

## Article

# Big Data Analysis of the Key Attributes Related to Stress and Mental Health in Korean Taekwondo Student Athletes

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**Abstract:** In the present study, we used big data analysis to examine the key attributes related to stress and mental health among Korean Taekwondo student-athletes. Keywords included “Taekwondo + Student athlete + Stress + Mental health”. Naver and Google databases were searched to identify research published between 1 January 2010 and 31 December 2019. Text-mining analysis was performed on unstructured texts using TEXTOM 4.5, with social network analysis performed using UCINET 6. In total, 3149 large databases (1.346 MB) were analyzed. Two types of text-mining analyses were performed, namely, frequency analysis and term frequency-inverse document frequency analysis. For the social network analysis, the degree centrality and convergence of iterated correlation analysis were used to deduce the node-linking degree in the network and to identify clusters. The top 10 most frequently used terms were “stress”, “Taekwondo”, “health”, “player”, “student”, “mental”, “exercise”, “mental health”, “relieve”, and “child.” The top 10 most frequently occurring results of the TF-IDF analysis were “Taekwondo”, “health”, “player”, “exercise”, “student”, “mental”, “stress”, “mental health”, “child” and “relieve”. The degree centrality analysis yielded similar results regarding the top 10 terms. The convergence of iterated correlation analysis identified six clusters: student, start of dream, diet, physical and mental, sports activity, and adult Taekwondo center. Our results emphasize the importance of designing interventions that attenuate stress and improve mental health among Korean Taekwondo student-athletes.

**Keywords:** Taekwondo; Korean student-athlete; stress; mental health



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## 1. Introduction

Since Taekwondo was adopted as an official event in the Sydney Olympic Games in the year 2000, it has become internationally recognized as both a martial art and a sport [1]. As it has evolved into a modern Olympic sport [2], Taekwondo has grown significantly in popularity [3], with competitions now taking place in 210 countries across five continents [4]. In Korea, where the sport originated, there are currently 10,774 Taekwondo athletes, approximately 9800 (90.96%) of whom are classified as student-athletes (<13 years, 1587; 13–15 years, 2690; 16–18 years, 3021; 19–22 years, 2502) [5].

Emphasis on success is prevalent in Taekwondo, as in other sports, including within Korea's elite sport system [6]. As an example, official Taekwondo competitions (qualifiers, semi-finals, and finals) are held on the same day [7]. This requires athletes to maintain peak physical condition over a prolonged period of time, while dealing with the pressure

of competition and having to control their stress and anxiety prior to competing [8]. There is further pressure on student-athletes in Taekwondo as competitive results and academic achievement are the only factors determining progression to higher levels of education and career paths. Therefore, these athletes are generally compelled and even forced into prolonged cycles of competition that can significantly increase their experience of stress and pressure [9]. Yet, while the physical impact of participating in elite sports is well documented, there is a relative lack of research on the mental health of elite athletes [10].

Several studies have investigated whether martial arts such as Taekwondo improve mental health [11]. According to Moore et al. [12], who researched the positive effects of martial arts training on mental health: (a) male karate students reported less depression than other male college students [13], (b) a meta-analysis examining tai chi and mental health reported that 16 studies observed significant improvements in depression arising from tai-chi training, (c) subjects with behavioral problems who participated in a Taekwondo program for 6 months reported a significant decrease in anxiety [14], and (d) after studying Taekwondo for eight weeks, a group of female participants reported more characteristics associated with well-being (i.e., self-concept) than a comparison group [15]. Similarly, elementary-school students who trained in Taekwondo had improved prosocial behavior compared to other martial arts groups [16,17].

However, some researchers have reported negative effects on adolescents who train in martial arts [18]. Participation in power sports, such as weightlifting, wrestling, and oriental martial arts (Taekwondo, judo, karate), increases antisocial behavior in adolescents [19]. This evidence indicates that there is uncertainty about the social-psychological outcomes of martial arts practice on young participants [18]. In addition, Taekwondo attack strategies mainly focus on powerful kicking techniques [20,21]. This attacking approach is quite different from other Olympic combat sports, such as boxing, wrestling, and judo [22]. Therefore, intense physical and technical training is important for elite Taekwondo athletes to improve their physical abilities [22]. Furthermore, along with the physical and technical difficulties of Taekwondo, Korean Taekwondo student-athletes experience different environmental characteristics compared to athletes in other sports and countries.

In Korea, many young children practice Taekwondo [23]. However, only 5711 middle- and high-school student-athletes are registered with the Korean Olympic Committee [5], and even among them, 44% quit sports as athletes after beginning college [5]. Why do many Taekwondo student-athletes not continue to exercise? In 1972, the government of the Republic of Korea introduced the “College Sports Specialist Entrance Examination System” so that student-athletes could focus on training without being burdened by their studies [24]. Through this system, student-athletes were able to gain admissions to universities based on competition scores and not academic achievements. As a result of this system, training time increased, such as training 6 days a week and training 4 times a day, and camp training became a common practice in schools to aid student-athlete life management [25,26]. In Korea, about 30 universities have established and operated Taekwondo departments [27]. Admission to a prestigious university in Korea is especially important because it greatly affects the careers and employment of students [28]. Many of the Taekwondo student-athletes are de-socialized from Taekwondo due to the physical strain and the achievement of the goal of entering college [29]. In other words, while training, Taekwondo student-athletes are exposed to additional stress [30] from an education system centered on grades and college entrance exams, compared to other students [29]. Therefore, although these psychological stresses are expected to affect mental health, unfortunately, epidemiological studies on the mental health of Korean Taekwondo student-athletes have not been attempted. In addition, current research available on Taekwondo has focused primarily on adult male athletes [7] and competitions [31–33].

Accordingly, our goal in this study was to analyze the key attributes related to the stress and mental health of Korean Taekwondo student-athletes through an analysis of the unstructured data on this topic identified in Naver (NAVER Corp., Seongnam, Korea) and Google (Alphabet Inc., Mountain View, CA, USA). Identifying factors that influence

the stress and mental health of student-athletes through big data analysis will provide basic academic data regarding their psychological state, allowing for the development of strategic interventions to improve the mental and physical health of these student-athletes.

## 2. Literature Review

### 2.1. Sports, Taekwondo, and Sustainability

The 17 SDGs (Sustainable Development Goals) of the 70th UN General Assembly in 2015 are an agenda, to be achieved by 2030, for humankind to realize the philosophy of sustainable development [34]. The president of the International Olympic Committee (IOC), Thomas Bach, emphasized that sports will be more effective than any other means for achieving goals 3, 4, 5, 16, and 17 of these 17 development goals [35].

Sports and development can be largely interpreted as two perspectives: “development of sports” and “development through sports” [36]. Although these two approaches have something in common, in that they encourage participation in sports, there is a clear difference in their goals [37,38]. From the 1970s to the present day, Korea has been contributing to official development assistance, a part of international development cooperation, through the overseas dispatch of Taekwondo masters [39].

### 2.2. Stress and Mental Health

Stress is the body’s response to a challenge or demand, manifesting as emotional or physical tension. Stress can be caused by any event or thought that makes one feel angry, nervous, or frustrated [40]. According to the World Health Organization [41], “Mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community.” This definition is important in that it emphasizes that mental health is more than just the absence of a mental disorder or disability [41].

Stress is common at every stage of life. Previous research has indicated that, as of 2019, 51.5 million adults in the United States experience mental health problems each year [42]. Although this prevalence suggests that approximately 1 in 5 American adults experience mental health issues, social issues influencing mental health are more likely to affect young individuals during key periods of socialization. In Korea, 1 in 4 adults has suffered from a mental illness such as stress, depression, or anxiety at least once [43]. In a situation where the level of mental health of Korean adults is more serious than that of the United States, the number of adolescents receiving treatment for mental illness is steadily increasing, from 22,587 in 2016 to 275,557 in 2020 [44]. These factors are important to consider as the physical and mental changes occurring during adolescence are critical determinants of health in adulthood [45]. Adolescents may not have the strategies to cope with social pressure and stress, which places them at high risk of mental illness [46,47]. Moreover, students often experience psychological pressure [48–51]. This psychological pressure can be increased in student-athletes in Korea, who commonly choose to pursue their sporting careers at the expense of their education, which increases the pressure on sports performance and outcomes. In fact, under the elite sporting system, school absences are common from as early as middle school [6]. Therefore, Korean student-athletes experience significant stress in all areas of their lives, both as students and athletes [24].

### 2.3. Big Data

The term “big data” denotes a large volume of complex and rapidly growing datasets from numerous autonomous and independent sources [52]. Big data is distinct from standard data in terms of volume, velocity, and variety [53], reflecting the faster rate at which modern data is generated than in the past. Accordingly, big data achieves near real-time velocity and greater variety than traditional data. In turn, techniques for analyzing big data have become increasingly diversified in recent years [54–56]. Currently, Korea offers favorable conditions for big data to flourish, by virtue of its globally superior network infrastructures and the immense amount of data produced [57–59]. Therefore, big data

analysis has the potential to expand research in various fields, such as discourse analyses on social phenomena, cognitive analyses, securing product competitiveness via analyses of changes in social trends, and the creation of value through the examination of new convergences.

### 2.3.1. Text-Mining Analysis

Text-mining analysis is the process of discovering new knowledge from the large-scale volume and variety of a selected digital text set [60–63]. This involves extracting relevant terms, calculating their frequency of use, and determining their meaning [64]. In this study, text-mining analysis was performed using both frequency and term frequency-inverse document frequency (TF-IDF) analyses. Frequency analysis calculates the number of times a term appears in a given document, using the TF-IDF approach to weigh each term according to its uniqueness in a text document [59,65]. Thus, the TF-IDF value increases as the frequency of instances of a particular word in a specific document increases, while the number of documents including the specific word decreases [59].

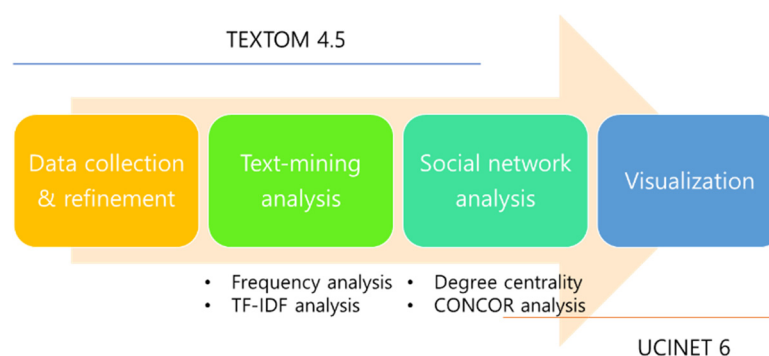
### 2.3.2. Social Network Analysis

Social network analysis (SNA) is a strategy for investigating social structures [66]. Furthermore, SNA can be used to quantitatively analyze the characteristics of objects that constitute a social network model, using nodes and links [67]. In this study, SNA was performed using both degree centrality and the convergence of iterated correlation (CONCOR) analysis. Degree centrality refers to the sum of the nodes connected to a central node in a given network. This makes it possible to determine the number of nodes with which a central node exhibits a relationship. CONCOR analysis was performed to analyze the structures of the relationships among the latent sub-clusters (i.e., the relationships and patterns between words). The greater the similarity between the relationships and patterns, the greater the degree of structural equivalence between the other words [68].

## 3. Materials and Methods

### 3.1. Research Procedure

The research procedure, which involved big data analysis, is shown in Figure 1. First, data were collected and refined using the big data collection and analysis solution presented by TEXTOM 4.5 (The Imc Inc., Daegu, Korea). This software automatically collects text data, refines it through a stemmer, and counts the frequency of words to create a matrix of selected words [69]. TEXTOM is an analysis package made for easy access by users, implementing the full text software developed by Professor Loet Leydesdorff (University of Amsterdam) on the web, for Korean analysis by TEXTOM 4.5 (The Imc Inc., Daegu, Korea) in Korea [70]. The resulting software, released by the Korea Information and Communication Technology Association [71], is currently being used successfully in various studies registered with the National Research Foundation of Korea [72]. Second, the top 50 words were derived through text-mining analysis (including both frequency and TF-IDF analysis) of the refined data. Third, the selected data were converted into matrix format to perform the SNA (including both degree centrality and CONCOR analysis) using UCINET 6 (Analytic Technologies Corp., Lexington, KY, USA). Finally, the derived data were visualized using tables and figures. The steps of this process are shown in Figure 1.



**Figure 1.** Research procedure.

### 3.2. Data Collection and Refinement

This study was approved by the Institutional Review Board of Kyung Hee University, Global Campus, Gyeonggi, Korea (No. KHGIRB-20-672). The data collection period extended from 1 January 2010, to 31 December 2019. Search terms were as follows: “Taekwondo + Student athlete + Stress + Mental health” (the meaning of + is that the data must include these words). The big data collection and analysis solution of the web crawling program TEXTOM 4.5 (<http://textom.co.kr>; accessed on 2 December 2021) was used to collect unstructured text from webpages, blogs, and news articles [73], as provided by Naver and Google, which are the most commonly used search engines in Korea [74].

In this study, data collection referred to the identification and clarification of the types of information being investigated. The scope of the collected data was limited to the characteristics of the keywords. The process of converting unstructured text data into a structured format is known as data refinement [68]. During data refinement, the monosyllabic parts of Korean speech were deleted as they did not represent the correct meaning.

### 3.3. Data Analysis

In this study, both text mining and SNA were performed to determine the level of stress and mental health effects in Taekwondo student-athletes in Korea. TEXTOM 4.5’s big data analysis solution, as well as the Netdraw visualization tool of the UCINET 6 social network analysis software [54], were used to perform both text-mining and SNA.

## 4. Results

### 4.1. Results of Data Collection

In this study, we collected texts related to the keywords “Taekwondo + Student athlete + Stress + Mental health” that were published in Korea on Naver and Google between 1 January 2010 and 31 December 2019. The results are shown in Table 1. In total, 3149 data points were collected using TEXTOM 4.5, with the total volume of data amounting to 1.346 MB.

**Table 1.** Collection channels, number of data points, and volume.

Collection Channel	Number of Data Points	Volume
Naver	2130	1.051 MB
Google	1019	0.295 MB
Total	3149	1.346 MB

### 4.2. Text-Mining Analysis

The results of the frequency analysis of the top 50 terms related to the stress and mental health of Taekwondo student-athletes are shown in Table 2. Our findings indicated that the top 10 most frequently used terms were “stress” (886), “Taekwondo” (693), “health”



(469), “player” (390), “student” (387), “mental” (311), “exercise” (304), “mental health” (199), “relieve” (173), and “child” (157).

**Table 2.** Results of the frequency analysis.

Rank	Term	Frequency	Rank	Term	Frequency
1	Stress	886	26	Adolescent	55
2	Taekwondo	693	27	Influence	51
3	Health	469	28	High school student	50
4	Player	390	29	Training	48
5	Student	387	30	Friend	48
6	Mental	311	31	Mind	47
7	Exercise	304	32	Need	46
8	Mental health	199	33	Activity	46
9	Relieve	173	34	Effect	45
10	Child	157	35	Time	45
11	Person	103	36	Start	44
12	Elementary school student	95	37	Adult	44
13	Sports	86	38	Competition	44
14	Work	75	39	MOOTO	43
15	Physical	73	40	Education	41
16	Diet	71	41	Life	41
17	Study	71	42	Physical strength	41
18	Body	68	43	Korea	40
19	Boxing	65	44	Improving	40
20	School	62	45	Happiness	40
21	Help	61	46	Flesh	39
22	Athlete	60	47	Management	39
23	Taekwondo center	59	48	Kickboxing	39
24	Talk	58	49	Myself	38
25	Think	57	50	Dream	37

Note: MOOTO = A Taekwondo Corporation in Korea.

Second, as shown in Table 3, the top 10 most frequently occurring results of the TF-IDF analysis were “Taekwondo” (697.357), “health” (587.001), “player” (525.824), “exercise” (521.561), “student” (505.935), “mental” (478.436), “stress” (428.873), “mental health” (379.076), “child” (370.265), and “relieve” (352.649). Unlike the results of the frequency analysis, the ranking of “exercise” slightly increased in the TF-IDF analysis, while the ranking of “stress” decreased.

#### 4.3. Social Network Analysis (SNA)

In this study, degree centrality and CONCOR analyses were used to perform SNA. A higher degree of centrality was considered to indicate a significant number of links among the terms, resulting in a significant impact on the overall network [54]. Therefore, degree centrality analysis was performed to examine how connected the derived terms were to “Taekwondo + Student athlete + Stress + Mental health” (Table 4). The top 10 most frequently occurring results of the degree centrality analysis were “stress” (0.095628), “Taekwondo” (0.077691), “student” (0.054709), “player” (0.051682), “health” (0.041592), “exercise” (0.037108), “mental” (0.031726), “mental health” (0.027018), “child” (0.021973), and “person” (0.016143). Unlike the results of the text-mining analysis, the ranking of “person” increased slightly in the degree centrality analysis, while the ranking of “relieve” decreased.

**Table 3.** TF-IDF results.

Rank	Term	TF-IDF	Rank	Term	TF-IDF
1	Taekwondo	679.357	26	Think	180.885
2	Health	587.001	27	MOOTO	179.167
3	Player	525.824	28	Training	169.191
4	Exercise	521.561	29	Influence	168.925
5	Student	505.935	30	High school student	168.910
6	Mental	478.436	31	Friend	162.154
7	Stress	428.873	32	Competition	159.986
8	Mental health	379.076	33	Mind	158.776
9	Child	370.265	34	Adult	157.471
10	Relieve	352.649	35	Need	156.455
11	Person	274.247	36	Activity	156.455
12	Elementary school student	256.167	37	Effect	156.308
13	Sports	250.596	38	Time	153.054
14	Work	220.717	39	Start	152.835
15	Diet	220.239	40	Education	149.078
16	Study	220.239	41	Physical strength	146.734
17	Physical	219.257	42	Improving	145.442
18	Boxing	206.272	43	Kickboxing	145.408
19	Body	205.310	44	Life	144.517
20	School	196.752	45	Korea	143.155
21	Taekwondo center	194.181	46	Dream	143.063
22	Athlete	192.669	47	Management	141.805
23	Help	188.177	48	Happiness	140.993
24	Adolescent	185.801	49	Program	136.624
25	Talk	181.949	50	Flesh	136.455

Note: TF-IDF = Term frequency–inverse document frequency analysis.

Second, a CONCOR analysis was performed to analyze the structures of the relationships among the latent sub-clusters in the network. The results are presented in Table 5 and Figure 2. Based on these results, homogenous groups were identified according to their shared relationships and correlations, resulting in six clusters (including students, the start of dreams, diet, physical and mental state, sports activity, and adult Taekwondo center). The first cluster (visualized in yellow) included the terms “school”, “student”, “study”, “mental health”, “work”, “time”, “need”, “friends”, “improving”, and “Taekwondo”, and was categorized as “student.” The second cluster (visualized in green) included the terms “start”, “dream”, “think”, “talk”, “Korea”, “player”, and “elementary school student”, and was categorized as “start of dream.” The third cluster (visualized in white) included the terms “diet”, “relieve”, “effect”, “boxing”, and “kickboxing”, and was categorized as “diet”. The fourth cluster (visualized in orange) included the terms “physical”, “mental”, “health”, “person”, “life”, “help”, “mind”, “body”, “flesh”, and “management”, and was categorized as “physical and mental.” The fifth cluster (visualized in red) included the terms “sports”, “activity”, “stress”, “child”, “adolescent”, “athlete”, “myself”, “physical strength”, “influence”, and “education”, and was categorized as “sports activity”. The sixth cluster (visualized in purple) included the terms “adult”, “Taekwondo center”, “training”, and “MOOTO”, and was categorized as “adult Taekwondo center”. The terms “high school student”, “competition”, and “happiness” did not form clusters.

**Table 4.** Results of the degree centrality analysis.

Rank	Term	Degree Centrality	Rank	Term	Degree Centrality
1	Stress	0.095628	26	Help	0.007960
2	Taekwondo	0.077691	27	Adolescent	0.007848
3	Student	0.054709	28	Time	0.007735
4	Player	0.051682	29	Adult	0.007623
5	Health	0.041592	30	Activity	0.007511
6	Exercise	0.037108	31	High school student	0.007287
7	Mental	0.031726	32	Education	0.007063
8	Mental health	0.027018	33	Life	0.007063
9	Child	0.021973	34	Effect	0.007063
10	Person	0.016143	35	Korea	0.006951
11	Elementary school student	0.015471	36	Mind	0.006951
12	Sports	0.013453	37	Training	0.006726
13	Work	0.012556	38	Physical strength	0.006726
14	Relieve	0.010987	39	Myself	0.006390
15	School	0.010762	40	Influence	0.006390
16	Athlete	0.010538	41	Dream	0.006166
17	Talk	0.010202	42	Happiness	0.006166
18	Boxing	0.010090	43	Competition	0.006054
19	Think	0.009978	44	Case	0.005942
20	Study	0.009641	45	Taekwondo center	0.005942
21	Diet	0.009529	46	Research	0.005717
22	Body	0.008969	47	Physical	0.005717
23	Need	0.008632	48	Degree	0.005605
24	Friend	0.008072	49	Relive stress	0.005605
25	Start	0.007960	50	Parents	0.005605

**Table 5.** Results of the CONCOR analysis.

Cluster	Terms
1 Student	Student, School, Study, Mental health, Work, Time, Need, Friend, Improving, Taekwondo
2 Start of dream	Start, Dream, Think, Talk, Korea, Player, Elementary school student
3 Diet	Diet, Relieve, Effect, Boxing, Kickboxing
4 Physical and mental	Physical, Mental, Health, Person, Life, Help, Mind, Body, Flesh, Management
5 Sports activity	Sports, Activity, Stress, Child, Adolescent, Athlete, Myself, Physical strength, Influence, Education
6 Adult Taekwondo center	Adult, Taekwondo center, Training, MOOTO

Note: CONCOR = convergence of iterated correlations, MOOTO = Taekwondo Corporation in Korea.





improve the environment in which Taekwondo student-athletes function, which will, in turn, provide physical and psychological benefits.

Second, the dream cluster highlights the unique Korean socio-cultural context in which student-athletes choose to begin their careers as early as possible in order to reach an elite level. Indeed, even at the elementary school level, Korean Taekwondo student-athletes tend to begin their athletic careers with the goal of becoming elite Taekwondo athletes. However, exercise cessation due to excessive training, injury, motivation, and/or stress has been reported in young athletes [83,84]. Therefore, there is a need to formulate a long-term plan that is conducive to the holistic development of young student-athletes, rather than focusing only on their physical and motor development for specific sport participation [85]. We hope that this strategy will help more student-athletes to achieve their dreams.

Third, as highlighted by the diet cluster, Taekwondo is a sport that requires strong dietary restriction and weight loss, such as that achieved through boxing and kickboxing. In particular, according to Barley et al. [86], martial arts athletes engage in more weight loss strategies than athletes participating in other combat sports. However, because most student-athletes are under the age of 19 years [5], maintaining an appropriate weight and participating in weight class competitions, rather than engaging in indiscriminate weight-loss strategies, will improve their overall level of stress and mental health.

Fourth, as revealed by the physical and mental cluster, most student-athletes who participate in sports, such as Taekwondo, engage in constant exercise to achieve an optimal fitness level. The exercise that they undergo differs from that of other student-athletes who do not experience weigh-ins. However, losing weight in order to achieve an optimal fitness level [87,88] can negatively affect physical and mental health [89], increase their levels of stress hormones [90], decrease athletic performance [91–95], and lead to exhaustion, which is often regarded as unconscious avoidance in response to diverse stressors [96,97]. Therefore, systematic coaching programs that contribute to increases in student-athletes' positive emotional experiences are required, given that these emotional experiences are conducive to the formation of a strong sense of identity and self-esteem, which can help to alleviate exhaustion [98]. Such programs may substantially contribute to reducing stress and improving the mental health of Korean Taekwondo student-athletes.

Fifth, as indicated by the sports activity cluster, student-athletes are expected to meet their fundamental goals and foster necessary competencies with diverse experiences [99]. Thus, we need to help Taekwondo student-athletes experience a diverse range of sporting activities to ease their stress levels, develop positive social networks, and foster ethical behaviors—a process known as holistic development [100]. However, performance-first policies in elite sports programs ignore the quality of life and future functioning of student-athletes. Therefore, education programs must acknowledge that athletes are students first, meaning that more holistic rather than performance-first strategies for career development are required to ensure optimal academic input in combination with athletic outcomes. Such programs will allow students to maintain their best performance, engage in creative play, undergo persistent practice, and experience well-coordinated team playing from the early stages to when they enter higher elite levels.

Sixth, in reference to the adult Taekwondo center cluster, 90% of Taekwondo centers in Korea are composed of elementary-school students [101]. However, Taekwondo centers are the primary places in which people can practice this sport; adults are often unable to practice the sport in centers dedicated to children and adolescents, given the high-stress environment designed to produce elite athletes. For this reason, adult Taekwondo centers (e.g., MOOTO) have emerged to meet the needs of training adults. Therefore, the stress and mental health of Taekwondo student-athletes are closely related to adult Taekwondo training.

Finally, our analysis revealed that “high school student”, “competition”, and “happiness” did not form a cluster. In Korea's elite sporting system, it is critical for high-school student-athletes to enter college by undertaking competitions. However, a previous study noted that more than 40% of freshmen and junior students who entered college as athletes

stopped practicing their sports later on because they became emotionally and physically exhausted [102]. It should be made clear that college admission is not the only life goal to which one can aspire, and that the happiness of student-athletes is paramount for their holistic development. In support of this attitude, the National Collegiate Athletic Association publishes Mental Health Best Practices, which are developed and approved by proven institutions to support and promote the mental health of student-athletes [103]. Thus, considering the terms and clusters identified in this study, a system that can support and promote mental health, such as the mental health practice guidelines of Korean student-athletes, is required.

## 6. Conclusions

In this study, we conducted a big data analysis to investigate the key attributes related to stress and mental health in Korean Taekwondo student-athletes. The top 50 terms were derived through frequency, TF-IDF, and degree centrality analyses. Among these 50 items, “stress”, “Taekwondo”, “health”, “players”, “students”, “mental”, “exercise”, and “mental health” were some of the most highly ranked terms. In addition, CONCOR analysis identified six clusters, which were labeled as follows: “student”, “start of dream”, “diet”, “physical and mental”, “sports activity”, and “adult Taekwondo center”. These results highlight the need to develop a strategic intervention for ameliorating stress and improving mental health among Korean Taekwondo student-athletes. Therefore, if a stress reduction and mental health promotion program is developed based on the six derived clusters, it can contribute to the development of guidelines regarding the mental health of Taekwondo student-athletes. These mental health guidelines can also serve as useful mental health standards for student-athletes and their coaches.

However, approaches like big data analysis have limitations in specifically identifying individual stress levels, such as performance, exercise, and career choices of Taekwondo student-athletes, as well as manifestations of mental disorders, such as the abuse of drugs, school violence, and bullying. Furthermore, although the results of this study may be useful for the Korean population, there are limitations in the characteristics of the sample, and therefore the results must be interpreted with caution for other cultures. Additional epidemiological studies are required to determine the factors influencing stress and mental health in this population and to identify strategies for improving the overall well-being and development of student-athletes. Therefore, in a follow-up study, an epidemiological investigation on the mental health of Taekwondo student-athletes is required. In addition, research on the development and application of mental health programs centering on the six derived clusters is also required.

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