ORIGINAL ARTICLE

The Relative Age Effect of Elite Taekwondo Athletes

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ABSTRACT

Background. It is because athletes' physique, physical strength and experience are vital in sports. **Objectives.** This study was conducted to confirm the relative age effect in Taekwondo, which is an important factor in sports. **Methods.** Data on the date of birth of 12,054 Taekwondo athletes registered in the Korean Sports Association and data on the date of birth of 11,034,421 public data by the National Statistical Office of Korea were collected, and the birth months were compared. Also, data on the birth dates and the national competition awards of 428 elementary student Taekwondo athletes were collected to confirm the relative age effect. **Results.** The results are as follows. First, there was a statistically significant difference in comparing the birth month between the general public and Taekwondo athletes. Second, as a result of comparing the birth month of the current elite Taekwondo athletes according to the elementary school player registration, there was a statistically significant difference, and it was found that students with relatively early birth months had a high frequency of player registration. Third, as a result of comparing the birth month of elementary school Taekwondo athletes according to the national competition awards, there was no statistical difference. **Conclusion.** The athletes with the early birth month had relatively high winning results in the national competitions.

KEYWORDS: *Sports, Taekwondo Athlete, Relative Age Effect, Elementary School.*

INTRODUCTION

In most countries, education and evaluation are conducted within the group of people born in the same year. It is a system that divides people born from January 1 to December 31 in the same year into one grade level and provides education according to the grade (1). These grade-level divisions are conducted chiefly worldwide.

Various previous studies have been reported concerning age and grade. One of them is a study on relative age. Relative age is a term that refers to the difference in the birth month when born in the same year (2). In other words, it is a theory that if a grade is composed of people born from January to December, students born in January will inevitably have better physical, cognitive, and mental development than students born in December (3). Therefore, students born close to

January in a grade level are bound to have many advantages called the Relative Age Effect (RAE).

In the case of RAE, pedagogy studies have long been concerned with academic achievement and learning disabilities (4-6). It is reported to primarily affect younger students more than the other age groups (7, 8). Also, RAE notes that those with relatively early birth months are given more opportunities compared to later birth months, resulting in higher achievement levels (9).

Meanwhile, in the sports field, it was noted from previous RAE studies that there are differences in athletes' physical, cognitive, and psychological aspects (10). It is because athletes' physique, physical strength and experience are essential in sports. Thus, RAE is vital in selecting and nurturing young athletes (11). In fact, in sports

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games, it is reported that athletes with relatively early birth dates receive more benefits in athlete selection and training (12, 13) and also that late birth month athletes have a relative disadvantage, leading to cases where they quit (14, 15). Thus, RAE is also an important factor in sports.

Research on soccer, baseball, etc., has been conducted at RAE research in the sports field (16, 17) and shows the difference in RAE depending on the sports. Different characteristics exist in different sports and thus is important to check RAE for each sport. Moreover, the prior studies are limited to professional sports, and in Taekwondo, only studies based on Olympic athletes are reported. In the case of Olympic athletes, most consist of adult athletes, making it challenging to check the relative age effect seen the most in younger ages (8). Therefore, this study aims to confirm the RAE for Taekwondo athletes. Specifically, this study confirmed RAE in Korean athletes and compared them with the general public's birth month. In addition, as the RAE is more potent at a younger age, we used the data from elementary school students to compare national competition awards and birth months according to the registration of elementary school players. It can be used as primary data in selecting and training athletes while confirming RAE in Taekwondo.

MATERIALS AND METHODS

Method Material. This study aims to confirm the relative age effect on elite Taekwondo athletes in Korea. To this end, the data on the birth month of 12,054 Taekwondo athletes registered in the Korean Sports Association were analyzed. Birth months of 11,034,421 of the general public provided by Statistics Korea were compared. In addition, data on the birth month of 428 elementary school students (age 11 to 13) and the national competition winning records were collected to confirm the relative age effect of Taekwondo athletes. It confirmed the relative age effect of elementary school students, where the relative age effect is seen the most (7, 8).

Data Collection Procedure. In this study, to confirm the relative age effect on Taekwondo athletes, the birth month of athletes was collected from the Korean Sports Association, an international Olympic member organization. In addition, public data from the National Statistical Office of Korea were used to compare the birth months of Taekwondo athletes and the general public. The Taekwondo athlete data were analyzed by recording the athlete registration year, date of birth, gender, and winning records using Excel 2013, and the general public's date of birth was recorded and analyzed. The Korean Sports Olympic Committee provided data on Taekwondo athletes.

Data Processing Method. In this study, frequency analysis according to birth month was conducted to confirm the relative age effect of elite Taekwondo athletes. Frequency analysis was performed by month and category using Excel 2013 (Q1: January, February, March; Q2: April, May, June; Q3: July, August, September; Q4:October, November, December) and analyzed. In addition, in this study, the same number of cases was compared to confirm the difference between the general public and the Taekwondo athletes. For this, the following formula was applied. The formula is an example of the formula for the adjusted number of public cases in January, and the difference between the adjusted number of public cases and the birth month of Taekwondo athletes was analyzed by Chi-square (18).

GJ = general public cases adjusted in January
NGJ = number of general public cases in January
NTG = number of total general public cases
NTA = number of Taekwondo athlete cases

A Chi-square analysis was conducted to determine the difference between Taekwondo athletes' birth months and records in elementary school, and the SPSS21.0 program (SPSS Science, Chicago, USA) was applied. All statistical significance levels were set to.05.

RESULTS

Analysis of the Frequency of Birth Month Distribution among Elite Taekwondo Athletes and the General Public. (Figure 1) shows the frequency of birth month distribution among Taekwondo athletes and the general public. As a result, there were most people born in January in Taekwondo athletes (1251 athletes, 10.4%) and the general public (1155 people, 9.6%), and the least people born in December (791 Taekwondo athletes, 6.6%; 908 general public, 7.5%) Specific birth month data is shown below in (Table 1).
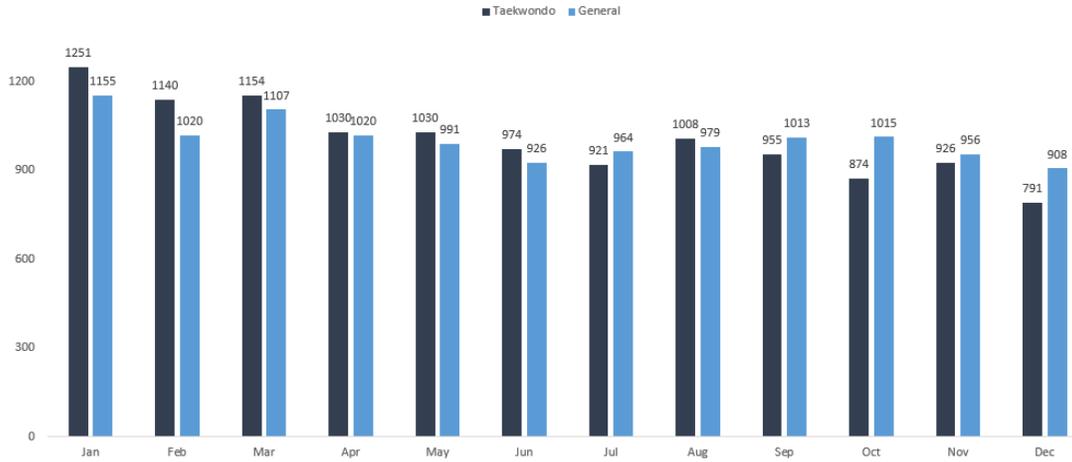
Figure 1. Distribution of Birth Month in Taekwondo Athletes and General Public

Table 1. Results of Birth Month Frequency Analysis of Elite Taekwondo Athletes and General Public

Division	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
General public												
N	1155	1020	1107	1020	991	926	964	979	1013	1015	956	908
%	9.6	8.5	9.2	8.5	8.2	7.7	8.0	8.1	8.4	8.4	7.9	7.5
Taekwondo athlete												
N	1251	1140	1154	1030	1030	974	921	1008	955	874	926	791
%	10.4	9.5	9.6	8.5	8.5	8.1	7.6	8.4	7.9	7.3	7.7	6.6

In addition, the distribution of Taekwondo athletes and the general public's birth month is categorized into 4 categories, and the analysis results are shown in Table 2 and Figure 2 below. As a result, the birth month of Taekwondo athletes is as follows, Q1 (January to March) (3545 people, 29.4%), Q2 (April to June) (3034 people, 25.2%), Q3 (July to September) (2884 people, 23.9%), Q4 (October to December) (2591 people, 21.5%), and the birth month of the general population is as follows, Q1 (January to March) (3281 people, 27.2%), Q3 (July to September) (2957 people, 24.5%), Q2 (April to June) (2937 people, 24.4%), and Q4 (October to December) (2879 people, 23.95%) in that order. In addition, as a result of cross-analysis, it was found that there were statistical differences (x^2=27.8, df=3, P<0.001) in the birth month of the general public and Taekwondo athletes.
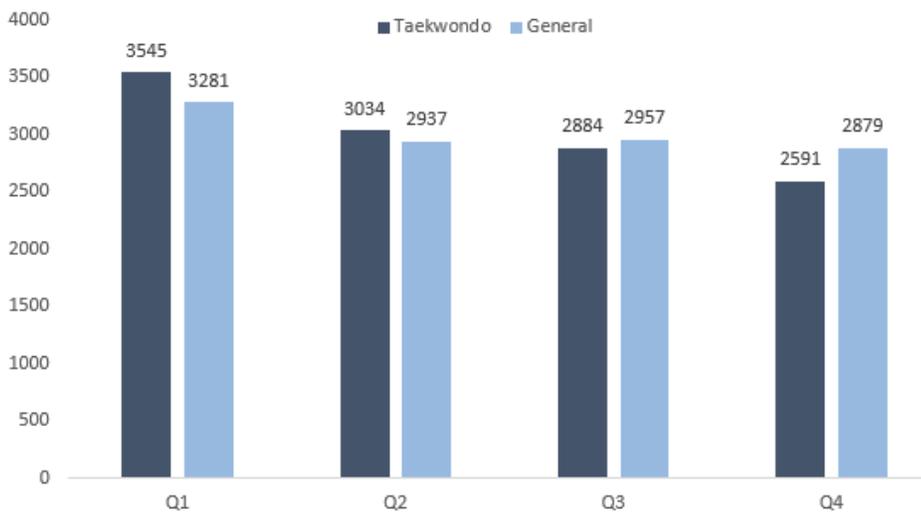

Figure 2. Distribution of Taekwondo Athletes' Birth Month by Category

Table 2. Results of Monthly Birth Frequency Analysis of Elite Taekwondo Athletes

Division	Q1	Q2	Q3	Q4
General public				
N	3281	2937	2957	2879
%	27.2	24.4	24.5	23.9
Taekwondo athlete				
N	3545	3034	2884	2591
%	29.4	25.2	23.9	21.5

X^2=27.8, df=3, P<0.001

Table 3. Analysis of Differences in Birth Month of Elite Taekwondo Athletes According to Whether They Are Registered as Elementary School Athletes or Not (%)

Division	Q1	Q2	Q3	Q4	Total
Registered elementary school athlete					
Yes	83 (34.3)	64 (26.4)	45 (18.6)	50 (20.7)	242 (100)
No	43 (23.1)	48 (25.8)	47 (25.3)	48 (25.8)	186 (100)

X^2=7.876, df=3, P=0.049

Table 4. Analysis of the Difference in Relative Age Effect According to the Winning Performance of Elite Taekwondo Athletes (%)

Division	Q1	Q2	Q3	Q4	Total
National Competition Winning Results					
Yes	56 (33.3)	45 (26.8)	30 (17.9)	37 (22.0)	168 (100)
No	70 (26.9)	67 (25.8)	62 (23.8)	61 (23.5)	260 (100)

X^2=3.260, df=3, P=0.353

Analysis of Relative Age Effect in Elementary School Elite Taekwondo Athletes. Analysis of differences in the birth month of elite Taekwondo athletes according to whether they were Taekwondo athletes in elementary school.

Table 3 is the result of analyzing the birth month of elite Taekwondo athletes according to whether they were athletes in elementary school. It is to confirm when they started Taekwondo concerning their birth month. The results are as follows. As a result, the monthly birth frequency of being registered as a Taekwondo player in elementary school is Q1 (34.3%), Q2 (26.4%), Q4 (20.7%), and Q3 (18.6%) in that order. The frequency of those who were not registered as an athlete was Q2 and Q4 (25.8%), Q3 (25.3%), and Q1 (23.1%). In addition, the difference in the birth month of elite Taekwondo athletes according to elementary school was found to be statistically significant as x^2=7.876, P=0.049.

Analysis of Relative Age Effect of Elite Taekwondo Athletes: National Competitions Winning Record. Table 4 compares the birth month of elementary school Taekwondo athletes according to the national competition awards. As a result, in the case of athletes with national competition awards, the monthly birth frequency was Q1 (33.3%), Q2 (26.8%), Q4 (22.0%), and Q3 (17.9%) in that order. Q1, which is a relatively early birth month, was found to be about 10% higher than that of Q3 and Q4. On the other hand,

in the case of athletes who did not win national competitions, the monthly birth frequency was Q1 (26.9%), Q2 (25.8%), Q3 (23.8%), and Q4 (23.5%) in that order. In the case of athletes, the difference according to the birth month was analyzed to be about 3% (Q1 and Q4). In addition, there was no statistically significant difference in the month of birth according to the national competition awards (x^2=3.260, P=0.353).

DISCUSSION

In most sports, various efforts are made to select excellent athletes, one of which is the relative age effect (19). In particular to sports, the relative age effect has a considerable relationship to athletes' physique, physical strength, and psychological factors, making many researchers interested in RAE. Therefore, this study was conducted to confirm the relative age effect in one of the sports, Taekwondo, and the following are the discussions.

First, this study confirmed the difference between the distribution of the birth month of the general public and the birth month of Taekwondo athletes. As a result, it was found that there was a statistically significant difference in the distribution of birth months between the general public and Taekwondo athletes. Especially when comparing Q1 (January to March) and Q4 (October to December), there was a difference of about 3% in the case of the general public, while

about 8% in the case of Taekwondo athletes, showing that there was a relative age effect. Previous studies also reported a difference in distribution between the birth month of the general public and that of athletes in basketball, badminton, archery, and soccer (13, 20), stressing the importance of the relative age effect.

In addition, in this study, the birth month of Taekwondo athletes was analyzed according to whether they were registered as elementary school players. It is to check whether they have been Taekwondo athletes since elementary students. As a result, it was found that there was a statistically significant difference in the registration of Taekwondo athletes according to each category of the birth month in elementary students. It was found that the earlier their birth month was, the more likely they were registered as a Taekwondo athlete, and the later their birth month was, the less likely they were registered as a Taekwondo athlete. Because of this trend, it can be interpreted that students with early birth months tend to be more active as Taekwondo athletes. This effect can be understood that students' physical and psychological factors are more advantageous, concluding that birth month is essential when starting as a Taekwondo player (11).

On the other hand, after checking the winning results of elite Taekwondo athletes according to the birth month, there was no statistically significant difference. However, in the case of national competition-winning records, 33% of the Q1 (January - March) birth range had winning records, while about 22% of Q4 (October - December) birth range had winning results, showing a difference of about 11%. On the other hand, in the case of no winning records, 26% of Q1 and 23% of Q4 did not have winning records, with a difference of about 3%. Although he was not statistically different, it was confirmed that in the case of elementary student Taekwondo athletes, those with relatively early birth months had a higher winning rate at national competitions. In the case of young athletes, winning results would

affect factors such as experience, and self-confidence will inevitably have a positive effect on growing athletes. Therefore, in the case of Taekwondo, relatively early birth months born athletes are advantageous.

This study is significant because it analyzes the Korean Taekwondo athletes, who won the most Olympic medals in the field, and it looks at elementary students where the relative age effect is seen the most. However, this study's limitations are that the gender of patients was not separately analyzed, and the study subject was selected from only one country. Therefore, future studies would be meaningful if they analyze gender separately and compare countries.

CONCLUSION

This study was conducted to analyze the relative age effect on Taekwondo athletes. The results of this study are as follows. First, a result of comparing the birth month between the general public and the Taekwondo athletes showed a statistically significant difference. Second, according to the elementary school athlete registration, the current elite Taekwondo athletes' birth month was statistically different, and the students with a relatively early birth month showed a high frequency of player registration. Third, there was no statistically significant difference when comparing the birth month of elementary school Taekwondo athletes according to the national competition-winning records. However, it was analyzed that the athletes with the early birth month had relatively high winning results in the national competitions.

APPLICABLE REMARKS

- This study is judged to be used as basic information in selecting taekwondo athletes.
- This study is considered vital information in nurturing elite athletes and confirms the relative age's effect on various sports fields.

FUNDING

REFERENCES

1. Helsen WF, van Winckel J, Williams AM. The relative age effect in youth soccer across Europe. *J Sports Sci*. 2005;**23**(6):629-636. **doi:** 10.1080/02640410400021310 **pmid:** 16195011
2. Kwon MH. The Relative Age Effect in Korean Sports - In Case of Soccer. *Korean J Physic Educat*. 2000;**39**(4):92-100.

3. Sedano S, Vaeyens R, Redondo JC. The Relative Age Effect in Spanish Female Soccer Players. Influence of the Competitive Level and a Playing Position. *J Hum Kinet*. 2015;**46**:129-137. **doi:** 10.1515/hukin-2015-0041 **pmid:** 26240656

4. Davis BG, Trimble CS, Vincent DR. Does age of entrance affect school achievement? *Element School J*. 1980;**80**(3):133-143. **doi:** 10.1086/461183

5. Diamond GA. A clinically relevant classification of chest discomfort. *J America College Cardiol*. 1983;**1**(2 Part 1):574-575. **doi:** 10.1016/S0735-1097(83)80093-X

6. Uphoff JK, Gilmore J. Viewpoint 2. Pupil Age at School Entrance-How Many Are Ready for Success? *Young Child*. 1986;**41**(2):11-16.

7. Russell RJH, Startup MJ. Month of birth and academic achievement. *Personal Individ Differ*. 1986;**7**(6):839-846. **doi:** 10.1016/0191-8869(86)90082-6

8. Dalen T, Ingvaldsen RP, Roaas TV, Pedersen AV, Steen I, Aune TK. The impact of physical growth and relative age effect on assessment in physical education. *Eur J Sport Sci*. 2017;**17**(4):482-487. **doi:** 10.1080/17461391.2016.1268651 **pmid:** 28038501

9. Navarro JJ, Garcia-Rubio J, Olivares PR. The Relative Age Effect and Its Influence on Academic Performance. *PLoS One*. 2015;**10**(10):e0141895. **doi:** 10.1371/journal.pone.0141895 **pmid:** 26517552

10. Schorer J, Cobley S, Bräutigam H, Loffing F, Hütter S, Büsch D, et al. Developmental contexts, depth of competition and relative age effects in sport: a database analysis and a quasi-experiment. *Psychol Test Assess Model*. 2015;**57**(1):126.

11. Nakata H, Akido M, Naruse K, Fujiwara M. Relative Age Effect in Physical Fitness Among Elementary and Junior High School Students. *Percept Mot Skills*. 2017;**124**(5):900-911. **doi:** 10.1177/0031512517722284 **pmid:** 28756733

12. Gadžić A, Milojević A, Stanković V, Vučković I. Relative age effects on motor performance of seventh-grade pupils. *Europe Physic Educat Rev*. 2017;**23**(4):534-542. **doi:** 10.1177/1356336X16671696

13. Ibanez SJ, Mazo A, Nascimento J, Garcia-Rubio J. The Relative Age Effect in under-18 basketball: Effects on performance according to playing position. *PLoS One*. 2018;**13**(7):e0200408. **doi:** 10.1371/journal.pone.0200408 **pmid:** 29985940

14. Aune TK, Pedersen AV, Ingvaldsen RP, Dalen T. Relative age effect and gender differences in physical education attainment in Norwegian schoolchildren. *Scandinavia J Educat Res*. 2017;**61**(3):369-375. **doi:** 10.1080/00313831.2016.1148073

15. Romann M, Fuchslocher J. Influence of the selection level, age and playing position on relative age effects in Swiss women's soccer. *Talent Develop Excellence*. 2011;**3**(2):239-247.

16. Williams JH. Relative age effect in youth soccer: analysis of the FIFA U17 World Cup competition. *Scand J Med Sci Sports*. 2010;**20**(3):502-508. **doi:** 10.1111/j.1600-0838.2009.00961.x **pmid:** 19538534

17. Abel EL, Kruger MM, Pandya K. A relative age effect in men's but not women's professional baseball: 1943-1954. *Psychol Rep*. 2011;**109**(1):285-288. **doi:** 10.2466/05.PR0.109.4.285-288 **pmid:** 22049668

18. Lee JY, Moon WJ, Jung KC, Oh HR. Relative Age Effects of Korean Male Combat Sports Athletes. Sport Science, 38(2), 63-72. Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2014). Age at peak performance of successful track & field athletes. . *Int J Sport Sci Coach*. 2020;**9**(4):651-661. **doi:** 10.1260/1747-9541.9.4.651

19. Kirkendall DT. The relative age effect has no influence on match outcome in youth soccer. *J Sport Health Sci*. 2014;**3**(4):273-278. **doi:** 10.1016/j.jshs.2014.07.001

20. Delorme N, Boiche J, Raspaud M. Relative age and dropout in French male soccer. *J Sports Sci*. 2010;**28**(7):717-722. **doi:** 10.1080/02640411003663276 **pmid:** 20480428