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Vol. 7 No. 1

1. **Comparison of Physique and Physical Fitness Factor Characteristics of College Taekwondo Majors by School Year**
- Jusik Park, Donggyu Yoon, Minjeong Kim, Mingyun Son

2. **Analysis of Indicators Related to Adult Disease in Middle-Aged Obese Women in Korea**
- Wookwang Cheon

3. **A Study on the Factors of Influence for the Acceptance of Nuclear Power Generation: With a Focus on the Enhancement of Corporate Image Via Sports Cultural Marketing**
- Jinkee Park

4. **Comparison of the Lower Extremity Muscle Flexibility according to Low Back Pain among High School Baseball Players**
- Daeho Ha, Jidong Tian, Wookwang Cheon

5. **A Study on the Emotional Labor Environment and Quality of Life of Sports Instructors at Elementary Schools**
- Kicheol Kim, Sukkyung Lee

6. **The Relationship among Stress, Exercise Flow and Exercise Exhaustion of College Soccer Players**
- Sunghoon Kim, Changyoung Kim, Gaptaik Ro

7. **Critical Reviews of NBA Official Data based on Sport Analytics**
- Hyongjun Choi, Ruofei Du

8. **The Relationship between the Sense of Creation, Social Adaptation, and the Feeling of Happiness Via Spectating Sports Events**
- Hwansuk Choi, Sunggu Jo, Jaeho Kim

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Comparison of Physique and Physical Fitness Factor Characteristics of College Taekwondo Majors by School Year

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Abstract

Purpose: *In this study, the number of students enrolled in the practical classes is decreasing as the academic year increases due to the reduction of required courses and the expansion of major electives in order to give students voluntary class options unlike in the past for Taekwondo students. Considering that as a result, physical strength and practical skills may decrease, this study intends to compare and analyze the differences by grade level by measuring the physique and physical strength of students enrolled in the Department of Taekwondo.*

In addition, the results of this study are intended to be used as basic data for organizing and reorganizing the curriculum by grade level.

Method: *The subjects of this study were Taekwondo majors enrolled at K University in D city, 27 first graders, 26 second graders, and 26 third graders (total 79), and the characteristics of body composition and physical fitness factors were compared and analyzed.*

Results: *As a result of body composition measurement, body fat percentage and body mass index were statistically significantly higher in second grade than in first grade. As a result of measuring the physical fitness factors, it was found that the first graders were statistically significantly higher than the third graders in the Harvard Step test, which is an evaluation item for cardiorespiratory endurance. The sound reaction time was found to be statistically significantly faster in the first year students than in the second year students. The stand-up long jump, which is a quickness evaluation item, was statistically significantly higher in first-year students than in third-year students.*

Conclusion: *In conclusion, it is considered that the decrease in the frequency of use of the practical practice space and face-to-face classes in the university due to COVID-19 had a negative effect on the physical composition and development of physical fitness of Taekwondo students. Based on the results of this study, it is thought that it is necessary to seek ways to improve the physical strength and practical ability of Taekwondo students.*

[Keywords] ***Taekwondo, Physique, Physical Fitness, Body Composition, Harvard Step Test***

1. Introduction

Taekwondo events can be subdivided into demonstration, Poomsae, and sparring events. Taekwondo's recognition and popularity are increasing day by day, starting with the official Olympic Taekwondo competition, Poomsae events at the Asian Games, and Taekwondo demonstration events[1]. As people around the world's interest in Taekwondo increases, research in various fields related to Taekwondo is being conducted, and it is making a hit around the world as a new Korean Wave cultural content[2]. Due to the increase in interest in Taekwondo, it is reported that various physical and technical training is being applied to show the best performance in various competitions, centering on sparring, Poomsae, and demonstration events[3].

A number of preceding studies on improving Taekwondo athletes' performance report the importance of physical and psychological training to improve their performance [4][5][6][7].

The Ministry of Culture and Tourism[8] reported a decrease in physical strength along with an increase in the physique of elementary school students through a survey on national physical strength[9] reported a decrease in the physical strength of female middle school students. Another study analyzed the tendency of male middle and high school students to develop their physical strength and reported that their physical strength also increased as the school year went up.

Looking at previous studies on Taekwondo training, physique, and physical strength, most of the studies were conducted on various subjects, including elite athletes, and their physique and physical strength characteristics according to their performance level[10][11][12][13][14][15][16][17].

In a previous study comparing the physical strength of high school and college Taekwondo athletes, Park Kwang-dong said that college athletes have better muscle strength, agility, flexibility, balance, and endurance than high school athletes. In addition, it was reported that high school athletes continued to grow as college athletes, and physical strength improved as the school year increased. As physical strength directly affects the health of the general public and the performance of elite athletes, research is being actively conducted from various perspectives. In this regard, studies have also been conducted on changes in physical composition and strength factors for cadets of the Air Force Academy[18][19][20].

When looking at the results of various previous studies related to physical strength as described above, physique and physical strength factors are considered very important for both the general public and elite athletes to improve their health and performance. In addition, it can be seen from the results of previous studies that there are differences in physical strength factors and performance levels according to the increase in school year and age.

This study aims to compare and analyze the physique and physical characteristics of college Taekwondo majors who are not elite athletes but regularly participate in practical classes compared to ordinary students.

A number of previous studies have reported differences in physique and physical strength factors for Taekwondo athletes. This study is distinguished from previous studies in the following aspects. This study targeted college Taekwondo majors; unlike in the past, required courses were reduced and major elective courses were expanded for voluntary class selection; as a result, the number of students enrolled in practical classes decreased as their school year increased; as a result, physical strength and practical ability may decrease.

This study aims to provide basic data for organizing and reorganizing the curriculum for each school year by comparing and analyzing the differences by school year through the measurement of physique and physical strength of college Taekwondo majors.

2. Research Method

2.1. Research subject

This study was conducted with 79 male students enrolled in the Taekwondo Department at K University in D city who voluntarily wanted to participate in this study (27 first-year students, 26 second-year students, 26 third-year students). The physical characteristics of the study subjects are as shown in <Table 1>.

Table 1. Physical characteristics of subject.

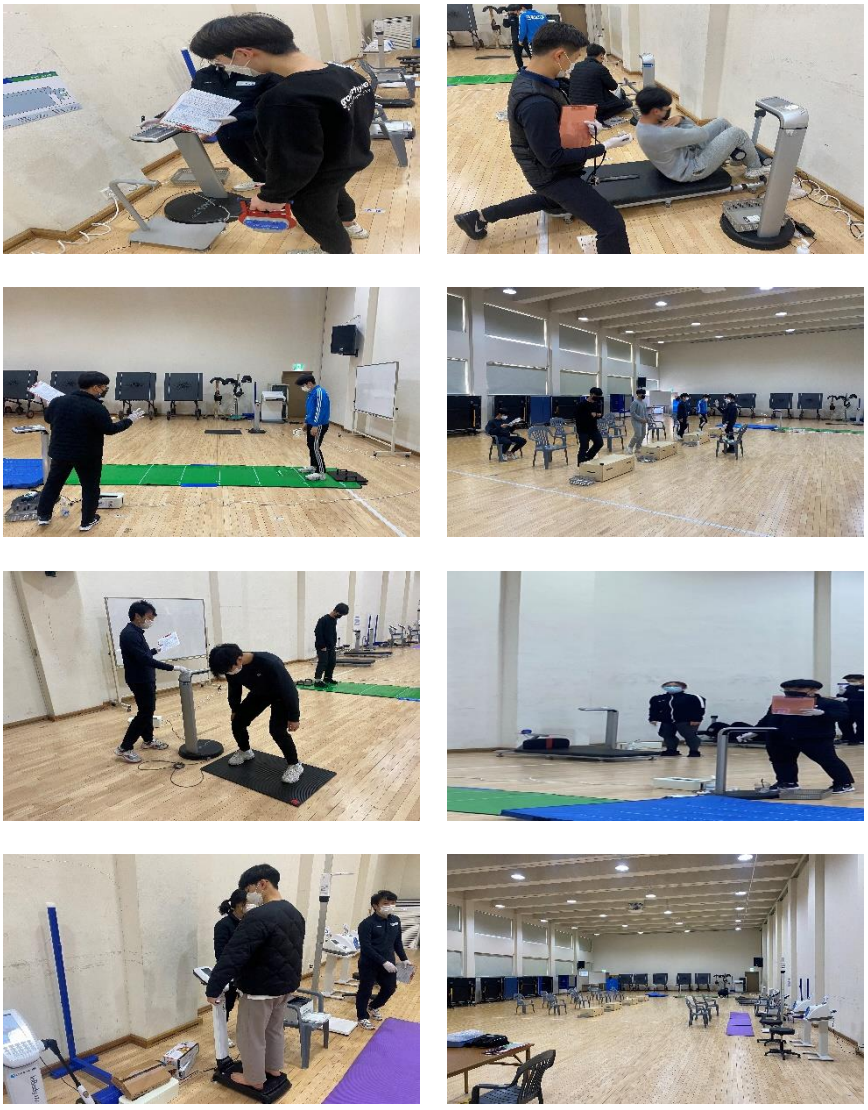
Grade	Age(yr)	Height(cm)	Body weight(kg)	%fa (%)	BMI (kg/㎡)
1(n=27)	19.04±0.19	171.35±6.44	64.30±7.86	16.24±5.56	21.83±1.77
2(n=26)	19.96±0.19	170.31±8.28	68.68±10.85	21.83±8.13	23.53±1.99
3(n=26)	21.15±1.12	169.26±7.48	65.40±10.76	20.84±6.80	22.73±2.84

Note: Values : mean ± SD.

2.2. Measurement items

The physique and physical fitness factors of this study were measured according to the measurement manual of the D Metropolitan City Sports Science Center. The measurement items were body composition, muscle strength (grip strength), muscular endurance (sit-up), cardiorespiratory endurance (Harvard step test), flexibility (Sit & reach), reaction time (sound response), and quickness (Standing long jump).

Figure 1. Image of physique and stamina measurement.



2.3. Data analysis

For the data processing of this study, the mean and standard deviation of each measurement item were calculated using the SPSS 25.0 program. Multivariate analysis of variance (MANOVA) was performed on the differences between groups by measurement item. The statistical significance level was set to p<.05.

3. Results

The results of comparative analysis of physique and physical characteristics according to grade increase among students enrolled in Taekwondo Department of K University in D city are as follows.

3.1. Body composition

<Table 1> shows the results of measurement of the body composition of Taekwondo students by grade level.

Table 2. Body composition.

Items	Group(n)	Mean±SD	F	p	post-hoc
Height(cm)	1(n=27)	171.35±6.44	0.523	0.595	
	2(n=26)	170.31±8.28			
	3(n=26)	169.26±7.48			
Body weight(kg)	1(n=27)	64.30±7.86	1.426	0.246	
	2(n=26)	68.68±10.85			
	3(n=26)	65.40±10.76			
Fat(%)	1(n=27)	16.24±5.56	5.005	0.009	1<2***
	2(n=26)	21.83±8.13			
	3(n=26)	20.84±6.80			
BMI (kg/m2)	1(n=27)	21.83±1.77	3.902	0.024	1<2***
	2(n=26)	23.53±1.99			
	3(n=26)	22.73±2.84			

Note: Values : mean ± SD, **p<.01, ***p<.001.

3.2. Physical fitness factor

<Table 2> shows the results of measurement of physical fitness factors by grade of Taekwondo students.

Table 3. Physical fitness factor.

Items	Group(n)	Mean±SD	F	p	post-hoc
Grip strength(kg)	1(n=27)	38.99±8.55	0.881	0.419	
	2(n=26)	36.27±9.02			
	3(n=26)	36.29±8.28			

Grip strength(kg)	1(n=27)	47.30±9.27	0.187	0.830	
	2(n=26)	48.00±10.07			
	3(n=26)	46.46±8.01			
harvard step test	1(n=27)	49.29±5.86	4.922	0.010	1>3**
	2(n=26)	45.42±6.03			
	3(n=26)	42.83±10.09			
Sit & reach(cm)	1(n=27)	17.89±7.10	1.114	0.334	
	2(n=26)	20.53±6.99			
	3(n=26)	19.35±5.20			
Audio reaction time(sec)	1(n=27)	0.292±0.03	10.477	0.000	1<2***
	2(n=26)	0.343±0.04			
	3(n=26)	0.317±0.05			
Standing long jump(cm)	1(n=27)	230.11±29.93	4.281	0.017	1>3*
	2(n=26)	211.22±28.09			
	3(n=26)	205.19±38.63			

Note: Values : mean ± SD, *p<.05, **p<.01, ***p<.001.

4. Discussion

This study measured, compared, and analyzed the body composition and physical strength factors for Taekwondo majors at K college located in D Metropolitan City. It was conducted for all school years, but data for seniors were excluded from the analysis process of the measurement results. This is because there were not enough participants who were seniors due to field training and early employment in the process of agreeing to voluntary participation after explaining the purpose and contents of this study.

Looking at the measurement results of body composition, there was no statistically significant difference by school year in height and weight. In the case of body fat percentage, 21.83±8.13% of sophomore were statistically significantly higher than 16.24±5.56% of freshmen (p<.001). The body mass index was also statistically significantly (p<.001) higher than 21.83±1.77kg/m2 in freshmen at 23.53±1.99kg/m2. As a result of this study, the body fat percentage and body mass index of freshmen were lower than those of second and juniors. This is consistent with the study that the body fat rate increased due to the decrease in physical activity of most college students due to the COVID-19 pandemic compared to the face-to-face class before the COVID-19 pandemic[21]. Despite the government's strengthened social distancing guidelines, first-year students prepared for intensive entrance exams (practice) for the purpose of entering college. Second and juniors were restricted from using practical labs in colleges due to COVID-19, and practical training hours were reduced due to non-face-to-face classes, indicating higher body fat percentage and body mass index than freshmen.

As a result of comparing and analyzing the differences in physical strength factors by school year, there were no statistically significant differences in grip, sit-ups, and trunk forward flexion.

However, as a result of measuring the long jump in place, which is an evaluation item for muscular strength, the freshmen was 230.11±29.93cm, which was statistically significantly higher than the 205.19±38.63cm of juniors ($p<.05$). There is a prior study comparing physical strength factors such as muscle strength, muscle endurance, quickness, agility, and cardiopulmonary endurance of high school Taekwondo athletes and college Taekwondo athletes[17]. It reported that college students had better records in standing long jump than high school students, which is partially contrary to this study.

In addition, there is a prior study that investigated the status of non-face-to-face practical classes for college sports education following the COVID-19[22]. It was partially consistent with this study, reporting that students were most dissatisfied with the fact that they could not acquire physical education skills while conducting non-face-to-face physical education practical classes.

In addition, according to previous studies[23] analyzing the physical activity and psychological status of college students majoring in dance in COVID-19 situations, the average number of times they went to school before COVID-19 began was the highest at 5 days a week and 3 days a week after COVID-19 began. In the case of arts and physical education-related departments, it is judged that first-year students who continued exercising while complying with the government's social distancing policy showed higher points in evaluation items of physical activity and psychological status than third-year students who had limited practical classes.

As a result of measuring the sound reaction time, it was found that the freshmen were 0.292±0.03 seconds, which was statistically significantly faster ($p<.001$) than the sophomore who had 0.343±0.04 seconds. Considering the results of previous studies[14][24] that better athletes had faster direction changes and visual responses, first-year students, who had relatively short suspension periods and higher frequency of exercise, are considered to be maintaining faster responses to stimuli than second and juniors. According to a recent study[25] on college students' perception of physical exercise in the COVID-19 era, they know the importance of exercise, but report that they could not exercise due to lack of time and knowledge to exercise alone. In addition, in the results of a previous study[26] on college Taekwondo majors' perception of non-face-to-face real-time practical classes using Zoom in the COVID-19 Pandemic era, it was reported that Taekwondo practical skills had difficulty performing specific movements depending on the size of the exercise space. In the case of movements that require dynamic movement, it was reported that training was difficult in a narrow place. In particular, it has been reported that it is difficult to perform Taekwondo movements at home due to noise between floors. The results of these preceding studies are believed to support some of the results of this study, which showed faster response times for freshmen who continued to exercise until relatively recently than for second and juniors who had a longer period of limits of time and the number of people.

As a result of the Harvard Step Test, an item for evaluating cardiopulmonary endurance, the first-year students were 49.29±5.86, which was statistically significantly higher ($p<.01$) than 42.83±10.09 in the third-year students. There is a previous study comparing the difference in maximum oxygen intake, body fat percentage, and constant-speed muscle strength by dividing college Taekwondo athletes into excellent and non-excellent athletes according to their winning experience[27][28]. It was reported that the average maximum oxygen intake of Taekwondo excellent athletes was 57.81±9.4ml/kg/min, and the average maximum oxygen intake of non-excellent athletes was 44.3±9.8ml/kg/min.

It reported the following: Taekwondo competition is held by dividing weight classes. athletes try to lose weight in various ways. Most athletes control their meals and perform an increased volume of aerobic exercise. For quick recovery from fatigue during a short break, training to improve aerobic power is applied.

According to the Normality Test, there is a prior study that tested the determinants of professional fitness and performance of excellent Taekwondo athletes in Thailand, Korea, and Spain [29]. It was mentioned that the competitiveness of contact sports is achieved by coordinated activities of hands and feet, and because it relies heavily on the function of the respiratory circulation system, it is important for training programs to improve the respiratory circulation system through continuous aerobic exercise. There is a study conducted a test to find out the effect of the current situation in which wearing masks has become common due to the COVID-19 pandemic on the cardiopulmonary fitness of adult men. As a result of having the subjects wear various types of masks and conduct exercise load tests on male college students, there was no significant difference according to the type of mask. However, it was reported that wearing a mask affected the exchange function during maximum load exercise, reducing aerobic performance such as maximum oxygen intake and ventilation threshold [30].

There is another study that studied the effect of wearing a mask due to COVID-19 on breathing and cardiovascular response [31]. It applied 4km/h-1 walking (light exercise) for 20 minutes, 6km/h-1 walking (middle-level exercise), and 8km/h-1 running (high-intensity exercise) exercises. As a result, blood pressure and ventilation increased when 8 km/h-1 running exercise was performed. It is reported that the psychological burden of wearing a mask and doing aerobic exercise had an effect on the reduction of cardiopulmonary endurance. This study did not directly measure the maximum oxygen intake, but calculated the physical efficiency index through the Harvard Step test used to evaluate cardiopulmonary endurance.

It may be difficult to directly compare the results of previous studies, but first-year students showed a higher tendency than second-year students. In addition, statistically significantly higher than that of juniors is believed to have been affected by the long and short duration of exposure to the COVID-19 pandemic situation and the suspension time of exercise.

The discussion of physical strength factors can be summarized as follows. There are the results of previous studies by [17] and [32] that showed that physical strength such as muscle strength, agility, balance, and flexibility improved as the school year increased. In contrast, in the results of this study, the lower the school year, the higher the agility, response time, and cardiopulmonary endurance. Considering the results of a number of previous studies [23][25][33], it is believed that the decrease in the frequency of face-to-face classes due to COVID-19 had an effect. In particular, in the case of non-face-to-face practical classes, it is believed that the actual amount of physical activity was reduced compared to the face-to-face practical practice.

There is a previous study that analyzed the effect of college athletes' exercise stress on emotional factors in the COVID-19 situation [34]. It was reported that the temporary closure of the training center created anxiety among college athletes and reduced confidence. In the COVID-19 situation, there is a prior study on elite corporate-sponsored, professional, and college athletes on emotional awareness, psychological experience, and coping methods of adult athletes [35]. It was reported that the specific situation of COVID-19 increased the psychological burden by reducing the sense of competition and athletic performance due to various training restrictions, resulting in increased anxiety. This study compared and analyzed the differences by school year through the actual physique and physical strength measurement of Taekwondo students in a new non-face-to-face environment called COVID-19 for Taekwondo students in a specific area. Through this, although practical classes through face-to-face are very important to acquire various skills of Taekwondo, some negative effects of school year increase were confirmed as mentioned in previous studies [36] of high school and college Taekwondo athletes who quickly adapted to the non-face-to-face-to-face environment.

5. Conclusions

The subjects of this study were Taekwondo majors enrolled at K University in D city, 27 first graders, 26 second graders, and 26 third graders (total 79), and the characteristics of body composition and physical fitness factors were compared and analyzed.

As a result of body composition measurement, body fat percentage and body mass index were statistically significantly higher in second grade than in first grade.

As a result of measuring the physical fitness factors, it was found that the first graders were statistically significantly higher than the third graders in the Harvard Step test, which is an evaluation item for cardiorespiratory endurance. The sound reaction time was found to be statistically significantly faster in the first year students than in the second year students. The stand-up long jump, which is a quickness evaluation item, was statistically significantly higher in first-year students than in third-year students.

In conclusion, it is considered that the decrease in the frequency of use of the practical practice space and face-to-face classes in the university due to COVID-19 had a negative effect on the physical composition and development of physical fitness of Taekwondo students. Based on the results of this study, it is thought that it is necessary to seek ways to improve the physical strength and practical ability of Taekwondo students.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	JS	-Set of concepts☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	JS	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	DJ MJ MG	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Analysis of Indicators Related to Adult Disease in Middle-Aged Obese Women in Korea

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Abstract

Purpose: *The purpose of this study is to compare and analyze the differences in adult disease related indicators according to the presence or absence of obesity for a healthy life and prevention of the adult diseases for the middle aged women.*

Method: *In this study, the raw data of the 8th 1st year of the 2019 Korea National Health and Nutrition Examination Survey (KNHANES 2019) was downloaded and reprocessed for use according to the purpose of study. A total of 8110 males and females participated in the 2019 Korea National Health and Nutrition Examination Survey, of which 4381 females were extracted. From the data of 4381 women, 658 people in their 40s (ages 40-49) were extracted, of which 598 people were selected as the study subjects, excluding 26 underweight and 34 missing people. For the statistical processing, the mean and standard deviation of all questions were calculated by using SPSS 27.0 package. In order to compare the differences among the adult disease related indicators for the women according to obesity, t-test was conducted to compare the differences for each measurement question according to the presence or absence of obesity. The statistical significance level was based on p<.05, respectively.*

Results: *In terms of the differences in the blood lipids related variables according to obesity, TC, TG, and LDL-C turned out to be significantly higher in the obese group than in the normal group (TC; p<.01, TC; p<0.001, LDL-C; p<0.5). and HDL-C turned out to be significantly (p<.001) higher in the normal group than in the obese group. In terms of the hypertension related variables, the systolic and diastolic blood pressures turned out to be significantly higher in the obese group than in the normal group (systolic: p<.001, diastolic: p<.01), respectively. The diabetes related variables turned out to be significantly (p<.001) higher in the obese group than in the normal group in fasting blood sugar, glycated hemoglobin, and insulin concentration, respectively.*

Conclusion: *Gathering the results above, it was evident that obesity among women in their 40s are more likely to contract adult diseases such as blood lipids, high blood pressure, and diabetes. In the future studies, it is considered that additional analysis of age, gender and related variables are necessary.*

[Keywords] ***Obesity Women, Adult Disease, Blood Lipids, Subjective Recognition of Body Type, Korea National Health and Nutrition Examination Survey***

1. Introduction

Obesity is a very prevalent disease across the globe, and it not only imposes a huge health and economic burden on any society, but is also closely related to the metabolic syndrome [1][2]. Obesity is known to be the largest cause of changes in diet and decrease in physical activities, and also has a phenomenon that increases along with metabolic syndrome [3]. In a study on the prevalence of metabolic syndrome, it was reported to be higher in women than in men [4], and obesity has been reported to increase the risk of vascular and neurological complications such

*The Eighth Korea National Health and Nutrition Examination Survey (KNHANES Ⅷ-1), Korea Disease Control and Prevention Agency (2019).

as atherosclerotic cardiovascular disease, insulin resistance, diabetes, and cerebrovascular accidents, respectively[5][6].

Obesity causes high blood pressure, and weight loss is a common way for its improvement, yet it is difficult to address obesity because overweight and obese people consume more calories to maintain their weight. Furthermore, an additional food intake triggers a higher sodium intake, leading to a high prevalence of obesity[7].

Obesity is closely related with dyslipidemia, and drug dyslipidemia among the obese patients is characterized by high triglycerides and low high density lipoprotein cholesterol (HDL-C), while the high low density lipoprotein cholesterol (LDL-C) causes arteriosclerosis as the factor of inducement[8]. Numerous studies have demonstrated that those with higher levels of LDL-C have a higher risk of myocardial infarction and more abdominal fat accumulation. It has also been reported that the increased total cholesterol and LDL cholesterol are common yet primarily associated with the saturated fat consumption and not so much with weight gain and obesity[9]. Furthermore, obesity is primarily caused by insulin resistance and pro-inflammatory adipokines, and vitamin D deficiency has been reported to affect adipose tissue function and lipid status in obesity. However, it has been reported that metabolically healthy obesity has a low correlation with dyslipidemia[10][11].

Diabetes has been associated with the increased risk of atherosclerosis, coronary heart disease (CHD) and peripheral arterial disease, and even for those without diabetes, fasting blood glucose concentration and glycated hemoglobin (HbA1c) are associated with the risk of vascular disease[12][13]. Obesity and diabetes are both associated with the increased risk of cancer, and this is a worrisome trend for cancer rates given the increasing prevalence of obesity and diabetes across the globe. The relationship between hyperinsulinemia, chronic inflammation, and antihyperglycemic drugs has been identified as a basic mechanism, and the most common obesity and diabetes related cancers are reported as endometrial cancer, colorectal cancer, and postmenopausal breast cancer[14]. Examining the studies related to overweight and obese women, the Gestational Diabetes Mellitus (GDM:) is increasing with obesity[15], and drug treatment and diet are primarily used[16]. In the early stage of GDM, treatment is started with diet and exercise, and if such measures do not reach the blood sugar target, insulin therapy is implemented[17].

In general, the obese patients are known to have a much stronger muscular strength than the normal or underweight patients, and it has been reported that the obese patients with sarcopenia have weakened their muscular strength[18][19]. Furthermore, a study evaluating the effects of resistance training on muscular strength, abdominal obesity metabolic risk, and inflammatory markers among the postmenopausal women reported an improvement in their muscular strength and a decrease in fat after high intensity resistance training[20]. In particular, the sarcopenic obesity is characterized by a low skeletal muscle mass, and is often seen among the middle aged and older women. For the prevention and treatment of obesity and hypothyroidism, it has been reported that the resistance exercise improves muscle mass and strength and decreases fat mass[21]. In 2013, 19.9% of the European women aged 50 or older were affected by obesity, and it was reported that the highest prevalence rate was 21.6% for those aged 70 or older[22].

In the study of subjective recognition of body type related to obesity, the self-perceived body image of the Korean women is garnering much attention due to the unhealthy weight control behavior. It has been reported that the younger and the higher the underweight ratio, the more likely they perceived their body size as being normal or overweight, and that the incorrect body image recognition and unhealthy weight control behavior caused various problems[23].

As for the obesity related adult diseases, the prevalence of various diseases such as metabolic syndrome, dyslipidemia, hypertension, and diabetes are present together. Hence, the purpose of this study is to compare and analyze the differences among the adult disease related indicators according to the presence or absence of obesity for a healthy life and prevention of adult diseases among the middle aged women.

2. Research Method

2.1. Research subject

This study is a secondary analytical study using the raw data of the 8th 1st Korea National Health and Nutrition Examination Survey (KNHANES 2019) conducted by the Ministry of Health and Welfare and the Korea Centers for Disease Control and Prevention. When downloading the data, a consent was made for the collection and use of personal information for the Korea Centers for Disease Control and Prevention, and the agreement to comply with the statistical data users was reached. A total of 8110 males and females participated in the 2019 Korea National Health and Nutrition Examination Survey, and among which, 4381 females were extracted with priority.

From the data of 4381 women, 658 people in their 40s (ages 40-49) were extracted, and 598 people were selected as the study subjects, excluding 26 underweight and 34 missing people. The physical characteristics of the study subjects are as illustrated in <Table 1>.

Table 1. Physical characteristics of the study subjects.

	Age (yr)	Height (cm)	Weight (kg)	BMI (kg/m2)	Waist (cm)	Neck (cm)	People (n)
Obese	44.86 ±2.93	159.26 ±5.54	67.41 ±9.35	26.57 ±3.37	86.71 ±8.46	31.60 ±1.28	268
Normal	44.47 ±2.89	160.70 ±5.21	54.30 ±4.54	21.01 ±1.24	73.70 ±4.78	34.20 ±1.98	330
t-value	-1.655	3.278***	-22.431***	-27.799***	-23.615***	-19.262***	

Note: Mean and standard deviation, ***p<.001.

2.2. Research tools and variables

The 2019 8th 1st Korea National Health and Nutrition Examination Survey is consisted of basic variables, health survey, screening survey, and nutrition survey. In this study, 658 women aged 40-49 years were extracted based on the number of years of age since their conception as the basic variable. Furthermore, the obesity prevalence variables were recoded to exclude underweight (26 patients) and missing values (34 patients), while 330 normal and 268 obese patients were used in line with the purpose of this study.

In the health survey and screening survey, the factors related to the adult diseases were classified into 5 categories and were consisted of blood lipids, high blood pressure, diabetes, muscular strength, and subjective perception. The specific definitions of the variables used in the study are as follows.

2.2.1. Blood lipids variables

Blood lipids variables: TC (total-cholesterol), HDL-C (high-density lipoprotein), TG (triglycerides) were used without processing the raw data, while LDL-C (low-density lipoprotein) is the formula according to the Friedewald equation Calculated LDL-C was calculated using the formula (LDLc=TC-(TG/5+HDLc)).

2.2.2. Hypertension and diabetes variables

Hypertension-related variables: Systolic blood pressure (SBP), diastolic blood pressure (DBP), and 60second pulse rate (60s HR) were used as the raw data.

Diabetes-related variables: FBS (Fasting Blood Sugar), HbA1c, and Insulin were used as raw data.

2.2.3. Muscular strength and the subjective awareness variables

As for the grip strength, the average value was derived and used by adding the results of the first, second, and third measurements. The subjective health perception was 1 = very good, 2 = good, 3 = average, 4 = bad, 5 = very bad, and the subjective recognition of body type was 1 = very bad, 2 = slightly skinny, 3 = average, 4 = slightly obese, and 5 = very obese used the raw data for the 5-point Likert scale.

2.3. Data processing

This study used the data published in the 2019 Korea National Health and Nutrition Examination Survey, and as for the statistical processing, the mean and standard deviation of all questions were calculated by using the SPSS 27.0 package. In order to examine and understand the difference in the adult disease-related indicators of women according to obesity, the t-test was conducted to determine the difference in each measurement question according to the presence or absence of obesity. The statistical significance level was based on $p<.05$, respectively.

3. Results

The results of analyzing the indicators related to adult diseases according to obesity are as follows.

3.1. Blood lipids related variables

The results of analyzing the differences in the lipid components according to obesity are as illustrated in <Table 2>.

Table 2. Comparison of lipid components according to obesity.

	TC (mg/dL)	HDL-C (mg/dL)	TG (mg/dL)	LDL-C (mg/dL)
Obese	201.37 ±33.46	54.33 ±11.28	125.25 ±86.05	121.72 ±32.24
Normal	194.28 ±30.56	61.07 ±11.96	87.33 ±55.57	115.66 ±27.01
t-value	-2.677**	6.950***	-6.383***	-2.451*

Note: Mean and standard deviation.

The differences in the lipid-related components according to obesity are as illustrated in <Table 2>. TC, TG, and LDL-C turned out to be significantly higher for the obese group than for the normal group (TC; $p<.01$, TC; $p<0.001$, LDL-C; 0.5), while HDL-C turned out to be significantly higher in the normal group than in the obese group ($p<.001$), respectively.

3.2. Hypertension and diabetes-related variables

The results of comparing the differences in the diabetes-related variables according to the presence or absence of obesity are as illustrated in <Table 3>.

Table 3. Comparison of the hypertension and diabetes-related variables according to obesity.

	SBP(mmHg)	DBP(mmHg)	60s HR	FBS (mg/dL)	HbA1c (%)	Insulin (μU/mL)
Obese	115.03 ±14.25	75.78 9.29	58.67 17.89	100.79 ±19.52	5.6819 ±0.67	10.10 ±6.79
Normal	109.75 ±12.03	73.60 8.29	54.4 5.76	92.83 ±17.89	5.4544 ±0.48	6.03 ±3.23
t-value	-4.817***	-2.995**	-.788	-4.964***	-4.781***	-9.504***

Note: Mean and standard deviation.

<Table 3> illustrates the differences between hypertension and diabetes-related variables according to obesity. The hypertension-related variables, systolic and diastolic blood pressure, turned out to be significantly higher in the obese group than in the normal group (systolic: p<.001, diastolic: p<.01), yet there was no significant difference in terms of the heart rate at 60 seconds. Furthermore, the diabetes-related variables turned out to be significantly (p<.001) higher in the obese group than in the normal group in fasting blood sugar, glycated hemoglobin, and insulin concentration.

3.3. Muscular strength and subjective cognition related variables

<Table 4> illustrates the differences in the muscular strength and subjective cognition-related variables according to obesity.

Table 4. Differences in muscular strength and subjective recognition-related variables.

	Grip(L)kg	Grip(R)kg	Subjective	
			Health awareness	Body type recognition
Obesity	52.57 ±10.78	54.80 ±11.45	2.87 ±0.77	4.18 ±0.59
Normal	51.70 ±8.77	53.66 ±9.65	2.68 ±0.74	3.10 ±0.57
t-value	-1.080	-1.297	-3.006**	-22.576***

Note: Mean and standard deviation.

The differences in terms of the muscular strength and subjective recognition-related variables according to obesity are as illustrated in <Table 4>. As for the muscular strength related variables, there was no significant difference demonstrated in terms of the grip strength (left, right), and subjective awareness turned out to be significantly higher in both the health and body type recognition (health: p<.01, body type: p<.001).

4. Discussion

4.1. Blood lipids

As a result of this study, TC, TG, and LDL-C among the lipid-related components according to obesity turned out to be significantly higher in the obese group than in the normal group (TC; p<.01, TC; p<.001, LDL-C; p< .5), while HDL-C turned out to be significantly (p<.001) higher in the normal group than in the obese group. Such results demonstrated that the obese group had a result value related to dyslipidemia, and on the contrary, the HDL-C turned out to be higher

in the normal group. Examining the related studies, abnormal lipid metabolism is very commonly observed among obese patients, and approximately 60 to 70% of them are dyslipidemia. among the obese patients with lipid abnormalities, TG, VLDL, and Apo B levels turned out to be high, while HDL-C and Apo AI levels turned out to be low[24]. Furthermore, while the level of LDL-C turned out to be within the normal range, an increase in the level of VLDL-C is a cause of arteriosclerosis, and hence, attention ought to be paid thereto[25].

4.2. Hypertension and diabetes-related variables

As a result of this study, the difference between hypertension and diabetes-related variables according to obesity turned out to be significantly higher in the obese group than in the normal group (systolic: $p<.001$, diastolic: $p<.01$), yet there was no significant difference in terms of the 60second heart rate. Furthermore, the fasting blood glucose, glycated hemoglobin, and insulin concentrations turned out to be significantly ($p<.001$) higher in the obese group than in the normal group. Such systolic and diastolic results suggest that the obese group has a higher risk of hypertension and cardiovascular disease than the normal group. Furthermore, the fact that the fasting blood glucose, glycated hemoglobin and insulin concentrations turned out to be high in the obese group confirmed the fact that obesity was closely related to diabetes.

As for the related studies, according to a study on the effect of abdominal obesity and drinking on high blood pressure in adults, it was reported that the risk of prevalence of hypertension increased rapidly during dangerous drinking accompanied by abdominal obesity[26].

According to a study that investigated the effects of physical activity, body mass index, and depression on health-related quality of life according to the presence or absence of hypertension in elderly women, age, education, physical activity, body mass index, and depression were significant predictors for health-related quality of life. In addition, it was reported that the higher the amount of physical activity and the lower the body mass index, the lower the depression, the higher the health-related quality of life[27]. In a study on hypertension and weight loss, arterial hypertension, overweight, and obesity are closely related. And, it was reported that weight loss has a positive effect on blood pressure, and obese patients with high blood pressure need weight management[28].

Furthermore, many studies on the relationship between obesity and diabetes are currently conducted. The co-morbidity of obesity and diabetes is high worldwide and is also primarily caused by the 2 factors of insulin resistance and insulin deficiency[29]. It has also been reported that obesity, diabetes, and metabolic syndrome are the factors which place an excessive burden on the heart in the studies of diabetes and cardiovascular disease, and it has been reported that if either one returns to normal, the prevalence of the cardiovascular disease is lowered[30].

4.3. Muscular strength and subjective recognition-related variables

There was no significant difference in terms of the difference as for the grip strength (left, right) according to obesity, and the subjective recognition turned out to be significantly higher in both health and body type recognition in the obese group (health: $p<.01$, body type: $p<.001$). The results of the subjective awareness and body shape recognition suggest that these women have poor health awareness and poor body shape recognition. Furthermore, while there was no significant difference in terms of grip strength, muscular strength training in obese female patients is important in the long term, suggesting that the strength training should be performed concurrently with the prevention of metabolic syndrome for old age. Examining the previous studies related thereto, a cohort study conducted in the UK reported that when the grip strength increased, and the waist circumference also increased, the sarcopenic obesity was reversed in the report on the obesity and muscular strength in men and women[31][32]. The studies on the health awareness targeting obese people are very inadequate, and in the studies on the mental health status and the health-related life related practice of the middle-aged

women, the women who participate in the regular exercise reported to have a higher health awareness[33]. In the research papers related to the body type recognition, it was reported that the body type recognition of the normal and obese people with obesity had different patterns and that the obese women performed more weight control than the normal women[34].

5. Conclusion

Gathering the results above, it was evident that the obesity in women in their 40s had a high correlation with the blood lipids, hypertension, and the diabetes-related vales, and the management of related indicators was important to prevent the adult diseases. In the future studies, it is considered that the additional analysis of age, gender, and related variables in greater detail will be necessary.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	WC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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A Study on the Factors of Influence for the Acceptance of Nuclear Power Generation: With a Focus on the Enhancement of Corporate Image Via Sports Cultural Marketing

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Abstract

Purpose: *The purpose of this study is to structurally examine and understand how the acceptance of nuclear power generation occurs via the sports cultural marketing activities for enhancing corporate image.*

Method: *In this study, a quantitative study via a questionnaire was conducted for men and women aged 20 years or older residing in area K. In a survey conducted for 500 residents in the nuclear power plant area, a sample of 456 (91.2%) people was extracted, and the results of the survey were analyzed by using the PASW18.0 and the AMOS 18.0 statistical programs, while the hypothesis was tested at the level of statistical significance at p<.05.*

Results: *As a result of the correlation analysis performed, the relationship between the constructs turned out to be a positive (+) correlation, and hence, the direction of the relationship between the variables presented by the research model and the research hypothesis was consistent, while the significance level also satisfied p<.05. As a result of the fit of assessment performed for the research model, IFI=.979, FMIN=.229, NFI=.973, RMSEA=.076, TLI=.986, and CFI=.979 were demonstrated. The overall fit index demonstrated in the research model was $\chi 2(41)=104.032$, p<.000. Hypothesis 1 was dismissed as the relationship between the sports cultural marketing and the acceptance of nuclear power generation of Hypothesis 1 (Estimate=.005, C.R.=.080) had no significant effect at the level of significance p<.05. Furthermore, the relationship between the sports cultural marketing and the corporate image of Hypothesis 2 (Estimate=.652, C.R.=14.299) turned out to have a significant influence at the level of significance p<.001, and hence, Hypothesis 2 was adopted. Hypothesis 3 was adopted since the relationship between the corporate image and the acceptance of nuclear power generation (Estimate=.541, C.R.=8.865) of Hypothesis 3 turned out to have a significant effect at the level of significance p<.001.*

Conclusion: *Gathering the results above, first, the KHNP's sports cultural marketing activities did not directly influence the acceptance of nuclear power generation as a matter of causal variable. Second, the KHNP's sports cultural marketing ought to be utilized as a means for increasing the acceptance of nuclear power generation by local residents through the zero high corporate image while acting as a major activity to enhance the corporate image. Accordingly, it is evident that the sentiment induced by the KHNP's sports cultural marketing activities will operate as an important tool in shaping the general local residents' reaction towards the KHNP.*

[Keywords] ***Acceptance of Nuclear Power Generation, Sports Cultural Marketing, Corporate Image, Social Contribution, Policy Acceptability***

1. Introduction

1.1. Need and purpose of the study

Nuclear power has no resources to completely replace nuclear power for the production of electricity essential for the growth of national industries. Despite recent efforts to promote alternative energy such as wind and solar power, and considering the current technology and social situation, reducing or abandoning nuclear power cannot be a viable policy alternative.

While the nuclear power plays a very important role in making contribution to the nation's electricity production, it does pose a risk in that it might threaten the people's lives and the ecological environment at any time[1]. In particular, since the Fukushima nuclear incident in Japan in 2011, it was confirmed that such risks are in the peripheries of real day to day life. In the case of Japan, they were proud of the safety of their nuclear power plants, and many experts did not foresee as to whether the accident at a nuclear power plant in Japan would bring about unexpected consequences. After the Fukushima nuclear power plant explosion, which caused unimaginable damages, many changes have taken in the positive perceptions of nuclear energy[2].

Varied support for the residents within the vicinity of nuclear power plants is very important compared to other areas in terms of improving the quality of life of local residents living near hazardous facilities such as nuclear power plants and enhancing equity with other areas, and such can help to increase the confidence and reduce conflicts. Among the various support projects extended for the residents within the vicinity of nuclear power plants, the priority is to improve the living environment by using the social overhead capital.

Following which, the health and medical support service projects for local residents and health related health care services account for a large portion. A program which combines sports and culture in terms of the health care services is among the representative projects for residents within the vicinity of nuclear power plants. It is necessary to examine and understand as to whether the currently implemented sports cultural marketing project actually satisfies the needs of residents. In particular, it has been known that the local residents' satisfaction with the acceptance of nuclear power generation originate from various efforts of the KHNP, yet it is necessary to examine and understand as to whether sports cultural marketing has a mediating effect[3].

Sports and cultural events are closely related to such phenomena as politics, culture, economy, and tourism. Beyond the fundamental dimension of exchange and understanding through sports, sometimes as a means of concealment for the public manipulation, sometimes as a medium for economic profit generation via product marketing and tourist attraction, or as a means of social integration through the sales of the society and culture and group immersion, sports are utilized as a venue[4].

In general, companies have made much effort towards achieving the goal of generating large management profits through productivity improvement, management innovation, and efficiency with the goal of profit generation[5]. Recently, companies have pursued other strategies given the limitations of brand differentiation strategies by using external factors including product quality and price. Among them was sports sponsorship. Many private and public companies are attempting to improve their corporate image by encouraging local residents to have a positive attitude towards sports sponsorship by participating in major sports programs[6].

Recently, many companies have used social contribution activities as a strategy to help improve their corporate image and differentiate their brands. Since the importance of corporate social responsibility in society has increasingly become important, companies are expanding their responsibility and interest in society as a whole beyond the phase of pursuing economic benefits. Such social contribution activities are used as an area included among their social responsibility activities, and examining the definition of social responsibility activities, in a study, it was defined as the economic, legal, and ethical responsibilities which a company must perform, and also as an act that is voluntary and strategically practiced for the purposes of public interest[7]. The effect of a company's social contribution activities not only has a positive effect on the corporate image to consumers, yet also increases the consumer's intent to purchase[5][8].

Such social contribution activities have been carried out in various ways in the overall areas of society. In particular, recently, the number of cases of contribution activities carried out such as those by the central government, local governments, public enterprises, and professional athletic clubs has increased[9]. Largest examples include 'SK Wyverns Green Volunteer Corps', an environment related activity, 'FC Seoul Happiness Plus' providing support for the educational expenses for multiple children of low income families, and 'Rooney-Huinjeong's Spike of Love' for Hyundai Capital's professional volleyball team fundraising for children with leukemia, may be seen among the social contribution activities carried out through sports.

Social contribution activities combined with sports are consistently expanding from a corporate strategic point of view, and furthermore, corporate objectives are linked to the social contribution activities. In the future, such a trend will be further expanded, and the proportion of social contribution activities carried out for the purposes of enhancing corporate image and securing brand assets is expected to increase[10]. Social contribution activities, including sports, have a high interest in the media, and the effect of exposure is quite large to that extent[11].

The confidence in a company or brand evaluated by the consumers today has become the asset of the company and the brand[12]. That is so because the confidence in a company or brand is an important motivator for the consumers to consume, and at the same time, provides a sense of comfort and satisfaction[13]. In a dualistic model study between the corporate association and brand affinity, it was claimed that the corporate capability association has had a positive effect on the confidence in individual brands[14], and that the product related factors of corporate image has had a positive effect on the brand confidence[15]. In general, confidence in a company affects the attitudes of consumers. The concept of attitude is defined variously by scholars, but the common characteristic is that attitude is learned and produces a consistent response. Attitude is the attitude of consumers towards a specific company, and it has been reported in many previous studies[16][17] that it is affected by the company's confidence. However, it was presented that the attitude may also be converted into beliefs and return to companies[18]. Naturally, it is the attitude towards advertising, not attitude, yet their study suggests that the attitude can also affect the confidence. Furthermore, in other studies, when the research hypothesis was tested after excluding the attitude towards the product from the research model, the research model in which the influence of the attitude towards the company and the positive influence on the intent to purchase was more appropriate. In a future study, it was proposed that the causal relationship between attitude and confidence be re-validated[19].

In light of the details above, it is necessary to articulate as to whether a structural relationship is formed in connection with the confidence and attitude towards the company through a positive information through the social contribution activities in the sports sector of the company. In particular, it is necessary to closely examine the influence of the residents of the nuclear power plant on various projects to enhance the confidence and corporate image of the KHNP.

Considering such, the purpose of this study is to structurally examine as to how the acceptance of nuclear power generation occurs through the sports cultural marketing activities to enhance the corporate image.

1.2. Model of research

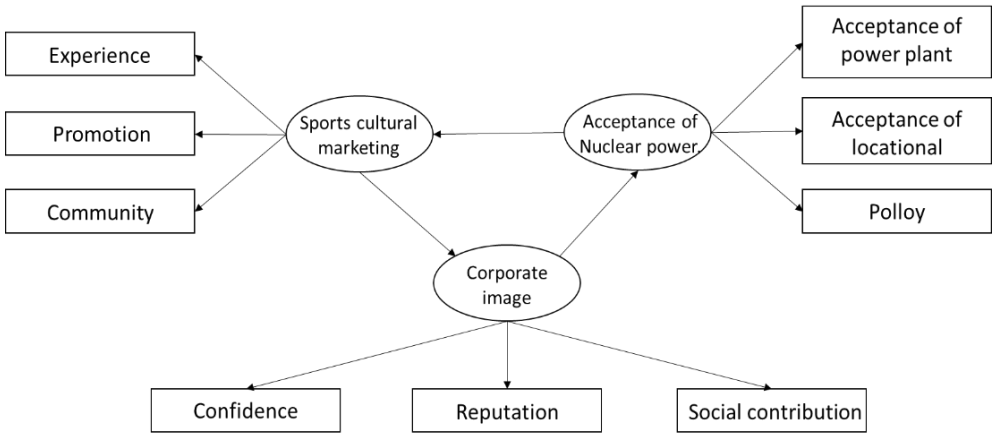
The ultimate purpose of this study is to learn about what methods may be used to accept nuclear power generation from an even more positive perspective by the local residents of nuclear power plants. Among the factors influencing the acceptance of nuclear power generation, it is important to articulate the fact that confidence, reputation, and social contribution towards the KHNP act as causative variables for the acceptance of nuclear power generation, and the sports cultural marketing acts as a causative variable to enhance corporate image. Based on the results of the previous studies of comprehensively organized factor variables, the research

model illustrated in <Figure 1> was presented based on the logical relevance of causal relationships, and the fit of the research model was validated.

As illustrated in <Figure 1>, sports cultural marketing (experience, publicity, and community) can have a positive (+) effect on the acceptance of nuclear power generation, and the sports cultural marketing has a positive (+) effect on corporate image, and as for the KHNP's corporate image factors (confidence, reputation, and social contribution), a structural model was established, which might have a positive (+) effect on the acceptance of nuclear power generation.

This study seeks to examine not only the effect of the independent variables selected via the previous studies on the acceptance of nuclear power generation, which is the dependent variable, but also the structural relationship of how the relationship between the selected independent variables operates on the dependent variable.

Figure 1. Model of the study.



That is, the direction of the causal relationship between the sports cultural marketing and the corporate image has been determined, and the corporate image and the acceptance of nuclear power generation have been proven through the previous studies. However, the studies on the causal model of sports cultural marketing, corporate image, and acceptance of nuclear power generation are yet inadequate.

Hence, the hypotheses tested in this study were established as follows.

H 1: The sports cultural marketing will have a positive (+) influence on the acceptance of nuclear power generation.

H 2: The sports cultural marketing will have a positive (+) influence on the corporate image.

H 3: The corporate image will have a positive (+) influence on the acceptance of nuclear power generation.

H 4: The corporate image will mediate the acceptance of nuclear power generation via the sports cultural marketing.

2. Research Method

2.1. Research subjects and sampling

In this study, the men and women aged 20 years or older residing in city K were set as the population, and the survey was conducted for 1 month from September to October 2019.

Table 1. Demographic characteristics of the survey subjects.

Variable	Classification	Frequency (people)	Percentage (%)
Gender	Men Women	215 241	47.1 52.9
Age	Less than 40 40 or older and less than 60 60 or older	187 224 45	41.0 49.1 9.9
Region	Kyeongju region Other regions	456 0	100.0 0.0
Occupation	Relevant institutions Other institutions	0 456	0.0 100.0

The questionnaire was conducted through a face-to-face interview by a trained surveyor, and the convenience sampling method and self-assessment entry method were used for sampling. A total of 500 samples of the questionnaires were collected, and a total of 456 (91.2%) valid samples were obtained, excluding 44 questionnaires containing insincere data and non-responses. The demographic characteristics of the survey subjects are as illustrated in <Table 1>.

2.2. Structure of the measurement tools

This study sought to examine and understand the relationship between the corporate image and the acceptance of nuclear power generation perceived by the residents towards the KHNP's sports cultural marketing activities. In order to validate as to whether sports cultural marketing's activity type operates as a leading factor in enhancing the corporate image, a measurement tool was constructed to examine as to whether the corporate image has a mediating effect.

As for the structure of the measurement tool used for this research model, the sports cultural marketing variable was consisted of a total of 15 questions, consisting of 5 questions for experiential sports culture support, 5 questions for sports culture promotion, and 5 questions for community activation, while the corporate image variable was consisted of 5 questions of corporate confidence, 5 questions of corporate reputation, and 5 questions of social contribution image. Furthermore, a total of 49 questions were consisted of 4 questions on the demographic characteristics, and all questions were structured based on a 5-point Likert scale.

Table 2. Analytical results of the confirmatory factors.

Variable	Questions	Estimate	S.E.	C.R.	AVE
Confidence	TRU 1	3.904	.040	104.817***	.511
	TRU 4	3.846	.040	96.852***	
	TRU 5	3.803	.040	95.605***	
	TRU 3	3.800	.040	95.173***	
	TRU 2	3.776	.040	94.806***	
Reputation	REP 1	4.026	.037	109.663***	.367
	REP 5	3.947	.039	100.397***	
	REP 3	3.831	.039	98.169***	
	REP 4	3.827	.039	97.546***	
	REP 2	3.658	.039	94.233***	
Contribution	IMA 1	3.912	.037	105.284***	.507
	IMA 4	3.879	.038	100.956***	
	IMA 5	3.846	.040	96.266***	
	IMA 2	3.816	.038	99.275***	
	IMA 3	3.645	.043	84.892***	
Experience	EXP 1	4.151	.037	111.703***	.506
	EXP 5	4.039	.041	99.020***	
	EXP 3	4.035	.039	103.816***	

	EXP 4	3.963	.042	94.561***	
	EXP 2	3.726	.042	88.142***	
Publicity	PUB 1	4.217	.036	117.445***	.475
	PUB 5	4.086	.038	108.595***	
	PUB 3	4.066	.036	111.470***	
	PUB 4	3.987	.039	102.171***	
	PUB 2	3.798	.041	91.767***	
Community	COM 1	4.202	.036	116.597***	.555
	COM 3	4.090	.038	108.777***	
	COM 5	4.044	.040	101.225***	
	COM 4	3.932	.041	95.613***	
	COM 2	3.853	.039	97.935***	
Nuclear A	NUA 5	3.634	.050	73.161***	.832
	NUA 4	3.621	.051	70.880***	
	NUA 3	3.393	.049	68.647***	
	NUA 1	3.583	.053	68.078***	
	NUA 2	3.180	.057	55.331***	
Region A	REA 1	3.423	.056	61.477***	.807
	REA 5	3.327	.053	62.369***	
	REA 3	3.292	.052	63.805***	
	REA 4	3.164	.057	55.826***	
	REA 2	3.116	.058	53.694***	
Policy A	POA 2	3.270	.049	67.022***	.883
	POA 3	3.250	.051	64.213***	
	POA 1	3.197	.050	64.350***	
	POA 4	3.182	.049	65.485***	
	POA 5	3.116	.053	58.795***	
Model fit	$\chi 2$=2472.270(df=909, p=.000), RMSEA=.061, NFI=.882, RFI=.817, IFI=.922 TLI=.915, CFI=.922				

Note: ***p<.001.

2.3. Data processing method

The statistical processing of the data collected to conduct this study was based on the SPSS Ver. 18.0 statistical package program and the Amos 18.0 program, which were used for computational processing according to the purposes of data analysis, and the statistical techniques used are as follows. First, the frequency analysis was performed to examine and understand the demographic characteristics of the sample. Second, the confirmatory factor analysis and correlation analysis were performed to analyze the validity of the questionnaire. Third, the structural equation model was used to analyze the causal structure of sports cultural marketing, corporate image, and acceptance of nuclear power generation.

3. Results

3.1. Correlation analysis

As a result of the correlation analysis performed by using SPSS, and as illustrated in <Table 3>, the relationship between the constructs turned out to have a positive (+) correlation, and given which, the direction of the relationship between the variables presented by the research model and the research hypothesis turned out to be consistent, and the significance level also satisfies p □.05. However, the correlation coefficient between the sports cultural marketing and the acceptance of nuclear power generation turned out to be slightly lower than that of the other variables.

Table 3. Correlation analysis.

	1	2	3	4	5	6	7	8	9
Confidence	-								
Reputation	.789**	-							
Social contribution	.807**	.838**	-						
Experience	.519**	.535**	.510**	-					
Promotion	.510**	.518**	.507**	.813**	-				
Community	.556**	.573**	.539**	.734**	.787**	-			
Acceptance of power generation	.423**	.439**	.427**	.326**	.291**	.289**	-		
Acceptance of region	.446**	.463**	.454**	.322**	.284**	.274**	.894**	-	
Policy acceptability	.556**	.531**	.561**	.370**	.314**	.308**	.802**	.852**	-

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

3.2. Analysis of the research model

In this study, the fit indicators of χ2 verification, IFI (incremental fit index), FMIN (minimum value of discrepancy function F), NFI (normal fit index), and RMSEA (The fit indices such as root mean square error of approximation), TLI (Turcker-Lewis coefficient), and CFI (comparative fit index), etc., were demonstrated. The research model for the corporate image and the acceptance of nuclear power generation by the sports cultural marketing was verified through the structural equation model analysis, and as for the results for the evaluation of the overall fit of the research model are as illustrated in <Table 4>, and the results of the fit of assessment of the research model, they turned out to be IFI=.979, FMIN=.229, NFI=.973, RMSEA=.076 , TLI=.986, and CFI=.979, respectively. This is, in light of the criteria that a good model is evaluated when IFI, NFI, TLI, and CFI is 0.8-0.9 or better, which are the fitness criteria presented by Bagozzi, & Yi (1988), and if and where RMR and RMSEA are .05-.08 or below, they are evaluated to be good model, all of the fit indices of the saturation model presented in the research model turned out to exceed the standard value. In general, the goodness of fit of the model by χ2 is determined to be satisfactory when the p-value is 0.05 or more. In the correlation matrix of <Table 3>, the low correlation coefficient of sub-factors of sports cultural marketing and acceptance of nuclear power generation is determined to be reflected in the evaluation of the fitness index of the research model.

Table 4. Evaluation of the fit of the research model.

Construct	$\chi 2$	*df*	Normed $\chi 2$	*p*	IFI	FMIN	NFI	RMSEA	TLI	CFI
Final model	104.032	24	4.335	.000	.979	.229	.973	.076	.968	.979

The overall fit index demonstrated in this research model was χ2(41)=104.032, p<.000, and some of the fit indices evaluating the fitness of the research model demonstrated satisfactory results, yet the sample size was large and sensitive in terms of multivariate normality (Bentler & Bonett, 1984), the fit of the overall model was determined through other fit indices. Accordingly, the IFI, which is a general fit which explains the proposed model well among the absolute fit indices, is better than .90 (Bentler & Bonett, 1984), yet since it is a numerical value that is centered upon the empirical cases used in social science research, it cannot be said that it is absolute, and the results demonstrated that the research model for proving the research hypothesis is relatively suitable.

In order to examine to what extent the measurement scale of each variable in the structural model has been reflected in the matching process of the overall model, path estimates were

additionally derived to ensure that it was possible to confirm whether the hypothesis was accepted. The structural model through the path coefficient of the research model is as illustrated in <Figure 2>.

Figure 2. Path model analysis.

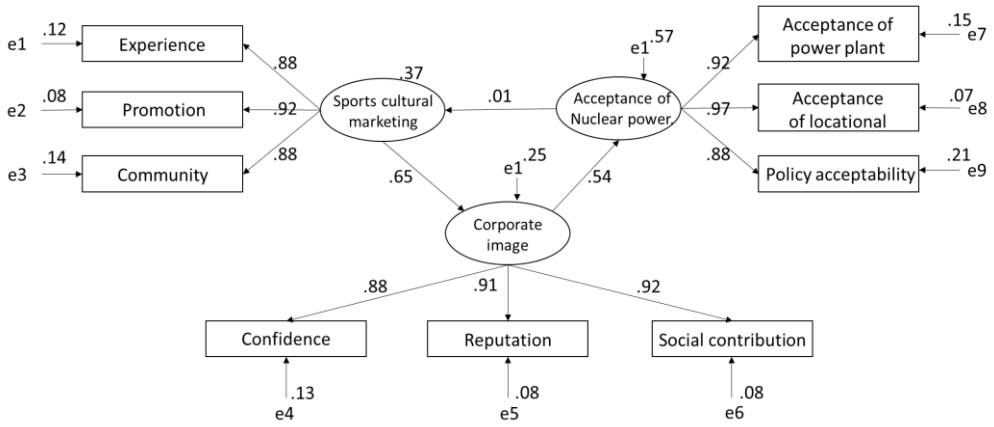


Table 5. Results of the hypothesis testing of the research model.

Hypothesis	Path			Estimate	S.E.	C.R.	Hypothesis test
Hypothesis 1	Sports cultural marketing	⇨	Acceptance of nuclear power generation	.005	.088	.080	Dismissed
Hypothesis 2	Sports cultural marketing	⇨	Corporate image	.652	.049	14.299***	Adopted
Hypothesis 3	Corporate image	⇨	Acceptance of nuclear power generation	.541	.083	8.865***	Adopted
Hypothesis 4	Validation of mediating effect						Adopted

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

As a result of validating the research hypothesis through the structural equation model analysis of the research model on the relationship between the sports cultural marketing, corporate image, and the acceptance of nuclear power generation, it is as illustrated in <Table 5>. Hypothesis 1 was dismissed as the relationship between the sports cultural marketing and the acceptance of nuclear power generation of Hypothesis 1 (Estimate=.005, C.R.=.080) turned out to have no significant effect at the level of significance p<.05. That is, it turned out that the sports cultural marketing had no direct effect on the changes in terms of the acceptance of nuclear power generation.

Furthermore, the relationship between the sports cultural marketing and the corporate image of Hypothesis 2 (Estimate=.652, C.R.=14.299) turned out to have a significant influence at the level of significance p<.001, and hence, Hypothesis 2 was adopted. Hypothesis 3 was adopted as the relationship between the corporate image and the acceptance of nuclear power generation (Estimate=.541, C.R.=8.865) of Hypothesis 3 turned out to have a significant effect at the level of significance p<.001. Accordingly, it turned out that there was no direct effect on the acceptance of nuclear power generation by the sports cultural marketing, but had a mediating effect of the acceptance of nuclear power generation through enhancement of the corporate image. It is reasonable that direct effects ought to also be established to prove mediating effects, but it can be interpreted that the questions measured somewhat low in the direction of correlation and overall statistical power demonstrated direct effect values.

4. Discussion

The purpose of this study was to articulate the structural relationship between the KHNP's sports cultural marketing, corporate image, and acceptance of nuclear power generation. Based on the previous studies, the hypothesis of the study was presented. Based on the results of analyzing the research model by conducting a questionnaire survey on local residents, the discussion is as follows.

First, as a result of the analysis of Hypothesis 1, the hypothesis which claimed that 'sports cultural marketing will have a positive (+) effect on the acceptance of nuclear power generation' was dismissed. In this study, it was confirmed that the sports cultural marketing does not operate as a direct causal variable on the acceptance of nuclear power generation. While the results of previous studies of some other companies are contradictory, it ought to be taken into account that the risk perception of nuclear power generation will be strong. Examining the responses of the questionnaire, the correlation between the sports cultural marketing and the acceptance of nuclear power generation was very low. Even if it causes independent change in sports cultural marketing, it would be considered to be recognized as a separate dimension from the acceptance of nuclear power generation. Accordingly, the effect which takes precedence over others is recognized due to the formation of a direct relationship with the government and institutions such as the KHNP.

Second, as a result of the analysis of Hypothesis 2, the hypothesis which claimed that 'sports cultural marketing will have a positive (+) influence on the corporate image' was adopted. This is consistent with the research results which demonstrate that the perception of a company's programs has a positive effect on the confidence of the company[20][14]. Furthermore, in a study on the effect of corporate association of sports companies on relationship quality, attitude, and loyalty, it is in line with the research results demonstrating that the corporate association has a positive effect on the corporate confidence[21].

What is evident from such results is that when the consumers receive information about the corporate capabilities or information about the company's sports, cultural marketing and social contribution activities, they form the confidence in the company. It may also be interpreted that the KHNP's brand, which actively implements sports, cultural marketing and social contribution activities, can give confidence to the local residents. Hence, the KHNP should engage in more sports cultural marketing and social contribution activities and expose information through various activities so that the consumers can access much related information. A company's reputation is based on the individuals' subjective opinion and acts as one of the judgment criteria used to evaluate the good or bad of a company's business activities. The company's reputation is not formed overnight, yet comes from the accumulated corporate image over a long period of time and is a comprehensive evaluation of external stakeholders. Such corporate reputation implies not only the current activities of the company, but also the expectations for the past and future activities[22]. An analysis was performed as to how the sports CSR activities affect the corporate evaluation and customer attitudes, and the fit of the CSR activities has a significant impact on corporate confidence and corporate confidence affects corporate image, and it is also reported that they have an effect on the customer satisfaction and customer loyalty[23]. Based on the results of this study, it was evident that the KHNP's sports cultural marketing activities using sports has a high marketing effect as they have had a positive effect on the company's evaluation and customer attitude.

Third, as a result of the analysis performed of Hypothesis 3, the hypothesis which claimed that 'corporate image will have a positive (+) influence on the acceptance of nuclear power generation' was adopted. Corporate image is the totality of people's concepts and impressions of a company, and as consequently, people have positive and negative attitudes toward a com-

pany. It is explained that it is a collective impression formed by the interaction of all the experiences, expectations, feelings, and impressions the public has towards a specific company, and that the evaluation of services is made through the association with such corporate image[24]. The factors of acceptance of nuclear power generation were classified into reality, practicality, region, and alternative acceptance, and it was also claimed that confidence in the actors have had a positive effect on acceptance. Furthermore, it is reported that the factors of acceptance of nuclear power generation ought to be added to the corporate image factor in consideration of the regional specificity of the nuclear power region[25].

Fourth, as a result of the analysis of Hypothesis 4, the hypothesis which claimed that 'corporate image will mediate the acceptance of nuclear power generation by the sports cultural marketing' was adopted. Most of the early studies on the CSR activities of organizations focused on profit generation regarding how the CSR activities directly affect a company's sales or profits. Recently, however, the studies which validate the invisible potential effects such as how a company forms a positive image and reputation through the CSR activities, beyond the quantitative results of a company's CSR activities, have become the mainstream[26]. Research results demonstrate that the CSR activities have a positive effect on the cognitive aspects of consumers such as beliefs, attitudes, and identification as well as behavioral aspects such as purchase intention and loyalty[27][28]. Furthermore, it is claimed that it has a positive effect on the creation of tangible and intangible performance achievement including the enhanced corporate image, increased financial value, and enhanced market value and competitiveness. Hence, despite the strong awareness of local residents on the sensitive issue of nuclear energy, it has been claimed that positive changes in the attitudes of local residents can be continuously brought about by continuously strengthening sports cultural marketing activities to improve the corporate image[29][30].

5. Conclusions

The conclusions of this study are as follows.

First, the KHNP's sports cultural marketing activities have not directly influenced the acceptance of nuclear power generation as a causal variable. The most important matter which the KHNP should strive for in carrying out the social contribution activities is carrying out the social contribution activities appropriate for the characteristics and image of the company. This may be regarded as one of the most controversial aspects of the social issue of nuclear energy. Hence, the KHNP ought to actively carry out the sports cultural marketing activities as a way to enhance the corporate image even if it has no direct effect.

Second, the KHNP's sports cultural marketing ought to be utilized as a way to increase the acceptance of nuclear power generation by the local residents through the zero high corporate image while operating as a major activity to enhance the corporate image.

Accordingly, it is evident that the sentiment induced by the KHNP's sports cultural marketing activities will operate as an important tool in forming the general local residents' reaction towards the KHNP. The structural relationship has been presented based on the review of the KHNP's social contribution activities related to the sports cultural marketing and the theoretical and empirical discussions on the KHNP's corporate image and the acceptance of nuclear power generation.

6. References

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	JP	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Comparison of the Lower Extremity Muscle Flexibility according to Low Back Pain among High School Baseball Players

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Abstract

Purpose: *The purpose of this study is to compare the flexibility of high school baseball players' LBP Group and bilateral lower extremity muscles.*

Method: *This study conducted a questionnaire survey and measurement of muscle flexibility targeting 23 high school baseball players in Korea. The questionnaire consisted of 7 items on basic information and 4 items on past and present back pain, and muscle flexibility measurement (Tomas test, Hip extension, HBD, SLR, Trunk rotation) tests were conducted. As for the data processing of this study, the mean and standard deviation of all questions were calculated by using the SPSS 26.0 package. The two-way ANOVA was performed to examine the effect of each measurement according to the LBP Group (LBP; presence or absence) × both sides (dominant, non-dominant), and if an interaction was found, the post hoc test was conducted. The independent sample t-test and paired t-test were performed for the post hoc verification. The statistical significance level was based on p<.05.*

Results: *As a result of the Thomas test conducted for the LBP Group and both sides of the lower extremity muscle flexibility, the both sides of the main effect turned out to be significant [F(1,21)=4.905, p<.05]. In the case of the hip extension, the main effect of both sides turned out to be significant [F(1,21)=6.768, p<.05], and the main effect of the LBP Group also turned out to be significant [F[(1,21)=5.065, p<.05]. Furthermore, in the case of the SLR, the main effect of the LBP Group turned out to be significant [F(1,21)=5.395, p<.05].*

Conclusion: *Gathering the results above, as a cause of the LBP among the high school baseball players, there is a possibility that a decrease in flexibility due to hip flexion and extensor tension may be induced, and hence, the possibility of inducing LBP was confirmed due to the excessive use of the back muscles of the accelerator during the pitching and hitting sections. In the future studies, it is necessary to develop and apply the programs which can prevent and rehabilitate the LBP.*

[Keywords] ***High School Baseball Player, LBP, ROM, Lower Extremity Muscle Flexibility, Dominant and Non-Dominant***

1. Introduction

Low back pain (LBP) occurs frequently among young adult players[1], and the LBP at this point in time is highly likely to be caused by structural problems as well as non-structural problems[2]. For this reason, 3 factors were primarily reported in the previous studies. First, given the rapid bone growth in the growth phase, bones become weak, and since the muscles and ligaments cannot keep up with the bone growth and development, an imbalance in the decrease in the muscle's flexibility occurs[3][4]. Second, the amount, intensity, and duration of training may be noted. Since this period is one of regular and continuous training, overuse often causes LBP such as spondylolysis, a stress fracture of the lumbar spine[5]. Lastly, there is the specificity of sports events. Because each sport requires a different type of movement, the incidence and prevalence of LBP varies. In a previous study, LBP among young adults generally occurred in 10%

to 15% of the total, and among the sports athletes, it was reported that 37.5% in baseball, 48.6% in athletics, and 50 to 86% in gymnastics were reported to rise. According to a report on the survey, the highest incidence rate is in the order of shoulder (27%), elbow (23%), and waist (21%). As such, LBP is an important disease that ought not to be overlooked among young adult baseball players[6][7].

Baseball is a sport which is consisted of throwing, hitting, and defending movements and is also a sport which repeats movements in the same direction, and it is also reported that the repetition of such movements causes an imbalance in the trunk muscles, which causes LBP[8][9]. Furthermore, it is known that the difference in flexibility of the left and right muscles of the dominant side and the non-dominant side is a factor that causes LBP[10][11].

Examining the baseball and LBP related studies, the history of LBP affects the pelvis and lumbar kinematics during the baseball hit, and it also has a relationship with the lumbar flexion angle and angular velocity throughout the bat swing[12][13]. The school aged athletes experience LBP due to unhealthy lifestyles such as late bedtime, short sleep times, and long video games, which contribute to the LBP induced lifestyle related diseases[14]. Youth baseball players suffer from LBP and knee pain, and the cause of such pain is the elbow and shoulder pain caused by excessive training during their childhood[15]. The prevalence of LBP among the young athletes participating in various types of sports varies according to age, gender, and sports field, and to prevent such LBP, it is necessary to develop a diagnosis and rehabilitation program[16]. The diagnosis program requires medical examinations including medical check, physical examination, and MRI, and the rehabilitation program is applied based on such diagnostical results[17]. In a study related to back injuries among the high school baseball players, the horizontal adduction caused by overtraining on the dominant side was an independent risk factor for the back injuries during the season, and the limitation of shoulder function not only causes shoulder and elbow injuries, but also the risk of back injuries[18]. In particular, a lot of LBP is induced by the pitchers during baseball positions, and trunk stability is important to alleviate this LBP. Furthermore, a core stability evaluation method should be developed and applied[19]. As a result of investigating the non-specific LBP of college athletes, it turned out that there was a close relationship with core function, and most of the college students had low core function. Hence, it is necessary to strengthen the core muscles in order to prevent injuries in athletes. It is also an important factor in increasing the endurance and appropriate proportions of extensors and flexors[20].

According to a previous study conducted on the flexibility of the LBP and lower limb muscles, those with LBP had shorter hamstrings, lowered SLR (Straight Leg Raising) angle, left-right difference, and lower fingertip-to-floor distance (FFD), and the flexibility of the lower extremities falls during the growth period. That is, as the flexibility of the lower extremities is lowered, there is a possibility that the movements of the pelvis and lumbar spine may change, which is highly likely to be a factor causing LBP[21]. As a result of evaluating the differences between subjects who experienced mild mechanical LBP, it was reported that hamstring flexibility and tension have a strong relationship with LBP[22][23]. Furthermore, a state-of-the-art medical device is required for the diagnosis and treatment of LBP among the sports athletes, but since these medical devices are too expensive, it is necessary to develop a simple and easy way to measure and evaluate[17][24].

However, the studies examining the relationship between LBP and lower extremity muscle flexibility among youth adult sports athletes are inadequate[1]. Hence, the purpose of this study is to compare and analyze the differences in terms of the flexibility of the lower extremity muscles according to the LBP and dominant and non-dominant among high school baseball players.

2. Research Method

2.1. Participants

This study was conducted for 23 Korean high school baseball players, and the purpose, method, and risks of the study were explained to the subjects, coaches, and parents in writing and verbally in advance, and written consent was secured. Furthermore, this study was conducted with the approval of the Research Ethics Committee of Tsukuba University (Approval Number 28-64). The characteristics of the participants are as illustrated in <Table 1>.

Table 1. Characteristics of the participants.

	Overall (n=23)	LBP (n=15)	Non-LBP (n=8)
Age (years)	17.00±0.91	17.17±0.88	16.88±0.99
Height (cm)	176.55±5.96	176.71±5.54	176.30±7.07
Weight (kg)	79.38±10.95	81.19±11.34	75.99±9.95
BMI (kg/m^2)	25.47±3.46	26.17±3.99	24.35±1.86
Baseball Career (years)	5.63±1.92	5.37±1.45	6.11±2.65

Note: All values are mean ± standard deviation. LBP; low back pain, BMI; body mass index.

2.2. Questionnaire survey on low back pain

The questionnaire was distributed and completed in October, which is the off-season period. After securing the permission to participate in the research in advance, they visited each school and conducted a survey, and since all participants were minors, the purpose of the study and questionnaire questions were explained to help them understand. Seven questions of basic information of the subjects (age, height, weight, baseball career, main position, pitching side, batting side) and four questions of the past and present LBP (point LBP, pain level, pain location, LBP onset timing) were surveyed. Thereafter, based on the results of the questionnaire survey, the subjects were divided into the groups with and without LBP, and the definition of LBP was defined as a case of pain in the lower back <Table 1>.

2.3. Measurement of muscle flexibility

The muscle flexibility was measured by a passive test and was photographed by using a digital camera. The range of motion (ROM) and distance (only HBD) were calculated by using the software which analyzes the images based on the secured photos. Furthermore, the data were analyzed by classifying them into a dominant side and a non-dominant side. There are 5 measurements, which are the Thomas test, Hip extension, Heel Buttock Distance (HBD), Straight Leg Raising (SLR), and the Trunk rotation, whose detailed measurement methods are as follows <Figure 1>.

2.3.1. Thomas test

The angle of hip flexion was measured from a line parallel to the bed and the long axis of the femur.

2.3.2. Hip extension

The angle between the line parallel to the bed and the long axis of the femur was measured.

2.3.3. HBD

Calibration was performed by attaching a 1m indicator to a vertical line from the ceiling, and the measurement was taken by connecting the maximum protrusion of the heel and buttocks in a straight line.

2.3.4. SLR

The angle between the line parallel to the bed and the long axis of the femur was measured.

2.3.5. Trunk rotation

The angle between the line connecting the acromion of both sides and the horizontal line was measured.

Figure 1. Measurement of muscle flexibility.

Note: A: Thomas test, B: Hip extension, C: Heel buttock distance (HBD), D: Straight leg raising (SLR), E: Trunk rotation.

2.4. Statistical analysis

As for the data processing of this study, the mean and standard deviation of all questions were calculated by using SPSS 26.0 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY, USA) Package. The two-way ANOVA was performed to examine the effect of each measurement according to the presence or absence of LBP (2) and both sides (2) (dominant, non-dominant), and in the event of an interaction, a post hoc test was performed. As for the post hoc test, the independent sample t-test and the paired sample t-test were performed. The statistical significance level was based on $p<.05$.

3. Results

In this study, the results of measuring changes in the lower extremity muscle flexibility according to the LBP Group (with and without) and both sides for high school baseball players are illustrated as follows.

3.1. Changes in each metric according to the LBP group and both sides

3.1.1. LBP group and thomas test for both sides

Table 2. Thomas test results according to LBP group and both sides.

Group	Passive thomas test		(Paired sample) t-value
	Dominant	Non-dominant	
LBP	23.51±5.28	20.58±5.61	-1.972
Non-LBP	22.83±5.40	20.56±6.89	-1.432
(Independent sample) t-value	.291	.007	

Note: All values are mean ± standard deviation.

The results of the LBP Group and the lower extremity muscle flexibility for both sides of the Thomas test are as illustrated in <Table 2>. In the case of the Thomas test, the main effect of both sides turned out to be significant [F(1,21)=4.905, p<.05]. However, the main effect and the interactive effect of the LBP Group were not demonstrated. As a result of the post hoc test of the main effect of both sides, the non-dominant demonstrated a lower trend than the dominant in LBP, yet there was no significant difference demonstrated.

3.1.2. LBP group and hip extension for both sides

Table 3. Hip extension results according to LBP group and both sides.

Group	Passive Hip extension		t-value
	Dominant	Non-Dominant	
LBP	25.51±3.42	28.81±3.55	4.004***
Non-LBP	29.75±4.22	30.51±2.72	.510
t-value	-2.618*	-1.180	

Note: All values are mean ± standard deviation, *p<.05, ***p<.001.

The hip extension results of the LBP Group and both sides for the lower extremity muscle flexibility are as illustrated in <Table 3>. In the case of the hip extension, the main effect of both sides turned out to be significant [F(1,21)=6.768, p<.05], and the main effect of the LBP Group also turned out to be significant [F(1,21)=5.065, p<.05]. However, no interactive effect was demonstrated. As a result of the post hoc test for the main effect of both sides, dominant turned out to be significant (p<.05) for the LBP. Furthermore, as a result of the post hoc test conducted for the main effect of the LBP Group, the LBP turned out to be significant (p<.05) for dominant than for the non-LBP.

3.1.3. LBP group and HBD for both sides

Table 4. HBD results according to the LBP group and both sides.

Group	Passive HBD		t-value
	Dominant	Non-dominant	
LBP	5.41±3.53	5.38±3.29	-.056
Non-LBP	3.49±2.77	3.48±2.75	-.010
t-value	1.322	1.397	

Note: All values are mean ± standard deviation.

The HBD results of the LBP Group and both sides for the lower extremity muscle flexibility are as illustrated in <Table 4>. In the case of the HBD, there was no significant difference demonstrated in terms of the main effect of both sides and the LBP Group, and no significant difference was demonstrated in the interactive effect.

3.1.4. LBP group and SLR for both sides

Table 5. SLR results according to the LBP group and both sides.

Group	Passive SLR		t-value
	Dominant	Non-dominant	
LBP	89.13±5.24	91.31±5.77	1.535
Non-LBP	84.94±7.02	84.93±5.71	-.004
t-value	1.624	2.532*	

Note: All values are mean ± standard deviation, *p<.05.

The SLR results of the LBP Group and both sides for the lower extremity muscle flexibility are as illustrated in <Table 5>. In the case of the SLR, the main effect of the LBP Group turned out to be significant [F(1,21)=5.395, p<.05]. However, the main effect and the interactive effect of both sides were not demonstrated. As a result of the post hoc test on the main effect of the LBP Group, the LBP turned out to be significantly (p<.05) higher for the non-dominant group than for the non-LBP Group.

3.1.5. LBP Group and trunk rotation for both sides

Table 6. Trunk rotation results according to the LBP group and both sides.

Group	Active trunk rotation		t-value
	Dominant	Non-dominant	
LBP	41.13±6.72	45.42±5.32	2.511*
Non-LBP	44.45±10.26	44.65±7.75	.049
t-value	-.939	.284	

Note: All values are mean ± standard deviation, *p<.05.

<Table 6> illustrates the trunk rotation results for the LBP Group and both sides for the lower extremity muscle flexibility. In the case of the trunk rotation, there were no significant differences demonstrated for both sides and the LBP Group and the interactions. However, in the both sides of the LBP, dominant turned out to be significantly (p<.05) lower than that of the non-dominant. Such an aspect is considered to be due to the differences in the number of people of the LBP Group.

4. Discussion

This study compared the lower extremity muscle flexibility according to the LBP Group and both sides (dominant and non-dominant) for the high school baseball players, and the results were derived accordingly. A discussion of each question is as follows.

4.1. Discussion of the lower extremity muscle flexibility related results according to the LBP Group and both sides

In the case of the Thomas test for the LBP Group and both sides for the lower extremity muscle flexibility, the both sides' main effect turned out to be significant, and the non-dominant athletes with LBP tended to have lower Thomas test values than the dominant.

Such results of the Thomas test significate that the hip flexor flexibility was lower in the dominant side of baseball players with LBP than the non-dominant side. Hence, it implicates that there is a tension of the anterior thigh muscle due to the decrease in the flexibility on the dominant side. It is also considered that such tension has the potential to induce LBP. Examining the studies related thereto, and according to a study which surveyed the prevention and treatment of lumbar spine injuries among the major league professional baseball players, it is highly likely that LBP can be induced if the tension of the anterior femoral flexor is high, and to prevent such, diagnosis and treatment as well as the prevention of damages is significant[25].

In the case of the hip extension test of the lower extremity muscle flexibility of the LBP Group and both sides, both sides and the LBP Group turned out to be significant. The players with LBP had significantly lower hip extension values in terms of non-dominants than the dominants. Furthermore, LBP turned out to be significantly lower in terms of dominant than the non-LBP. Such results of hip extension significate that the flexibility of hip extension angle was lower in the dominant side of baseball players with LBP than the non-dominant side. Hence, the flexibility of the iliopsoas and rectus femoris muscles, which are the dominant anterior thigh muscles, fell, which implicates that such tension may induce LBP. Examining the studies related thereto, and in a study on the relationship between core stability and communication among the high school baseball players, the decreased core stability was reported to be a potential risk factor for the players' LBP, and hence, the core stability evaluation ought to be performed[26].

In the case of the LBP Group and the HBD test of both sides for the lower extremity muscle flexibility, there were no significant differences demonstrated in terms of the main effects of both side and the LBP Group, nor for the interactive effect.

Such HBD results did not demonstrate a significant difference, yet demonstrated a tendency of high tension. The high tension of the quadriceps muscle in the anterior thigh suggests the possibility of LBP induction. Examining the papers related thereto, and as a result of a survey conducted with 272 players who experienced LBP across 6 seasons among the Major League baseball players, it was reported that they returned through a rehabilitation program for an average of 51 days, among which, most players had rehabilitation focused on the improvement of their core stability and flexibility[27].

In the case of the LBP Group and the SLR test of both sides for the lower extremity muscle flexibility, the main effect of the LBP Group turned out to be significant. In terms of the non-dominant, the level of SLR turned out to be significantly higher for the LBP than for the non-LBP.

Such results of SLR suggest that the hamstring's flexibility is high on the non-dominant side of the players of LBP. Based on the results discussed in the previous studies, a clear conclusion has not yet been reached. Examining the studies related thereto, it was reported that the hamstring's length had a potential risk factor for LBP among high school baseball players, and such results were a guideline for the development of a future preventive program[28].

In the case of trunk rotation of the LBP Group and both sides for the lower extremity muscle flexibility, there were no significant differences demonstrated between both sides and the LBP Group and the interaction. However, trunk rotation for both sides and the LBP turned out to be significantly lower for the dominant than for the non-dominant. Such an aspect is considered to be due to the differences in terms of each individual of the LBP Group.

Such results significate that the flexibility of baseball players with LBP turned out to be low for the dominant side rotation. Such a phenomenon suggests the possibility of inducing LBP due to the imbalance of the circuit related muscles. Examining the studies related thereto, the rotation of baseball players while hitting balls is accompanied by a twisting phenomenon in the direction opposite to the direction of movements. Given such a reason, it is reported that the LBP of baseball players is caused[29][30][31].

5. Conclusion

Gathering the results above, and as a cause of LBP among the high school baseball players, there is a possibility that a decrease in flexibility due to hip flexion and extensor tension may be induced, and hence, the possibility of inducing LBP was verified due to the excessive use of the back muscles of the accelerator during the pitching and hitting sections. In the future studies, it is necessary to develop and apply the programs which can prevent and rehabilitate LBP.

6. References

6.1. Journal articles

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	DH	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	WC	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	JT	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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A Study on the Emotional Labor Environment and Quality of Life of Sports Instructors at Elementary Schools

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Abstract

Purpose: *The purpose of this study is to investigate the relationship between the emotional labor environment of sports instructors at elementary schools in Jeonbuk and the quality of life of them to figure out the difficulties faced by the sports instructors in the field in order to present improvement plans.*

Method: *Specifically, the following results were derived from conducting in-depth interviews with sports instructors of Jeonbuk by using a semi-structured questionnaire from November 2020 until December 2020 as the purposeful sampling method.*

Results: *First, most of the elementary school sports instructors were temporary workers for the term of less than one year, and they complained of serious emotional labor in their discussion with school officials and consumers in the processes of contract renewal, opening classes for additional sports activities such as after school classes, and notification of contract renewal. Second, the sports instructor hiring method dependent to the discretion of school officials and the form of employment with a period of employment shorter than one year were leading to the lack of expertise in physical education of sport instructors and the necessity for sport instructors to have a sideline for livelihood. Third, although the role of sports instructor is assisting home room teachers in physical education classes, the roles and work of sports instructors were not clearly identified, and sports instructor were leading actual physical education activities. Fourth, although sports instructors had the status of instructors, they were performing the work of teachers, but there was no study space (desk, computer, chair, etc.), locker room, or resting space for sports instructors and sports instructors were seriously discriminated in terms of welfare.*

Conclusion: *In particular, during physical education classes at nearby schools to which they were dispatched once or twice a week, sports instructors were taking a rest in their private car between classes.*

[Keywords] ***Elementary Schools, Emotional Labor, Work Environment, Quality of Life, Sports Instructors***

1. Introduction

"In a single word, sports instructors were 'invisible humans' and 'butlers'."

In recent years, school physical activities intended for practicing happiness education to foster the students' dreams and talents are largely psychodynamic, cognitive, and affective areas, and various health activities which contribute to the cultivation of their ability to think creatively and social skills are being carried out[1]. In particular, physical education and sports activities provided by elementary schools provide their students with high quality physical activities and knowledge needed for health, and furthermore, continuing physical education is the cornerstone of the social welfare policy to prevent adult diseases and reduce medical expenses for the elderly required in the time of super-aging.

Moreover, unlike the middle school teachers, in the case of the elementary school teachers, in a situation where they teach about 10 different subjects, in order to solidify the fundamentals of the elementary education and secure the professionalism of their curriculum, through the Enforcement Decree of the Education Act 1992 on music, art, and special subjects, the subject dedicated system was established, and in terms of the physical education subject which requires professionalism, a project to place a physical education teacher is actively carried out[2]. However, while the activities to secure the teacher's status and professionalism in consideration of the professionalism of music, health, nutrition, art, and computer subjects have consistently progressed, the physical education teachers are still the 'sports assistant instructors' and 'sports instructors' despite majoring in physical education, and maintain temporary worker status.

Contrary to the government's policy of recommending continuing physical education programs for each life cycle and further promoting continuing physical education at the time of entering an aging society, elementary school sports instructors are currently elementary school sports assistants providing assistance for the homeroom teachers, and the demand for institutional improvement regarding accountability, etc., is undergoing discussion[3][4][5].

'Sports instructor' is the group of temporary workers supervised by the offices of education of cities and provinces and directly selected by elementary schools under the auspices of the Ministry of Education, Science and Culture as ‘sports instructor’ following the increase of employed personnel, while being used as the name of 'sports assistant instructor' for the purposes of promoting the activation of school physical education by triggering interest in the students’ physical education class and reducing the burden of physical education class for the home room teachers or physical education teachers by introducing the sports instructor system exclusive for the elementary school physical education[2].

To help vitalize the elementary school physical education and form the lifelong exercise habits, and as an assistant for the elementary school physical education class, and under the responsibility of the homeroom teacher, they are carrying out and providing the physical education class related cooperation and guidance, physical education related teaching aids and facility management, PAPS work related support, sports related events such as sports competitions, support for regular classes and after school sports activities (after school activities and school sports clubs, etc.) related guidance, summer vacation program operation, physical education activities which require specialized knowledge, as well as the leadership and agility required to lead school events[2][4]. As such, while they are assistant lecturers for the homeroom teacher, the classes are led by sports instructors, and they are in charge of the tasks other than their teaching assistant related role, such as school leadership management, sports events, and award performance management, and hence, a very serious emotional labor occurs given the situations among the colleague teachers and students[6][7].

Emotional labor is a behavioral activity which creates or suppresses one's emotions in order to please others, which is largely divided into inner and superficial actions. Inner action refers to the actual expression of the emotion one desires to express, while surface action is the effort made to falsely express the emotion one does not actually feel[8][9]. According to a report by the Korea Research Institute for Vocational Education and Training in 2013, occupational groups which perform continuous emotional labor report a higher job satisfaction and turnover due to their severe mental and physical stress suffered, and their lower work efficiency[8][9][10] and as an occupational group with a high emotional labor, the study of emotional labor on sports instructors has consistently progressed, as it emerged in the order of food service related jobs, sales and sales related jobs, and beauty, accommodations, travel, entertainment, and sports related jobs[2][8][9][10]. Furthermore, in the case of sports instructors who are vulnerable for the employment contracts, most of them area involved with 2 to 3 types of part time jobs for maintaining emotional labor and livelihood due to employment instability caused by their status inequality with their contract renewed in the units of 3 months, 10 months, 11 months, and 12

months, etc. As such, it is apparent that the sports instructors are emotional laborers who suffer from a lot of distress in a poor work environment due to their job insecurity and poor level of wages.

Examining the previous studies conducted on emotional labor in the sports field, the studies on emotional labor, job burnout, and work environment for senior sports instructors, recreation instructors, Taekwondo instructors, and sports facility leaders were consisted carried out[10][11][12], while the sports leaders emphasize that they are emotional laborers in the service industry. Furthermore, examining the previous studies conducted on the emotional labor focused on sports instructors, a total of 3 studies were conducted, one of which on the middle school students[7] and two on the elementary school sports instructors[3][4]. Since the introduction of the sports instructors system in 2008, the studies on the sports instructors carrying out their livelihood as 'sports instructors' as temporary workers are very inadequate.

In recent years, at a point in time when the need for physical education is more stressed as a measure for health and stress, as well as the lack of exercise due to the rate of obesity of elementary school children and the entrance exam environment, approximately 92% of elementary school principals have had a positive effect on the vitalization of the school physical education[6][13][14][15]. Furthermore, approximately 89% of elementary school teachers and approximately 87.4% of elementary school students have demonstrated a high satisfaction with the placement of sports instructors[16][17] and it has been reported that the role of sports instructors has a very positive effect in the site of elementary schools where there are many female teachers, and hence, since 2017, the elementary school sports instructors' placement project has expanded nationwide[3][15][18]. Notwithstanding which, gathering the previous 5studies, the will and participation of the homeroom teacher are very important for the vitalization of elementary education, which ought to provide the basis for the continuing physical education, yet in a vertical relationship rather than mutual cooperation between the homeroom teachers and the sports instructors, such as for essential matters, the quality of the life of sports instructors is in the form of temporary worker employment[3][13][15][19][20].

Examining the sports instructors of Elementary schools in Jeollabuk-do, as of 2018, a total of 124 people (38 in Jeonju, 20 in Gunsan, 20 in Iksan, 10 in Jeongeu, 7 in Namwon, 7 in Gimje, 9 in Wanju, 1 in Jinan, 3 in Muju, 0 in Jangsu, 2 in Imsil, 3 in Sunchang, 2 in Gochang, and 2 in Buan) are serving[21], and while the scope of application of the sports instructors' placement project has expanded ceremoniously, in the case of Jeollabuk-do, in 2014, a large reduction was made by 50% from 310, and compared to the positive effect of the sports instructors' activities and educational satisfaction, which is an exceptionally reduced occupational group, which is vulnerable against job insecurity and employment front[14][15][18][19][20][22]. Compared to the positive synergy effect of sports instructors, the reduction of sports instructors in Jeollabuk-do, which is drastically reducing the instructor system, must eventually join the National Educational Civil Service Union of the Public Transport Union of the Korean Federation of Trade Union, and to improve the treatment of the occupational environment institutionally and educationally, they must be improved through negotiations with the Ministry of Education and local offices of education.

In particular, the issue of elementary school sports instructors as an occupation is the issue of low salaries which are less than the minimum cost of living for 2 people, and in addition to the regular 21:00 hours of class work, they participate in after school classes, childcare, sports clubs, and clubs to make incidental profits, and given a situation where after school classes are performed on behalf of an outside company, the quality of life of sports instructors, who have to work concurrently to making their living, the quality of their lives is declining.

Hence, this study seeks to improve the quality of life through the work environment, educational environment, and welfare environment where the elementary school sports instructors

experienced emotional labor as occupations affiliated with the Jeollabuk-do Office of Education through the in-depth interviews conducted with 7 elementary school sports instructors, and it is also intended to provide the basic data to help improve the quality of professional life of the sports instructors.

2. Research Method

2.1. Research subjects

This study has conducted the nonprobability sampling in order to examine the quality of life of sports instructors based on the emotional labor environment, work environment, educational environment, and welfare environment experienced by the elementary school sports instructors in the field as a profession and examined the direction of improvement, thereby conducting a metaphysical study determined to be appropriate for the purposes of this study in consideration of the qualitative research method and the purpose of the study based on the professional knowledge of the expert group as one one of the purposeful sampling methods[14][23].

The prerequisites for the specific research subjects are, first, a person with a physical education instructor level 2 and a professional physical education instructor certificate, who has expertise in physical education, and who has expertise in life or practical aspects who have obtained a professional sports instructor license, are selected. Second, those with their field experience as elementary school sports instructors with at least 5 years were selected. Third, the sports instructors with active rapport building in the district representing Jeollabuk-do were preferentially selected. Lastly, in order to examine the quality of life of the sports instructors, the research participants who were making their living while being active as sports instructors (part time activities) were selected primarily <Table 1>.

Table 1. Research subjects.

NO	Name	Age	Gender	Highest academic achievement	Qualification	Affiliation	Career (years)	Multiple income
1	AAA	38	Male	Graduate school for education	Class 2 permanent physical education teacher, Class 2 professional sports instructor	Elementary school A in Jeonju	9	3 jobs
2	BBB	32	Female	Graduate school for education	Class 2 permanent physical education teacher, Class 2 daily sports instructor	Elementary school B in Jeonju	6	2 jobs
3	CCC	34	Male	Graduate school for education	Class 2 permanent physical education teacher, Class 2 daily sports instructor	Elementary school C in Namwon	7	3 jobs
4	DDD	33	Male	Graduate school for education	Class 2 permanent physical education teacher, Class 2 daily sports instructor	Elementary school D in Gunsan	7	3 jobs
5	EEE	34	Male	Graduate school for education	Class 2 permanent physical education teacher, Class 2 daily sports instructor	Elementary school E in Jeongeup	7	4 jobs
6	FFF	38	Male	Graduate school for education	Class 2 permanent physical education teacher, Class 2 professional sports instructor	Elementary school F in Jeongeup	7	2 jobs
7	GGG	37	Female	Graduate school for education	Class 2 permanent physical education teacher, Class 2 daily sports instructor	Elementary school G in Iksan	8	2 jobs
Number of cases							7 people	

2.2. Data collection method

This study has conducted a metaphysical study to examine and understand the quality of life of and the improvement directions for sports instructors based on their emotional labor environment, work environment, educational environment, and welfare environment experienced by the elementary school sports instructors in the relevant field as a profession. The primary data were literature research, the Internet based data related to the sports instructors, and internal data of the Ministry of Education and Science to collect the data from various angles and conducted in-depth interviews, while a semi-structured interview was structured with a focus on the literature research and multifaceted data, and in order to prevent the interview results derived according to the researcher's personal questioning skills in advance, the interviewee were asked to express their thoughts on very specifically presented questions.

In particular, it afforded flexibility by changing the questions according to the interview situation, and within the limit that does not deviate from the purpose of the study, the opinions of the research participants were identified through the general questions and the opinions of the general questions were materialized. As for the specific method, first, the literature research was conducted by using sports instructors, degrees related to emotional labor and quality of life, academic papers, the National Assembly Library, the National Library of Korea, paper portal institutions (RISS, KISS), and the online newspaper articles, etc. Second, based on the documents collected from institutions including the Ministry of Education, Science and Technology and the offices of education, which are the institutions which recruit and manage elementary school sports instructors, the data were collected with a focus on the support plan for elementary school (special) school sports instructors from 2014 to the present.

Third, based on the collected data, a professional group of 1 physical education related PhD holder and 2 sports instructors was formed to check on the semi-structured questionnaire and the interview related matters through a metaphysical approach. An in-depth interview was conducted with 7 subjects of Jeollabuk-do sports instructors who were selected <Table 2>. As for the in-depth interview, the researcher personally visited the school of 7 sports instructors from November 2020 through December 2020 and conducted interviews within an hour or so, and conducted 2 online interviews at weekly intervals. The data were collected on the phone and via emails. Furthermore, before the interviews, the recording process and the recorded contents were not used for any purpose other than that of the research, and the recording was made, then transcription was performed[24][25]. To classify the research materials selected for the study and increase the reliability of the content related classification of the analyzed paper during the analytical process, the research materials with 3 fellow researchers consisted of 1 physical education related PhD holder and PhD candidates. After the analysis performed, the inter-rater agreement was confirmed to confirm the data category agreement among the analysts (Borg & Gall, 1983). Based on which, reliability and validity were secured by secondarily verifying the face validity of the experts by a professor of physical education.

Table 2. Categories of the semi-structured questionnaire.

Categories	Semi-structured questionnaire
1. Emotional labor environment of sports instructors	Emotional labor environment experienced as sports instructors and the ways of improvement
2. Working environment of sports instructors	Systematic work environment as sports instructors and the improvement plan
3. Physical education environment of sports instructors	Physical education environment of sports instructors and the improvement plan for equipping them with professionalism
4. Welfare environment of sports instructors	Welfare environment as sports instructors and the improvement plan

2.3. Data analysis

To achieve the purpose of this study, the inductive category analytical method was used for the data collected through the in-depth interviews with 7 participants. Specifically, by using the investigator triangulation based on the expert group meeting to increase the internal validity of the inductive analysis before preparing the research results, the internal product was verified with this researcher and expert group based on the contents organized after the in-depth interviews, and internal criticism was conducted, and reliability of the data and validity of the study were secured accordingly.

2.4. Integrity and ethics of the study

Before beginning this study in consideration of the ethical issues of the research, a full explanation was provided for the research participants on the background and purpose of this study, as well as guarantee of the anonymity of personal information, and the fact that the collected data will not be used for any other purpose. The study was conducted by selecting the research participants. Furthermore, increase the integrity of the research, the integrity of the research was secured via undergoing a member check process based on the investigator triangulation and peer debriefing.

Specifically, the triangular verification method was used as a method of collecting the in-depth interview related data and supplementary data from the Ministry of Education and Science by structuring a semi-structured questionnaire with a focus on literature research and the experts with prior experiences. Based on the collected data, an expert group consisted of a physical education expert and 2 sports instructors who did not participate in this study and had experiences in conducting qualitative research reviewed the research results, and together with the researcher who designed this study, the research results were reviewed, and the efforts were made to improve the integrity of the research through the process of reviewing the study[26].

3. Research Results and Discussion

This study seeks to examine and understand the quality of life of the sports instructors based on their emotional labor environment, work environment, educational environment, and the welfare environment experienced by the elementary school sports instructors in the field as a profession, as well as their directions of improvement, and present issues and ways of improvement thereto.

3.1. Emotional labor environment experienced as sports instructors and the ways of improvement

Emotional labor is labor of deceiving one’s real feelings and dealing with stakeholders with showcasing emotions[9][10][12]. As noted in the study of Yongnam Park et al. (2021) which claimed that the sports instructors move with sandbags on their body, the emotional labor environment for the sports instructors turned out to be very serious. 'Lecturer' is a temporary worker who serves and works as a teacher, yet whose salary is lower than the minimum wage and the right to hire is granted at the discretion of the principal during the contract renewal and selection process, and hence, emotional labor was occurring in multiple ways in the course of contract renewal and transfer to other schools[22][27][28].

3.1.1. Emotional labor environment among school officials

Most sports instructors arrived on time and left work just as the average teachers, and were in charge of physical education classes for 21 hours a week as with the homeroom teacher, as

well as for the elementary school physical activity and movement activities including after school classes, athletic competitions, and sports clubs, while being engaged with most of the business activities even across the sports fields other than their assigned tasks. As implied by the status description of 'sports instructor,' which indicates their status as temporary workers, a very serious emotional labor occurs at the time when the renewal of contracts, continuation and establishment of after school activities are decided each year, and unfair work due to non-regular workers is prevalent.

"Every time the contract is renewed, I get stressed out. However, the decision to renew the contract first depends on the principal, and so I have to do most of the work assigned by the teachers I work with, the vice principal, and the principal. Since the sports instructors' salaries are so low, we have to take care of even a single one after school to making a living with extra allowances, and so, it is very common to understand the faculty and head teachers who have the right to make after school related decisions." (AAA)

"Since I have children to raise and I'm not young, the cost of living is quite high. Since I'm making less than the minimum wage, it is difficult to make a living with my salary alone, and I have to offer additional after school classes and physical education classes to make ends met. At first, I chose this job because I majored in physical education, but now I'm very skeptical. There are many teachers younger than me, and even though I have worked at the school for long, my status is a temporary worker and I'm noticing that I won't be able to run after school classes, and now, I'm thinking maybe I should quit." (GGG)

The sports instructors system is one intended to further revitalize the elementary school physical education classes to help encourage lifelong sports in 2008, and it an institutionalized vocational group activity, supervised by each city and provincial offices of education, which account for 80% of the executed budget, and 20% by the Ministry of Culture, Sports and Tourism. While various physical education activities are conducted within the school, the satisfaction of sports instructors among students, teachers, and parents is very high, the selection process is still at a standstill. In fact, the number of sports instructors, which was 2,911 in 2014, decreased to 1,899 in 2020, and the cause of the annual decrease in sports instructors is "poor treatment," and the government is in a serious situation in promoting the elementary school education, which is the first step towards the lifelong physical education[16][17].

Most of the sports instructors, who majored in physical education at the specialized physical education and education graduate schools, and despite their being very high quality manpower, are concerned about their job insecurity in a situation where the renewal of contracts and additional classes are decided at the discretion of the faculty during the contract renewal and selection process given systemic limitations. A very serious emotional labor has been prevalent, and the number of sports instructors has declined each year due to actual turnover, suggesting that the job stress caused by wage issues and work environment of sports instructors is the largest cause of the emotional labor of sports instructors. Accordingly, it has been interpreted that emotional labor will be reduced only if and as soon as the sports instructors system promotes regularization of their status and specialization to address the status limitations for the sports instructors.

3.1.2. Emotional labor among the students and parents

Most of the sports instructors work from March to December and renew their contracts, and also have a system which requires them to change schools every few months if not every 2 years. If the principal or another school is assigned, the after tax salary, which is less than the minimum wage of sports instructors, is KRW 1.7 million, and consequently, from 2:30PM to 4:40PM, additional after-school, caring physical education and sports club classes had to be undertaken to generate additional income and maintain their minimum livelihood. If they were not established, most of the sports instructors were the livelihood type sports instructors who had to take on

additional part-time jobs such as multiple income[29]. As a result, in a situation where the school where they work desperately needs to open courses, they need to attract students and manage them through parent counseling, a serious emotional labor occurs in a situation where the sports instructors play the role of teacher, while the consumers approach the concept of private tutoring institutions' instructors.

"In the previous school, after school tuition was paid by the school, so I offered badminton classes and soccer for the children at a more planned and systematic pace. The children found it difficult at first, but at the end of the semester, their skills improved a lot and they liked it. However, the school I am currently working at is an after school class which is funded by the beneficiary, whose children pay tuition. As a result, classes are organized around their interest rather than education, and I must understand what the parents and students want." (BBB)

"I'm offering only one class after school. Until last year, the school had two after school classes, an after school class on Saturdays, and a sports day on Saturdays for an athletic competition, yet since I was assigned to another school this time, this school only operated one after school class. However, even after school, the cost of education varies according to the number of students, and so I give out snacks to children every day, saying that they are a reward during after school classes, and I have no option but to do so." (DDD)

As such, after school and care activities were operated at the discretion of school officials according to the type of school. In the case of downtown areas, the system was opened at the discretion of school officials at the expense of the beneficiary, and in the case of areas outside the city center, the system was supported by the city and provincial office of education. In some schools, the school system pays in advance and guarantees the right to class through a comprehensive demand survey, whereas in the case of beneficiary centric schools, a subordinate relationship was formed by and between the parents and students. At a point in time when a variety of activity programs are recommended in schools for prior learning, arts and sports and cultural activities according to most multiple income families, and if a policy system is constructed which operates after school classes with the budget of the office of education rather than the beneficiary is not borne by the beneficiary so that sports instructors can focus on the class area, the emotional labor of sports instructors would like be significantly curtailed.

3.2. Ways to improve the emotional labor environment for the sports instructors

As such, the sports instructors were making their living as serious emotional laborers across various relationships between school officials, students and parents. In the modern society, the stress of instructors educating students tends to be transferred to the learners, and in terms of pedagogy, they are making efforts to relieve the stress from work and the surrounding environment[22][27]. However, while most of the physical education classes are in charge of elementary school classes, it is apparent that the discrimination in the status and benefits of a 'lecturer' is the emotional abuse of the teachers. Given which, there are many sports instructors who are physically and mentally fatigued and are working part-time after their primary work and making multiple income to make their ends met.

"After work, I go to another job, and when I go home after then, it is over 11 o'clock on weekdays and I get home at 1AM on Saturdays. When I get home, my 1 and 2 year old children are sleeping and my wife waits for me. On weekdays, I only see him sleeping. Leisure is like a distant story for me." (AAA)

"I exercise every Thursday, but I don't have time other than that. I have to go to work again." (BBB)

"After work, I see my 3 children and my wife wait for me, but I can't get home late. When the multiple income is over, I go home immediately, take a shower, put the children to bed, and prepare for work tomorrow. At least, having a cup of coffee with a close teacher after going to school relieves stress." (DDD)

As such, it was discovered that the sports instructors at the elementary school are physically and emotional laborers who perform a very serious emotional labor and work activities within the school. Despite being emotional laborers, the reality was that they were hit by the front lines of making their living and could not even adequately relieve stress of their emotional labor. With the recent enforcement of the Emotional Labor Protection Act on October 18, 2018, and despite efforts to improve the emotional labor environment, as mentioned in the previous studies, emotional labor which takes place in a mutually vertical relationship within the work environment is ultimately concerned about the transfer of work, and consequently, depression can be passed on to the learners, and hence, it is determined that the highest priority is the attention of the offices of education and school officials is required to improve the working environment and the emotional labor environment survey of the sports instructors in the soonest time possible.

3.3. The emotional labor environment experienced as sports instructors and the ways of improvement

3.3.1. Job environment according to the contract and renewal decisions at the discretion of school officials

Sports instructors are performing their primary task of providing classes for 21 hours a week and physical education classes for grades 3 through 6 together with other teachers as an assistant with the homeroom teacher. However, as it is evident based on the difference between 'teacher' and 'lecturer,' the work environment as an instructor turned out to be very poor. Most of the sports instructors who work up to 2 or 3 jobs to make their living due to low salaries are also sports instructors, and the labor system that is driving the frontline of livelihood type employment has reduced professional educators who need to improve their professionalism and is driving them towards the livelihood type temporary workers. In particular, for the 3rd to 6th graders, they took the initiative in class rather than auxiliary activities, and were taking the initiative rather than assisting, and as for the classes for the 1st and 2nd grader, which require a lot of effort, are sometimes replaced with upper grade physical education classes without notice. During the season of track and field day, the 1st to 6th graders were led as a whole to perform additional mass game such as skipping rope, and so additional work was piled up. Furthermore, on top of the physical education work, the very personal teacher's work and school chores (library cleanup, tree planting, and hard work, etc.) were called for, and so they were performed the tasks not as "teacher," but as "butler."

"It is always rewarding to teach students. I love my job, but it is very difficult now that I have to take on other job after work due to insufficient living expenses given such a low salary which is less than the minimum cost of living to focus on my work. I used to love doing my work because I liked it, but now that I have a family, I have no choice but to take on multiple jobs to make ends met." (AAA)

"After graduating from the Department of Physical Education, I majored in Physical Education at the Graduate School of Education. That is why I'm very proud of this profession. There is what is called 'a small wage for starters of professional career,' but I go to work every morning and do the same work as a teacher, but I feel skeptical because the salary accounts for only about half that of a teacher in the same class. Those who are thinking of getting married or have families are inevitably faced with a situation where they have to make additional income after school classes or sports club guidance after regular classes due to financial difficulties." (BBB)

"During the athletic competitions, the principal ordered a skipping rope performance for all students. It's easy to say, so I put the students together all day, practiced it, and taught it while my throat was soar. There are times when I'm working outside the scope of my work, and my allowance is not included in the 21 hour shift. Sometimes, when they ask me to manage the net when teachers carry out physical

education activities, or during library cleaning, or flower bed cleaning, I feel very bad and confused whether I'm a teacher or a butler." (FFF)

According to Article 2 Paragraph 11 of the National Basic Livelihood Security Act of the Ministry of Health and Welfare, and examining the selection criteria for the median income and livelihood medical benefit and the minimum level of coverage for households, and in 2020, for single-person households, KRW 1,757,194, for two-person households, KRW 2,991,980, for three-person households, KRW 3,870,577, for four-person households, KRW 4,747,174, and for five-person households, KRW 6,506,368 were disclosed as the minimum livelihood security.

The lecturers with more than 2 years of experience due to poor working environment and low salaries are seriously considering changing their job, or most of them are physical education experts with a master's degree or higher, yet this leads to a lack of professionalism in physical education following their occupational distress[27][28]. Moreover, emotional labor is very serious due to some teachers who do not care about extra work outside of work, and in order to increase the professionalism of sports instructors n physical activity and enhance the quality of education, it is necessary to improve the system to support the priority in the stabilization of the salary system and the allocation of after school classes and pay attention to the human rights of the sports instructors.

3.3.2. Job environment according to the notice of the renewal of contract by school officials and the authority to decide on activities outside of regular classes

Sports instructors started as 10-month temporary workers in 2008 and there are differences by region. Jeollabuk-do signed a three-month contract as a contract worker after mass reduction in personnel in 2014, signed a contract for 11 months from 2015 to 2017, and started the contract as a 12-month contract worker from 2018. The current contract period for 2019 was also 12 months, which is the same as last year, while the improvement of the working environment was still at a standstill.

In a study on the actual condition of the elementary school sports instructors system and the plan for the amendment of the School Sports Promotion Act, reports that the information on the renewal of contracts for sports instructors is provided by phone at the discretion of the principal[18], and that they are suffering from job insecurity and career stress during the winter break. Despite the fact that the instructor system ought to have been established for more than 10 years, they abuse their power in the system by taking wages and contracts as hostages against the sports instructors, and hence, efforts are needed for regularization, legalization, and institutionalization of the sports instructors system in consideration of the working environment as soon as possible.

"After completing the contract every year due to an unstable contract, I usually apply for unemployment benefits after the contract expires in November, and make a living with unemployment benefits for December through February. When an announcement comes up in February, I always prepare the same documents, renew a contract, go through interviews, and until the announcement comes out a few days later, I was under pressure from an unstable short-term contract. I feel pity for myself that I will end up living a mosquito, depending on the principal of the school, just because I have an interview in the future." (AAA)

"Elementary school sports instructors are required to assist their homeroom teachers in conducting cooperative physical education classes. However, in reality, it is not possible to have a joint class with someone who is wearing a skirt. It would be better if they give me the initiative in the physical education class and leave everything up to me, but if they watch me run my classes quietly from behind, I feel like I'm being evaluated, and my pride is hurt." (FF)

Table 3. Current status of changes in the sports instructors as of 2020.

Cities & provinces	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gangwon	59	62	89	112	242	299	299	295	290	295	295	295	290
Gyeonggi	146	115	112	144	144	161	150	150	139	132	122	128	125
Gyeongbuk	53	48	111	136	319	273	200	136	70	70	70	70	70
Gyeongnam	64	84	111	136	280	421	320	299	271	254	240	227	226
Gwangju	24	24	51	63	67	89	80	69	54	45	42	41	40
Daegu	33	35	47	58	58	164	132	50	50	50	50	50	50
Daejeon	24	24	41	50	110	132	80	80	80	80	80	80	80
Busan	45	51	67	81	101	92	75	64	63	58	57	50	50
Seoul	90	96	129	169	392	584	339	342	316	336	339	342	342
Sejong	0	0	0	0	10	22	21	21	23	26	26	26	26
Ulsan	20	20	26	32	88	102	79	66	56	44	42	41	41
Incheon	31	37	54	61	79	229	208	114	69	49	49	49	49
Jeonnam	57	79	104	124	193	292	280	211	190	190	184	178	173
Jeonbuk	72	73	94	115	309	310	150	149	148	136	124	124	122
Jeju	18	18	24	35	80	113	104	67	51	57	45	38	37
Chungnam	45	40	87	118	196	311	210	175	125	114	114	114	114
Chungbuk	44	50	67	82	184	206	184	120	103	84	76	73	70
Total	825	856	1214	1516	2852	3800	2911	2408	2098	2020	1951	1926	1,905
Change	0	+31	+358	+302	+1336	+948	-889	-503	-310	-78	-69	-25	-21

Recently, the proportion of female elementary school teachers has increased, and there are many schools that wish to arrange sports instructors every year due to the aging of teachers. However, given the low wages and unstable contract positions, it was common for the sports instructors to leave jobs, reduce the number of employees, and dismiss existing instructors at the principal's discretion. Examining the office of education's data in <Table 3>, large-scale reductions were made at the time of transition from 2013 to 2014. Consequently, it is reported that the sports instructors are experiencing a very serious job stress due to job security and insecure contracts rather than enhancing the professionalism of physical education[18].

Despite the fact that class assistance is specified on the school sites, most of them are in charge of 21 hours of regular classes, and it is time to improve the treatment of most sports instructors as their form of service has become fixed.

According to a study by Jihyeon Kim (2019), the number of sports instructors nationwide was 1,951 as of 2018, which has decreased since 3,800 in 2013, and when vacancies occur due to systemic issues, the number of instructors gradually decreased due to a natural decrease, and in the elementary school physical education field, homeroom teachers avoid physical education, leading to the vicious cycle of lowering the quality of elementary school physical education. Given the characteristics of elementary schools in Korea, female teachers are large in number, and they lack the specificity and professionalism of physical education, which leads to a phenomenon of avoidance of physical education classes.

Hence, the Ministry of Education changed the system of sports instructors to a fixed salary system and an indefinite contract rather than a temporary worker who feels job insecurity in order to improve the system for social stability from the perspective of the school and the students' perspective, whereby an education system should be established so that they can focus on school work and learners.

3.4. Physical education environment of the sports instructors and the plans of improvement

3.4.1. Sports instructors as professional physical education educators rather than assistant instructors

Without doubt, sports instructors are specified as a job which assists homeroom teachers, yet in practice, sports instructors have independently conducted physical education classes for grades 3-6. While many university students of education oppose the right to teach sports for sports instructors and lecturer group, the homeroom teachers in the actual school site lack the professionalism of physical education classes, and hence, they entrust sports classes to sports instructors and sit behind them or spend private time in most cases, this was found to be the case mostly.

"Even though we teach 21 hours a week, there are cases where we are asked to work beyond working hours, and in class, the home teachers don't even participate in class, and even if they do, they play games, read, and sleep." (AAA)

"Classes are always taught by sports instructors, not as assistant classes, and the homeroom teachers come by chance, but they see if the kids are doing well and take care of their private affairs." (CCC)

As a result of taking such initiative in running classes, in the event of an unexpected situation, issues arise regarding the responsibility and responsibilities of sports instructors who are playing the role of assistants, and they have the right to decide to increase the use and equipment in order to improve the quality of physical education classes. Furthermore, since there is no dedicated seat for the sports instructors, there were situations where the head of sports department's attention had to be avoided, and they took a break in the meeting room and narrow space of the school office. Sports instructors are exposed to several hours in hot summer and cold winter due to the nature of the subject, and there was not even any personal space during breaks, and hence, there were frequent situations in which attachment to the school and the attention of the staff had to be noticed.

"Whenever there is a sports event, outside of regular class hours, most sports instructors are in charge of training students outside of class. Since the school says that they are in charge of physical education, the school assumes that it is very natural. They do it for free without any payment, and if they go to a competition and win a championship, they are excluded from the award for their achievements. All the credit goes to the head of physical education department who rarely shows up and who does not even participate in training sessions." (AAA)

"I'm in charge of classes for grades 3-6, but sometime, my homeroom teachers ask me to change and run classes for grades 1-2. Originally, we were not supposed to be able to take on the Wise Life class for grades 1 and 2, but in the case of grades 1 and 2, the energy is overflowing and they are difficult to manage, and so, regardless of the intention, there are people who sometimes use us recognizing that we are temporary workers. I want to say no, but I'm patient because I fear that the relationship will deteriorate." (FFF)

Various sports events are held each year. Among which, regional athletics competitions and various sports club competitions are held, and it is said that difficulties arise in the process of preparing these sports events. It is said that the school wants sports instructors to provide guidance and training for the preparation for the competition. If they receive a separate allowance or have won a prize in a competition without being included in the number of hours,

compensation and hard work must be returned to the physical education specialized teachers, and sports instructors are complimented briefly afterwards, and hence, the role and work activities of sports instructors must be systematically presented in detail.

3.4.2. Improvement plan for securing professionalism of sports instructors

Sports instructors collect membership fees from the sports instructors meeting and conduct elementary sports instructors training every year at the meeting. This is also practiced independently by the sports instructors' meeting, and the office of education is setting up a place and paying small snack fees, whereby the sports instructors themselves are taking the initiative to enhance the professionalism of physical education. However, there are limitations as sports instructors, and hence, they hoped to conduct it twice a year (summer vacation and winter vacation) to improve the professionalism and quality of the office of education's leading physical education. In fact, during the summer vacation, and for about 3 to 5 days, a research institute designated by the office of education recruits professors, incumbent teachers, vice principals, principals, and professional sports instructors to undergo training for sports instructors once a year, and they are improving their physical abilities.

However, since it is conducted with the same content and subject every year, education on various teaching methods, use of new sports, and the teaching methods which can be used with various tools and instruments should be provided. Sports instructors hoped to undergo frequent training on teaching methods according to their age and new uses and equipment and usage related methods, as they run classes with the most enjoyable physical education methods that can be practically used in the field.

"In the past, we had been called in for training before March, but in recent year, we have been receiving training during summer vacation. However, it would be nice to conduct real training, such as experiencing various teaching methods and new sports, with similar training every year." (CCC)

"I think it is necessary to have a meeting with the physical education teachers. I would like to have a time to share information while talking about each class, and have a forum to share class research and examples of individual student's disposition related judgments." (DDD)

"First of all, I think classes should be completely entrusted. What is lacking is that the group training for sports instructors should be further increased quarterly than before. Sports instructors are full of enthusiasm, but on the contrary, it is a pity that training and research activities are not supported." (EEE)

As one of the national policies, sports instructors began as a part of the 'School Sports Revitalization' project, and the office of education and each school recruited physical education majors above a certain standard for elementary schools and placed them across various schools. However, the most problematic lesson gained thus far is the fact that the elementary school sports instructors are teaching sports exclusively rather than assisting them, thereby causing conflicts. Since the first implementation in 2008, 10 years have passed, and there is a conflict with the homeroom teachers, who took a lot of time to improve the system, students, parents, and the classroom teacher who avoided physical education classes.

As such, rather than improving the problem of the fixed working style of sports instructors, as a teacher who directly interacts with students like an average teacher, through professionalism and communication in physical education, they ought to be exposed to various sports activities. Furthermore, it is necessary to improve the system for the recognition of the teaching authority and treatment of the sports instructors by giving them to the sports instructors, who are not dedicated to physical education but the practical instructors.

3.5. Welfare environment of the sports instructors and the improvement plan

3.5.1. Welfare environment such as space for research and rest, etc.

Welfare issues were discussed as many difficulties including the working environment. There is no assigned place even when they work. There was no basic personal work place, so they sat all day on one side of the office meeting room, had to change clothes in the bathroom even if they were dispatched once or twice a week, and took a break in the car before participating in classes, and there were not even chairs and desks for the sports instructors. They were working in an environment where there was a gym equipment room and a desk and chair to take a break, or where there was no air conditioner or heater. In particular, it was not uncommon for them to be kicked out of the most important classroom which was most important for the students, and there were cases where problems with the administrator who misunderstood the school caused problems with the specified annual allowance or salary, which almost caused a disadvantage.

"There is a situation in which seats are suddenly moved from a designated office space to a storage space for sports equipment, equipment, or storage, and colleagues from other schools do not have a seat, so they either sit in one side of the office or only have one desk and one chair in a space the size of 2 pyeong. This is the situation facing the head of physical education department and sports instructors. There is not even a separate classroom." (DDD)

"When I go to a nearby school to run physical education classes, there is no place to rest in the middle of summer. After taking a break at my car, I go to the gym in time for class, teach the students, and rest in my car again with much sweat. There are desks and chairs in the gym, but they tell me to remove them because they don't look nice. Where should we rest? At the very least, there is not even a space to lead work activities to improve the work preparation and post class precautions and professionalism of physical education. I think this is very labor intensive industry, which is even worse than the security work. I tell my younger friends that this not a place to stay for long and instead, quickly develop their skills and leave for another job." (FFF)

While it is natural that there ought to be a seating arrangement for class, research activity time and rest space when working at a minimum, most of the sports instructors live with desks and chairs next to gym equipment, or even had nothing at all. Furthermore, since they were unable to be paid their annual leave allowances, they were forced to take annual leaves, and even class work was at the discretion of the teachers. In practice, the treatment and welfare of sports instructors were very poor. Accordingly, it is suggested that the office of education and school officials need to improve the human rights of sports instructors so as not to cause unbiased human rights violations in the field through conducting a fact-finding survey to improve the human rights and welfare environment for the sports instructors.

3.5.2. Improvement plan for the welfare environment of sports instructors

It is evident that the limited activities and poor working environment which originate from the name of "sports instructors" are the root causes of lowering the quality of physical education[2][20]. Accordingly, in order to provide stability in the employment form of sports instructors, efforts for the working environment and welfare environment should be prioritized in the educational field oriented towards human rights as a matter of policy. Accordingly, the Ministry of Education, regional offices of education, and school officials must face the fact that the distinction between permanent and temporary workers in the educational field is another discrimination within the school which serves as a model for education, and there is a need for a practical system for the working environment, job training, and welfare environment as much as for the average teachers[30][31][32].

4. Conclusion and Recommendation

4.1. Conclusion

The purpose of this study is to specify the improvement plans through the in-depth interviews to articulate the relationship between emotional labor and quality of life experienced by the sports instructors of elementary school of Jeonbuk in the field. In order to solve this problem, 7 elementary sports instructors with at least 5 years of field experience, and possessing the qualification of class 2, have applied the nomadic sampling method to improve the emotional labor environment and quality of life for the elementary school sports instructors, and a result of examining the improvement plan for their emotional labor environment and quality of life, the conclusion has been reached as follows.

First, most of the elementary school sports instructors were temporary workers contracted for less than a year, and they complained of their serious emotional labor between school officials and consumers in the process of the contract renewal, offering additional sports activities such as after school, and the notification of contract renewal.

Second, according to the discretion of school officials as the sports instructors, the method of hiring instructors and employment of less than a year were driven to the lack of sports instructors' lack of sports expertise and a sideline for livelihood, and it is the time to change the instructor's name for the establishment of elementary school physical education and to improve the policy system for their status stabilization.

Third, while the role of sports instructors is the physical education class assistant role for the homeroom teacher, the roles and tasks of sports instructors were not clearly separated in the field, and they were leading the actual physical activities. In order to secure the professionalism of the elementary school physical activity, the educational foundation, such as creative physical education classes and instructor training, ought to be established based on the empowerment of sports instructors for them to take the lead in physical education classes and the training and research activities in the school.

Fourth, while the elementary school sports instructors are lecturer by definition, they are performing their duties as teachers, and yet, there was no space for research as lecturer (desk, computer, and chair, etc.), no changing room, no resting space for teachers, and a serious welfare discrimination was committed in terms of education and human rights. In particular, when performing physical education classes on dispatch for the nearby schools 1-2 times a week, they take a break in their own car and conduct classes, and hence, improving the welfare of sports instructors and enhancing their environment ought to be prioritized.

The elementary school sports instructors system recognized the importance of elementary school physical education for the continuing physical education and medical cost reduction, and was institutionalized in 2008 as a policy. However, as a lecturer, the sports instructors have performed more than their role of taking charge of physical education, not as class assistant, and were vulnerable emotional laborers in the selection, re-selection and additional class selection process, and were emotionally abused.

Accordingly, the welfare environment and educational environment based on the space of research and educational activity to improve the name and status of sports instructors and enhance the professionalism and physical education competency of sports instructors must be prioritized, thereby enabling the settlement of the elementary school sports sites, which are the cornerstone of the continuing physical education for life.

4.2. Recommendation

As such, it is sought to make a recommendation for a follow-up study on improving the working environment of sports instructors and further improve their quality of life.

First, this study has been limited to a specific region of Jeollabuk-do, and the results were derived from the in-depth interviews conducted with 7 study participants. Accordingly, it is

somewhat difficult to generalize the results of this study for the emotional labor environment and the quality of life of all sports instructors. Hence, in future studies, it would be necessary to study the sports instructors of all regions with a focus on their representative attempts. Second, many sports instructors have taught students with the memories of the physical education subject they learned in middle and high school. In order to improve the quality of school physical education and help many physical education majors for their career pathfinding, physical education related colleges, departments, and faculties must offer and research subjects such as the understanding of elementary physical education, instruction and practical skills, and management of sports equipment to foster experts.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution

Lead Author	KK	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	SL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Relationship among Stress, Exercise Flow and Exercise Exhaustion of College Soccer Players

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Abstract

Purpose: *Soccer, as the most representative team sport, is an event that shows the best performance by forming organizational and cohesiveness within the team through interactions between leaders and players and players and players. Also, soccer players feel various psychological changes and experience stress, which is a negative emotional or psychological state in various situations such as maladaptation to the environment, defeat, and immaturity in performance. Athlete Stress, exercise flow and exercise exhaustion of college football players are highly correlated with each other, and it is necessary to understand the relationship between various variables to effectively cope with stress for players to improve their performance. The purpose of this study is to analyze the structural relationship between stress, exercise flow, and exercise exhaustion of college football players.*

Method: *In this study, a questionnaire was conducted through convenience sampling among 250 college soccer players belonging to the University Soccer Federation, and among them, 215 copies of the questionnaire were analyzed according to the purpose of the study, excluding 35 copies of the questionnaires that were answered insincerely. To achieve the purpose of this study, frequency analysis, confirmatory factor analysis, reliability verification, and correlation analysis were performed using SPSS 26.0 and Amos 21.0, and the structural equation model was verified.*

Results: *The mean of each variable was 2.524 to 4.516, and the standard deviation was .613 to 1.464. As a result of examining the kurtosis and skewness values for normality verification, the skewness was .903 to .384, and the kurtosis was from .975 to -.026. As a result of confirmatory factor analysis, χ^2=99.092(df=41, p<.001, Q=2.417), TLI=903, CFI=.928, RMSEA=.081, and the standardization coefficient were .627-939. appear. Exercise stress was found to have a negative effect on exercise commitment. Exercise stress was found to have a positive effect on exercise exhaustion. Exercise commitment was found to have a negative effect on exercise exhaustion.*

Conclusion: *Based on the results, the necessity of developing a stress management program to improve the performance of college football players and applying it to the current situation was suggested. The necessity of developing a stress management program to improve the performance of college football players and Stress has a negative effect on exercise flow, which means that systematic stress management is required for athletes. Second, stress is a variable that directly affects exercise exhaustion. Finally, exercise flow helps to lower exercise exhaustion. As a suggestion based on this research results, it is necessary to efficiently manage the stress of soccer players by exploring the stress factors of elementary, middle, and high school soccer players. Second, it is necessary to develop a program that can efficiently manage stress for college football players and analyze the effect by applying it to the field. Lastly, since the psychological state of the coaches directly affects the players, it is necessary to efficiently manage the stress of the coaches through research on the stress factors of the coaches as well as the players.*

[Keywords] ***Stress, Exercise Flow, Exercise Exhaustion, Performance, Soccer***

1. Introduction

1.1 Objectives of research

As a team sport, soccer is a sport that shows the best performance by forming organizational and cohesiveness through interaction between the coach and players and between players and players. In this process, soccer players feel various psychological changes and experience stress, which is a negative emotional or psychological state in various situations such as maladaptation to the environment, defeat, and immaturity in performance. An appropriate level of stress can be an important factor in a person's goals and growth, but if the stress is too excessive or not effectively managed, it becomes an obstacle to personal growth and work efficiency[1].

According to Martens, Vealey & Burton (1990), stress comes from imbalance or inconsistency between the demands of the environment and one's abilities or appears according to the outcome of the game and whether the goal is achieved[2]. Also, in severe cases, it decreases exercise performance[3], exhaustion[4][5], exercise flow[6], and lowers happiness[7][8] and sports injury[9] as a negative factor. These preceding studies prove that college soccer players are experiencing stress due to their improved performance, academic performance, and the burden of their own career path. In the study results related to college soccer players other than the stress scale, it was found that the stress on performance, control, environment, career, leaders, study, and significant others(parents, and colleagues) was high. It was found that the changed stress factors were directly related to the performance of the players[10].

Exercise flow is a factor that has a great influence on performance and performance, and it means belief and hope that appear through sports participation, and it can be said to include intrinsic motivation such as commitment and involvement due to the desire for continuous sports participation[11]. When the level of exercise flow is high, self-confidence increases[12], has a positive effect on psychological factors determining performance[13], and has a positive effect on stress reduction and prevention of burnout[14][15]. The exercise flow is a variable that can be changed according to the stress level of the athletes as an antecedent variable of the athletes' best performance. On the other hand, exercise exhaustion refers to a state of being psychologically, physically, and emotionally completely exhausted as a result of stress acquired over a long period of time due to one's worries, worries, and excessive training[16].

As a determinant of exercise burnout, it was found that psychological factors appearing in the exercise situation come from chronic stress, excessive training, defeat in competition, and failure to meet expectations of leaders, parents, and colleagues(significant others)[17]. In addition, previous studies related to exercise exhaustion selected stress as an antecedent variable of exercise burnout among various psychological factors, indicating that stress and exercise burnout are closely related[18].

In summary, the stress, exercise flow, and exercise exhaustion of college soccer players are highly correlated with each variable, and it is necessary to understand the relationship with various variables for effective stress coping of players to improve their performance. It will be a meaningful study to confirm the effectiveness of the athletes' stress scale. The purpose of this study is to analyze the relationship between stress, exercise immersion, and exercise exhaustion of college football players to help them improve their performance.

1.2 Study hypothesis

The research hypothesis conforming to the purpose of the study is as follows,

Hypothesis 1. Stress will negative affect exercise flow.
Hypothesis 2. Stress will affect exercise exhaustion.
Hypothesis 3. Exercise flow will negative affect exercise exhaustion.

2. Method

2.1. Participants

The subjects of this study were 250 college football players belonging to the University Soccer Federation through convenience sampling, but 215 copies of the questionnaire were analyzed according to the purpose of the study, excluding 35 copies of the questionnaire that were answered insincerely. <Table 1> shows the characteristics of the research subjects.

Table 1. Subject characteristics.

Variables	Sub-variable	N	Percentage (%)
Grade	Fresh man	85	39.5
	Sophomore	57	26.5
	Junior	47	21.9
	Senior	26	12.1
Position	Defender	92	42.8
	Midfielder	84	39.1
	Forward	27	12.5
	Goalkeeper	12	5.7
Total		215	100

2.2. Validity and reliability of measurement tools

2.2.1. Stress

For the stress scale of college football players, the scale developed by Hong and Kim (2019) was used[10]. The scale consisted of 6 factors, performance stress (10 questions), control stress (5 questions), environmental stress (5 questions), career stress (4 questions), major other stress (6 questions), and academic stress (3 questions) consisted of a 5-point Likert scale.

As a result of confirmatory factor analysis, TLI=.954, CFI=.961, RMSEA=.070, indicating a satisfactory level of fit. As a result of reliability analysis, the value Cronbach's α value was found to be between .85-.92, which indicating appropriateness

2.2.2. Exercise flow

For college soccer players' exercise flow, the tools used in the study of Jung (2004) were used[19]. Behavioral immersion (4 items) and cognitive immersion (8 items) were composed of 12 items with 2 factors on a 5-point Likert scale. As a result of confirmatory factor analysis, TLI=.929, CFI=.944, RMSEA=.086, indicating a satisfactory level of fit. As a result of reliability analysis, Cronbach's α value was 87~.90, indicating appropriateness.

2.2.3. Exercise exhaustion

Athlete burnout questionnaire (ABQ) developed by Raedeke (2001) was translated and used for college soccer players' exercise burnout questionnaire[16]. Decreased sports value (5 items), emotional/physical exhaustion (5 items), and decreased sense of achievement (5 items) are 15 items with 3 factors and are to be answered on a 5-point Likert scale.

2.3. Data processing

The data processing of this study was analyzed using SPSS 26.0 and Amos 21.0.

To verify the validity and reliability of the measurement tool, confirmatory factor analysis and reliability analysis (Cronbach's α coefficient) were performed. To find out, the mean, standard deviation, skewness, and kurtosis were analyzed through descriptive statistics analysis. To find out the construct validity of the overall measurement model, construct reliability (CR) and average variance extracted (AVE) were analyzed through confirmatory factor analysis, and average variance extracted to find out discriminant validity. The exponential (AVE) value and the coefficient of determination (r2: the square of the correlation coefficient) were compared, and the hypothesis was verified using a structural equation model (SEM). The bootstrapping method was used to analyze the mediating effect of leader trust, and the significance level was set to α=.05.

3. Results

3.1. Descriptive statistics analysis of each variable

The descriptive statistical analysis for normality verification is shown in <Table 2>. The mean of each variable was 2.524 to 4.516, and the standard deviation was .613 to 1.464.

As a result of examining the kurtosis and skewness values for normality verification, the skewness was .903 to .384, and the kurtosis was from .975 to -.026. It was found that normality was satisfied as it did not exceed ±2.

Table 2. Descriptive statistical analysis.

Variables	M	SD	Kurtosis	Skewness
Performance stress	3.874	1.075	-.202	-.705
Control stress	3.567	1.153	-.270	-.590
Environmental stress	3.191	1.021	-.209	-.018
Career stress	3.498	1.195	-.684	-.442
Major typing stress	3.260	1.246	-.975	.088
Academic stress	3.255	.712	-.912	-.903
Cognitive immersion	4.349	1.464	-.333	-.119
Immersion in action	4.516	1.226	-.026	-.575
Decrease in sports value	2.524	.613	-.855	-.412
Emotional and physical exhaustion	2.951	1.109	-.541	.384
Decreased sense of achievement	2.874	1.095	-.345	.321

3.2. Measurement model evaluation

The results of verification of the structural validity of the measurement model are shown in <Table 3> and <Table 4>. As a result of confirmatory factor analysis, χ^2=99.092(df=41, p<.001,

Q=2.417), TLI=903, CFI=.928, RMSEA=.081, and the standardization coefficient was .627~ It turned out to be 939. AVE and CR (Construct Reliability) values were analyzed using standardization coefficients. Concentrated validity is appropriate when AVE value is .5 or more and CR value is .7 or more, and discriminant validity is determined by AVE (Average Variance Extracted) value. When it is larger than the coefficient, it can be evaluated as suitable. As a result of checking these criteria, discriminant validity and convergent validity were found, confirming the construct validity of the overall measurement model.

Table 3. AVE and coefficient of determination of the measurement model.

Variables	CR	AVE	r^2		
			Stress	Exercise flow	Exercise exhaustion
Stress	.884	.564	1		
Exercise flow	.852	.744	.504	1	
Exercise exhaustion	.769	.625	.391	.333	1

Table 4. Model suitability.

X^2	DF	Q	RMSEA	TLI	CFI
105.985	41	2.585	.065	.934	.951

3.3. Research model verification

The verification results of the research model are shown in <Table 5>. The fitness of the research model was found to be appropriate. The verification of the research hypothesis based on the structural model analysis results is as follows.

First, with the path coefficient -.409 (t=-4.145, p < .001) that “the stress of college football players will have a negative effect on exercise commitment”, stress had a statistically significant negative relationship with exercise commitment. appeared to be

Second, with a path coefficient of .368 (t = 2.719, p < .01) that “the stress of college football players will have a positive effect on exercise exhaustion”, stress has a statistically significant positive relationship with exercise exhaustion. appear.

Third, “College soccer players’ exercise commitment will have a negative effect on exercise exhaustion.” is a path coefficient of -.267 (t=-2.254, p < .001), indicating that exercise commitment had a statistically significant negative relationship with exercise exhaustion.

Table 5. Path coefficient and direct/indirect effect.

Hypothesis	Path			β	t
Hypothesis 1	Stress	⇒	Exercise flow	-.459(-.409)	-4.145***
Hypothesis 2	Stress	⇒	Exercise exhaustion	.249(.368)	2.719**
Hypothesis 3	Exercise flow	⇒	Exercise exhaustion	-.160(-.267)	-2.254*

4. Discussion

The purpose of this study is to analyze the relationship between stress, exercise commitment, and exercise exhaustion of college football players to help them improve their performance. The discussion based on the results of this study is as follows.

First, it was found that the athletic stress of college soccer players had a negative effect on exercise commitment. These results were found in previous studies that exercise stress had a negative effect on the performance of athletes supported this study[4][6][7][8][20]. College soccer players may show helplessness and interest in sports due to stress related to their game performance, career path, major hitter, control, environment, major hitter, and schoolwork. You need to understand and empathize with your concerns. According to a study by Kim and Hong (2019), most college soccer players train in camps, and the players themselves feel they are under control, and in the dormitory where players can rest comfortably, they give autonomy rather than control, so that players can psychologically You need to be able to find stability[9].

In addition, rather than the authoritative and coercive leadership of leaders, effective leadership that can give sincerity and positive feedback should be exercised to increase trust in the leader. Rather than recognizing the coach as a difficult and difficult opponent, players should perceive the coach as a comfortable and reliable leader, so that players can accept and implement the coach's instructions, tactics, and strategies. In this respect, program application research and psychological counseling that can effectively manage the stress of college football players are required.

Second, the exercise stress of college soccer players was found to have a positive effect on exercise exhaustion.

These results are supported to the results of this study in previous studies that exercise stress is a predictor of exercise exhaustion[17][18][21]. According to a study by Choi and Ryu (2012), this study is supported by the fact that there is a positive relationship between exercise stress and all sub-factors of exhaustion[22]. College soccer players may have high levels of stress due to leaders, parents, and colleagues(significant others). These results can lead to quitting exercise and player retirement due to exercise exhaustion, so it is necessary to systematically manage the stress of the players.

Third, exercise flow of college soccer players was found to have a negative effect on exercise exhaustion. These results are supported by previous studies that exercise commitment is negatively related to exercise burnout[14][15]. Athletes' exercise flow is a psychological phenomenon that occurs in the best performance[23][24], and as the level of immersion of the players increases, it has a positive effect on performance, which can appear as game satisfaction or performance satisfaction. It is thought to be improved and prevent exercise exhaustion.

5. Conclusion

The conclusions of this study are as follows.

First, stress has a negative effect on exercise flow, and systematic stress management is required for athletes. Second, stress is a variable that directly affects exercise exhaustion. Third, exercise flow helps to lower exercise exhaustion.

Recommendations for future research are as follows.

First, it is necessary to efficiently manage the stress of soccer players by exploring the stress factors of elementary, middle, and high school soccer players.

Second, it is necessary to analyze the effect of developing a program that can efficiently manage stress for college football players and applying it in the field.

Third, since the psychological state of the coaches has a direct effect on the players, it is necessary to effectively manage the stress of the coaches through research on the stress factors of the coaches as well as the players.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	SK	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	GR	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	CK	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Critical Reviews of NBA Official Data based on Sport Analytics

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Abstract

Purpose: *This study was to identify and to recognize the critical moment of NBA official data using sport analytics techniques. Previous studies have already had the research area on the basketball that the sport science was to be applied into enhancing of performance in the practice. The official data was recently considered in many researchers that the official data has been gathered by scientific methods such as advanced technologies. Current trend of performance analysis of sport intends to extent the data range that the official data could be gathered from the official website and it would be a massive dataset.*

Method: *The sport analytics techniques using big data analysis were utilized that the NBA official data from 2015-2016 to 2020-2021 seasons contained more than 3,040,000 events. The Python scripts to gather the NBA official data were utilized and the gathered data as csv format. All analysis of data was executed within R studio with R programming that the changes of numbers of events between seasons and successful rate of each events were compared in this study. Statistically, the frequency analysis was used for the determination of data.*

Results: *This study was to recognize the critical moment among the NBA official data that there were two findings mainly. First of all, frequencies of events on 2-pt jump shots have been decreasing and frequencies of events on 3-pt jump shots have been increasing between season. Particularly, the short-distance shots such as 2-pt tip-in, 2-pt layup, 2-pt jump shots were more presented in each season than the long-distance shots. Secondly, the successful rate of shots and outcomes between season have not been differently presented.*

Conclusion: *Consequently, this study has found the displacement of critical changes within the official NBA data that it could indicate the originality of basketball match rather than characteristics of playing. It is also important that the playing trend would be differently observed when the skill or players' style was able to be considered. Further research is also required that the critical point of recording change on the sequencies of time line would need to be concerned.*

[Keywords] ***Basketball, Statistics, Sport Analytics, Frequency Analysis, Playing Trend in Basketball***

1. Introduction

Sport science is showing the pathway of further information and contents of performances. In past decade, sport scientist have concerned to find the best way to enhance performances through the training sessions or after the matches[1]. The scientific approaches to figure the best way out for enhancing performances, therefore, were variously tried. Some research has considered the systematic reviews about the impacts of the winter Olympic that it could have been the external factors to influence the performance of player or teams[2]. There are a couple of way to aid enhancing performance in a practical field of sport that the physiological approaches[2][3] are usually considered. The reason why the physiological principle would be able

to aid the process of enhancing performance that a particular training method or environment[3]. However, the way to analyze and to feedback the information of performance based on coaching perspectives, it is worth to separate the techniques such winning and losing, elite and non-elite, and offensive/ defensive situation[4].

Recently, the way to gather performance data was more effectively developed. The scription of programming, such as Python, R and other programming, would be used to gather and to arrange data relevant to performance enhancement or performance itself. The analyzing data using big data analysis has applied to the field of sport science that the phenomenon of performances in soccer was one of critical research area[5]. Especially, in soccer, the tactical analysis of performance would need a lot of fundamental factors relating to team performance. The passing frequencies with successful rates within a particular situation in soccer have commonly presented the conceptional events relevant to successful outcome. The performance analysis of sport, commonly known as a notational analysis of sport, has expended the principle that it includes the area of technology of data gathering, data processing of performance, and evaluation of performance in sport[6][7]. Thus, the data analysis within a huge range of data is used to summarize the characteristics of team performance or individual performance[8][9][10].

As the technology of data gathering and processing have developed, the official data of sport event could have been providing for public easily. The official data of many sports has been providing performance data such as successful passes, rate of successful pass(%), and ball possession through the official web site in soccer. Also, the basketball data is able to be collected easily based on the official data through the official web site. The official data of NBA(National Basketball Association) in USA is also providing various concepts of performance data by xml, csv, and other format. It influences to the research trend that the official data of sport event is able to present critical summary of performance[11]. Using the official data to analyze performance would bring advantage and disadvantage[12]. The sequential factor would be not considered when time factor is not included in the official data[13]. However, the critical moment would be recognized within the official data when the data would be concerned by a particular circumstance. It is necessary to figure out whether or not a possibility of application based on sport analytics would be used. Thus, this study was to find out a critical moments among the NBA official data based on Sport Analytics technique.

2. Methodology

2.1. Subjects

The NBA official data could be gathered from the web site (https://nba.com/stats) that totally 1,060 matches' data were selected as subjects in this study. The NBA official data was included 'play by play' events that totally 3,040, 524 events were considered in this study. <Table 1> is shown the summary of subjects.

Table 1. characteristics of the subjects.

Season	No. of match	Total event	avg. of event/match
2015-2016	210	601,557	2,864.6
2016-2017	204	596,645	2,924.7
2017-2018	212	590,868	2,787.1
2018-2019	212	614,516	2,898.7
2019-2020	193	539,265	2,794.1
2020-2021	29	97,673	3,368.0
total	1,060	3,040,524	-

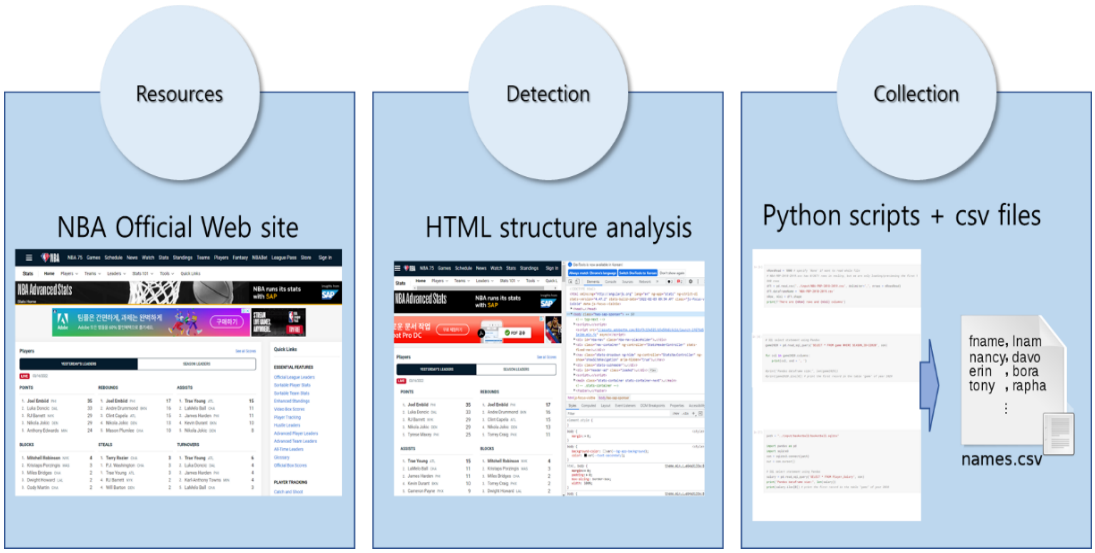
2.2. Variables used

The variables in this study were frequencies of 2-pt dunk, 2-pt hook shot, 2-pt jump shot, 2-pt layup, 2-pt tip-in, 3-pt hook shot, 3-pt jump shot and 3-pt layup grouped by season from 2015-2016 to 2020-2021. In addition, the numbers of events were not related to the shots among the NBA official data that it indicated as 'non-shots events' in this study.

2.3. Data collection

The NBA official data was collected from the official website (https://www.nba.com/stats) that all stats and information have been gathered by a crawling, as one of data analytics techniques. <Figure 1> is shown the procedure of data collection in this study. All NBA official data from 2015-2021 season were analyzed on HTML scripts and then saved as csv files with Python programming.

Figure 1. Steps of data collection in this study.



2.4. Data processing and analysis

The collected data was transformed into data frame format that R and R studio were used for data process and analysis. First of all, as collected data were separated by season, all data was read into R data and then merged into a file. Secondly, the raw data were determined that the frequency analysis were basically concerned as statistical analysis. There are 3 kinds of analysis points that 1) the differences of shots between NBA seasons, 2) the differences of outcomes of the shots between NBA seasons were considered.

3. Results

3.1. Distribution of shots among total events grouped by NBA season

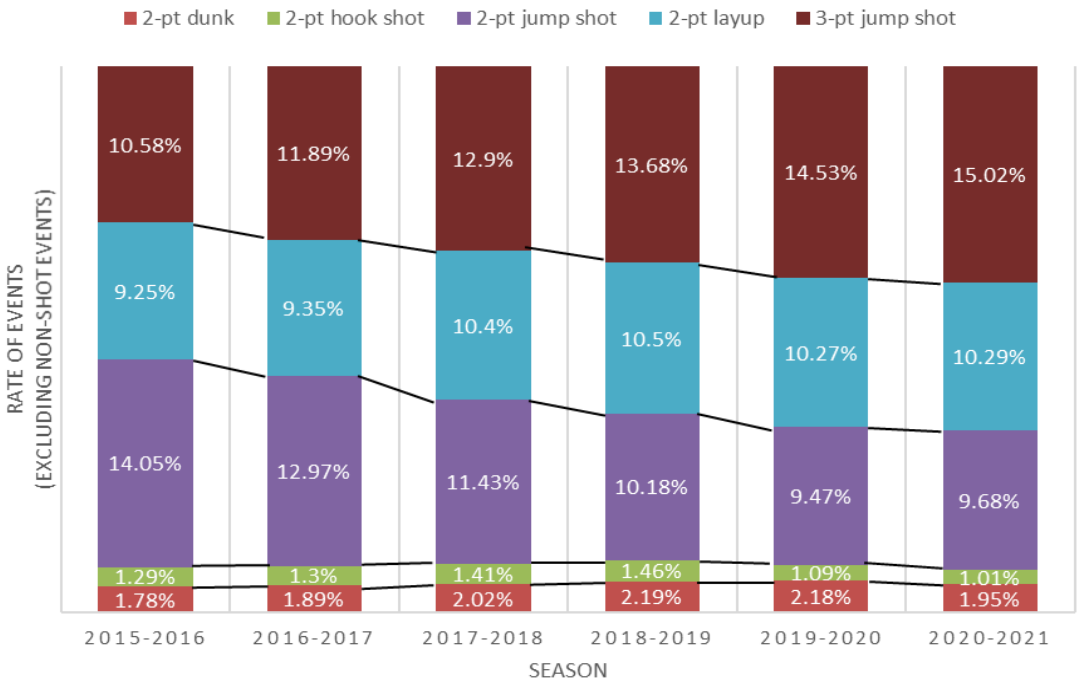
The NBA official data were analyzed that the NBA seasons from 2015-2016 to 2020-2021 were used to compare the changes of each shots. Short-distance shots, such as 2-pt dunk, 2-pt hook shot, 2-pt jump shot, 2-pt layup and 2-pt tip-in, have observed variously than the long-distance shots (3-pt hook shot, 3-pt jump shot, and 3-pt layup). <Table 2> is shown that the shot distribution among the events from 2015-2016 season to 2020-2021 season.

Table 2. Distribution of events grouped by season.

Seasons / Type of Shots	Events by Season					
	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Non-shots events	379,269	373,428	365,400	380,959	336,868	60,599
2-pt dunk	10,720	11,293	11,921	13,441	11,740	1,908
2-pt hook shot	7,772	7,750	8,330	8,952	5,874	985
2-pt jump shot	84,515	77,406	67,530	62,577	51,077	9,456
2-pt layup	55,646	55,810	61,447	64,505	55,362	10,053
2-pt tip-in	-	-	-	3	-	2
3-pt hook shot	5	4	1	0	0	0
3-pt jump shot	63,628	70,949	76,233	84,079	78,344	14,670
3-pt layup	2	5	6	0	0	0
Total events	601,557	596,645	590,868	614,516	539,265	97,673

As <Table 2> is presented, 2-pt tip-in, 3-pt hook shot and 3-pt layup were rarely found in each season from 2015-2016 to 2020-2021. It did not mean that types of 3-pt shots were no influenced upon the outcomes or trend of match between seasons. Among the events in this study, a number of Non-shots events were almost covered in total numbers of events so that it was necessary to compare displacement of distribution of shots' types excluding the numbers of non-shot events. <Figure 2> is shown the rate of shot events in each season.

Figure 2. Total numbers of shots grouped by NBA season.



3-pt jump shot has been increasing that the long-distance type of shots was able to be easily executed. On the other hand, the 2-pt jump shot has been decreasing that short-distance type of shots are able to be not easily executed which meant the pressure of defense has been stronger and stronger.

3.2. Outcomes and successful rate of shots grouped by NBA season

<Table 3> is presented the total frequencies of shot distribution by successful outcomes (made or missed). The successful rate of 2-pt dunk was the greatest rates among the shots that it was same results on each reason. The successful rate of 2-pt layup shot was secondly greater than other shots. It was similar rate with 2-pt hook and 2-pt jump shots. The lowest rate of successful shot was 3-pt jump shot that it would be caused by distance of shot.

Table 3. Frequencies of event's outcome grouped by season.

Shots / Season/ outcome		2-pt dunk	2-pt hook shot	2-pt jump shot	2-pt layup	2-pt tip-in	3-pt hook shot	3-pt jump shot	3-pt layup	non-shots events	Total events
2015-2016	O	9,736	3,930	32,837	31,321	-	1	22,522	-	379,269	601,557
	X	984	3,842	51,678	24,325	-	4	41,106	2		
	%	90.8	51	39	56.3	-	20	35.4	-		
2016-2017	O	10,257	3,922	30,845	31,711	-	-	25,405	1	373,428	596,645
	X	1,036	3,828	46,561	24,099	-	4	45,544	4		
	%	90.8	51	40	56.8	-	-	35.8	20		
2017-2018	O	10,654	3,841	27,732	33,966	-	1	27,530	1	365,400	590,868
	X	1,267	4,489	39,798	27,481	-	-	48,703	5		
	%	89.4	46	41	55.3	-	100	36.1	17		
2018-2019	O	12,026	4,239	25,925	35,313	-	-	29,793	-	380,959	614,516
	X	1,415	4,713	36,652	29,192	3	-	54,286	-		
	%	89.5	47	41	54.7	-	-	35.4	-		
2019-2020	O	10,512	2,787	21,519	30,200	-	-	28,061	-	336,868	539,265
	X	1,228	3,087	29,558	25,162	-	-	50,283	-		
	%	89.5	47	42	54.6	-	-	35.8	-		
2020-2021	O	1,684	474	4,039	5,507	-	-	5,353	-	60,599	97,673
	X	224	511	5,417	4,546	2	-	9,317	-		
	%	88.3	48	43	54.8	-	-	36.5	-		

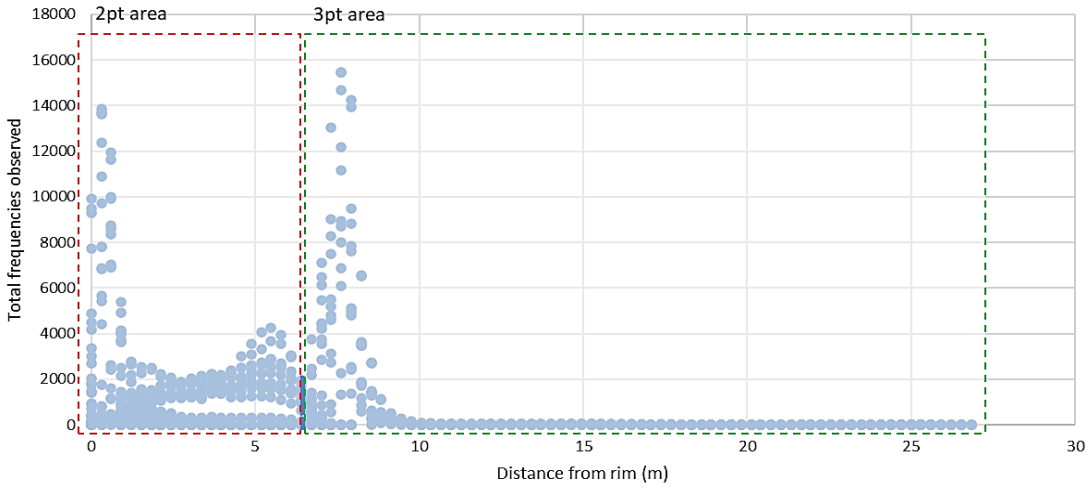
Note: O-make, X-miss, %-% of made shot.

In <Table 3>, the most greatest rate of successful events was 2-pt dunk shot in 2015-2016 season. It is similarly presented on other seasons that it is the most accurate shot among the shots considered in this study. However, the comparison of successful rate of each shots would be referenced within each season, but it would not intend to explain the critical moment or events. Thus, the comparison of the most accurate shot among the shots considered in this study would be determined between seasons.

Interestingly, from 2015-2016 season to 2017-2018 season, there were 3-pt hook shot and 3-pt layup shots observed. It could not be generalized that it has happened because the defensive strategy would be more sensitive. However, the reason why the frequencies of those 3-pt hook shot and 3-pt layup shots have not been observed has to be proven with objective data analysis. In addition, the decreasing number of 2-pt shots would have a relation with the increasing numbers of 3-pt shots.

<Figure 3> is shown the distribution of shots' distance by whole data used in this study. As the distribution of shots' distance shown, 2-pt shots were variously attempted between 0 meters and 7.5 m from the rim of basket. Interestingly, 3-pt shots were attempted between 7.5 meters and 27 meters.

Figure 3. Distribution of shots distance from 2015-2016 to 2020-2021 NBA season.



4. Discussion

The result of distribution of shots among total events was grouped by NBA season from 2015-2016 to 2020-2021. The frequencies of total events on 2020-2021 season were less than other season that it was caused by the COVID-19 pandemic in the field of sport. The NBA matches during the COVID-19 pandemic were influenced by government policy that it caused numbers of matches played getting reduced[14]. It is not only for NBA matches, but physical activities have been also reduced, especially the frequency of physical activities were reduced as same as reducing time of physical activities[15]. Decreasing percentage of 2-pt jump shot between NBA seasons, however, is not effected by the number of matches played. It meant that the critical trends of playing style in NBA could be changed by season[16][17][18]. Playing styles and player's characteristics have been often considered with the official data.

The result of this study also pointed that the playing style was changing that the long-distance shots were not difficult and rare shots any more. The non-shots events were the factors not relevant to shots directly, such as steals, turnover, time-out, substitution, and fouls. The displacement of frequencies on shots between seasons would be observed that it would include different type of playing in NBA. It is not only the evidence that following findings would be related to this finding.

The frequencies of events' outcome on each type of shot were similarly presented and the successful rates of shots were also similarly presented between seasons in this study. It indicates that originally basketball matches have own characteristics contained a particular events as common events and the other events as un-common events. It is reasonable that an unit data, which would be used in recording process of a particular performance, would be an action but many actions in a change of shots at once. Thus, a particular shot would explain a particular type of shots that the critical trend of shots in a whole season would be similarly presented[19].

On the other hand, the distances between shots and rim of basketball were also interestingly presented that the 2-pt shots, such as 2-pt tip-in, 2-pt layup, and 2-pt jump shots, were distributed broadly that 3-pt shots. It meant that 2-pt shots would be occurred various times, but 3-pt shots would be occurred on a particular area on basketball court. In order to defense well,

the break-down of defensive formation would be a way to score a point[20]. In basketball strategy, the way to get a score might be a various cases including 2-pt field goal strategy and free-throw goal strategy. Almost all of winning strategy in basketball would follow the 2-pt field goal strategy. The 2-pt field goal strategy is using when the opposition team is able to be easily attacked. On the other hand, 3-pt goal strategy would be used when the team could not drive into the basket or into the position under the basketball. There is another reason why the 3-pt goal strategy is used for a particular team that the pressure time, such as man-to-man defense situation or full-pressure, would cause the type of the oppositional shots. Previous research relevant to the basketball researches have already supported the fact of interaction between teams. This study has also pointed that the short-distance shots has decreasing and the long-distance shots has increasing from 2015-2016 season to 2020-2021 season. It meant that the playing pattern and strategy both have been changed[19][21][22][23].

It is not only the game changes, but it would be a displacement of audience, or culture changes for audience in basketball matches. As results of this study, the changes of type of shots between 2015-2021 seasons would influence the joys and fun of basketball matches for audiences that it could bring a major impact. Basketball matches were popular because it is one of contact sports between players. The audience of basketball matches would get a surrogate satisfactions from the players, but it would be decreased if the long-distance shots would increase in the NBA matches.

5. Conclusion

This study was to identify and to recognize the critical moment among the seasons from 2015-2016 to 2020-2021. Consequently, the number of short-distance shots have been decreased and the number of long-distance shots have been increased. But, the successful rate of each shots were not differently presented in this study. Thus, it is necessary to look over the principle reason of this sort of changes during matches that player's characteristics in a team has to be considered with clustering of playing patterns.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	HC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑

Corresponding Author*	RD	-Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Relationship between the Sense of Creation, Social Adaptation, and the Feeling of Happiness Via Spectating Sports Events

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Abstract

Purpose: *The purpose of this study is to present the direction for not only hosting sports events but also managing them by examining and understanding the influence of the sense of creation via watching sports events on the social adaptation and the feeling of happiness.*

Method: *In this study, convenience sampling was used for the sampling method for 260 people who experienced watching sports events in 2021, and the survey was conducted by using the self-administration method. Among the collected questionnaires, 249 questionnaires were used as valid samples, excluding the data with insincere responses or omissions of some of the contents of the survey. The frequency analysis, Cronbach's α coefficient calculation, confirmatory factor analysis, correlation analysis, and the structural equation model using the statistical package program SPSS 23.0 Program and AMOS 18.0, were performed.*

Results: *In this study, as a result of the confirmatory factor analysis performed across all measurement items, it was confirmed that the model fit criteria were satisfied, and it turned out that there was no problem with concentrated validity. There was no multi-collinearity problem in the correlation between the variables, and it turned out that all fit indices were satisfied in the model fit of the study. The standardized coefficient value for the effect of sense of creation via watching sports events on social adaptation turned out to be .289, which turned out to have a significant effect at a significance level of .001, and the standardized coefficient value for the effect of the sense of creation via watching sports events on the feeling of happiness turned out to be .312 with a significant effect at the significance level of .001. The standardized coefficient value for the effect of social adaptation on the feeling of happiness turned out to be .326, which demonstrated a significant effect at the significance level of .001.*

Conclusion: *The conclusions reached by undergoing the research process demonstrate the fact that the sense of creation via watching sports events influences the social adaptation and feeling of happiness, and expectations about the economic, temporal, and social costs of spectators via watching sports events, and the participation of excellent players, efforts to improve performance, and provision of various convenience facilities are needed to ensure that they can feel satisfaction.*

[Keywords] ***Sports, Sports Events, Sense of Creation, Social Adaptation, Feeling of Happiness***

1. Introduction

1.1. Need and purpose of the study

Sports events refer to hosting various events and festivals via sports for specific people in a specific location with a specific purpose of sports[1]. Furthermore, it is a broad concept which includes not only a simple competition, but also ancillary cultural events and various other activities held in the host region[2].

Sports events trigger interest and fun for the participants and spectators through sports related contents, from hosting sports teams or clubs to sponsoring sports events, participating in mega sports events, and hosting sports events where the participants and spectators can participate in various forms, while carrying out all activities related to sports including hosting the sports events[3].

Sports events are among the economic ripple effects such as creation of jobs and inflow of spectators through sports tourism, expansion of business investment opportunities across various related industries, urban regeneration related effects through the urban reconstruction projects including roads, construction and maintenance, as well as the social integration effects such as enhancing the self-esteem and affection of local residents through the urban image enhancement effect, etc., are the factors which make the local people expect regional development[4]. That is, hosting sports events in the local community allows the local residents to expect to improve their overall quality of life based on the benefits in terms of socio-cultural, environmental, and economic aspects[5][6].

However, since the emergence of various sports events, it was also discovered that the expected effect on the sports events has been limited[7], and to overcome such limitations, a discussion of the legacy aspect of sports events, which is a new standard for the impact of sports events, has been conducted[8]. In particular, legacy is a result created and held through the sports events, and may be said to be all tangible and intangible things which remain over the long term as positive and negative results[9].

Recently, there has been much interest in urban development based on facilities, including stadia related to sports events, and this is not simply a concept for ex post use of the sports facilities. The values and culture pursued by the sports competitions would take root in the host region and positively change and sustain the physical, social and economic environment, thereby instilling the awareness and interest in sports events among local residents, as well as a feeling of happiness and life whereby the quality of life may be improved accordingly[10][11].

Hence, the purpose of this study is to build and present the direction for not only hosting sports events but also for managing sports events by examining and understanding the influence of sense of creation via watching sports events on the social adaptation and feeling of happiness.

1.2. Theoretical background and research hypotheses

Sense of creation is a structured concept which exists within an individual and is also described in various terms such as desire, impulse, interest, task, and thesis, and it is also expressed in terms of essential physiological, instinctive, philosophical and religious aspirations, developmental tasks and social needs. Sense of creation is an action with motives and values, equated with having a general attitude towards life and the world, defined as a desire for what others need of me and while performing the role of responsible parent, guardian, and guide for the next generation, one confirms one's own worth through 'caring.' When extended to society, it refers to the role of a responsible citizen, a person contributing to the local community, and a leader[12].

Social adaptation refers to the act of managing interpersonal relationships and the personal daily life through social and leisure roles in the local community[13]. Social adaptation ability, which means interpersonal relationships, adaptability, impulsivity, responsibility, etc., as recognized by an individual, enables on to adapt to changes in the social environment and maintain smooth human relationships, and can actively change one's own social environment, and since leisure activities are behaviors and experiences in a social environment, they can help induce the personal and social interactions and contribute to the personal development as

well as socialization[14]. Feeling of happiness is a positive psychological state which depends on how one perceives one's life and is satisfied with one's life[15].

In particular, when evaluating one's own life, the more positive the expected result, the better the feeling of happiness, and the more pleasant and comfortable the mind, the more positive emotions, and such a psychological feeling of happiness is intimately related to the social and physical environment such as an individual's income level, education, and occupation[16][17].

The sense of creation exists in a wide variety of forms within a broad range of psycho-social structures, and as a result of many different activities in individual and social characteristics, it is said that it is expressed via internal and cultural demands, interests, trust, responsibility, and behaviors and interactions[18]. The sense of creation is related to happiness and well-being, and also turned out that social adaptation is related to happiness and satisfaction[19][20][21][22].

Based on such a theoretical background and the results of the previous studies, it turned out that there is a relationship between the sense of creation, social adaptation, and the feeling of happiness, and the following hypotheses were established.

Hypothesis #1. The sense of creation via watching sports events will influence the social adaptation.

Hypothesis #2. The sense of creation via watching sports events will influence the feeling of happiness.

Hypothesis #3. Social adaptation will influence the feeling of happiness.

2. Research Method

2.1. Subjects and sampling technique

In this study, 260 people who experienced watching sports events in 2021 were surveyed, and convenience sampling was used for the sampling method, and the survey was conducted by the self-administration method. Among the collected questionnaires, 249 questionnaires were used as valid samples, excluding the data with insincere responses or omissions of some of the contents of the survey.

2.2. Measuring instrument

The measurement tool used for this study is a questionnaire, and as for the sense of creation, the questionnaire used for the studies of Erikson (1950), Gilmoon Kim, Namwoon Jeong, Jaeho Yoon (2020), Okhee Lee and Jiyeon Lee (2012), and Geonhee Park and Seunggeun Baek (2012) was used[23][24][25][26], and as for the social adaptation, that used for the study of Geungyoung Lee and Jaeseong Chae (2018), Soonbeom Hong, Kwangbong Seo, Jiyeol Lee (2019), Seongho Jang and Inhyeong Kim (2016), and Minhee Lee and Koomyeong Kwon (2018) was used[27][28][29][30]. As for the feeling of happiness, the questionnaire used for the study of Jin Woo and Yeonhee Seo (2021), Geunyoung Jeong (2021), Jiseung Yang and Jinjong Eom (2021) was used[31][32][33].

2.3. Analysis of data

The data processing of this study statistically validated as follows according to the purpose of data analysis by using the statistical package programs of SPSS 23.0 Program and AMOS 18.0.

First, the frequency analysis was performed to examine and understand the general characteristics.

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

Third, the confirmatory factor analysis was performed for the factors of the sense of creation, social adaptation, and the feeling of happiness.

Fourth, the correlation analysis was performed to examine and understand the conventions between the variables.

Fifth, the structural equation model was used to examine and understand the relationship between the sense of creation, social adaptation, and the feeling of happiness.

3. Results

3.1. Validity and reliability of the questionnaire

In this study, validity and reliability were measured to determine the conformity of the questionnaire structure, and the RMSEA was applied as a fitness index. Meanwhile, if it is .8-.9 or more for CFI, TLI, and GFI, and .09 or less for RMSEA, it may be said to be a conforming model.

<Table 1> illustrates the fact that the results of confirmatory factor analysis of all measurement items demonstrated TLI .936, CFI .955, and RMSEA .087, confirming that the model satisfies the model fit criteria. Furthermore, the concept reliability and variance extraction index values both exceeded .7 and .5, indicating that there was no issue with the concentration validity. Furthermore, as a result of validating the Cronbach's α coefficient for reliability analysis, it turned out that for the sense of creation, α=.956, for social adaptation, α=.924, and for the feeling of happiness, α=.897.

Table 1. Confirmatory factor analysis and reliability.

	x^2	x^2/df	TLI	CFI	RMSEA	*Cronbach's α*
Sense of creation	362.278	5.94	.936	.955	.087	.956
Social adaptation	-	-	-	-	-	.924
Feeling of happiness	-	-	-	-	-	.897

3.2. Correlation analysis

Table 2. Correlation analysis.

	1	2	3
Sense of creation	-		
Social adaptation	.376**	-	
Feeling of happiness	.354***	.427***	-

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

<Table 2> illustrates the fact that there is a statistically significant correlation between most variables as a result of verifying the correlation between the variables, and since all correlation coefficient values did not exceed .85, it is apparent that there is no multi-collinearity problem.

3.3. Results of the hypothesis test

Table 3. Confirmatory factor analysis.

	x^2	x^2/df	TLI	CFI	RMSEA
Model fit index	387.164	5.94	.936	.955	.087

<Table 3> illustrates the fact that TLI=.936, CFI=.955, and RMSEA=.087 as the model fit results of this study, which satisfies all fit indices.

Table 4. Results of the structural equaling modeling analysis.

Path	Estimate	S.E.	t-value	
H1. Sense of creation → Social adaptation	.289	.145	3.465***	Accept
H2. Sense of creation → Feeling of happiness	.312	.128	2.997***	Accept
H3 Social adaptation → Feeling of happiness	.326	.153	3.241***	Accept

Note: ***p<.001.

As illustrated in <Table 4>, the standardized coefficient value for the effect of sense of creation via watching sports events on the social adaptation turned out to be .289, which turned out to have a significant effect at the significance level of .001. The standardized coefficient value for the effect of sense of creation on the feeling of happiness turned out to be .312, which turned out to have a significant effect at the significance level of .001. Furthermore, the standardized coefficient value for the effect of social adaptation on the feeling of happiness turned out to be .326, which turned out to have a significant effect at the significance level of .001, and hence, Hypothesis #1, 2, and 3 were all adopted.

4. Discussion

In this study, the sense of creation via watching sports events turned out to have an effect on the social adaptation and the feeling of happiness. Concerning such results, the hosting of sports events turned out to have an effect on the awareness of local residents, as well as the motivation and satisfaction of volunteers[34][35], and also turned out that it also influenced the expected effect and the social consciousness of local residents, and hence, the results of this study are supported[36].

Gaining the sense of creation, social adaptation, and the feeling of happiness via watching sports events is feeling a sense of satisfaction, and such satisfaction is an important concept which is the ultimate goal of participation in the consumption activities, which may be said to be the extent of subjective utility or benefit obtained for time and social costs[37]. Furthermore, satisfaction is a judgment of whether a consumer has reached a state of satisfaction as time passes after receiving a specific service, etc., and is classified and evaluated according to the agreement between expectations and experiences as satisfied or dissatisfied, and it means

that the feeling of happiness is felt by receiving a favorable feeling through watching sports events[38][39].

Consequently, in order to improve the spectators' watching satisfaction and induce positive behavioral intentions, the social support and efforts from local governments which host sports events are needed, and the ultimate goal of the spectators of sports events is to watch sports events, and hence, in the effort to help improve the environment of sports events, local governments ought to establish an organic cooperative system with the organizers of the competition in charge of the operation of sports events to ensure that excellent players can participate, strive to improve performance, create environment for stadium watching facilities, promote publicity, and expand convenience facilities toward improving the satisfaction of spectators, etc.

Hence, it is important to determine to what extent the sports events' spectators meet the expectations they have before selecting sports events[40], and since there is a positive correlation between the sports event selection attributes and behavioral intentions, if the spectators' intention, preferences and goals are comprehensively considered, it would be possible to induce the continuous direct and indirect participation and watching of sports events by the spectators.

5. Conclusion

The purpose of this study is to examine and understand the influence of the sense of creation via watching sports events on the social adaptation and the feeling of happiness, and present future directions for the operation of sports events as well as the hosting of sports events.

In this study, 260 people who experienced watching sports events in 2021 were surveyed, and convenience sampling was used for the sampling method, and the survey was conducted by the self-administration method. Among the collected questionnaires, 249 questionnaires were used as valid samples, excluding the data with insincere responses or omissions of some of the contents of the survey. As for the data processing of this study, the following conclusions were reached by performing the frequency analysis, Cronbach's α coefficient calculation, confirmatory factor analysis, correlation analysis, and the structural equation model by using the statistical package programs of SPSS 23.0 Program and AMOS 18.0.

First, the sense of creation via watching sports events influences the social adaptation.

Second, the sense of creation via watching sports events influences the feeling of happiness.

Third, the social adaptation influences the feeling of happiness.

Hence, it is apparent that the sense of creation via watching sports events has a significant effect on the social adaptation and the feeling of happiness, and for the spectators to feel satisfied with their expectations for economic, time, and social costs via watching sports events, it is necessary to have the participation of athletes, efforts to improve performance, and the provision of various convenience facilities, etc.

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7. Appendix

7.1. Authors contribution

Initial name	Contribution

Lead Author	HC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	SJ	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	JK	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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