwan were invited to the competition. It was divided into two categories: competition and performance. There were 11 competitions, 65 gold medals, 129

performances, and 1, 2, 3 awards were on the line to enhance the competitiveness and viewing value of the performances.

As the last Chinese National Sports Festival of the 20th century, the Chinese National Sports Festival set a precedent for hosting at different times and places. Ahead of the closing ceremony of the fifth democratic competition, the organizing committee announced that the sixth Chinese National Sports Festival will be held in Tibet, which is called "the rooftop of the world," and Beijing, the capital, in August and September. The competition will be divided into two categories: competition and performance. There are 13 sports events and about 200 performing events, and the game rules are further standardized and to be scientific, while researching and improving the game equipment for the first time. Some of the event objects were changed. For example, a small iron that was hard to see was changed to a 20cm diameter rubber disk. In the case of pearl ball competitions, the crafting of balls and racket materials were further refined and the operation and safety of swing equipment were improved, laying a good foundation for the norms and development of the Chinese National Sports Competition. After this competition, an ordinance on the establishment of events was enacted, and a declaration system was established for the approval of events.

2.1.4. Expansion stage

In 2000, the National Sports Commission's 2001-2010 Sports Reform and Development Summary said, "We should further promote the dominance of the national sports community to develop national sports resources and discover, organize and distribute traditional martial arts events. Ethnic regions should link the development of traditional martial arts and the promotion of national unity." A total of three ethnic minority martial arts competitions were held at this stage, each in ethnic regions and developed cities. In September 2003, the 7th National Minority Traditional Martial Arts Competition, which was held in the city of Yinchuan for eight days, featured 4,574 athletes in the 14 events and 124 events. The competition had the largest number of events and participants ever. In November 2007, the Minority Traditional Martial Arts Competition, which was held in Guangzhou, participated in 15 events of the competition, 148 events of the performance, and 6,381 participants participated in the event. The 9th National Sports Festival, held in September 2011, attracted 6,771 athletes in 16 sports and 188 sports, showing an increasing number of participants and the size of participants compared to the previous year[2][14][15].

3. Research Results

3.1. Gansu province's history of ethnic minorities traditional martial arts competitions

The 3rd Minority Traditional Martial Arts Competition, which was held throughout the province, was held from September 6 to 8, 1994 in the Autonomous Prefecture of Suknam Yugo. The National Traditional Martial Arts Competition was organized by the People's Commission and Sports Commission and organized by the Suknam Prefecture government. Throughout the province, 16 delegations and 419 athletes participated, including Jiju City, the Seobuk National Academy, the Seobuk Minority Teacher Training Center, and the Cooperative National Education High School, excluding Gyeongyang province. They participated in 28 detailed events including wrestling, martial arts, elephant tug-of-war(gapga), and horse racing, and performed performances such as waist sword taking, shepherding, gonangchu, and horse riding. During the competition, the awards were awarded to all 16 national sports organizations and eight advanced individuals.

The 4th Minority Traditional Martial Arts Competition, which was held throughout the province, was held in Muwi City from September 5 to 7, 1998. The traditional martial arts competition was organized by the provincial people's committee and sports committee, organized by the Muwi administration and participated by 509 delegates from 17 local state and northwest ethnic academies, northwest ethnic minority teacher training centers, and cooperative high schools. They participated in folk wrestling, martial arts, gapga, horse racing(speed horse racing, horse packing, hada), shepherding,

gonangchu, iron rod support, child fights, archery competitions, and performances. Jang Ye and Wu Wei tied for first place and Jin Chang came in third. In the performance event, the Jucheon team won the shepherding and gonangchu event. The Jangye team won the championship in the field of iron bar support and child fights. The Pyungryang team won the martial arts category, while the Imha team received the Excellence Award. Representatives from Muwi, Gamnam, Jucheon, Gayokgwan, Imha, and Yongnam won the Sports Ethics Award. 18 institutions and 18 individual athletes were rated as advanced minority athlete groups and individuals from all provinces.

The 5th Minority Traditional Martial Arts Competition, which was held throughout the province, was held in Nanju from August 18 to 23, 2002. The competition is hosted by the People's Commission and Sports Commission and organized by the People's Government of Nanju City. There are 38 detailed sports in four categories: wrestling, martial arts, and Gapga, etc. The seven events, including horse racing events, Gonangchu, shepherding, red flag picking, and group horse riding, were held in Yeongdeung prefecture in advance. A total of 17 delegates, including ethnic teacher training centers and partners, as well as 700 judges and executives, participated. They selected 39 gold medals, 38 silver medals, and 34 bronze medals. In the case of the Imha team, the Donghyang people did club picking and Boan people did waist sword taking. The Wuwei team rode horses as a group. Iron bar support, which was carried out by the Yugo people, and the Baijiquan, which was carried out by Yemeni students at the Center for the Training of Minority Teachers in the Northwest, won the Excellence Award. Advanced groups and individuals were selected according to their performance.

The 6th Minority Traditional Martial Arts Competition, which was held throughout Gansu Province, was held in the city of Gayokgwan from August 18 to 23, 2005. The competition was organized by the People's Commission and Sports Commission and hosted by the provincial government. More than 630 athletes from 17 teams, including National University, Northwest Minority Teacher Training Center, and partners, participated in six events, including wrestling, martial arts, horse racing, archery, Gapga, and pearl ball, and seven performance events. A total of 62 gold medals were on the line, and the city of Gayokgwan won 11 gold medals, ranking first. Twenty teams of 17 athletes and 86 athletes won the Sportsmanship Award.

The 7th Minority Traditional Martial Arts Competition, which was held throughout the province, was held in Juchui City from July 28 to 31, 2010. The competition was organized by the People's Committee and the Sports Committee and organized by the government of Juchui City. About 1,200 athletes, coaches, judges, staff, observers from all walks of life, leading representatives of ethnic sports, and journalists from 14 cities, northwest ethnic universities, northwest ethnic minority teachers training centers, and three high schools specialized in partners. Among them, there are about 900 players, coaches, and referees. The main stadium of the competition is in Sukju-gu, Juchui City, and the event was held from July 27 to 28 at the Aksehyeon Branch Hall. The National Sports Competition is the largest event ever, with seven competitions and 10 performing events. The seven competition events were subdivided into 73 events including traditional wrestling, martial arts, gapga, horse racing, top-spinning, skating, and running. In detail, there are 10 Gapga, 16 martial arts, 22 wrestling, 9 horse racing, 7 skates, 5 runs, and 4 top-spinning events. All of these events are ethnic minority traditional sports with distinct ethnic characteristics and a wide-ranging popular base. Compared to before, three items were newly established: top-spinning, skating, and running. Five gold, three silver, and two bronze medals were selected for the performance of this National Sports Competition. Specifically, "Gilsangchiryeon" of Jangye City delegation, "guajang" of Gannanju delegation, "baekmahon" of Nongnam City delegation, "waist sword taking" of Yimha-ju delegation, and "gonangchu" of Juchiwi city delegation received gold prizes. The "taichichuan" of the Geumchang City delegation, the "club picking" of Yimha-ju delegation, and the "Crushing" of the delegation of Juchwi City received silver awards. The "health gymnastics" of the Gayokgwan delegation and "shepherding" of the delegation of Juchui City received bronze prizes. Combining these "vibrant" sports and art, these distinctive performance events are highly spectacular and artistic and have been well received by audiences for showing the essence of national sports culture in all provinces. During the competition, they also honored 20 individuals and 14 institutions that contributed to the traditional martial arts project of ethnic minorities throughout the provinces.

Table 2. Summary of gansu province's national sports festivals for the ethnic minorities' traditional sports.

Order	Period	Venue	Events		Size	Prize
			Competition	Performance		
1	1994. 9.6-8	Suknam Yogo people's autonomous prefecture	-4 events: wrestling, martial arts, gapga, horse riding -28 sub events	Waist sword taking, shepherding, gonangchu, horse riding	16 delegations (419)	16 provincial athletic institutions, 8 individuals
2	1998. 9.5-7	Muwi city	-4 events(wrestling, martial arts, gapga, horse riding -28 sub events	Gonangchu, iron bar support, child fight	17 delegations (509)	18 provincial minority athletic institutions, 18 individuals
3	2002. 8.18-23	Nanju city	-4 events(wrestling, martial arts, gapga, horse riding) -37 sub events	Gonangchu, shepherding -7performance events	17 delegations (700)	16 provincial minority athletic institutions, 11 individuals
4	2005. 8.18-23	Gayokguan	-6 events: wrestling, martial arts, horse riding, archery, gapga, pearl ball -63 sub events	Gonangchu, shepherding, iron bar support -7performance events	17 delegations (630)	19 provincial minority athletic institutions, 9 individuals
5	2010. 7.28-31	Juchi city	-7 events: wrestling, martial arts, gapga, horse riding, top-spinning, skating, running 73 sub events	Gilsangchiryeon, guajang, baekmahon, waist sword taking -10performance events	17 delegations (900)	14 provincial minority athletic institutions, 20 individuals
6	2014. 8.10-12	Chingyang city	- 8 events: wrestling, martial arts, gapga, horse riding, top-spinning, skating, running, folk health/beauty -74 sub events	Gilsangchiryeon, guajang, tug of war, waist sword taking, Uighur tap dance 6performance events	17 delegations (848)	17 provincial minority athletic institutions, 100 individuals
7	2018. 7.18-7.21	Baekeun city	8 events: wrestling, martial arts, gapga, horse riding, folk crossbow, running, football, folk health/beauty -74 sub events	Competition, technique, comprehensive performance-7 events	17 delegations (875)	17 provincial minority athletic institutions, 106 individuals

3.2. Analysis of the competition environment for traditional minority sports competitions in gansu province

The Gansu Province Minority Traditional Martial Arts Competition is a comprehensive sports competition jointly held by the Gansu Province People's Committee and the Sports Committee. The first and second competitions were mainly held in performing events, and from the third event, a four-year event was established with two events, the competition and performance. By sport, the Gansu Province Minority Traditional Martial Arts Competition has gradually been linked to the National Minority Traditional Martial Arts Competition, and the number of participants has increased as the rules of the game have been revised. In particular, the 6th Minority Traditional Martial Arts Competition was successful at Gayokguan, a tourist attraction in Gansu Province. On the other hand, citizens were prepared to greet participants in each region with the attitude of their owners in order to promote citizens through TV, newspapers, and the Internet. On the other hand, it was sponsored by the local Jugang group that the provincial government would provide a budget, combining the competition with the market economy. This provides a new paradigm for the game's management model, which will be held in the upcoming event. According to the results of the game, first of all, ethnic sports are developing very disproportionately in various parts of the country. For example, the 5th and 6th competitions, Nanju City has always demonstrated its absolute skills, explaining the close relationship between economic movement and economic development. In terms of the team's dominance in each event, the Gannan team has an absolute ability in horse riding by Tibetan compatriots against the backdrop of a natural environment. The Yimha team showed great potential in martial arts, which took advantage of the early development of archery and won three gold medals in the sixth competition. On the other hand, Nongdonggyeongyang, Pyeongryang, and Yongnam areas, which are Han people's regions, have fully revealed the problem that sports activities of minorities in Han people are not

becoming common due to poor performance. Next, there is a problem in which the level of players is jagged and the reserve manpower of national sports is insufficient. There is a relatively boisterous scene, but at a tactical level it needs to be improved, and in many games, it has all been one-sided. In the event of a landslide victory in Gapga, the players also said that retired veterans and local coaches and newcomers were mostly amateurs. Ethnic sports were not active everywhere, most of them were desperate and ill-prepared, and the lack of reserve manpower for the competition was serious.

3.2.1. Connecting national traditional martial arts and local festivals

The traditional Chinese holidays are a stage that fully shows the appeal of each ethnic minority's traditional martial arts culture, and performances and games of ethnic minorities' sports events form the main body of the holiday culture. Gansu Province is seeking to promote the health of the local economy and the entire nation by attracting brand competitions with strong foundations and influence in each ethnic minority region thanks to the Sports Health Brand Project. It was held four times in a row until 2007, like the Marco Salsa Racing Competition, which was first established in Machi Prefecture, Gannan Province in 2004. Among them, 32 teams from 18 prefectures, including Gan, Qing, and Ning, participated in the fourth competition, attracting 30,000 visitors a day, totaling 106,000 tourists from both inside and outside China. In Imdam Prefecture, which has a large influence and a long history inside and outside China, 618 tug-of-war of 10,000 people events were held on the fifteenth of lunar January. The tug-of-war rope used in the 2007 game was 1,260 meters long, weighs about 10.05 tons, and has a diameter of 6 centimeters, with 150,000 participants already taking part. It is the best ever and was listed in the Guinness Book of World Records in Shanghai in 2001. In addition, various channels and media outlets of CCTV are promoting and reporting the convention, which has a historic participation and good public base. Shanglangje, a traditional Tibetan holiday in Gannan, Gansu Province, is popular. The holiday originated from the annual harvesting of firewood by the monks of Rapgolsa and developed into a picnic holiday with the clergy and the laity participating. Hyangrang means getting paid in Tibetan. It was called Hyangrang(scent wave) because firewood was called Hyang(scent) and woodcutters were called Rang(wave). Hyangrangeol is held around June 15th of the lunar calendar every year and begins on June 6th of the lunar calendar. During the festival, there were rituals such as collecting mulberry leaves and throwing arrows, but gradually developed into pure entertainment activities. Tibetan compatriots engage in recreational activities rich in the taste and characteristics of life[10][18][28]. There is horse racing, yak, tug-of-war, wrestling, running, singing, and dancing. The Hyangrang Festival is a festival that combines various elements such as folklore, national sports, and tourism. Overall, Gansu Province's large-scale festivals still differ from some other regions in terms of promotion, overall planning, and internal and external influence. Therefore, government ministries' policies and funding should be strengthened, and local folklore and traditional martial arts culture should be displayed in a group through the promotion of each media. A comprehensive large-scale event of sports tourism and trade counseling, national sports, and through economic extremism, tourism, investment, and trade counseling are encouraged to attract domestic and foreign tourists. This stimulates the local economy and provides fertile soil for Gansu Province's superior national martial arts events, enabling them to be well inherited and developed in the great background of current economic global integration. Gansu Castle is one of many ethnic groups, so all ethnic groups have their own sports. In addition, because of the lack of co-participation and lack of many competitions, Gansu Province or the relatively high prevalence of the 8th and 9th competition events was added. For example, the 8th increased bodybuilding, and the 9th added to the football game. Most of the demonstration items are unique to each nation, and the exhibition and performance at the National Sports Festival are extremely meaningful for the spread and protection of peoples' culture.

3.3. Combination of gansu minority traditional martial arts and school physical education

3.3.1. Development and succession linked to the traditional martial arts of ethnic minorities in gansu province

3.3.1.1. Development and succession of excellent traditional martial arts events

Gansu Province is a large multi-ethnic area, so there are three ethnic groups of its own: Yugo, Donghyang, and Boan. Among these many ethnic groups are many great traditional martial arts events. Therefore, experts in the field of pedagogy should be organized to actively discover and organize them. Discard useless things, systematize and rationalize them, and create a scientific evaluation system that integrates them organically with the window of school physical education. While filling the national traditional martial arts event with valuable resources for school physical education, it gradually attracts people's attention and understanding of excellent traditional martial arts. Eventually, going to physical education for the life through school physical education takes root in the fertile soil of public physical education. In terms of basic physical education facilities, for example, places and equipment and teaching qualifications are relatively high in terms of school physical education. Since most traditional martial arts events do not have high demands for places and equipment, the infrastructure of school physical education can basically satisfy the conditions for developing physical education. Gansu Province's superior martial arts can be spread and developed in a wider environment only when students have more access to these items in their daily lives and learning.

3.3.1.2. Making ethnic minority martial arts competitions linked to school sports

The construction of training sites during the development of competitive sports has traditionally been a significant means of national importance and has also made great contributions to the sports business in China. A study of the national team's performance at the Gansu Minority Traditional Martial Arts Competitions found that in order for provincial sports to develop well, a minor ethnic sports training base should be established by referring to this method of physical education[8][11]. It is possible to provide sustainable development for prospective ethnic sports talent in the castle by distributing national sports events to schools of various levels in Gansu Province and organizing professional training organizations. The National Education Ministry's "Guidelines for Teaching Physical Education Courses at General High Schools across the country" describe it as follows. "We combined the world's outstanding athletic achievements with the succession and development of the traditional martial arts of our people. We should pay attention to the implementation of the period and diversity of textbooks while emphasizing the characteristics of ethnicity and China." This indicates that national education was planned and organized because it needed the supply of schools, especially high schools[18][29]. The development of traditional martial arts at various levels of schools is not only beneficial to students' own qualifications, but also more beneficial to create an environment for the development of traditional martial arts, which is beneficial to both the succession of national and school physical education.

3.3.2. Establishment and revitalization of the competition environment of traditional sports of ethnic minorities

National physical education is a necessary means for the transmission and development of national physical education and is the basis for developing national physical education. Combined with the reform of new subjects among elementary, middle, and high school physical education schools, the school provides and develops excellent national physical education programs while increasing students' qualifications. The requirements in the new subject table include: "One of the important tasks of classroom classes is the process of making a student's mental asset by internalizing scientific knowledge and activities that allow students to gain knowledge and develop abilities. The acquisition and refractory of knowledge must conform to the student's cognitive discipline and must be autonomously constructed by the student's experience[13][30]. Teachers should also help students open a window of knowledge and recreate the process of forming knowledge by operating certain educational strategies during class. Encourage students to experience knowledge and encourage students to apply knowledge to improve their memory and understanding of knowledge. It helps students to get back to their knowledge. It also helps to activate their knowledge of textbooks." The curriculum of school physical education is not tailored to rigid classes and is flexibly operated in a large framework. National Physical Education provides a good foundation for the future development of national physical education by participating in elementary, middle, and high school physical education and by

encouraging students to enjoy their mind and body in the activities of national sports events, train their bodies, and understand national sports culture.

3.3.2.1. National traditional martial arts cultural resources and activities linked to elementary, middle, and high school physical education curriculum

Gansu Province is located in northwestern China, and the economy is relatively underdeveloped. Although education investment has been steadily increasing in recent years, it is far from investing in education in advanced countries and regions. Due to the serious lack of school physical education facilities, it is difficult to carry out the education prescribed by the Ministry of Education, especially in the modern Western physical education and cultural system. Athletics, gymnastics, and ball games, for example, are difficult to develop due to factors of place and equipment, but many traditional martial arts are athletic entertainment that people gradually form in many years of production labor, and not so much demand for stadium equipment as to develop with single lumber or stone. If we materialize sports with physical education, entertainment, and education based on the specific circumstances of the ethnic region, we will be able to overcome the lack of physical facilities due to the lack of educational expenses. As a result, school sports activities are limited, and introducing a traditional martial arts culture in schools can play an important role in students' mental and physical health and thought education. The effective promotion of students' mental and physical health development and the full promotion of national physical education under the establishment of new subjects have deep historical significance and value in the succession and development of ethnic minority culture[7][9]. Also, according to the current demand for basic education reform, the new demand for reform is not for unified physical education across the country, but for new physical education curriculum standards. The goal of the new physical education curriculum is to present curriculum goals, learning field goals, and level goals based on "health first," but physical education instructors in each region are taking a flexible approach by presenting only a large scope without breaking down the contents and methods needed to achieve them[5][31]. By combining resources and student hobbies, it is advantageous to reflect regional characteristics rather than uniform physical education subjects. Based on the completion of educational goals, according to the needs of new departments, the development of curriculum teaching resources using the innate benefits of many ethnicities and items in Gansu Province has a profound impact on personality education.

3.3.3. Fostering traditional martial arts at the school level

In the field of high school sports, as seen in previous Gansu Provincial National Sports Competitions, the high school sports team has always been a vital part of the national sports competition. At the Northwestern National University, athletes, coaches, and high schools with long-standing ethnic sports traditions are stabilized so that they can organize teams to participate in the People's Sports Festival based on their actual situation. Following the way led by the Ministry of Education at the Universiade, more and more universities are developing talent to pass on and develop national culture, explore academic disciplines, and develop them all[3][8][32]. Taking advantage of the experience of training in other sports events, we introduced athletic training, physiology, biochemistry, motor psychology, motor biomechanics, and motor medicine into the track of national physical training and established a system of selection, training, and talent. This contributed to many national athletic talents in Gansu Province and furthermore for the nation.

3.3.4. Establishment of a high school ethnic sports competition environment

The high school is responsible for fostering various high-quality talents for the nation's economic construction and social development. Rich national sports resources will be an important part of high school physical education research. The Department of National Traditional Martial Arts is an emerging science that inherits and promotes national culture and organizes and promotes minority sports that promote health and entertainment scientifically. The establishment of the National Physical Education Research High School first strengthened the study of the Olympic Games of the National

Physical Education and planned the planning personnel, resources, and time by referring to the Olympic promotion and supply management methods[9]. Research was conducted on each stage of the competition to find a suitable form for national sports and gradually professionalized and marketized national sports events with mature conditions so that they could be widely distributed throughout the country, and even around the world[1][11]. On the other hand, they studied the techniques and rules of national sports in depth, revolutionized the playground, equipment, and rules, and promoted the development of national sports. The full application of the theory of national physical training to actual education and training boldly studies the rationality of sports skills and improves sports skills to the extent that they conform to the rules of exercise, thereby improving the recreational and viewing value of sports skills. This favors the improvement of a player's performance, the fair play of the sport, and the use and maintenance of places and equipment.

3.3.5. Analysis of successful opening of traditional martial arts in gansu province high school

Gansu Province is a large area of ethnic minority population with abundant ethnic traditional martial arts cultural resources, and how to utilize these good birth conditions is a common task for many sports-related stakeholders. In 2005, Guojangmu was adopted as an optional physical education subject at Nanju University, and 180 students in six classes learned it in the aerobics classroom at first. It soon gained high recognition from students and quickly spread to schools. Pil, a professor at Nandae Seobuk National Sports and Culture Research Institute, said that Guojangmu entered university physical education classes because the current university physical education model is the educational model of the western competition sports, which is widely benchmarked[7][8]. Although this western physical education style is relatively mature, it is very helpful for students' physical strength and health, however, many non-professional students participating in the running, jumping, and throwing of western sports are too dull to attract much interest. Instead of copying Tibetan dances, Nandae's gym teacher went to Gannamjang District several times to record them as D/B, and organized and classified various Guojangmu. While maintaining the power of original culture, the western national sports dance based on Guojangmu was carefully selected, excavated, organized, and distributed.

4. Conclusion

Combining excellent national traditional martial arts resources with school physical education curriculum is a beneficial way to inherit national traditional martial arts culture and develop school physical education curriculum resources. Gansu Province is located in the west and the development of economic conditions is relatively delayed. And elementary, middle, and some universities' spending on physical education is greatly lacking from the perspective of relatively developed areas, and physical education is relatively underdeveloped. The method of adding traditional national physical education to school physical education based on regional characteristics and economic conditions is a new topic of development of school physical education courses, quality improvement education, and regional promotion sports. Therefore, utilizing the traditional martial arts cultural resources of ethnic minorities to find, organize, and develop scientific textbooks, and introduce the traditional martial arts culture of ethnic minorities into the school physical education course is an effective way to solve the difficulties and conflicts facing the school physical education projects. It is recommended that experts and scholars be organized in the Physical Education and Functional Division to conduct practical research in schools and that textbooks with characteristics of traditional martial arts culture suitable for sex schools should be produced under the national level 3 course management system. In addition, a systematic system of traditional martial arts programs can be established to refer to many cases of success that have already matured. Based on excellent sports events at the National Convention, traditional martial arts events can be discovered and distributed. Furthermore, it is necessary to develop the traditional martial arts culture of the Chinese people by utilizing the educational resources of

Chinese high schools and eventually spread to the world through the excavation, organization, dissemination, and promotion of Chinese physical intangible cultural heritage.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	ZW	-Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/>
Corresponding Author*	SL	-Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Corresponding author*
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Kinematic Analysis of Jasebaqueo Pparunbal Dollyuchagi Motion in TAEKWONDO

Seonghun Kim¹

Chungang University, Seoul, Republic of Korea

Boseob Heo^{2*}

Kosin University, Busan, Republic of Korea

Abstract

Purpose: The purpose of this study is to compare and analyze pparun bal dollyuchagi(fast spin kick) motion of Taekwondo players, divided as outstanding ones and unskilled ones, to provide kinematic information on Taekwondo kicks and pparun bal dollyuchagi motion, and analyze differences in kicks between comparative groups.

Method: The subjects of this study are Taekwondo players in their 20s who are attending the Taekwondo department at K University, five outstanding ones who have won prizes at domestic competitions and five unskilled ones who have not won competitions. Prior to the experiment, the subjects were asked for consent and explained how to proceed with the experiment. Kinematic data were collected using eight digital cameras. Statistical processing in this study was conducted using SPSS 22.0 software, and statistical analysis values were calculated as mean(M) and standard deviation(SD). An independent sample t-test was conducted to analyze the differences between groups, and the statistical significance probability was set to $p < 0.05$.

Results: There was no significant difference in the total execution time during the comparative analysis between the skilled and unskilled players of Jasebaqueo Pparunbal Dollyuchagi, and significant differences were found in the left and right variables of body center. Also, significant differences were found for each event in the hip, knee, and ankle joints of the lower extremities.

Conclusion: According to the experiment, it is necessary to select an efficient hitting distance to improve the completeness of the pparun bal dollyuchagi motion, and to hit the target, the width of the center of mass displacement on the left and right sides must be small and balanced without shaking. The knee joint and ankle joint should be quickly extended when striking a target, then vertically moved quickly to perform a perfect motion. This study is considered significant in that it provided fundamental data necessary for the efficient performance of kicks.

[Keywords] Kinematic, Pparun Ball Dollyuchagi, Center of Mass, Time Required, Angle

1. Introduction

1.1. The necessity of research

Taekwondo competition is a game that determines the outcome through various skills and tactics. This is a game in which one scores by directly hitting the other while various movements and mutual interaction, and kicks are important means of attack[1][2]. In Taekwondo sparring competitions, the players attack and defend in response to the movement of the opponent, and over 90% of the kicking skills are used[3][4]. Factors for performing highly coordinated kicking skills include muscle strength, speed, stamina, balance, flexibility, coordination, etc[5][6]. The main purpose of the technical change in kicking is to shorten the distance of the attacking foot and reduce the time required for hitting, which has greatly contributed to improving the performance of the players. Many studies have been

conducted qualitatively and quantitatively in terms of kinematic mechanics and various studies have been reported[7][8]. Taekwondo competitions require fast kicks, short reaction times, and accurate strikes to increase the chances of scoring. It also requires the connection of techniques such as attack, defense, counterattack, and proper timing of kicks in response to the opponents' step positions[9].

Among them, pparun bal dollyuchagi is a technique that is used quite frequently during competitions. It involves pulling the back foot toward the axis using a step and kicking it with the front foot at the same time[10]. In real-world competition situations, players can shake the opponent's center and connect to the next skill, which is mainly used because of the advantage of scoring with the first attack[11]. With pparun bal dollyuchagi, one is easy to change posture, and it can be said to be a kick to score points. An analysis of its function is an important issue for competition performance. Therefore, the analysis of the most favorable speed and timing is required[12].

In a prior study of Taekwondo kicks, Ko S(2006)[12] said that moving fast in the direction of movement during pparun bal dollyuchagi reduces the time required, and that the hip joints bend as much as possible to strike the target quickly. Seo D, Lee Y(2007)[13] compared and analyzed the performance time of pparun bal dollyuchagi, the speed change and the angle of the lower limb segment. In addition, Seo Y(2017)[14] analyzed the displacement, time, angle, velocity, and angular velocity variations during Taekwondo players's side kick. Many researchers have actively analyzed the behavior of the kick techniques, which identified the mechanical principles and characteristics of a single motion and they can be used as data for technological development[15][16][17].

However, the previous research focused only on analyzing the basics of Taekwondo kicking techniques as a study of single movements. In real games, most of them are scored due to connected kicks in attack and defense situations. Rather than using only a single kick motion technique, more complex techniques are used to connect two or more techniques to attack an opponent[18][19]. The connection between judgment and techniques is paramount because it requires instantaneous reactive techniques for attack, defense, and counterattack[20].

In a prior study on the connecting motion of Taekwondo kicks, Ko J, Kim K, Chung N(2020)[21] conducted a video analysis of Taekwondo kicks for comparative groups of sparring and Poomsae players. Through this, he studied the time variables, positional variations, velocity variations, and angular of the center of mass and the angular variations of the limbs. In addition, Kim J(2016)[22] confirmed the effect of dynamic preliminary movements through the stationary position and standing position when performing the kick after the retreat step.

Pparun bal dollyuchagi is popular in Taekwondo competitions and is a technique for effective scoring. Therefore, the analysis of this kicking technique can have a significant effect on the performance. However, the papers so far focus on improving the form and technique of kicking as a single movement, and lack of research on kicks with continuous motion. For this reason, the need for this study is thought to be very high.

Therefore, the purpose of this study is to provide basic data for the performance of techniques by comparing and analyzing skilled and unskilled players in jasebaqueo pparun bal dollyuchagi motion and presenting differences in key kinematic factors.

2. Research Method

The subjects of this study are male players in their 20s who are majoring in Taekwondo at K University. Among them, five skilled players who have won prizes at domestic competitions and five unskilled players who have no winning experience were selected. The general characteristics of the study subjects are as shown in Table 1, and the measuring tools and analysis equipment used in this study are as shown in Table 2. This study was conducted in the kinematics laboratory of the P University, and the study subjects were explained on the purpose and precautions beforehand. After measuring the body elements of the study subjects with Inbody 570, warm-up exercises were performed for 15 minutes in the experimental environment of the kinematics laboratory. Afterward, the subjects fully practiced and performed jasebaqueo pparun bal dollyuchagi. After securing space as shown in <Figure

1> to conduct the experiment, eight high-speed cameras were installed on the front, rear, left, and right sides at intervals of 5m from where the subjects performed the kicks. The shutter speed of the camera was set to 1/250 sec, and the camera speed was set to 100 frames/sec. Three-dimensional spatial coordinates were established to capture the control point frame for two seconds. For digitization, the subjects wore black tights. 32 reflective markers are attached to the segmented surface and joint points to allow the camera to recognize the subject[12][23][24].

Afterward, in order to adapt the subjects to the experimental environment, they were allowed to warm up and practice the kicks so that they could perform accurately. Repeating side kicks were performed five times for each subject, and among them, the most accurate and highly completed movements were selected and analyzed[25][26]. Jasebaqueo pparun bal dollyuchagi motion was set as shown in <Figure 1> with six events and five phases. Data processing in this study was performed using SPSS 22.0 software. This calculated statistical analysis values as means(M) and standard deviations(SD), independent sample t-test was conducted to analyze differences between groups, and statistically significant probabilities were set to $p < .05$.

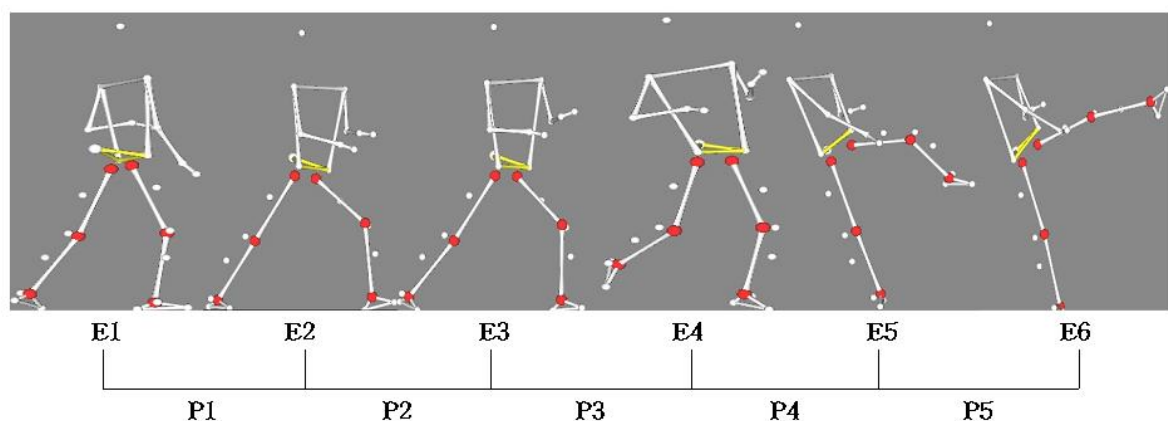
Table 1. Participants characteristic(N=10).

N	Age	Height	Weight	Career
Taekwondo kyorugi(5)	20.00±1.00	172.20±5.76	69.04±6.47	9.20±0.83
Taekwondo demonstra(5)	20.80±1.92	171.60±3.28	63.66±7.47	9.00±3.39

Table 2. Measuring tools[27].

Instrument	Model	Company	Technique
Camera	Motionmaster100	VISOL	3D motion capture
Soft ware	KWON3D	VISOL	Analyze process
IN BODY	570	InBody	Body measurement
Trigger master	TM-0014	VISOL	Save & compatible

Figure 1. 6 event and 5 phases.



Note: Event 1: The first moment the foot moves from the set motion after the signal, Event 2: The moment the left foot, which kicks after a step change, touches the ground, Event 3: The moment the right foot takes off from the ground, Event 4: The moment the left foot takes off from the ground, Event 5: The moment the left knee joint bends to its maximum, Event 6: The moment the foot hits the target.

3. Research Results

3.1. Difference in time required

Analysis of the difference in the time required for jasebaqueo pparun bal dollyuchagi is as follows <Table 3>.

Table 3. Lead time by each phase(unit: sec).

	Skilled	Unskilled	<i>t</i>	<i>p</i>
P1	0.49±0.10	0.52±0.09	- 0.527	0.613
P2	0.19±0.17	0.30±0.22	- 0.880	0.405
P3	0.41±0.21	0.26±0.30	0.926	0.381
P4	0.24±0.19	0.31±0.27	0.607	0.561
P5	0.48±0.36	0.26±0.03	1.050	0.324

Note: Mean±SD, independent t-test.

If you look at the difference in the total performance time of each phase during jasebaqueo pparun bal dollyuchagi, the skilled players were 1.81 sec and the unskilled players were 1.65 sec. The unskilled were faster, but there was no statistically significant difference.

According to a prior study by Seo Y(2017)[14], there was no significant difference between the two groups in the time variable during the single kick motion. These results may be considered that the time variable is not a decisive factor in hit success in the two kick motions. For both martial arts, the game time is short, and they directly charge the opponent and exchange offense and defense. Therefore, it is thought that implementing action quickly is the most important factor and it should be considered. In addition, these results are similar to the results of a prior study of Ko J, Kim K, Chung N(2020)[21] that compares and analyzes the average time required for jasebaqueo dollyuchagi of the sparring players group and the Poomsae group. It was similar to Kim J(2016)[22]'s prior study on dollyuchagi with retreating step motion that states that there is no statistical difference in the time required and in average numbers. However, it has been reported that the kick was able to perform more effectively in terms of the speed of the strike.

In this study, there were no statistically significant differences in the time required by phase. These results are thought to be due to experiments in groups with more than nine years of training experience. In addition, the experimental environment was tested in a static state, not in a real competition situation, and it is believed that it was an important factor that the performance of the motion had to be done quickly for the fast kicks.

3.2. Differences in the displacement of the center of mass

3.2.1. Differences in the displacement of the center of mass in jasebaqueo pparun bal dollyuchagi

The results of the analysis of the differences in the displacement of the center of mass in jasebaqueo pparun bal dollyuchagi of Taekwondo are as follows. If you look at the center of the mass shift displacement left/right(X), the unskilled players in E1 were higher than the skilled players, and there was a statistically significant difference($p<.01$). In E2, E3, E4, E5, and E6, there was no significant difference between skilled and unskilled players. A prior study of Kim M(2013)[28] reports that in the case of left and right movements of the center of mass during dwihuryochagi, the center of mass tended to be biased in the opposite direction of the direction in which the kicking was made. This is believed to be due to the shift in the center of mass as weight shifts depending on location. It also reported that the deviation is very large depending on the landing position of the supporting foot. A prior study by Cho H(2014)[29] also showed that the skilled players had a smaller width in the left and right directions and less shaking than the unskilled players, which was similar results[30].

In this study, skilled players have numerically less center of mass in the left and right directions than unskilled players, and they are close to the center point and perform stable kicks. In addition, it is

thought that training to reduce the width of the left and right center of mass and move the vertical section low and fast is necessary for efficient kicking of the unskilled players.

Looking at the center of mass vertical(Z-axis) shift displacement, there was a numerical difference between the skilled and unskilled groups in all sections of E1, E2, E3, E4, E5, and E6.

According to a prior study by Park H(2010)[31], there was no significant difference in each phase of the center of mass displacement in the vertical direction(Z-axis) in the comparative group of Taekwondo sparring players and Poomsae players. These two groups were found to move vertically in the center of mass, and similar patterns of motion were reported. Furthermore, prior work by Yeon J(2005)[15] showed no significant difference in both vertical displacement. This is a move by the subjects to strike the target accurately by lowering the center of mass.

According to a prior study by Do H(2002)[32], the height of the center of mass depends on the body shape and the length of the legs. Physical conditions such as the length of the legs of the kicker cannot be overcome, but a low center of mass during landing can make the vertical distance larger, allowing proper movement.

In this study, both skilled and unskilled players are judged to have shifted upward in order to hit the target, and the movement is considered to be the same.

Table 4. Center of mass(unit: m).

		Group	Mean±SD	t	p
X	E1	Skilled	0.350±.027	3.81	0.005**
		Unskilled	0.451±.052		
	E2	Skilled	0.426±.015	- 1.60	0.147
		Unskilled	0.468±.057		
	E3	Skilled	0.433±.009	- 1.44	0.186
		Unskilled	0.474±.061		
	E4	Skilled	0.443±.014	- 1.40	0.197
		Unskilled	0.485±.066		
	E5	Skilled	0.445±.032	1.36	0.211
		Unskilled	0.496±.076		
	E6	Skilled	0.451±.066	0.94	0.372
		Unskilled	0.496±.084		
Z	E1	Skilled	0.624±.017	0.57	0.583
		Unskilled	0.633±.027		
	E2	Skilled	0.606±.107	0.51	0.619
		Unskilled	0.596±.036		
	E3	Skilled	0.578±.010	0.56	0.587
		Unskilled	0.564±.056		
	E4	Skilled	0.611±.038	1.38	0.205
		Unskilled	0.664±.075		
	E5	Skilled	0.787±.093	- 1.27	0.238
		Unskilled	0.843±.032		
	E6	Skilled	0.831±.036	0.60	0.563
		Unskilled	0.846±.042		

Note: Mean±SD, independent t-test, p-value: *: p<.05, **: p<.01.

3.3. Difference in lower extremity angle

3.3.1. Difference in lower extremity angle of jasebaqueo pparun bal dollyuchagi

The results of analyzing the difference in the lower extremity angle of jasebaqueo pparun bal dollyuchagi are as follows.

Looking at the hip angle, at E2, skilled players had a higher left-hand side than the unskilled players, showing a statistically significant difference ($p < .05$). In E1, E3, E4, E5, and E6, there was no significant difference between skilled and unskilled players.

Kim J(2009)[33]'s previous study showed statistically significant differences between skilled and unskilled players in hip angle during momdollyochagi. This result is that when the support leg moves one step faster, the leg that kicks is already bent and the kick moves at the same time as the leg that kicks is rotated, and skilled players bend even more at the point of maximum flexion. Seo Y(2017)[14]'s prior study reported that when a kick motion begins, the femur is close to the body and the hip angle of a kick motion is minimized, so raising the height of the kicking foot will affect the efficient performance. Furthermore, Kim G(2008)[34]'s prior study reported that for effective kicking movements, mutual timing and coordination between the external force and the angular force of the lower extremity caused by pushing the ground, and the forces generated from related joints are important factors.

In this study, the hip joint of unskilled players showed a minimum angle in the E2 section compared to skilled players. This result is thought to be caused by the fact that the unskilled players' ankle joint, which performs jasebaqueo pparun bal dollyuchagi, has a smaller relative angle in the E2 section, so the upper body is bent forward.

Looking at the angle of the knee joint, the right side of the skilled players in E5 was higher and showed a statistically significant difference ($p < .05$). In E5, the left side of the skilled players was higher than unskilled players and showed a statistically significant difference ($p < .05$). In E6, the right side of unskilled players was higher than that of skilled players and showed a statistically significant difference ($p < .05$). In E1, E2, E3, and E4, there was no significant difference between the groups.

According to a prior study by Kim M(2013)[28], when the support leg landed on the ground, the knee joints bent a little, then extended the most when taking off. During the strike motion, the knee joint was stretched rapidly and then bent just before the strike, which is a similar result to this study. According to a prior study by Park C(2012)[35], the angle of the hip joint of the foot that kicks showed great angles from the start of dolgaechagi to the phase where the kicking foot falls to the ground except for the impact moment. These results were similar to studies in which skilled players did greater flexion and extension movements of the hip joints.

According to this study, it seems that skilled players put stronger force on the hitting foot by extending the supporting foot during moving to the phase of hitting the target more than unskilled players and that their right knee joint is smaller in the extension angle.

If you look at the ankle joint angle, at E4, the unskilled players' right side was higher than skilled players, which showed a statistically significant difference ($p < .05$). At E6, the skilled players' left side was higher than unskilled players, which showed a statistically significant difference ($p < .05$). There was no significant difference between skilled and unskilled players in E1, E2, E3, and E5.

According to a prior study by Kim D(2010)[30], the angle difference of the ankle joint was shown in the hitting phase. During the kick, the extension of the ankle joint was made to hit the target in the strike phase, and the skilled players' ankle joint extension was better. These results show that the angle of the ankle joint is important to perform the kick motion effectively. In addition, according to a prior study by Kim S(2000)[36], the toe tips of skilled players fell off the floor and the ankle joints began to backward flex, decreasing slightly in the hitting process, but maintaining the backward flexion without significant changes. In the case of unskilled players, they looked similar to skilled players, but their ankle joints were unstable, so they did not maintain a stable backward flexion.

In this study, it is thought that the joint angle was different because of the skilled players' flexion and technique at the moment they hit the target maintaining a stable backward flexion in the ankle joint at E4.

Table 5. Lower limb joint angle(unit: deg).

			Group	Mean±SD	<i>t</i>	<i>p</i>
Hip	E1		Skilled	113.83±12.78	- 0.152	0.883
			Unskilled	114.78±5.60		
			Skilled	127.86±6.20	0.797	0.448
			Unskilled	123.00±12.13		
	E2		Skilled	118.68±7.26	1.06	0.320
			Unskilled	111.66±12.69		
			Skilled	93.42±2.29	2.72	0.026*
			Unskilled	86.53±4.87		
	E3		Skilled	116.10±9.10	0.186	0.857
			Unskilled	114.87±10.94		
			Skilled	90.14±8.33	1.090	0.306
			Unskilled	83.39±11.00		
	E4		Skilled	115.10±7.01	0.382	0.713
			Unskilled	113.70±4.40		
			Skilled	107.00±6.53	0.013	0.990
			Unskilled	106.90±10.00		
	E5		Skilled	95.00±17.00	- 0.753	0.473
			Unskilled	104.00±20.00		
			Skilled	76.00±12.00	- 0.869	0.410
			Unskilled	82.00±11.02		
	E6		Skilled	86.00±22.00	- 1.623	0.143
			Unskilled	105.00±16.00		
			Skilled	70.20±20.50	0.382	0.712
			Unskilled	66.00±18.00		
Knee	E1		Skilled	158.31±8.40	- 1.938	0.089
			Unskilled	166.00±3.00		
			Skilled	160.00±11.00	- 0.525	0.614
			Unskilled	163.00±7.45		
	E2		Skilled	150.00±10.00	0.262	0.800
			Unskilled	150.18±10.04		
			Skilled	143.00±8.00	0.956	0.367
			Unskilled	140.00±6.14		
	E3		Skilled	151.00±13.00	0.271	0.793
			Unskilled	150.00±11.00		
			Skilled	130.00±3.00	0.727	0.488
			Unskilled	124.00±9.00		
	E4		Skilled	150.40±20.10	0.857	0.416
			Unskilled	135.00±23.18		
			Skilled	136.00±6.00	0.331	0.749
			Unskilled	134.00±12.40		
	E5		Skilled	155.00±6.30	2.642	0.030*
			Unskilled	137.00±14.00		
			Skilled	116.00±12.00	2.993	0.017*
			Unskilled	91.00±14.00		
	E6		Skilled	144.17±5.93	- 3.032	0.016*
			Unskilled	160.00±9.62		
			Skilled	167.00±5.00	- 0.277	0.788
			Unskilled	168.00±7.00		
Ankle	E1		Skilled	100.00±4.00	- 0.793	0.450
			Unskilled	101.31±4.24		

		Skilled	90.20±6.04	- 0.920	0.384
		Unskilled	95.00±9.50		
E2		Skilled	90.40±7.00	- 0.674	0.520
		Unskilled	92.20±7.00		
		Skilled	105.38±6.00	2.065	0.073
		Unskilled	92.00±13.40		
E3		Skilled	90.00±7.30	0.398	0.701
		Unskilled	90.00±9.00		
		Skilled	88.20±6.44	1.988	0.082
		Unskilled	80.24±6.20		
E4		Skilled	103.00±8.00	- 2.369	0.045*
		Unskilled	113.00±5.11		
		Skilled	94.00±5.00	- 0.936	0.376
		Unskilled	100.00±14.24		
E5		Skilled	92.40±6.20	- 0.633	0.545
		Unskilled	100.00±22.00		
		Skilled	134.00±8.20	0.984	0.354
		Unskilled	127.60±12.60		
E6		Skilled	80.00±5.00	- 1.680	0.132
		Unskilled	90.00±9.13		
		Skilled	137.12±3.41	2.822	0.022*
		Unskilled	119.11±13.85		

Note: Mean±SD, independent t-test, p-value: *: p<.05.

4. Conclusion

As shown above, considering the results, it was found that the unskilled players took less time to perform jasebaqueo pparun bal dollyuchagi than the skilled players. It has been shown that skilled players have a longer travel distance to hit targets. It is thought that it is necessary to select an efficient hitting distance for the kick and that the width of the center of mass displacement on the left and right sides should be small and steady to hit the target. There were differences in knee and ankle angles between skilled and unskilled players. This result is believed to be due to the fact that the hip joints and the ankle joints were maxed out at the moment they hit the target and delivered a strong force. In order to perform efficient kicks, it is believed that training of the popliteal muscle strength and flexibility will be necessary for the fast extension of the hip joint and ankle joint when hitting a target. It was difficult to determine the kinematic difference between skilled and unskilled players in connecting kicks in a static state. Other differences are thought to be due to the fact that the subjects were all selected as groups with more than nine years of training experience. In future studies, considering the nature of the sparring competition, it is necessary to analyze players' motions in real competition situations, analyze angular velocity and muscle strength ground reaction, and consider weight and weight classes, which will greatly contribute to improving sparring competition performance.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	SK	-Set of concepts <input checked="" type="checkbox"/>
		-Design <input checked="" type="checkbox"/>
		-Getting results <input checked="" type="checkbox"/>
		-Analysis <input checked="" type="checkbox"/>
		-Make a significant contribution to collection <input checked="" type="checkbox"/>
		-Final approval of the paper <input checked="" type="checkbox"/>
Corresponding Author*	BH	-Corresponding <input checked="" type="checkbox"/>
		-Play a decisive role in modification <input checked="" type="checkbox"/>
		-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
		-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
		-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Corresponding author*
E-mail: parkjs@kmu.ac.kr

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A Study on the Verification of Competency Management Factors of College TAEKWONDO Athletes and Strategies for Improving Performance

Sunjang Lee¹

Keimyung University, Daegu, Republic of Korea

Jusik Park^{2*}

Keimyung University, Daegu, Republic of Korea

Jongsoo Kim³

Keimyung University, Daegu, Republic of Korea

Abstract

Purpose: The purpose of this study is, as a previous study to help prepare specific goals and plans for the university students of Taekwondo major, is to identify and analyze the major areas of interest and their extent of interest for the underclassmen university students in Taekwondo major.

Method: To examine and understand the area of interest and the extent of interest of the university students of Taekwondo major, this study produced and conducted an open-ended survey questionnaire regarding religion, hobbies, Taekwondo major's area of interest, and future hopes. As for the data collected based on the questionnaires, the SPSS 26.0 program was used. The frequency analysis was performed to analyze the general characteristics of the study participants and the extent of interest of their area of interest, and the data collected via the open-ended questionnaire were subjected to the inductive content analysis.

Results: First, as a result of the inductive content analysis performed of the extent of interest for the hobby activities of the university students of Taekwondo major, the hobby activities were structured into 18 sub-areas, and the 18 sub-areas were further classified into the 5 general areas of physical activity(206), media activity(54), social group activity(37), literary activity(26), and others(6), respectively. In the general area, physical activity(62.61%) turned out to have the largest rate, followed by media activity(16.41%), social group activity(11.25%), and literary activity(7.9%), in terms of the extent of interest hobbies, respectively. Second, the first year and second year university students of Taekwondo major who analyzed the Taekwondo major's area of interest for the extent of interest of the university students of Taekwondo major turned out to have demonstration being the largest with 42 people(45.3%) among the 3 areas of Taekwondo of Poomsae, Sparring, and Demonstration, with 35 people(36.8%) for Poomsae, and 17 people(17.9%) for Sparring.

Conclusion: If the areas of interests of the underclassmen university students identified based on the results of this study were utilized as the basic data, it will be possible for the university students to present specific goals for their future career paths and occupations after graduation through their upperclassmen years.

[Keywords] University, Taekwondo, Major, Area of Interest, Extent of Interest

1. Introduction

University students are a group for which all responsibilities of adult life have been deferred to prepare for the leadership and professionalism they ought to have as adults in an organization called university. However, they are faced with urgent adulthood related tasks such as social independence, acquisition of appropriate gender roles, establishment of a view on life, and selection of career or establishment of ideological systems for the economic independence[1].

University plays a role in helping them acquire the basic economic power they need to lead their own lives. That is, it enables them to earn the economic income via work, and develop social and cultural activities based on the earned income. University also has the function of

actively responding for the development and maintenance of society while reflecting the demands and needs of individuals for their self-development.

According to a study by Kim[2], it was claimed that the domestic university students generally know well about their aptitudes, and the upperclassmen know better than the underclassmen, male students better than female students, and arts and sports university students better than other university students. Among the results of this study, it has been interpreted that the arts and sports university students in particular know their aptitudes better than other university students because they already have detailed major upon their enrollment at their university.

To prepare specific goals and plans for the career path related guidance and occupation counseling for the sports related university students, the prerequisite would be discovering the factors which have a significant impact on the career preparation related activities. The existing studies recommend a mentoring system by which the experienced and competent seniors pass on the wisdom they have learned in their professional life within the bounds of their organization to their colleagues and juniors, and provide them with a sense of stability through counseling and advice[3].

It has been known that most of the students specializing in physical education have felt struggle in terms of their identity given the infringement of their right to learn following excessive sports practice amidst their university life and their lack of interaction with other students, and the university sports athletes feel significant difficulties and problems in managing their class work as they concurrently pursue academics with sports even while consistently carrying out their personal training for the purposes of enhancing their personal sports skills and capabilities towards their career path[4].

Among which, Taekwondo has the largest number of athlete teams and athletes among the university sports, and the registered teams also have the largest number of university teams compared to other sports[5]. Taekwondo is a representative sport of Korea which has been recognized around the globe for its performance as well as being a unique martial art unique to Korea. Taekwondo's Poomsae is a form of martial arts practice which takes on a series of forms by which the movements of attack and defense are inter-connected, and which contains various purposes[6].

Taekwondo is recognized as a sport which may be enjoyed by everyone, regardless of age or gender, since its training may help everyone to conduct mental and physical training, personal protection, manners, social skills, and good character. Furthermore, in recent years, Taekwondo has not only taken on the character of a direct sport which directly participates in sports, but is also developing as a spectator sport, such as with people watching Taekwondo demonstration performances[7].

In particular, Taekwondo is a representative sport of Korea, and while it is operated at each university as an independent department in the existing realm of sports, problems are incrementally raised concerning the career path of Taekwondo students[8].

Hence, this study seeks to identify and analyze the major areas of interest and the extent of interest of the university students of Taekwondo major for the underclassmen as a previous study to help them prepare specific goals and plans for the career path and occupation of the university students of Taekwondo major. If the areas of interest of the underclassmen university students are identified, they would be utilized as the basic data which may present specific goals for their future career paths and occupations after they graduate through their upperclassmen years.

2. Research Method

2.1. Research participants

To identify the area of interest and the extent of interest of the university students of Taekwondo major, a survey questionnaire was conducted targeting 100 underclassmen(1st and

2nd year students) from K University in D City as for the sampling of purpose allocation. The data of a total of 95 people were analyzed, excluding the data from 5 people whose responses to the questionnaire were insincere. The general characteristics of the study participants are as illustrated in <Table 1>.

Table 1. General characteristics of the research participants.

Item	Description	Frequency	Percentage(%)
Gender	Male	66	69.47
	Female	29	30.53
College year	Freshmen	50	52.63
	Sophomore	45	47.37
	2 nd poom(dan)	4	4.21
	3 rd poom(dan)	13	13.68
	4 th poom(dan)	78	82.11
Total		95	100

2.2. Measuring tool

To examine and understand the area of interest and the extent of interest of university students of Taekwondo major, this study produced and conducted an open-ended questionnaire on religion, hobbies, Taekwondo major's area of interest, and future hopes. In the process of preparing the questionnaire, a meeting of experts was held. Before proceeding with the questionnaire, the purpose of this study, contents of the questionnaire, and the method of entry were advised to the respondents, and after securing their consent to participate in the study, the questionnaire was presented and proceed with. Furthermore, all of the questionnaire's questions were prepared in the manner of self-administration.

2.3. Data processing

The data collected based on the questionnaire produced to achieve the purpose of the study were utilized by using the SPSS 26.0 program. The frequency analysis was performed to analyze the general characteristics of the study participants and the extent of interest for the area of interest. The data collected based on the open-ended questionnaire were subjected to the inductive content analysis. The inductive contents analysis was performed, which reads over the response data for the open-ended questionnaire numerous times and organizes them into the meaningful units at the higher level. The collected data were categorized into the source data, detailed area, general area, and large area, and in the categorization process, the source data were organized into the meaningful areas.

3. Results and Discussions

3.1. Analysis of the type of religion for the university students of taekwondo major

The results of analyzing the types of religion of the university students of Taekwondo major are as illustrated in <Table 2>. The first and second year university students of Taekwondo major turned out to be the largest in number for those with atheism with 68 people(71.6%), followed by 18 Christians(18.9%), 6 Buddhists(6.3%), and 3 Catholics(3.2%), respectively. Such results demonstrate the fact that the underclassmen university students majoring in Taekwondo do not place much meaning on religion.

Table 2. Analysis of the type of religion.

Description	n	%	Extent of interest
Atheism	68	71.6	1
Christianity	18	18.9	2
Buddhism	6	6.3	3
Catholicism	3	3.2	4
Total	95	100.0	

3.2. Analysis of the extent of interest of the university students of taekwondo major

To analyze the extent of interest of hobby activities among the 95 university students of Taekwondo major, an open-ended questionnaire was presented and conducted, and consequently, a total of 329 questions of source data were collected. The inductive content analysis was performed for the collected source data, which classify them according to similar meanings. <Table 3> illustrates the results of the inductive content analysis for the hobby activities of the university students of Taekwondo major.

The analysis of the extent of interest for the hobby activities of the university students of Taekwondo major was structured into 18 sub-areas, and the 18 sub-areas were further classified into physical activity(206), media activity(54), social group activity(37), literary activity(26), and others(6). Physical activity(62.61%) turned out to have the largest ratio for the general area, followed by media activity(16.41%), social group activity(11.25%), and literary activity(7.9%), demonstrating the extent of interest for the hobby activities, respectively.

As for the physical activity in the general area, ball related sports(80) demonstrated the highest frequency of the extent of interest, followed by health exercise(76), racquet ball sports(18), leisure sports(16), and contact sports(16). As for the media activity, video watching(28) demonstrated the highest extent of interest, followed by music(19), recreation(5), and technology(2). The social group activity demonstrated the highest extent of interest for e-sports(22), followed by the interpersonal relationship and counseling(10), and food, photo, and shopping(5). As for the literary activities, craftsmanship(9) demonstrated the highest frequency of the extent of interest, followed by drawing(6), reading(5), studying(5), and writing(1). Then it turned out to be others(6), respectively.

This is also a natural result where the extent of interest of the students who practice Taekwondo among the fields of physical education demonstrated the highest rate of physical activity. While they major in Taekwondo, if they make a good use of the fact that they are interested in other sports, they would find a way to connect Taekwondo with other majors as well[9][10].

Furthermore, demonstrating interest in media activity, social activity, and literary activity itself can be interpreted that Taekwondo major students have a lot of potential. If interest, support, and support which can help them develop such potential at the university are achieved, they would likely have a positive influence on their personal growth[11] and their choice of career as their selection of goals will be efficiently made in regards to their career path upon and after graduation[12] following their underclass and upperclassmen years.

Table 3. Results of the inductive content analysis for the hobby activities.

General area (frequency/ratio)	Detail area (frequency/ratio)	Source data(frequency)
Physical activity 206/ 62.61%	Ball related sports 80 / 24.32%	Soccer(futsal) 47 / basketball 13 / bowling 6 / volleyball 4 / billiards 3 / foot volleyball 2 / table tennis 1 / dodgeball 1 / volleyball 1 / baseball 1 / various ball games 1
	Health exercise 76 / 23.10%	Exercise 30/running 16/jump rope 10/weight lighting 5/acrobatics, tricking 3/jogging 3/strolling 3/fitness 1/cross fit 1/running 1/treadmill

		1/long distance running 1/walking 1
	Racquet ball sport 18 / 5.47%	Badminton 13/tennis 3/table tennis 2
	Leisure sports 16 / 4.86%	Swimming 8 /rifle 3 / climbing 2 / scuba diving 1 / bicycle 1 / ski 1
	Contact sports 16 / 4.86%	Taekwondo13/boxing 1/jujitsu 1/martial arts 1
Medica activity 54/ 16.41%	Video watching 28 / 8.51%	Movie watching 16/ entertainment show watching 7/ animation watching 1/ youtube watching 1/ soap opera watching 2/ soccer game watching 1
	Music 19 / 5.78%	Singing 2/music 1/listening to music 12/playing instrument 4
	Recreation 5 / 1.52%	Play 1 / dance 3 / recreation 1
	Technology 2 / 0.61%	Video editing 1/computer work and machine 1
Social group activity 37/ 11.25%	E sports 22 / 6.69%	Playing game 17/e-sports 2/computer game 3
	Interpersonal relationship / counseling 10 / 3.04%	Mindset 1 / empathy 1/ listening to others well 1/ counseling 1/ making people around happy 1/ meeting friends 4 / curiosity 1
	Food, photo, and shopping 5 / 1.52%	Eating tasty food 5/gourmet tour 1/cooking 3/photo taking 2/ shopping 1
Literary activity 26/ 7.9%	Craftsmanship 9 / 2.74%	Craftsmanship 4/plastic model 3/knitting1/art activities by hand (craftsmanship and drawing, etc.) 1
	Drawing 6 / 1.82%	Painting 4/fine arts 1/landscape drawing 1
	Reading 5 / 1.52%	Collecting wording books 1 / reading 2 / book reading 2
	Study 5 / 1.52%	Study 1 / mathematics 1 / Chinese language 1
	Writing 1 / 0.30%	Writing 1
	Others 6 / 1.82%	None 3/others 2/cleaning 1

3.3. Differences in college life adaptation by experiences of participating in taekwondo demonstration competitions

<Table 4> illustrates the results of analyzing the university students of Taekwondo major's area of interest and the extent of interest. Among the first and second year university students of Taekwondo major, among Poomsae, Sparring, and demonstration, demonstration turned out to be the largest with 43 people(45.3%), followed by Poomsae with 35 people(36.8%), and Sparring with 17 people(17.9%). Such results demonstrate the fact that the area of interest and the extent of interest within the major of the students majoring in Taekwondo are incremental from Sparring[13][14] to Poomsae[15][16][17], and the extent of interest from Poomsae to the field of demonstration[18][19]. The growing interest in the field of demonstration may be related to the overseas internships[20]. This is a result which demonstrates the fact that the students who major in both Sparring and Poomsae are competitive as well, and is also the result demonstrative of the need for the students who major in Taekwondo to practice and study Taekwondo in a variety of ways rather than majoring in Sparring or Poomsae only.

Table 4. Analytical result of the taekwondo major's area of interest and the extent of interest.

Description	N	%	Extent of interest
Demonstration	43	45.3	1
Poomsae	35	36.8	2
Sparring	17	17.9	3
Total	95	100.0	

3.4. Analysis of the future hopes and the extent of interest of the university students of taekwondo major

The results of analyzing the future hopes and the extent of interest of the university students of Taekwondo major are as illustrated in <Table 5>. As for the future hopes of the first and second year university students of Taekwondo major, Taekwondo coach turned out to be the highest with 54 people(56.8%), national representative with 9 people(9.5%), police officer with 7 people(7.4%), physical education teacher with 5 people(5.3%), serviceman with 4 people(4.2%), overseas instructor with 3 people(3.2%), lecture, bodyguard, university professor, businessman, sports CEO, exercise prescriber, Taekwondo entrepreneur, and Taekwondo missionary with 1 people(1.1%) sequentially. The number of students who responded undecided about their future hopes turned out to be 5(5.3%). Such results demonstrate the purpose of majoring in Taekwondo. This is also a result evident that it may be connected to various groups of occupation in addition to Taekwondo coach[9].

Table 5. Analysis of the future hopes and the extent of interest of the university students of taekwondo major.

Description	N	%	Extent of interest
Taekwondo coach	54	56.8	1
National representative	9	9.5	2
Police officer	7	7.4	3
Undecided	5	5.3	4
Physical education teacher	5	5.3	4
Serviceman(ROTC)	4	4.2	5
Overseas instructor	3	3.2	6
Lecturer	1	1.1	7
Bodyguard	1	1.1	7
University professor	1	1.1	7
Entrepreneur	1	1.1	7
Sports CEO	1	1.1	7
Exercise prescriber	1	1.1	7
Taekwondo entrepreneur	1	1.1	7
Taekwondo missionary	1	1.1	7
Total	95	100.0	

4. Conclusion and Recommendations

This study was conducted for the purposes of analyzing the extent of interest for the area of interest of the university students of Taekwondo major. To achieve the purposes of the study, a survey questionnaire was conducted for 95 underclassmen students(1st and 2nd year students) at K University in D City, and the conclusions drawn from analyzing the data collected based on the questionnaire are as follows.

First, the types of religion of the first and second year university students of Taekwondo major were analyzed. As a result of the analysis, those having atheism turned out to be the largest with 68 people(71.6%), followed by 18 Christians(18.9%), 6 Buddhists(6.3%), and 3 Catholics(3.2%).

Second, as a result of the inductive content analysis performed of the extent of interest for the hobby activities of the university students of Taekwondo major, hobby activities were structured into 18 sub-areas, and the 18 sub-areas were further classified into physical activity(206), media activity(54), social group activity(37), literary activity(26), and others(6). Physical activity(62.61%) turned out to have the largest ratio for the general area, followed by media activity(16.41%), social group activity(11.25%), and literary activity(7.9%), demonstrating the extent of interest for the hobby activities, respectively.

Third, the first and second year university students of Taekwondo major who analyzed the Taekwondo major's area of interest and the extent of interest turned out to have the highest with 43 people for demonstration(45.3%) among the 3 areas of Taekwondo's Poomsae, Sparring, and demonstration, followed by Poomsae with 35 people(36.8%), and Sparring with 17 people(17.9%), respectively.

Fourth, as a result of analyzing the future hopes and the extent of interest of the university students of Taekwondo major, as for the future hopes of the first and second year university students of Taekwondo major, Taekwondo coach turned out to be the highest with 54 people(56.8%), national representative with 9 people(9.5%), police officer with 7 people(7.4%), physical education teacher with 5 people(5.3%), serviceman with 4 people(4.2%), overseas instructor with 3 people(3.2%), lecture, bodyguard, university professor, businessman, sports CEO, exercise prescriber, Taekwondo entrepreneur, and Taekwondo missionary with 1 people(1.1%) sequentially. The number of students who responded undecided about their future hopes turned out to be 5(5.3%).

Based on the details of the research results to date, the following recommendations are presented for the follow-up studies.

First, since the results of the responses of the first and second year university students of Taekwondo major would likely have a large impact on the university life and career path in the future, it will be necessary to build a system for the individualized counseling after examining and understanding the extent of interest for the students.

Second, based on the results of this study, it will be necessary to develop a program which may help to prevent the dropouts of the university students of Taekwondo major, and proceed with a study to validate the effect thereto.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	SL	-Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/>
Corresponding Author*	JP	-Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/>
Co-Author	JK	-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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Corresponding author*
E-mail: parkjs@kmu.ac.kr

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Comparison of Physical Strength Characteristics According to Performance Level of University TAEKWONDO DEMONSTRATION Majors

Jusik Park^{1*}

Keimyung University, Daegu, Republic of Korea

Jihye Jeong²

Keimyung University, Daegu, Republic of Korea

Jonggyu Son³

Keimyung University, Daegu, Republic of Korea

Gangjun Kwon⁴

Keimyung University, Daegu, Republic of Korea

Abstract

Purpose: The purpose of this study is to provide useful information on physical fitness training to improve the performance of Taekwondo demonstration majors by identifying the characteristics of physical fitness factors according to the performance level of university Taekwondo demonstration members.

Method: The subjects of this study are Taekwondo demonstration members enrolled in K University located in D city. The differences in body structure, physical fitness factors, isokinetic muscle function of the knee joint, and anaerobic exercise capacity were compared and analyzed for 3 male students in the national demonstration group and 3 male students in the general demonstration group.

Results: As a result of measurement of body structure, physical fitness factors, isokinetic muscle function, and anaerobic exercise capacity of the national demonstration team and general students, there was no statistically significant difference between groups. However, through the results of this study, it was confirmed that the ratio of flexor and extensor muscles needs to be improved to an ideal ratio of 55% to 65% as suggested in previous studies to prevent damage to the lower extremities of general students. In addition, the standing long jump and sargent jump, side step, eyes closed and one leg standing, and knee joint isokinetic muscle power showed a higher tendency in the national demonstration group compared to the general students. There was no statistically significant difference between groups in the measurement results of anaerobic exercise capacity.

Conclusion: Based on the results of this study, it is thought that it will be difficult to present the characteristics of the physical fitness factors according to the performance level of Taekwondo demonstration majors. However, considering the results of many previous studies and this study, it is thought that efforts to improve agility, power, and balance ability are needed to improve the performance of Taekwondo demonstration majors. It is judged that improvement of the flexion muscle/extension muscle ratio of the lower extremities is necessary to prevent additional injuries.

[Keywords] Taekwondo Demonstration, Performance, Physical Fitness Factors, Isokinetic Muscle Function, Anaerobic Exercise Capacity

1. Introduction

Taekwondo underwent development with a focus on sparring, yet as Taekwondo demonstration performances have recently been exposed via various media, it has claimed itself as the cultural contents representing Korea beyond Taekwondo as a martial arts sport. According to the results of the previous studies[1], it was claimed that the globalization of Taekwondo has played a major role in the introduction of the Olympic sport through Taekwondo as a sport, as well as the role of the Taekwondo demonstration team. The representative technical breaking of the Taekwondo demonstration is the action of taking a leap and breaking in the air by jumping

once, vertical rotation and breaking by using jump and rotation, and the horizontal rotation and breaking by using the horizontal axis rotation, and in addition, there are the obstacle breaking and the speed serial breaking, etc[2]. As such, the high level of difficulty of the Taekwondo demonstration requires excellent physical skills, and the Taekwondo demonstration team which used to be focused on men has now a greater number of women members equipped with excellent physical skills, and hence, can perform such a high level of difficulty breaking regardless of gender[3].

The leap and breaking of Taekwondo demonstration is a technique by which one uses a foot to jump by using the ground reaction force, then crosses the foot pushed by the ground reaction force in the air and the auxiliary foot to create a high airspace[4]. Among the results of a previous study comparing the kinematic characteristics of the ground and air movement of Taekwondo jumping forward kick in line with the level of skills[5], a high posterior inclination angle when rolling the foot, increase in the height of knee of the auxiliary leg lifted by flexing the hip joint, speed in the vertical direction during jumping, height of the lower extremity joint, and the timing of kicking with the 2 feet crossed are reported to have an effect on the height of the kick. Vertical rotation and breaking is a kick with a very high level of technical difficulty since it has a complex technical system which requires performing kicks with rotation in the air with a single stay in the air[6].

Among the results of a previous study on the analysis of the muscle activity during the Taekwondo's 540° rotation and back kick in movement[7], the most time was consumed to accurately achieve the projection trajectory of the body in order to improve the completeness of the movement in the jump section, and it was reported that the most important muscles in the take-off section of the 540° rotation and back kick where the rotation and jumping movements are combined, are the tibial muscles, abdominal muscles, and the gastrocnemius muscles. Among the results of a previous study comparing the kinematics of Taekwondo's back air rotation single foot kick and two foot kicks[8], it has been reported that the process of collecting ground reaction force is important, and the hip joint's range of motion was 10° larger than that of the knee joint, indicating that hip joint movement was difficult to jump.

The Taekwondo demonstration technical breaking differs in terms of the movements and functions of the body required for each specific event, and hence, an optimal training for each specific event is required[3], and to improve performance, it is necessary to improve the basic physical strength and the professional physical strength appropriate for the athletes[9]. According to the 2017 Sports White Paper[10], it is reported that, to improve the performance of athletes, it is necessary to first identify the factors which determine the performance, and systematically classify the factors influencing the performance to maximize the training effect. Despite the increasing number of competitions held every year including the Kukkiwon Taekwondo Hanmadang Competition, presidential contest of each university, Minister of Gender Equality and Family Competition, and Taekwondo Wonbae, the previous research conducted on the basics and professional physical strength of Taekwondo athletes has mostly focus on the sparring athletes only, and hence, it is believed that it will be somewhat difficult to provide differentiated information considering the characteristics of each Taekwondo demonstration event[11].

Considering the results of previous studies, there are still very inadequate previous studies on the characteristics of the physical strength factors and the differences according to the types of technical breaking and the performance level of students majoring in the Taekwondo demonstration. Hence, this study seeks to provide the information useful for the planning of scientific and systematic training programs by comparing and analyzing the differences in the body structure and physical strength factors among the general students training with the special kicks which are identical to those of the students active at the national Taekwondo demonstration team among the college and university Taekwondo demonstration team members.

2. Research Method

2.1. Research subject

The subjects of this study are Taekwondo demonstration members enrolled in K University in D city. After explaining the purpose and contents of this study to 3 male students working as a national demonstration team and 3 male students in a general demonstration group, participants who voluntarily expressed their intention to participate were included, and their physical characteristics are as shown in <Table 1>.

Table 1. Physical characteristics.

Group	Age(years)	Heigh(cm)	Weight(kg)	%fa(%)	BMI(kg/m ²)
National athlete(n=3)	23.67±2.08	170.47±3.70	67.13±5.33	14.73±6.23	23.18±2.85
General student(n=3)	20.00±0.00	175.57±4.14	68.23±4.33	13.87±2.52	22.60±0.89

Note: Values are mean ± SD.

2.2. Measurement items and methods

2.2.1. Body composition

Height was measured in cm using BSM 370(Biospace. Korea), and body weight, lean body weight, body fat mass, body fat percentage, and BMI were measured using InBody 770(Biospace, Korea)[12].

2.2.2. Physical fitness factors

To check the difference in fitness factors between groups, muscle strength(back muscle strength), muscle endurance(sit-up, repeated jump), muscle power(long jump, sargent jump), systemic reaction(sound, light), agility(side step), balance(eyes closed and one leg standing), coordination(visual perception) flexibility(trunk flexion and extension) were measured. All measurements were performed twice and better values were used as actual values[13].

2.2.3. Isokinetic muscle function test of the knee joint

For the isokinetic muscle function test, the isokinetic muscle function measurement system(CSMI, USA) was used to measure the muscle function of the knee joint according to the manual. The muscle strength of the knee joint was measured by performing flexion and extension movements of the knee joint three times at an angular velocity of 60°/sec and five times of the muscle power at 180°/sec. After performing three preliminary exercises, measurements were made, and peak torque, average power, total work, ratio of left and right(%), flexion and extensor ratio were calculated through the measurement results[14].

2.2.4. Anaerobic exercise test(wingate test)

Anaerobic exercise ability was measured with a Wingate test. It was measured for 30 seconds using a bicycle ergometer(Monark 818E, Sweden). Taking into account the characteristics of this measurement, prior training was conducted on the measurement procedures to reduce the decrease of will and power output in the second half of the test. As a result of the Wingate test, the values for peak power, average power, total energy, and peak drop were calculated[14].

2.3. Statistics processing

For statistical processing, the average and standard deviation of each measurement item were calculated using the SPSS 25.0 statistical program. An independent sample t-test was

performed to determine the differences between groups according to the measurement items. The significance level was set based on $p < .05$.

3. Results

3.1. Body composition

The results of comparative analysis of differences in physical characteristics between groups are shown in <Table 2>.

Table 2. Body composition.

Items	National athlete(n=3)	General student(n=3)	t	p
Height(cm)	170.47±3.70	175.57±4.14	-1.593	.186
Weight(kg)	67.13±5.33	68.23±4.33	-.648	.553
Career(year)	4.67±2.08	1.00±0.00	3.051	.038*
Lean mass(kg)	57.04±2.00	60.00±3.17	-1.366	.244
%fat(%)	14.73±6.23	13.87±2.52	.223	.834
BMI(kg/m ²)	23.18±2.85	22.60±0.89	.333	.756

Note: Values are mean ± SD, * $p < .05$.

3.2. Physical fitness factors

The results of comparative analysis of differences in physical fitness factors between groups are shown in <Table 3>.

Table 3. Physical fitness result.

Items	National athlete(n=3)	General student(n=3)	t	p
Back strength(kg)	138.67±6.01	142.67±21.08	-.316	.768
Sit-ups(reps)	56.67±8.96	49.67±10.60	.873	.432
Repeated jump(cm)	49.00±4.58	51.67±4.73	-.702	.522
Long jump(cm)	251.47±7.43	241.87±15.70	.957	.393
Sargent jump(cm)	63.67±4.04	57.00±7.21	1.397	.235
Sound response(sec)	0.248±0.02	0.227±0.03	.914	.412
Light response(sec)	0.268±0.02	0.259±0.02	.610	.575
Side step(reps)	53.33±2.08	48.67±4.04	1.778	.150
Eyes closed and one leg standing(sec)	103.65±62.55	43.11±9.11	1.659	.172
Coordination(point)	44.23±0.31	46.87±3.52	-1.295	.265
Trunk flexion(cm)	15.23±2.10	17.70±4.65	-.837	.450
Trunk extension(cm)	54.83±3.76	57.53±8.86	-.486	.653

Note: Values are mean ± SD.

3.3. Knee joint Isokinetic muscle function

The measurement results of isokinetic muscle strength and muscle power of the knee joint between groups are shown in <Table 4> and <Table 5>.

Table 4. Knee joint Isokinetic muscle strength(angular velocity 60°/sec).

Items	National athlete(n=3)	General student(n=3)	t	p
Right extensor(Nm)	162.67±34.65	194.33±20.40	-1.364	.244
Left extensor(Nm)	178.33±20.55	194.67±20.84	-.967	.388
Right extensor(%BW)	244.56±65.27	280.39±42.40	-.797	.470
Left extensor(%BW)	267.79±45.74	279.29±25.26	-.381	.722
Right flexor(Nm)	99.67±8.96	95.33±20.21	.340	.751
Left flexor(Nm)	97.67±10.50	101.00±11.14	-.377	.725
Right flexor(%BW)	149.65±24.22	138.28±37.49	.441	.682
Left flexor(%BW)	145.75±15.48	145.64±22.83	.007	.995
Left/right extensor(deficit)	-13.83±33.58	-0.87±14.64	-.613	.573
Left/right flexor(deficit)	0.99±17.88	-8.02±17.83	.618	.570
Flexor/extensor left ratio(%)	55.10±7.06	52.72±11.78	.300	.779
Flexor/extensor right ratio(%)	62.49±9.37	48.99±8.52	1.848	.138

Note: Values are mean±SD.

Table 5. Knee joint Isokinetic muscle power(angular velocity 180°/sec).

Items	National athlete(n=3)	General student(n=3)	t	p
Right extensor AP(watts)	224.67±34.36	214.33±5.51	.514	.634
Left extensor AP(watts)	217.00±55.38	208.00±21.52	.262	.806
Right extensor AP(%BW)	338.48±74.07	308.60±26.35	.658	.546
Left extensor AP(%BW)	325.84±91.82	297.92±12.55	.522	.629
Right flexor AP(watts)	135.00±17.06	101.33±17.95	2.355	.078
Left flexor AP(watts)	117.33±21.39	117.00±35.00	.014	.989
Right flexor AP(%BW)	203.23±40.52	145.87±28.91	1.996	.117
Left flexor AP(%BW)	175.63±35.57	169.16±57.24	.166	.876

Note: Values are mean±SD.

3.4. Anaerobic exercise capacity

The results of comparative analysis of the differences in anaerobic exercise capacity between groups are shown in <Table 6>.

Table 6. Anaerobic exercise capacity.

Items	National athlete(n=3)	general student(n=3)	t	p
Peak power(W)	614.70±49.24	622.68±121.91	-.105	.921
Peak power(W/kg)	9.20±1.08	8.88±1.18	.340	.751
Average power(W)	454.44±49.12	465.98±72.30	-.229	.830

Average power(W/kg)	6.80±1.00	6.66±0.61	.201	.850
Peak drop(%)	59.55±6.54	56.41±4.21	.698	.524

Note: Values are mean±SD.

4. Discussion

This study compared and analyzed the differences in the body structure, basic physical strength, and the professional physical strength among the 3 male students on the national Taekwondo demonstration team and the 3 male students of the general demonstration team training with the same special kick.

As for the measurement results of body structure, there was no statistically significant difference between the national team athletes and the general students, yet it turned out that the national team athlete had a higher level than the general student in terms of career ($p < .05$). Such results reflect the characteristics of university demonstration team members who are conducting professional Taekwondo demonstration skills training after entering college, and the 3 national demonstration members are attending their 4th year in college, and most of the 3 general students are freshmen. It is believed that there was no statistically significant difference between the groups in terms of the measurement results of the body structure since both the national demonstration team members and the general students participate in the same physical strength and technical training. As a result of the comparative analysis performed for the difference in the physical strength factors between the national demonstration team members and the general students, there was no statistically significant difference across all items of measurement.

However, most of the technical kicks of the Taekwondo demonstration require high speed [15][16] and strong agility to secure the time for stay in the air [17][18][19][20]. As a result of this study, the national demonstration team members demonstrated a tendency to be superior to the general students for the long jump in place, sergeant jump, and the side step, which are the items for the agility evaluation. This is not an analysis of the difference in terms of the performance level, yet among the results of a previous study [19] which analyzed the difference in terms of the physical strength factors between the national Taekwondo demonstration athletes and the sparring athletes of the corporate teams, it is believed that a partial support was extended for the research results which reported that the national team demonstration athletes had a higher agility than the sparring athletes of the corporate teams. Balance is the ability to maintain the body in a certain posture [2], and may be classified into the static and dynamic balance.

In this study, single foot standing with eyes closed, which is an item of evaluation for the static balance, was measured, and there was no statistically significant difference demonstrated between the groups, yet the national demonstration team demonstrated a tendency to be superior to the general students. Such results are believed to be partially supportive of the research results which claimed that the Taekwondo demonstration requires excellent balance in order to break multiple pine boards while staying the air, among the results of the previous studies [7] which compared the movement patterns of lower extremity joints when performing vertical jumps of the Taekwondo demonstration team members and average people. Even in the results of a previous study which compared and analyzed the differences in lower extremity's strength, trunk's strength, balancing skills, and proprioceptive skills between the national Taekwondo demonstration team members, sparring athletes, and general trainees [2], the balancing skills of the Taekwondo demonstration members were reported to be statistically and significantly higher than that of the sparring athletes and the general trainees, and hence, it is thought that balance will influence the ability to perform the Taekwondo demonstration. While

the differences according to the performance level of the demonstration athletes were not compared and analyzed, it is verified that agility and balance are very crucial physical strength factors in terms of the effect of a single kick according to the Taekwondo jump kick type on the lower extremity joint injury factors[3][5][20][21][22][23] among the results of the previous research on various breaking techniques of Taekwondo demonstration.

As a result of comparatively analyzing the difference in the isokinetic strength of the knee joint measured at an angular velocity of 60°/sec between the national demonstration team members and the general students, there was no statistically significant difference across all items of measurement. While the number of research participants was small, and no statistically significant difference was evident, according to a report by the Korea Institute of Sports Science(2015)[24], the ideal ratio of flexor and extensor muscles was 55 to 65%, and considering that the general students participating in this study are outside of this scope, it is considered that the possibility of injury is higher than that of the national team demonstration team members. In order for the general students to safely participate in the demonstration training against injuries, it is considered that the reinforcement exercises for strengthening the flexion muscular strength of the knee joint are needed.

Among the results of a previous study which compared and analyzed the physical factors, anaerobic exercise capacity, and the isokinetic muscle function of excellent and non-excellent male college Taekwondo athletes[25], the ratio of knee flexor and extensor muscles of excellent athletes demonstrated an ideal ratio, yet those of non-excellent athletes were verified to be off the recommended ratio. While it is difficult to discuss them directly, it is considered that the differentiated physical training ought to be applied considering the knee flexor and extensor ratio in order to improve the skills to perform Taekwondo kicks safely against injuries. As a result of comparatively analyzing the difference of the isokinetic muscle power of the knee joint measured at an angular velocity of 180°/sec, no statistically significant difference turned out across all items of measurement.

However, unlike the isokinetic muscle strength of the knee joint measured at an angular velocity of 60°/sec, the isokinetic muscle power of the knee joint measured at an angular velocity of 180°/sec demonstrated a higher trend across all items of measurement relative to the general students. Such results, as discussed in the comparative analysis of physical factors, are supportive of the results of the multiple previous studies[18][19][26][27][28] which claimed that, in order to perform highly difficult breaking of the perfect Taekwondo demonstration, horizontal movement skills using high speed and strong lower extremity agility for jumping are required. As a result of performing the comparative analysis of the difference for the anaerobic exercise capacity between the national demonstration team members and the general students, there was no statistically significant difference between the groups across all items of measurement.

The results of a previous study comparing the physical strength factors between the Taekwondo sparring, demonstration, and poomsae athletes(Hyeong-kyun Tak et al., 2019) reported that only peak power per body weight turned out to be statistically significantly higher for the sparring athletes than the poomsae athletes. The results of a previous study which compared the physical strength factors, anaerobic exercise capacity, and the isokinetic muscle function of excellent and non-excellent male college Taekwondo athletes[25] reported that the excellent athletes turned out to be statistically and significantly higher in terms of peak power, peak power per body weight, average power, average power per body weight, and total energy than the non-excellent athletes.

Hence, while it may be somewhat difficult to present the anaerobic exercise capacity as a key physical strength factor for practicing the highly difficult breaking of the Taekwondo demonstration, among the results of a previous study[15] on the kinematic analysis of the stepping motion of the national high jump athletes, and the results of the previous studies called "Variability Analysis on the Kinematic Factors for the Stepping Phase During Men's Success and Failure in High Jump(Jin-taek Lee, 2007)," it was reported that the last horizontal speed immediately before the leap for high jump is 8.19 m/s(Zhu jianhua) and 8.2 m/s(Sotomiyor) for the

world-class athletes, and hence, it is considered that the anaerobic exercise capacity will also be needed for the strong skills and ability to stay in the air for the Taekwondo demonstration athletes.

5. Conclusion

This study compared the characteristics of body structure and physical strength factors among three male students who are active as a national representative demonstrator among Taekwondo demonstrators attending K University in D city and three general demonstrators who are training the same special kick.

As a result of measurement of body structure, physical fitness factors, isokinetic muscle function, and anaerobic exercise capacity of the national demonstration team and general students, there was no statistically significant difference between groups. However, through the results of this study, it was confirmed that the ratio of flexor and extensor muscles needs to be improved to an ideal ratio of 55% to 65% as suggested in previous studies to prevent damage to the lower extremities of general students. In addition, the standing long jump and sargent jump, side step, eyes closed and one leg standing, and knee joint isokinetic muscle power showed a higher tendency in the national demonstration group compared to the general students. There was no statistically significant difference between groups in the measurement results of anaerobic exercise capacity.

Based on the results of this study, it is thought that it will be difficult to present the characteristics of the physical fitness factors according to the performance level of Taekwondo demonstration majors. However, considering the results of many previous studies and this study, it is thought that efforts to improve agility, power, and balance ability are needed to improve the performance of Taekwondo demonstration majors. It is judged that improvement of the flexion muscle/extension muscle ratio of the lower extremities is necessary to prevent additional injuries.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	JP	-Set of concepts <input checked="" type="checkbox"/>
		-Design <input checked="" type="checkbox"/>
		-Getting results <input checked="" type="checkbox"/>
		-Analysis <input checked="" type="checkbox"/>
Corresponding Author*	JP	-Make a significant contribution to collection <input checked="" type="checkbox"/>
		-Final approval of the paper <input checked="" type="checkbox"/>
		-Corresponding <input checked="" type="checkbox"/>
		-Play a decisive role in modification <input checked="" type="checkbox"/>
Co-Author	JJ	-Significant contributions to concepts, designs,
	JS	practices, analysis and interpretation of data <input checked="" type="checkbox"/>
	GK	-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
		-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

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