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The Effect of Functional Training on the Physical Strength Factor of Elite TAEKWONDO Athletes

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Abstract

The purpose of this study was to investigate the effect of functional exercise program for 6 weeks (three times a week, 60 minutes / session) on eight elite Taekwondo players. The data were processed using SPSS/PC 18.0 program and the mean and standard deviation were calculated. The effect of functional exercise program was applied to the paired sample t-test.

Results, Body composition items were weight ($p < .001$), BMI ($p < .001$). In addition, functional exercise program effect was Back strength ($P < .01$), sit-up ($p < .01$), repeated jump ($p < .01$) and side step ($p < .01$) were found to be effective in basic physical fitness items. In addition, there was statistically significant difference ($p < .05$) in all the measurement items as a result of Wingate test, an anaerobic exercise ability item before and after applying the functional exercise program. The maximal graded exercise test using treadmill showed a significant improvement ($p < .05$) in maximum oxygen uptake (VO_{2max}), exercise duration, and blood lactate concentration.

Results of this study, the functional exercise program used in this study is proposed as an appropriate program to improve the fitness factors required for Taekwondo training

[Keywords] *Functional Exercise Program, Wingate Test, Maximum Oxygen Uptake, Blood Lactate Concentration, Body Mass Index*

1. Introduction

Taekwondo is our traditional martial art that has the purpose of self-defense for survival. However, the reason why it was developed into a sport that people from all over the world enjoy today is because it was selected for Seoul Olympic Games in 1988, and 31st Summer Olympics in Rio de Janeiro in Brazil in 2016. From a national point of view, Taekwondo has a high possibility of winning medals at the Olympic Games. In the same context, active research on the mechanistic analysis of movement, physical fitness training, physiological variables and psychological factors for the improvement of performance based on elite athletes has been conducted and progressed for the scientization of Taekwondo[1][2][3][4][5][6][7]. As can be

easily seen from the various research data, most studies are focused on developing a technique-oriented approach to improving the performance of elite athletes and developing a training method to improve the professional fitness that affects performance[8][9]. However, many of Taekwondo majors are suffering from chronic body and leg injuries, which have been repeated many times during Taekwondo training. These injuries are a stumbling block to Taekwondo's continuous training[10]. Taekwondo training has a positive impact on physical development due to whole body exercise and integrated complex joint exercise. However, if proper functional exercise is not accompanied, there is a lot of movement that can induce leg injuries. Various kicking movements

move Taekwondo include ankle, knee and hip joint curve and extension as well as rotational movement, which can lead to serious damage if the connection of the exercise chains is improperly used chronically[11]. Therefore, this study is aimed at improving the internal stabilization muscle strength, which minimizes the risk of potential injury and the effective use of kinetic chain, which is emphasized in the functional exercise. Although this is not related directly to the improvement of the exercise performance to various types of Taekwondo practitioners, we want to develop an exercise program and apply it to elite Taekwondo players to determine its effect.

2. Method

2.1. Subjects

The purpose of this study was to investigate the change of body composition and physical fitness factors when a functional exercise program composed by the researchers is applied to 8 South America P nation players who participated in Muju WTF World Taekwondo Championships in 2017 for 6 weeks, 3 times a week, 1 hour a day. We fully explained the purpose and contents of this study to the subject, and all studies were conducted after preparing an agreement. The general characteristics of the subjects are shown in <Table 1>.

Table 1. Physical characteristics of study participants(n=8).

Items	Mean±SD
Age(years)	23.25±7.25
Height(cm)	174.21±9.22
Weight(kg)	61.76±6.79
BMI(kg/m ²)	20.33±1.26

2.2. Measurement items and methods

1)Body composition

The body composition of the subjects was measured using an extensometer and InBody 3.0(Biospace, Korea) to calculate height, weight, and body mass index(BMI).

2)Basic physical examination

In order to confirm the change of basic physical strength before and after applying this exercise program, muscular strength(back strength), muscular endurance(sit-up), wakefulness(sargent jump), agility(side step), equilibrium(light, sound) were tested. All measurements were conducted twice and better values were used as the real values.

3)Maximal graded exercise test

Maximal graded exercise test was performed using a treadmill(Quinton 4,500) and a respiratory gas analyzer(QMC). Measurement protocol of Korean Institute of Sport Science(KSSI) was used to calculate oxygen uptake, respiratory exchange rate, anaerobic capacity and maximum heart rate. Maximal ability limit was limited to a time when the respiratory exchange rate was 1.15 or more, when exercise intensity was 17 or more, and when the maximum oxygen uptake did not increase although exercise intensity was increased. In addition, blood lactate concentrations were measured immediately after exercise and at 3, 7, and 10 minutes of recovery during maximal graded exercise test.

4)Anaerobic exercise test

Anaerobic exercise capacity was measured by Wingate test. Anaerobic power for 30 seconds was measured using a Bicycle ergometer(Monark 818E, Sweden). Considering the characteristics of this measurement, we conducted a preliminary training on measurement procedures to advance the measurement and reduce the will decrease and low power output phenomenon towards the end of the test. The following measurement items were calculated through measurement. Peak power was defined as the maximum power during maximum pedaling movement for 30 seconds and mean power was calculated by dividing the power during the maximum pedaling movement by 30 for 30 seconds. Fatigue index was calculated as[(maximum value - minimum value) / maximum value x 100] using the maximum value and minimum value during maximum pedaling for 30 seconds.

2.3. Functional exercise program

The purpose of this study was to develop an exercise program that can contribute to the improvement of motions and efficient motor learning. The exercise program was performed three times a week for one week and one hour daily. <Table 2> shows the composition of the functional exercise program.

Table 2. Functional exercise program.

Items	Move composition	Time
Mobilization	Movement enhancement of joints	About 10 minutes (1 min × 1set)
Movement	Multiple motion (3D) involving rotation of the trunk	About 10 minutes (1 min exercise × 5set)
Plyo	Plyometric exercise	About 10 minutes (1 min exercise × 5set) + 1 min challenge)
Cardio	Simple but intense exercise(HIIT)	About 10 minutes (1 min exercise × 5set + 1 min challenge)
Active balance	Active balance movement focused on hip movements	About 10 minutes (1 min exercise + 5set)

2.4. Data analysis

Data were processed using SPSS/PC 18.0 to calculate the mean and standard deviation, and a pair-sample t-test was conducted to examine the effect of the exercise program before and after the exercise.

3. Results

3.1. Changes in body composition and physical fitness

<Table 3> shows changes in body composition and basic physical strength after applying the functional exercise program. Body composition was significantly decreased in body weight($p < 0.001$) and BMI($p < .001$). For basic physical strength, it was significantly increased in muscle strength in belly($p < .01$), sit-ups($p < .01$), repeated jumps($p < .01$), in place long jumps($p < .01$), sargent jump($p < .001$), side step($p < .01$).

Table 3. Changes in body composition and basic physical strength.

Items	Pre	Post	t-value
Weight(kg)	61.76±6.79	59.71±6.88	10.637***
BMI(kg/ m ²)	20.33±1.26	19.63±1.29	10.315***
Back strength(kg)	107.94±20.30	113.14±21.99	5.710**
Sit-ups(reps)	50.88±5.03	54.5±3.96	4.963**
Repeated jump(reps)	48.63±3.16	52.63±1.99	4.000**
Long jumpi(cm)	210.45±24.53	220.91±21.04	3.998**
Sergent jump(cm)	48.37±6.57	52.01±5.95	9.667***
Side step(reps)	48.25±3.33	50.88±4.45	4.930**
Standing with one foot with eyes closed (seconds)	41.02±3.33	50.6±40.23	5.629**
Responding to light (seconds)	0.293±0.044	0.295±0.032	0.248
Responding to sound (seconds)	0.283±0.04	0.285±0.038	0.930

Note: Value are mean±SD, ** $p < 0.01$, *** $p < 0.001$, Mean±SD

3.2. Changes in anaerobic exercise capacity

The changes in anaerobic exercise capacity measured by Wingate test are shown in <Table 4>. Peak power($p < .001$), Mean Power($p < .05$), Total Power($p < .01$), Peak drop($p < .01$) After the exercise program, it was significantly improved.

Table 4. Changes in anaerobic exercise capacity.

Items	Pre	Post	t-value
PP (Watt)	495.06 ±131.45	521.45 ±128.33	7.079***
MP (Watt)	364.86 ±111.90	373.96 ±113.54	1.7782*
TP (Watt)	10575.50 ±3225.35	11578.0 ±3826.50	3.975**
PD (Watt)	55.12 ±6.12	58.87 ±7.26	5.495**

Note: Value are mean±SD, PP : Peak power, MP : Mean Power, TP : Total Power, FD: Peak drop, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.3. Changes in aerobic exercise capacity

The changes in aerobic exercise capacity after applying the functional exercise pro-

gram are shown in <Table 5>. Maximum oxygen intake($p < .001$), exercise duration($p < .001$), blood lactate peak($p < .05$) were significantly increased after applying functional exercise program. In addition, in order to check fatigue recovery, blood lactate peak was measured and it was significantly increased from recovery 3 min($p < .05$), 7 min($p < .01$), 10 min($p < .01$), as shown in <Table 6>.

Table 5. Changes in maximal exercise load test results.

Items	Pre	Post	t-value
VO2max (mL/kg/ min)	50.10±5.54	51.00±5.24	7.079***
HRmax (time/min)	186.50±5.32	188.13±4.36	1.772
Time (sec)	815.13±118.27	944.0±124.09	0.829*
Lactate Peak (mM)	12.49±2.30	13.52±2.32	3.975**

Note: Value are mean±SD, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Changes in blood lactate concentration(mM).

Time	Pre	Post	t-value
Resting	2.90±1.15	2.45±0.63	0.987
After exercise	12.49±2.30	13.26±3.23	1.314
Recovery 3 min	12.10±2.62	13.50±2.58	3.068*
Recovery 7 min	10.78±2.60	13.10±2.74	3.884**
Recovery 10 min	9.57±2.22	11.88±2.45	4.846**

Note: Value are mean±SD, * $p < 0.05$, ** $p < 0.01$

4. Discussion

This study is based on the previous studies of Akuthota, Ferreior, Moore, and Fredericson(2008), and analyzed the effect of functional exercise to optimize the ability of human body to exert force through action of core muscles[12]. The program was developed and applied to elite Taekwondo players for 6 weeks. In various previous studies, core

stability training has been reported to significantly improve basic physical strength of athletes participating in sports such as track, volleyball, and soccer[13][14][15]. In addition, core and functional exercises have been reported to affect not only physical fitness but also health indicators related to growth of adolescent students[16][17][18].

Body composition and body mass index(BMI) decreased significantly in this study, and it was significantly increased in back strength, sit-up, in-place jump, sargent jump, repeating jump and side step. In the item of anaerobic exercise ability, there was a significant increase in both peak power, mean power, total power and peak drop. In addition, in the maximum exercise load test, which is a cardiopulmonary endurance test, it was able to confirm the effect of exercise program on maximal oxygen uptake, duration of exercise, and lactate concentration in recovery period.

As a result of applying the 6-week functional exercise program to national Taekwondo players, the increase in the power-related physical fitness items such as standing long jump and sargent jump items seemed to be influenced by the plyometric training included in the program. AS shown in the results of previous studies, the plyometric training has been used to improve the explosive power of the upper body, torso and lower body, and to increase the intrinsic sensory receptors in the body[19][20].

In the previous study, the 12-week periodic exercise using strength training and circuit training was performed to improve the performance of professional athletes[21]. As a result, a significantly improved results were obtained in half squat and Harvard step factors. This is similar to the content of the functional exercise program applied in this study. The five exercise tracks of MOBILIZATION, MOVEMENT, PLYO, CARDIO, ACTIVE BALANCE included in the contents of functional exercise program seemed to contribute to the improvement of internal stabilization muscle strength(core muscle) and efficient use of the kinetic chain in the functional exercise to improve the coordination with the lower extremity muscles and to improve the strength

and agility physical fitness factor. Byungju Park, Dongwook Ju(2011) suggested that Taekwondo players could have positive effects on the development of leg muscles and strength by applying various anaerobic training methods[22]. Daeryong Kim(2006) suggested the effect of combined training of abdominal muscles and lower extremities as a method to strengthen leg muscles and stability of Taekwondo athletes[11]. The functional exercise program used in this study also includes both the core muscles and lower extremity muscles, and it is possible to say that it includes all the exercise programs performed in the previous study.

Lactate concentration in blood is an index representing the ability to use aerobic and anaerobic energy. When the blood lactate concentration reaches 4 mmol/L, it is explained as Anaerobic Threshold. As a result of confirming the changes of lactate concentration in blood before and after applying the functional exercise program, it was significantly increased from lactate maximum level and recovery 3 min($p < .05$), 7 min($p < .01$), and 10 min($p < .01$). Harris, Sahlin, Hultman(1977) reported that the concentration of lactate in blood during stabilization was 0.56 ~ 2 mmol/L[23]. As the concentrations of lactate in blood before and after the exercise program of this study was included in this range, it can be confirmed that the subjects were in the same condition during the measurement of two periods. In addition, the results of previous studies showed that players with good physical abilities had the ability to last a longer period of exercise with high lactate content, and it is reported that this can be a criterion of fitness level[24][25]. Related to this, there was a significant increase in maximal oxygen uptake($p < .001$), exercise duration($p < .05$), and peak lactate($p < .01$) in this study. It is considered that it had a positive effect on the maximum athletic performance improvement of the elite Taekwondo athletes.

4. Conclusion

The purpose of this study was to investigate the possibility of minimizing the risk of

potential injury by improving exercise performance through application of newly developed functional exercise program to elite Taekwondo athletes. The results of the study showed that functional exercise program had a positive effect on body composition, basic physical strength and professional physical fitness. In addition, it was found that it significantly contributed to the improvement of anaerobic exercise capacity and cardiopulmonary capacity.

Therefore, it is thought that the functional exercise program used in this study can be used to improve physical imbalance and physical fitness of Taekwondo athletes as well as Taekwondo practitioners. However, in order to generalize the results of this study, it is necessary to analyze the subjects according to age, gender, and type of training in future studies.

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Effects of a 4-Week Vitamin B6·B9·B12 Supplementation on the Muscle Recovery and Muscular Function Induced by Acute Eccentric EXERCISE

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Abstract

We examined the effect of a 4-week vitamin B6·B9·B12 supplementation on the muscle recovery and muscular function induced by acute eccentric exercise. Twenty-nine subjects were volunteered for this study, and they were randomly assigned to either vitamin B6·B9·B12 supplementation group (n=14) or placebo group (n=15). Body composition was measured prior to testing. The vitamin B group was given two tablets of vitamin B6·B9·B12 supplement per day from 4 weeks before eccentric exercise until 72 hours after eccentric exercise, whereas the control group was given two placebo tablets. All subjects performed eccentric exercise using Biodex isokinetic machine after treatment period. They performed a total of 4 sets of eccentric exercise with 12 repetitions per set using their non-dominant arm. Blood samples were taken at pre-exercise, immediately after exercise, and at 6, 24, 48, and 72 hour post-exercise. Maximum isometric force (MIF) and range of motion (ROM) were obtained before and immediately after exercise and at 2, 6, 24, 48, and 72 hour post-exercise. Independent t-tests were conducted to analyze differences between groups in physical characteristics and total amount of work of eccentric exercise. Lactate dehydrogenase (LDH) concentration, MIF, and ROM were analyzed using 2-way repeated measure ANOVA. A main effect for test session and group effect were significant in LDH concentration ($p < .05$). A main effect for test session for MIF ($p < .05$) and ROM ($p < .05$) was significant. In both groups, LDH concentration significantly increased immediately after exercise and at 48, and 72 hour post-exercise compared to pre-exercise ($p < .05$). LDH concentration of vitamin B group was significantly higher than control group, independent of test session ($p < .05$). MIF and ROM significantly decreased from immediately after exercise to 48 hours after exercise, and 72 hours post-exercise, respectively, in both groups compared to pre-exercise ($p < .05$). In conclusion, the results of this study suggest that at least 4-week supplementation of vitamin B6·B9·B12 may not have a positive effect on the recovery of muscle damage and function induced by eccentric exercise.

[Keywords] Sport, Lactate Dehydrogenase, Maximal Isometric Force, Range of Motion, Delayed Onset Muscle Soreness

1. Introduction

Skeletal muscle damage frequently occurs by unaccustomed lengthening-type muscle action (eccentric contraction) and an exercise which is sufficient intensity and duration [1]. Indeed, exercise-induced muscle damage results in focal disruption of fiber ultrastructure including desmin and dystropin, increase in volume and circumference of the limb, decrease in the range of motion and muscular

strength, and delayed onset muscle soreness (DOMS) [2][3].

Muscle pain and muscle force loss are the most debilitating symptoms after muscle damage. However, muscle pain is usually not evident for several hours after eccentric exercise in humans, but the loss of muscle force is significantly detectable immediately after eccentric exercise. Mackey et al. (2004) [4] re-

ported that contractile force could be decreased by as much as 40-50%, and full recovery of force may not occur for some weeks after exercise. In the case of non-elite people, muscle pain or strength loss would be related to continue of exercise for their improvement of health. Especially, muscle force loss by muscle damage is closely related with exercise performance in elite sport athletes because the heavy competition schedule and training more than once within a single day are oftentimes their routine. Therefore, maximizing and accelerating the recovery from muscle damage is crucial to maximize their exercise performance[5].

There are variety of methods to treat muscle damage or DOMS, and it was known that ice, ultrasound, nonsteroidal anti-inflammatory medication, massage, and anti-oxidative vitamin are representative[6][7][8]. However, methods such as massage, ultrasound, and electrical therapies have disadvantage of longer time to treat compared other methods like medication usage, despite these methods were effective for alleviating muscle pain and inflammatory response, and also the equipment itself is expensive. In addition, although it was reported that nonsteroidal anti-inflammatory drug might have fast effect on decreased swelling, inflammation, and muscle soreness, this method is not recommended due to the major side effects such as gastrointestinal ulceration and bleeding, hepato-renal dysfunction and organ failure, and skin reactions[9][10][11].

The most economical and simplest way to prevent muscle damage is antioxidant treatment, and the most research has focused on the effects of the antioxidant vitamin C and E. Vitamin C, or ascorbic acid, is a potent water soluble antioxidant vitamin, placed in the cytosolic compartment of the cell[12]. Vitamin C exerts its functions by scavenging reactive oxygen species(ROS) and nitrogen species[13]. As vitamin E is the most important lipid soluble antioxidant vitamin, it is virtually found in most cell membranes[12]. It is known that vitamin E has function for stopping the progression of the lipid peroxidation chain reaction, as well as scavenging ROS such as superoxide and hydroxyl radicals[14].

Although there is still controversial about the benefit from the use of antioxidant to prevent muscle damage, it was proposed that the treatment of these antioxidant vitamins can prevent muscle damage by reducing of reactive oxygen species and increasing membrane integrity[12][15].

However, there is some limited evidence about a protective effect of muscle damage for antioxidant vitamin supplementation[16][17], and the majority of studies have failed to demonstrate a protective effect of for antioxidant vitamin treatment on muscle damage. Although it was suggested that long-term supplementation of antioxidant vitamins over 14 days may reduce symptoms of muscle damage, the effect of vitamin C & E on muscle damage is unclear and more researches are needed.

On the other hand, it is known that vitamin B6, 9, and 12 contribute to the synthesis of DNA and proteins and might stimulate the recovery of muscular function from exercise-induced muscle damage[18][19]. Especially, vitamin B6 plays an important role in amino acid and protein metabolism, and as an exercise-related function of vitamin B6, this vitamin has been reported to be associated with the energy-producing pathways such as glycogen breakdown of the body during exercise[20]. Vitamin B9, also known as folic acid is necessary for the synthesis, repair, and methylation of DNA. In the case of vitamin B9 deficiency, this can lead to impaired function of RNA and DNA, lipid metabolism, and muscle formation[21][22][23]. Lastly, vitamin B12 plays a vital role in the cell growth and development of the human body. Vitamin B12 is also required in DNA synthesis, erythrocytes formation, folic acid metabolism, nervous system development, and protein synthesis[18].

Considering the effects of vitamin B6, 9, and 12 on the synthesis of protein and repair from muscle damage, it could be expected that the supplementation of these B vitamins can contribute to maintain muscle function by muscle damage contributing rapid recovery and repair of muscle contractile and structural proteins. However, there is no study examining the relationship between

the muscle function and vitamin B6, 9, 12 supplementation. With this purpose, the current study examined the effects of vitamin B6, 9, and 12 supplementation during 4 weeks on the indices of muscle damage and muscle functions.

2. Methods

2.1. Subjects

Twenty-nine untrained healthy and college-aged men (aged 22.90 ± 2.16 years, height 175.21 ± 5.88 cm, weight 75.95 ± 10.29 kg) volunteered for this study. It was provided the explanation of purposes, procedures and risk of the study, and written informed consent. All subjects completed questionnaires about using medications and supplements, physical activity, medical history to exclude unqualified person. Subjects were composed of people who did not take drugs or vitamin supplements for at least 3 months and had no experience in surgery on the elbow joint. They refrained from high-intensity exercise and extra vitamin supplementation during this study. This study was approved by the Keimyung University's institutional review board for human subjects.

2.2. Supplementation

Twenty-nine subjects were randomly assigned to either a placebo group (dextrose mixture with sodium chloride; $n=15$) or a vitamin B6-B9-B12 supplementation group ($n=14$). Four weeks before the eccentric exercise, all subjects were given supplements. The subjects of vitamin supplementation group consumed two tablets of vitamin B6-B9-B12 (one tablet include 1.5 mg B6, 400 μ g B9, and 2.4 μ g B12; Garden State Nutritionals, U.S.A) per day from 4-week before eccentric exercise until 3 day after eccentric exercise. The placebo group also took two placebo tablets (one tablet include 450 mg glucose and 200 mg sodium chloride; Fitness farm Inc., Korea) per day during the same period.

2.3. Experimental procedures

Before supplementation, all subjects' weight and body composition were measured using InBody 520 (InBody, Korea). All subjects came back to the laboratory with remaining supplements after 4 weeks of supplementation period. Intake rate was determined by given pills versus those remained. The subjects continued to intake supplements during the 3 days after the eccentric exercise.

Subjects reported back to the laboratory after 4 weeks supplementation period in the morning after overnight fast and took a rest at least 15 min before obtaining measurements. ROM was measured first, and ROM was measured using a goniometer, assessing the elbow flexors on both arms by asking subjects to flex and extend their arms at the elbows. A resting blood sample was then taken from an antecubital vein. Before eccentric exercise, a researcher adjusted Biodex isokinetic machine (Biodex Medical Systems, U.S.A) to suit the subject's body, and then recorded machine's position for consistency.

MIF was measured by Biodex isokinetic machine, and each subject performed three MIF at fixed 45° of ROM with their non-dominant arm. After obtaining initial MIF, all subjects performed eccentric exercise using their nondominant arm elbow flexors to induce muscle damage at an angular velocity of $20^\circ \cdot s^{-1}$ and 100° of flexion. Eccentric exercise was comprised of 4 sets of 12 eccentric contractions with resting of 60 seconds. Total amount of work was recorded for each set and totaled. In addition, peak forces and decline of forces and ROM were also measured by measuring MIF and ROM at immediately after exercise, and 2, 6, 24, 48, and 72 hour post-exercise.

Blood samples were taken 3ml at pre-exercise, immediately after, and 6, 24, 48, and 72 hour after eccentric exercise protocol via vacutainer containing EDTA and immediately processed. Blood samples were analyzed for serum LDH.

2.4. Blood handling and LDH analysis

The collected blood samples were kept at room temperature for 30 minutes to clot then centrifuged at 3,000 rpm. Separated serum was put into microcentrifuge tubes and

stored at -80°C until analysis of LDH. LDH concentrations were analyzed by doing request at the Seoul Clinical Laboratories. Serum samples were mixed with R1(Lactate) and R2(NAD+) reagent(Roche, Germany) then read at 340-nm wavelength using HITACHI 7600(Hitachi, Japan) to analyze LDH concentration.

2.5. Statistical analysis

Statistical analysis was used the SPSS statistical data analysis software package(Version 25.0; IMB, U.S.A). Subjects' characteristics and total amount of work were analyzed using an independent *t*-test to compared between groups. To compare the differences between time and groups, LDH concentration(2 x 6), MIF, and ROM(2 x 7) were analyzed using two-way repeated ANOVA. The level of statistical significance was set at a $P < .05$. All data are represented as mean \pm SD.

3. Results

3.1. Baseline characteristics

Twenty-nine males were randomly assigned to either a placebo group($n=15$) or the vitamin B6·B9·B12 supplementation group($n=14$). All subjects successfully completed this study. Their physical characteristics are presented in <Table 1>. There were no statistical significant differences in physical characteristics at baseline between the two groups.

Table 1. Physical characteristics of subjects.

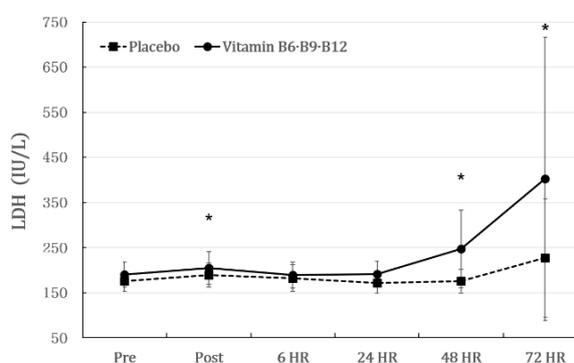
	Placebo group ($n=15$)	Vitamin B group ($n=14$)
Age(yrs)	23.40 \pm 1.76	22.36 \pm 2.47
Height(cm)	176.87 \pm 6.46	173.43 \pm 4.78
Weight(kg)	77.04 \pm 9.70	74.78 \pm 11.13
BMI(kg/m ²)	24.60 \pm 2.55	24.83 \pm 3.39
Body fat(%)	17.28 \pm 6.75	19.28 \pm 7.47
Skeletal muscle mass(kg)	36.28 \pm 3.87	33.89 \pm 3.24

Note: Values are presented as mean \pm SD. BMI: Body Mass Index. There was no significant difference between the two groups($P > .05$).

3.2. LDH concentration

LDH concentration showed significant group($P < .05$) and time effect($P < .05$) <Figure 1>. The vitamin B6·B9·B12 supplementation group had a significantly higher LDH concentration than placebo group, independent of test session. A significant time main effect($P < .05$) occurred for serum LDH concentration, independent of treatment, LDH concentration significantly increased at immediately after exercise, 48 and 72 hour after exercise compared to pre-exercise.

Figure 1. LDH concentration in response to eccentric exercise over time. Values are presented as mean \pm SD. *Significant different compared with Pre($P < .05$).

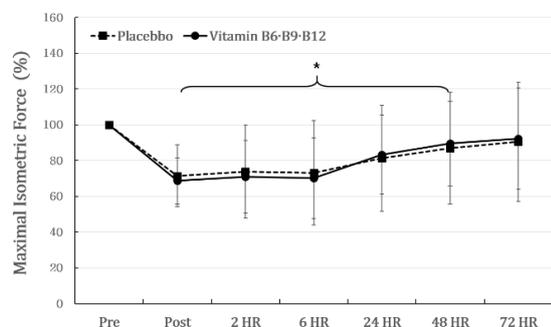


3.3. Muscular function

All subjects performed eccentric exercise to cause muscle damage. During the eccentric exercise, total amount of works were 2213.26 \pm 798.56 J and 2349.00 \pm 975.41 J for the placebo group and vitamin B6·B9·B12 group, respectively. There was no significant different between groups.

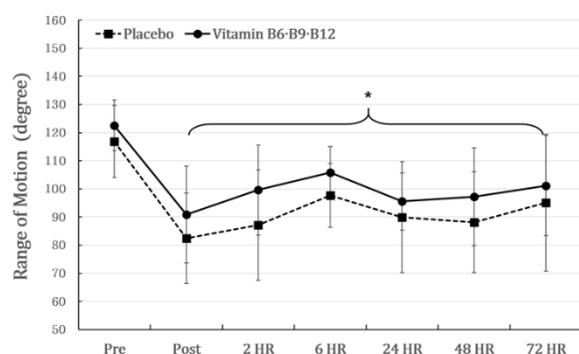
As shown in <Figure 2>, MIF was significantly reduced after eccentric exercise in both groups and demonstrated a time main effect($P < .05$). MIF were declined from immediately after exercise through 48 hours after eccentric exercise compared to pre-exercise in both groups.

Figure 2. MIF changes in response to eccentric exercise over time. Values are presented as mean \pm SD. *Significant different compared with Pre ($P < .05$).



The change of ROM is presented in <Figure 3>. A significant time main effect ($P < .05$) occurred for the decrease in ROM, independent of treatment from immediately after exercise through 72 hours after eccentric exercise. The reduction of ROM peaked at immediately after exercise. ROM showed to increase after immediately after exercise until 6 hour post-exercise but decreased again after 6 hour post-exercise.

Figure 3. ROM changes in response to eccentric exercise over time. Values are presented as mean \pm SD. *Significant different compared with Pre ($P < .05$).



4. Discussion

The present study examined the effect of a 4-week vitamin B6-B9-B12 supplementation on the muscle recovery and muscular function induced by acute eccentric exercise. As a main findings related to muscle damage, LDH concentration increased gradually until 72 hours after eccentric exercise in both groups, and B vitamins treatment group showed higher LDH concentration compared to the placebo group. As LDH is one of markers of

muscle damage, it is an enzyme that exists in the cell. LDH is released from the cell when the cell membrane is damaged by an event such as exercise. In this study, LDH increased up to 72 hours after exercise, and this result means that the eccentric exercise protocol used in this study was enough to induce muscle damage in both groups.

As a main finding of this study, LDH concentration of B vitamins treatment group was higher compared to placebo group. The magnitude of muscle damage could be influenced by various factors including age, sex, skeletal muscle mass, physical activity, and temperature[24]. However, there were no significant differences in total amount of work during eccentric exercise and skeletal muscle mass between two groups in this study.

Another factor that could influence on muscle damage state is the amount of supplements treated. To investigate the effect on muscle damage, Childs et al.(2001)[25] treated vitamin C and N-Acetylcysteine or placebo for 7 days after eccentric exercise. It was demonstrated that the LDH level of vitamin C and N-Acetylcysteine group was significantly higher than placebo group, and they concluded that the increase in LDH might be caused by a chain reaction of oxidation, which is occurred by reaction of supplementations with the increased free irons due to exercise. In addition, Braakhuis, Hopkins, and Lowe(2014)[26] reported that high doses of single vitamin can promote oxidative effects which can exacerbate muscle injury and functions. Pingitore et al.(2015)[27] also suggested that antioxidants may act as pro-oxidant depending on dose, timing, and period of intake. In our study, three subjects showed extremely high concentration of LDH at 72 hour after exercise, and these data were cause of significant group main effect between two groups. However, the average intake rate of these three subjects was 94.79%, and the average intake rate of B vitamin group except the three subjects was 84.38%. Thus, this result indicates that long-term and high levels of vitamin B6-B9-B12 supplementation may have negative effect on muscle damage.

In relation to muscle function, MIF and ROM decreased very fast after acute eccentric exercise, and the patterns of MIF and ROM in the current study are similar with the results of Bryer and Goldfarb(2006)[28]. It is known that the rapid decrease in muscle function occurred immediately after eccentric exercise is influenced by reduction in motor neuron activation, accumulation of lactic acid, depletion of energy sources, and impaired Ca²⁺ release[29].

Especially, Shafat et al.(2004)[17] and Martin et al.(2004)[30] reported the relationship between the reduction of MIF after eccentric exercise and the excitation-contraction(E-C) coupling failure. E-C coupling is the process that starts with the transmission of action potential from the T-tubule and ends with the cross-bridge of actin and myosin[31]. Also, it was suggested that a problem in the electrical stimulus transportation process and an impaired calcium release during E-C coupling by repeated and high intensity exercise can cause strength loss, and impaired E-C coupling among those factors may have greater effect on the loss of muscle strength compared to muscle damage during 5 days from immediately after eccentric exercise[32]. Therefore, the decrease in MIF observed in this study can be attributed to E-C coupling failure rather than contractile protein damage.

On the other hand, Corona et al.(2010)[33] suggested that contractile protein damage induced after E-C coupling failure, and Hwang et al.(2015)[34] reported that vitamin B9 increased the expression of myoblast differentiation, myotube formation, muscular structure related gene expression. Thus, considering the effects of vitamin B6, 9, and 12 on the synthesis of DNA and protein and the contribution of E-C coupling failure on muscle function damage, it is necessary longer recovery periods over 6 days to examine more accurate MIF recovery by the functioning of vitamin B6·B9·B12 on the recovery of the contractile protein. However, despite the effects of vitamin B6, 9, and 12 on the synthesis of DNA and protein, the intake of these B vitamins during 4 weeks may not seem to protect

the strength loss by eccentric exercise induced E-C coupling failure.

In this study, ROM also decreased after eccentric exercise, but ROM started to increase from immediately after exercise until 6 hours after exercise but decreased again at 24 hour post-exercise. The reduction of ROM by muscle damage is related with muscle soreness and muscle circumference. Although these variables were not measured in the current study, it was reported that muscle pain was highest at 24~48 hours after eccentric exercise, and muscle circumference was increased after 48 hours of muscle damage exercise[28][35][36]. Thus, the decrease in ROM after 24 hour post-exercise observed in this study is likely to be the effect of muscle pain and edema. In the case of ROM changes, vitamin B6, 9, and 12 supplementation group showed a tendency of higher ROM compared to placebo group, but statistically, there was no effect of B vitamins supplementation on improving ROM recovery.

5. Conclusion

The present study examined the effects of vitamin B6, 9, and 12 supplementation on the recovery of muscle structural damage and function. It was expected that vitamin B6, 9, and 12 intake would be effective to protect membrane stability and contribute to rapid recovery of muscle strength and ROM by contributing to the recovery of contractile proteins such as myosin and actin. However, vitamin B6, 9, and 12 supplementation for 4 weeks before eccentric exercise did not show protective effect on muscle membrane stability, rather it was found that high dose of B vitamins consumption could have a potential to worsen membrane damage. In addition, a 4-week vitamin B6, 9, and 12 supplementation had no significant impact on the recovery of muscle functional measures. However, it is unclear whether the loss of muscle function measured by MIF and ROM is due to muscular contractile protein damage. In conclusion, we suggest that a long-term supplementation of vitamin B6, 9, and 12 should not be encouraged to prevent muscle damage or to accelerate the recovery from muscle damage due

to the possibility of increasing LDH concentration by functioning as a pro-oxidant.

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A Study on the Impact of Exposure to Folk Gambling in Family During Adolescence in Korea and the Difference in the Perception of SPORTS Toto

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Abstract

This study aims to investigate the status of exposure to folk gambling in the families during adolescence for the lawful and unlawful participants of Sports Toto in Korea, present issues of household gambling, clarify the impact on the lawful and unlawful Sports Toto purchases made after reaching adulthood at the same time, analyze the differences in the efficiency for measures to eradicate the unlawful sports gambling as well as the perception towards Sports Toto, and derive substantive measures to facilitate the lawful purchases of Sports Toto and eradicate unlawful sports gambling. The subjects of this study are the average people who have experienced buying lawful and illegal Sports Toto in Seoul and Gyeonggi-do area, which are the leading cities with relatively developed recreational activities and living standards from June through September 2018. The characteristics of the subjects were analyzed by analyzing 750 valid samples out of the total of 1,000 questionnaires collected from 200 people experienced in illegal sports gambling who were additionally selected through 800 on site participants of stores and investigators and the researchers' acquaintances.

Thus, the results of this study are as follows.

First, the rate of respondents who witnessed gambling activities within their parents' households during their adolescence turned out to be high, and Go Stop and poker games were the folk gambling favored most by the parents. Second, 62.1% of the respondents were illegal sports gamblers, 62.4% of which turned out to favor participating in illegal sports gambling. Third, it turned to have a significant impact on the pre-adulthood folk gambling participation following the exposure to folk gambling activities and frequency within the parents' households during adolescence. Fourth, it turned out to have a significant impact on the lawful and unlawful Sports Toto purchases following the pre-adulthood folk gambling participation as well as the exposure to folk gambling of the parents within the household during adolescence. Fifth, it was found to have a significant impact on the monetary games favored oneself currently as well as the folk gambling favored by the parents during adolescence. Sixth, there was a significant difference in the perception of Sports Toto among the lawful and unlawful participants.

[Keywords] Sports Toto, Folk Gambling, Household Gambling, Money Game, And Illegal Sports Gambling

1. Introduction

1.1. Need for the study

The adolescents of modern times are acting in such a rapidly changing social and cultural context. In particular, the changes in the living environment due to computers and smartphones are associated with various issues such as those related to interpersonal

relationship and the Internet addiction[1]. This may be understood through the phenomena where the details on the Internet games and addiction are heavily dealt with in the recent adolescents related studies[2].

As the adolescents' problematic behaviors have increased, studies on them have been

conducted, and as gambling behaviors of adolescents have been deemed as problematic behaviors, there has been a rising interest in researching the gambling behaviors of adolescents[3]. As such, one of the important problems facing modern adolescents is their addiction to games and gambling. Gambling is directly related to money, so there is a tendency to think that gambling is unlikely to occur for the adolescents who are not economically productive. However, the number of adolescents with gambling experiences in the Korean studies conducted reached 54.9% to 82.3%[4][5][6][7], while the Internet gambling gaming experience reached 25.5% to 35.4%[8][9]. In a study of the age at which the gambling experience began[10], 68.42% of the problematic gamblers and pathological gamblers started gambling before the age of 20, 31.58% of whom turned out to have begun gambling before the age of 15. And in one study, the age at which the gambling behaviors began was 4th to 6th grade in elementary school, or 45.1%[11], and in a survey of 167 high school students in Korea, 15% of the respondents were found to have been experienced in purchasing unlawful sports gambling[12]. As such, examining the study which demonstrates that the earlier they began gambling, the more serious their gambling problem[6][10][13][7][14][15], preventive education for adolescents is urgent, and it is also necessary to identify and counter participation factors.

The illegal sports gambling, which is a most popular gambling activity among Korean adolescents, is a gambling crime organization which imitates 'Sports Toto', a sports betting industry implemented to source the fund to help support the development of each field of sports. Sports Toto is a sports and recreational game which predicts and votes on the results of sports for popular sports and issues refunds to the people concerned according to the accuracy rate of prediction[16], and is for public interest and a necessary state financial policy business. The sports betting business began in the United Kingdom in 1923 and spread to Europe, Asia, Central and South America, etc., and has been established around the world under the names of 'football pool', 'toto calico', 'quiniela', and 'sports

toto' [17]. The 'Sports Toto' business in Korea was introduced in 2001 to secure the financial resources necessary for the 2002 World Cup Soccer Games, and is used to promote school sports, support sports for the daily living, support physical education for the disabled, promote groups and athletes, support international tournaments, nurture sports industries, build infrastructures for the sports of the Republic of Korea, and expand sports welfare[18].

However, globally speaking, Sports Toto business gave rise to a new market called illegal sports gambling due to side effects at the same time as its growth and development. It is a convenient gambling market created, where one could easily participate online without restrictions both in terms of time and space if one has access to a computer or a mobile phone.

As the illegal sports gambling market has been facilitated with the passage of time, the achievements left behind in the sports world went beyond unethical behaviors such as game results manipulation, violation of rules, illegal players, and bribery of referees, as a bridge for accidents promoting criminal acts such as murder, fraud, intimidation, threat, and inducement of gambling participation for adolescents socially speaking. In the case of illegal sports gambling, since anonymity is ensured, access is provided to people very easily[19], and online gambling rooms are provided to the addicts dreaming of hitting jack pots via the Internet and mobile access while offering a gambling playgrounds which does not require adult validation for the adolescents' sports games. As such, illegal sports gambling business operators became criminal organizations seeking personal benefits by promoting subscriptions for people of all ages and genders while promoting pathological addicts.

According to the National Gambling Control Commission in 2015, the illegal sports gambling market reached the size of approximately KRW 22 trillion(JPY 2.1 trillion), which is approximately 3 times larger than that in 2011[20]. And according to a study on the status of illegal gambling[21], most gambling

business operators are operating their servers overseas to prepare for crackdowns such as by using third party bank accounts and third party mobile phones and are inducing additional betting by stimulating the curiosity of the teens by developing new items such as “ladder game.”

Examining the previous studies related to the illegal sports gambling, various studies have been conducted to eradicate illegal sports gambling as well as the adolescents’ illegal participation by the government and Sports Toto business department such as those concerning the illegal sports gambling participation[22][23], status and countermeasures[24][25], status of the illegal sports gambling operation and policy alternatives[26][27], and gambling characteristics [28]. Yet, most are concerned with identifying the status and investigation, and the substantive analysis of the illegal sports gambling participants is minimal at best. Thus, in this study, we investigated the folk gambling exposure patterns of adolescents against the legal and illegal participants of Sports Toto in Korea to clarify the impact on the illegal sports gambling after reaching adulthood as well as the pre-adulthood gambling activities, further to comparatively analyzing the effect of countermeasures to eradicate the illegal sports gambling together with the perception of Sports Toto towards enhancing the negative perception of Sports Toto and identifying practical countermeasures required for eradicating illegal sports gambling, thereby providing fundamental data which may be useful for the growth and development of the Sports Toto industry.

1.2. Purpose of the study

The purpose of this study is to systematically investigate the folk gambling exposure of participating with parents within households during adolescence, analyze the impact on the legal and illegal Sports Toto purchases after reaching adulthood, analyzes differences on the effect of countermeasures for eradicating illegal sports gambling as well as the perception of Sports Toto of the legal and illegal participants, and present desirable directions for the development of Sports Toto

and efficient countermeasures for eradicating illegal sports gambling. To this end, the issues to be solved specifically in this study are as follows.

First, what is the form of the folk gambling exposure during adolescence?

Second, what is the relationship of effect between in the pre-adulthood folk gambling participation following the exposure to the parents’ folk gambling within households during adolescence and exposure frequency?

Third, what is the relationship of effect in the legal and illegal Sports Toto purchases after reaching adulthood as for the exposure to the parents’ folk gambling within households during adolescence and direct participation?

Fourth, what is the relationship of effect between the monetary game preferred by oneself currently and the folk gambling preferred by the parents during adolescence?

Fifth, what are the differences in the perceptions of Sports Toto of the legal and illegal participants?

Sixth, what are the differences in the effect of the countermeasures for eradicating illegal sports gambling considered by the legal and illegal participants?

2. Research Method

2.1. Subject of the study

However, the subjects of this study are those who have experienced purchasing legal and illegal Sports Toto in Seoul and Gyeonggi-do area, which are the leading areas with relatively improved recreational activities and living standards from June through September 2018. As for sampling, the convenient sampling method was utilized among the non-probability sampling methods, and to distinguish those who experienced Sports Toto, educated surveyors visited the points of sales for Sports Toto in person, had the questionnaires completed and collected them in the form of self-administration method. In addition, to increase the rate of response of

illegal sports gambling participants, 200 people experienced in illegal sports gambling were selected via the surveyors and researchers' acquaintances for additional utilization for this study. Thus, out of the total of 1,000 questionnaires distributed to 800 field participants at the points of sale and 200 people experienced in illegal sports gambling selected, 750 questionnaires as qualified were used to derive the analytical results.

The demographic characteristics of the subjects are as illustrated in <Table 1>. The gender distribution was 83.2% for males and 16.8% for females, and the age distribution was the largest of 46.5% for those aged 26 to 45 years, followed by 38.6% of those aged 19 to 25 years, 11.2% of those aged 46 to 65 years, and 3.6% of those aged 18 or younger. The distribution of monthly income was the highest of 36.2% for those with KRW 1.5 million or less, followed by 26.2% of those with KRW 2.01 to 3 million, 19.6% of those with KRW 1.01 to 1.5 million, 10.5% of those with KRW 30.1 to 4 million, 4.4% for those with KRW 5.01 million or more, and 3.1% for those with KRW 4.01 to 5 million, respectively. The distribution by educational background was the highest with 36.5% of college graduates, followed by 30.6% of high school graduates, and 22.9% of those currently attending college.

Table 1. Demographic characteristics of the subjects.

Classification	Details	No. of people (N)	Frequency (%)
Gender	Male	624	83.2%
	Female	126	16.8%
Age	19 years or less	27	3.6%
	20-25 years	290	38.6%
	26-45 years	349	46.5%
	46--65 years	84	11.2%
Monthly income	1.5 million or less	271	36.2%
	1.51-2 million	147	19.6%
	2.01-3 million	197	26.2%
	3.01-4 million	79	10.5%
	4.01-5 million	23	3.1%
	5.01 million or more	33	4.4%

Highest education received	Attending junior high	5	0.7%
	Graduated from junior high	19	2.5%
	Attending high school	22	2.9%
	Graduated from high school	229	30.6%
	Attending college	172	22.9%
	Graduated from college	274	36.5%
	Graduated from college or higher institution	17	2.3%
	Others	12	1.6%
	Total	750	100%

2.2. Survey tools

In this study, questionnaire was used as a data collection tool to analyze the exposure patterns of folk gambling during the adolescence, perception of Sports Toto, and the effect of eradicating illegal sports gambling. The questionnaire consisted of a closed end type which was prepared by the researcher in order to identify the status of the parents' folk gambling exposure within households during adolescence, experiences of folk gambling participation during adolescence, folk gambling items preferred by parents, and monetary games preferred by oneself, whose contents were validated by 5 experts in social welfare and gambling. In addition, to analyze the differences in the perception of Sports Toto of the subjects and the efficiency of the countermeasures for eradication, the items used in "Policy Impact on Voting Right Business Following the Countermeasures for Eradicating Illegal Sports Gambling" by Park Gyeong-Rae et al.(2012)[27] in line with the purpose of this study.

The questionnaire used in this study were consisted of the types which could be obtained through the self-administration method, and the questionnaire was consisted of the items concerning the socio-demographic characteristics of the subjects, items related to the folk gambling exposure during adolescence, items related to the illegal

sports gambling experiences, items related to the perception of Sports Toto, and the items related to the efficiency of the countermeasures for eradicating illegal sports gambling.

2.3. Data processing method

After the questionnaire response data were collected and reviewed, the data determined to be poor or unreliable were excluded from the analysis through the search process, and the data suitable for analysis were analyzed using the SPSS 15.0 version for windows statistical package for the purposes of this study. The details of the analysis are as follows.

First, a descriptive statistical analysis was performed for the items consisted of nominal scale to identify the general characteristics of the samples and the types of folk gambling exposure during adolescence.

Second, to investigate the impact of the parents' gambling exposure within households during adolescence on the pre-adulthood folk gambling participation and the pre-adulthood folk gambling participation following the exposure frequency of folk gambling activities, a lambda analysis λ and a cross analysis X2 were performed.

Third, a lambda analysis λ was performed to investigate the effects of the parents' folk gambling behavioral exposure during adolescence on the illegal sports gambling participation and the impact of the folk gambling participation within household during adolescence on the illegal sports gambling participation.

Fourth, a cross analysis X2 was performed to investigate the influence of the parents' preferred gambling on one's preferred monetary game.

Fifth, a t-test was used to find out any difference in the perception of legitimate and illegal participants for Sports Toto.

Sixth, a cross analysis X2 was performed to find out any difference in the efficiency of the countermeasures for eradicating illegal sports gambling considered by the illegal and legal participants of Sports Toto.

3. Research Results

For this study, 750 valid questionnaires were used for the average people experienced in purchasing legal and illegal Sports Toto in Seoul and Gyeonggi-do area, and as a result of analyzing the folk gambling exposure and participation patterns within households during adolescence, impact on the legal and illegal Sports Toto purchase, perception of Sports Toto, and the efficiency of countermeasures for eradicating illegal sports gambling, such meaningful facts as follows were discovered.

3.1. Analytical results of the frequency of exposure form in folk gambling during adolescence

As illustrated in <Table 2>, as a result of examining the exposure patterns of folk gambling during adolescence, 74% of the respondents were exposed to the gambling behaviors of their parents during adolescence, it also demonstrated that the number was the largest for 5 times per year(40.1%) and less than 10 times per year(16.9%), while 9.3% of the respondents showed such a high rate of exposure frequency at 20 times or more per year. And as for the folk gambling preferred by the parents, Go Stop turned out to be the most preferred(65.4%), followed by others(18.1%) and poker game(8.4%), respectively. 57.5% of the respondents participated in folk gambling with their family during adolescence, and 61.8% participated in folk gambling before reaching adulthood. The respondents most favored Go Stop(31.7%), followed by poker game(25%) and Sports Toto(17%) as their favorite monetary games, respectively. The average spending at the time of participating in the folk gambling turned out to be KRW 20,000(JPY 1,900) or less for 59.4% of the respondents, while 31.2% of the respondents said they spent KRW 50,000(JPY 4,750) to 100,000(JPY 9,500). Examining the status of using illegal Sports Toto, 61.3% of the respondents who favored legal Sports Toto enjoy relatively healthy recreation, yet 38.7% of all prefer illegal Sports Toto, while 62.1% of the subjects experienced in participating in illegal sports gambling, respectively.

Table 2. Frequency analysis of the folk gambling exposure patterns during adolescence.

Classification	Details	No. of people (N)	Frequency (%)
Exposure to parents' folk gambling within household before adulthood	Yes	555	74
	No	195	26
Frequency of exposure to parents' folk gambling before adulthood	Never saw	195	26
	Less than 5 times per year	401	40.1
	Less than 10 times per year	126	16.9
	Less than 15 times per year	58	7.7
	20 times per year or more	70	9.3
Items of folk gambling favored by parents before adulthood	Mahjong	8	1.2
	Poker	63	8.4
	Chess	1	0.1
	Go	19	2.5
	Eastern chess	32	4.3
	Go stop	491	65.4
	Others	136	18.1
Folk gambling experience with family before adulthood	Yes	431	57.5
	No	319	42.5
Period of participating in folk gambling	No	268	35.7
	Before adulthood	463	61.8
	After adulthood	19	2.5
Monetary game currently favored by oneself	Mahjong	6	0.9
	Poker	188	25.0
	Chess	5	0.7
	Go	6	0.8
	Eastern chess	24	3.2
	Sports toto	128	17.0
	Internet game	103	13.7
	Go stop	238	31.7
Average spending at folk gambling participation	Others	52	6.9
	KRW 10,000 or less	264	35.2
	KRW 20,000 or less	182	24.2
	KRW 50,000 or less	128	17.2
	KRW 100,000 or less	105	14.0
	KRW 200,000 or less	15	2.0
	KRW 500,000 or more	27	3.6
Sports toto favored	Never participated	17	2.3
	Sports toto	459	61.3
Experienced in using illegal sports gambling	Private sports betting	291	38.7
	Yes	466	62.1
	No	284	37.9

Total 750 100

3.2. Analytical results of the impact on the pre-adulthood folk gambling participation following the exposure to folk gambling behaviors of parents during adolescence

As illustrated in <Table 3>, when they witnessed their parents playing folk gambling within households during adolescence, as a result of analyzing the results related to the pre-adulthood folk gambling participation, if they witnessed the behaviors of their parents playing folk gambling, 75.4% said they did participate before reaching adulthood and 24.6% responded that they did not, and in the case of not witnessing their parents's such playing behaviors during adolescence, 6.7% said they did participate before adulthood and 93.3% said they did not, and so λ showed a high correlation of 0.530, while the significance probability was 0.000, yielding a significant impact statistically, respectively.

Table 3. Analysis of the pre-adulthood folk gambling participation following behavioral exposure.

Classification	Pre-adulthood folk gambling participation		Total	λ (p)	
	Yes	No			
Parents' folk gambling activities during adolescence	Yes	418	137	555	0.530 (.000**)
	No	6.7	93.3	100.0	
		75.4	24.6	100.0	

3.3. Analytical results of the impact on the pre-adulthood folk gambling participation following the frequency of exposure to folk gambling of parents during adolescence

As illustrated in <Table 4>, as a result analyzing the participation in folk gambling before adulthood following the frequency of folk gambling exposure of parents within household during adolescence, in the case of not seeing their parents' folk gambling behaviors, 93.3% responded that they did not

participate in the folk gambling before reaching adulthood, and among the respondents who witness less than 5 times per year, 66.4% said that they did participate in the folk gambling before adulthood, 91.4% said that they did participate less than 15 times, and 85.7% participated 20 times or more. Examining the test statistics, X^2 was 300.441, and the significance probability was 0.000, yielding a statistically significant difference, respectively.

Table 4. Analysis of the pre-adulthood folk gambling participation following exposure frequency.

Classification		Pre-adulthood folk gambling participation			Total	X^2 (p)
Details		Yes	No			
Exposure frequency to parents' folk gambling during adolescence	None	People %	13 6.7	182 93.3	195 100.0	300.441 (.000**)
	5 times per year or less	People %	200 66.4	101 33.6	301 100.0	
	10 times per year or less	People %	105 83.3	21 16.7	126 100.0	
	15 times per year or less	People %	53 91.4	5 8.6	58 100.0	
	20 times per year or more	People %	60 85.7	10 14.3	70 100.0	

3.4. Analytical results of the impact on the illegal sports gambling purchase following the exposure of folk gambling behaviors of parents during adolescence

As illustrated in <Table 5>, as a result of analyzing the impact of the parents' folk gambling behavior within household during adolescence on the purchase of illegal sports gambling, in the case of witnessing the parents' folk gambling behaviors, 71.9% said that they did participate in illegal sports gambling, and 28.1% said they did not, and in the case of not witnessing it, 33.8% said that they did participate, and 66.2% said they did not. Examining the test statistics, λ has a low correlation of 0.222, and the significance probability is 0.000, which is statistically significant, respectively.

Table 5. Analysis of the illegal sports gambling participation following behavioral exposure.

Classification		Experiences of illegal sports gambling			Total	λ (p)
Details		Yes	No			
Parents' folk gambling activities during adolescence	Yes	People %	400 71.9	155 28.1	555 100.0	0.222 (.000**)
	No	People %	66 6.7	129 93.3	195 100.0	

3.5. Analytical results of the impact on unlawful sports gambling purchase following the pre-adulthood folk gambling participatory experiences

As illustrated in <Table 6>, as a result of analyzing the impact of folk gambling participation before adulthood on the purchases of illegal sports gambling, in the case of having experience in folk gambling before adulthood, 77.5% said they did participate in illegal sports gambling and 22.5% said they did not, and in the case of not having such experience, 41.0% said they did participate in illegal sports gambling, and 59.0% said they did not, respectively. Examining the test statistics, λ has a low correlation of 0.201, and the significance probability is 0.001, which is statistically significant, respectively.

Table 6. Analysis of the illegal sports gambling participation following folk gambling experience.

Classification		Experiences of illegal sports gambling			Total	λ (p)
Details		Yes	No			
Pre-adulthood folk gambling participation	Yes	People %	335 77.5	96 22.5	431 100.0	0.201 (.001**)
	No	People %	131 41.0	188 59.0	319 100.0	

3.6. Analytical results of the impact of the parents preferred folk gambling on the selection of monetary games one prefers

As illustrated in <Table 7>, as a result of analyzing the impact related to the folk gambling preferred by the parents and the monetary game preferred by oneself currently,

among the folk gamblings most preferred by the parents, poker is a monetary game to be preferred by oneself, and so poker is favored by 61.9%, followed by 26.3% for go among the go's, 25% for chess among the chesses, 39.9% for Go Stop among the Go Stop's, 15.5% for Sports Toto, and 11.8% for the Internet games. Examining the test statistics, X² is 441.167, and the significance probability is 0.000, which is statistically significant, respectively.

Table 7. Analysis of the preference of parents and oneself to monetary game.

Classification		Monetary game favored by oneself							X ² (p)
Details		Poker	Go	East-ern chess	Toto	Inter-net	Go stop	Oth-ers	
Folk gambling favored by parents	Peop- le %	39	0	3	10	1	9	1	441.167 (.000**)
		61.9	0.0	4.8	15.9	1.6	14.3	1.6	
Go	Peop- le %	1	5	2	9	0	1	1	
		5.3	26.3	10.5	47.4	0.0	5.3	5.3	
Eas- tern chess	Peop- le %	14	0	8	4	1	5	0	
		43.8	0.0	25.0	12.5	3.1	15.6	0.0	
Go stop	Peop- le %	113	1	11	76	58	196	28	
		23.0	0.2	2.2	15.5	11.8	39.9	5.7	
Oth- ers	Peop- le %	20	0	0	26	40	27	22	
		14.7	0.0	0.0	19.1	29.4	9.9	16.2	

3.7. Analytical results of the difference in perception of sports toto by the lawful participants and unlawful participants

As illustrated in <Table 8>, as a result of analyzing the perception of legal and illegal participants of Sports Toto, in the case of easy to quit since Sports Toto is least addictive, examining the test statistics, the t-value is 2.335, and the significance probability is 0.020, so it may be said to be a significant difference statistically speaking. When purchasing Sports Toto, in the case of watching sports is even more interesting, examining the test statistics, the t-value is 2.868, and the significance probably is 0.004, so it may be said to be a significant difference statistically. In the case

of Sports Toto increases the participation in watching sports, examining the test statistics, the t-value is 2.276, and the significance probably is 0.023, so it may be said to be a significant difference statistically. In the case of Sports Toto brings about diversification of recreational activities, examining the test statistics, the t-value is 2.705 and the significance probably is 0.007, so it may be said to be a significant difference statistically, respectively.

Table 8. Analysis of the differences in perception of sports toto.

Classification	Illegal participants		Legal participants		t	p
	Mean	Standard deviation	Mean	Standard deviation		
Low gambling characteristics	3.07	1.231	3.00	1.137	.799	.436
Low addictiveness	2.86	1.175	2.66	1.117	2.335	.020*
Recommend to others	2.71	1.051	2.72	1.051	-.037	.970
Part of sports	3.17	1.035	3.13	1.028	.525	.600
Positive view from those around	2.81	.955	2.84	1.014	-.402	.688
Increased fun watching	3.78	.967	3.57	1.015	2.868	.004**
Stress relieved	3.06	1.037	3.13	.984	-.860	.390
Increased watching participation	3.74	.934	3.58	.967	2.276	.023*
Joy with colleagues	3.82	1.008	3.73	1.015	1.232	.218
Diversification of leisure	3.38	1.043	3.17	1.030	2.706	.007**

3.8. Analytical results of first priority on the difference in impact of eradication of unlawful sports gambling for lawful participants and unlawful participants

As illustrated in <Table 9>, as a result of analyzing the impact of eradicating illegal sports gambling for legal and illegal participants, the first priority of the impact of eradicating illegal sports gambling considered by the illegal participants is, 31.3% for the increased convenience in purchasing Sports Toto, 30.7% in cracking down on illegal websites, 12.2% for increased betting amounts, and 12.2% for the promotion of prevention against participation via mass media, and the first priority considered by the legal participants is 52.1% for

cracking down on illegal websites, 20.4% for increased convenience in making purchases, and 14.4% for promotion of the participation prevention, respectively, and examining the test statistics, X^2 is 59.652, and the significance probability is 0.000, which may be said to be a statistically significant difference, respectively.

Table 9. First priority in the effect of eradicating illegal sports gambling.

Classification		Effect of eradicating illegal sports gambling								X^2 (p)
Details		In-crease d con- venience	In-crease d bet- ting amount	Di- ver- sified pro- duc- ts	Par- ti- cipa- tion pre- ven- tion pro- mote d	Social clubs crack- ed down	Web- sites crack- ed down	Oth- ers	Total	
Illegal partici- pants	Pe opl e %	146	57	48	57	14	143	3	466	59.6 52 (.00 0) **
		31.3	12.2	9.9	12.2	3.0	30.7	0.6	100	
Legal partici- pants	Pe opl e %	58	13	7	41	17	148	0	284	
		20.4	4.6	2.5	14.4	6.0	52.1	0.0	100	

3.9. Analytical results of second priority on the difference in impact of eradication of unlawful sports gambling for lawful participants and unlawful participants

As illustrated in <Table 10>, as a result of analyzing the efficiency of the countermeasures for eradicating illegal sports gambling for legal and illegal participants, the second priority of the impact of eradicating illegal sports gambling considered by the illegal participants is, 19.1% for the increased convenience in purchasing Sports Toto, 17.8% for the promotion of prevention against participation via mass media, 17.6% for the diversification of products, 15.9% for cracking down on social clubs, 15.5% for cracking down on illegal websites, and 13.7% for expanding the betting amounts, and the second priority considered for the impact of eradication by the legal participants is 31.3% for cracking down on illegal social clubs, 20.8% for the promotion of participation prevention, 12.7% for the increased convenience in purchases, and 10.9% for the diversification of products, respectively. Examining the test statistics, X^2 is

41.214, and the significance probability is 0.000, which may be said to be a statistically significant difference, respectively.

Table 10. Second priority in the effect of eradicating illegal sports gambling.

Classification		Effect of eradicating illegal sports gambling								X^2 (p)
Details		In-crease d con- venience	In-crease d bet- ting amount	Di- versified prod- ucts	Par- ti- cipa- tion pre- ven- tion pro- mote d	So- cial clubs crack- ed down	Web- sites crack- ed down	Ot- her s	Total	
Illegal partici- pants	Pe opl e %	89	64	82	83	74	72	2	466	41.214 (.000) **
		19.1	13.7	17.6	17.8	15.9	15.5	0.4	100	
Legal partici- pants	Pe opl e %	36	16	31	59	89	50	3	284	
		12.7	5.6	10.9	20.8	31.3	17.6	1.1	100	

4. Conclusion & Suggestion

The purpose of this study is to provide the fundamental data for the development of Sports Toto industry and the eradication of illegal sports gambling. To this end, differences among the folk gambling environment was analyzed for adolescence, and its future impact on the illegal sports gambling participation, perception towards Sports Toto, and the impact of eradicating illegal sports gambling were examined. The results derived may be discussed as follows.

First, in the household, the parents' folk gambling behaviors were easily exposed to the adolescents, and the participation in folk gambling with family before adulthood was easily observed without sanctions. This is supportive of the report that the gambling opportunities and the experience of large exposure to the gambling market are recognized as potential risk factors for gambling addiction as proposed by Shead, Derevensky, & Gupta(2010)[29], and the result that 22% of the male high school students are experienced in gambling in the study of Kim Seo-Yeon(2015)[22]. In addition, in the study of Lee Young-Bun, Lee Eun-Joo(2003)[30], in the

case of money betting games, Go Stop is most favored, whereas the counterparts are family and relatives, and the location is the house of relatives, and wherever close to one's own home, supporting the results of this study. As such, it is determined that folk gambling is classified as a general social game since it is often exposed to folk gambling within household for the adolescents, and it is also considered that most of them enjoy it without realizing that it is gambling, which is allowed under the false perception of their parents that their adolescents will not be negatively affected thereby. While folk games may have a low level of gambling characteristics engaging family members and relatives, folk gambling through which money is exchanged depending on who wins and loses will not be appropriate for the participation of adolescents.

Second, it was discovered that the possibility of participating in the folk gambling before adulthood is high according to the exposure of the parents' folk gambling activities and the frequency of exposure. This is consistent with the research results of Griffiths (1993)[31] where it is claimed that even if one of the parents has a problematic gambling behavior, the child is more likely to gamble. Folk gambling in the households tends to progress gradually mostly for its characteristics, and it is common to fall for gambling addiction after a certain period of social gambling period. While there is a tendency to think that adolescents would not fall for gambling since they lack the economic means, a study[32][33] reported that the problematic gambling rate of the adolescents is 4 times greater than that of the adults. Thus, the adolescents' participation in folk gambling in the households should be eradicated, and their parents should be cautious as to ensure that their folk gambling behaviors are not exposed.

Third, the exposure of the parents' folk gambling behaviors and the participation in folk gambling before adulthood during the adolescence shows that the possibility of participating in illegal sports gambling with strong gambling characteristics and addiction is increasing in purchasing Sports Toto in the future. This is supportive of the research results of Kwon Bok-Soon, Kim Young-Ho

(2011)[34] that the illegal sports gambling participation is influenced by the factors related to family and related to the local community culture, and also the result of the study of Ryu Hwang-Kwon, Choi Yi-Soon, Jang Hyo-Gang, Kim Jeong-Eun(2012)[35] such that the adolescents experienced in gambling will very likely continue their gambling problem until adulthood and the gambling addiction is highly likely. Illegal sports gambling is such a serious illegal gambling which destroys the families of the purchasers, causes economic deprivation, and demotivates the mentality of the workers under the notion that jack pot can be won. In addition, in the state, both the business operator and purchasers can be punished as they are illegal activities, so their crimes and responsibilities are very heavy. Thus, folk gambling activities in the households that may impact children before reaching their adulthood should not be exposed, and it should also be ensured that their participation before adulthood is precluded.

Fourth, the folk gambling most preferred by parents during adolescence is found to be very consistent with the monetary game most preferred by their children. Among which, if parents prefer those with high gambling characteristics and addiction such as Go Stop and poker game, it is highly likely that it will become a monetary game favored most by their children, and the relatively healthy folk gamblings such as chess, go, and eastern chess are found to have little impact on their children. This is consistent with the research results of Vitaro, Arseneault, & Tremblay (1997)[36] which presented that the adolescent gambling is influenced by the level of family gambling, and also those of Yeon Mi-Young(2006)[1] which presented that the family's gambling behaviors are correlated to the adolescents' gambling behaviors, distorted gambling beliefs, and future gambling motivations. Thus, in case parents need to expose their folk gambling behaviors to their children before adulthood, it would be desirable to proceed with sound folk games such as chess, go, and eastern chess which have lesser impact relative to Go Stop and poker with larger impact.

Fifth, it may be discerned that the legal and illegal Sports Toto participants have a positive perception that in using Sports Toto, it is not gambling yet it is quite addictive and since people do not look favorably upon it, it is not something to recommend to others as a matter of negative view, and it makes watching sports interesting, increases watching sports participation, and brings about the Diversification of leisure activities to conduct with friends and colleagues. In addition, it was found that the illegal participants have both negative and positive perceptions very strongly at the same time. This is consistent with Soh Jae-Wook(2016)[37] in that the legal and illegal participants of Sports Toto purchase it for the fun of watching sports yet the illegal participants are even more vulnerable to gambling characteristics and addiction as they participate for financial gains, and with Park Gyeong-Rae(2012)[27] in that they participate in sports betting to make sports games even more interesting for entertainment and recreation. Thus, to help the purchases participate more healthily, the clinic proposed in the study of Park Jun-Hui et al. (2014)[26] to prevent gambling addiction should be operated to manage and treat them while counteracting addicted purchases, and the methods of controlling daily purchase amount and frequency should also be considered by introducing electronic cards directly engaged in gambling addiction.

Sixth, those who experienced illegal participation thought that it would be effective to reduce the illegal participation via the improvement of Sports Toto's operation method, and the legal participants thought that cracking down would be conducive for the eradication of the illegal sports gambling. Unlike the legal purchasers who think that illegal participation will decline if illegal websites are cracked down, the illegal purchases seem to think first that improving the inconvenience of using the legal Sports Toto and improving competitiveness against the illegal Sports Toto will be the best way to induce and lead legal participation. This is consistent with the research results of Park Gyeong-Rae et al.(2012)[27] in that it is effective to reduce illegal sports gambling by increasing the

convenience of betting participation, enforcing strict crack downs, and increasing the betting amount. In addition, it is supportive of Kang Byeong-Woo(2008)[38] in that it is consistent with the need for a unified system where immediate evidentiary data can be collected and processed together with the discovery of the illegal sports gambling websites and where crack downs can be enforced, Thus, a most effective way to eradicate the illegal Sports Toto would be to improve unsatisfactory factors in purchasing Sports Toto as presented by Park Jun-Hui et al.(2014)[26] to guide the illegal participants to the legal area so as to build an environment where illegal purchases could no longer be made by regularizing crack downs.

5. Conclusion & Suggestion

As a result of conducting this study to investigate the differences in folk gambling exposure patterns within households during adolescence, folk gambling exposure, perception of Sports Toto, and the impact of eradicating illegal sports gambling against the participants of Sports Toto and the illegal sports gambling participants, the following conclusion has been reached.

As a result of this study, first, examining the exposure patterns of folk gambling during adolescence and the experience of the illegal sports gambling participation, the largest number of respondents witnessed gambling activities of their parents within their households, and Go Stop, a traditional folk gamble, and poker game were most favored by the parents. More than half of the respondents have participated in folk gambling with their family during adolescence, and if most of them have experienced participating in the folk gambling, they experienced gambling before reaching adulthood. The respondents currently show the highest rate of participation in Go Stop and poker for the most favored monetary games, and they mostly demonstrated KRW 20,000 (JPY 1,900) or less of spending on average. In addition, 62.1% of the entire respondents said that they did experience illegal sports gambling, of which

62.4% said they even more favor the illegal participation.

As a result of this study, second, if they witness their parents' folk gambling activities during adolescence, their likelihood of participating in folk gambling before adulthood increased, and the more they were exposed to their parents' gambling, their likelihood of participating before reaching adulthood also increased even more. Furthermore, if they witnessed their parents' gambling activities within households during adolescence, they turned out to be even more probable to purchase illegal Sport Toto to the legal Sports Toto, and if they participated in folk gambling with their family during adolescence, they had a higher likelihood of participating in the illegal sports gambling as well.

As a result of the research, third, the folk gambling favored by their parents during adolescence impacts the monetary games they currently favor themselves. The folk gambling preferred by their parents before adulthood is very consistent with the monetary game they currently favor as children.

As a result of the research, fourth, both the legal and illegal participants thought that, even while Sports Toto is not a gamble, since people around them do not look favorably upon it, they could not recommend Sports Toto of strong addiction to others. However, most of the participants had a positive perception that purchasing Sports Toto made watching sports interesting, increased participation in watching sports, and diversified recreational activities to enjoy with friends and colleagues.

As a result of the research, fifth, there was a difference in the effectiveness of the countermeasures for eradicating illegal sports for the legal and illegal participants of Sports Toto. The illegal participants thought increasing convenience for the participation of Sports Toto and cracking down on illegal websites would help to curb the illegal sports gambling as a most effective countermeasure, whereas the legal participants thought cracking down on illegal websites, illegal social clubs and clubs, and promoting participation

prevention via the mass media would help to reduce the illegal participation.

Combining the results of this study as in the above suggests that the exposure to folk gambling within households is likely to raise the possibility of participating in illegal sports gambling in purchasing Sports Toto in the future, and so the parents will likely need to control the management of the activities of folk gambling within households, while the senior management of Sports Toto should consider positive and negative perceptions of the legal and illegal participants manifested in reality to improve the image of Sports Toto and also endeavor to grow the business by integrating it into more rational management practices to eradicate illegal sport gambling.

Finally, the limitations of this study manifested in the course of conducting it point towards the accuracy of completing questionnaires due to the legal sanctions of the participation in illegal sports gambling and the distinction between the current participants and past participants of illegal sports gambling. In addition, according to the ages of the subjects, there were limitations to the difference in the accuracy of the timing related questions through the recollection of their past, and the lack of previous studies related to folk gambling within households led to the failure of controlling the subjective intervention of the researchers. Thus, it is necessary to perform family research at the same time by dividing the adolescents and their parents, and if more surveyors are deployed, and if the data of the current participants of illegal sports gambling could be obtained via the acquaintances and colleagues, even more meaningful results may be looked forward to.

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Assessing the Degree of SPORT Leadership Questionnaire Focusing on the Transactional and Transformational Leadership based on the MLQ-5X

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Abstract

Leadership is very important in sport. Leadership as provided by the coach plays a very significant role in the lives of athletes and in the athlete's sport experience. However, the means by which a coach demonstrates leadership behaviors may vary from coach to coach. Coaches at different levels of competition may be expected to interact with athletes differently due to the different levels of athletic ability and possibly the greater pressure to win for employment security. Coaching attitudes and actions may also differ based on their leadership ability and style. The Multifactor Leadership Questionnaire(MLQ) is a test that looks for the leadership ability and it is one that is accepted by a variety of organization such as sport teams, companies, and even militaries. The MLQ is a test that is widely used today, but just because it is used a great deal of the time, does not mean there are no flaws. The test is not perfect. Therefore, it is necessary to evaluate the Multifactor Leadership Questionnaire and to give some solutions for the test. In this study, the purpose and critiques of MLQ-5X were explored through literature review, and the evaluation and critique of MLQ-5X's practical and technical issues to solve problems that MLQ-5X has.

In the practical point, a cover sheet should be attached to each questionnaire by clarifying the nature of the study and the responsibility of each of the parties. Guarantying anonymity of all participants is important factor that would affect the result of study. Researchers should also provide the contact details to safeguard participants form harm caused by any issues that may have arisen due to the research. The MLQ-5X looks at transformational, transactional and non-leadership behaviors and evaluates each of these with various criteria. In reading the test results, each question is carefully evaluated. Some of the questions are very specific and require the test taker to choose from ambiguous answers such as "sometimes," "fairly often," etc. Many of the questions address various habits and behaviors as well as thinking processes.

For the technical issues, the MLQ-5X test has some strengths and weaknesses in respect to its potential practical application, design and validity. Because of excellent validity and reliability, the MLQ-5X has been used comprehensively worldwide. However, since the MLQ-5X has not been used many times in the sport organization studies, an internal reliability can be issued in the field of sport. The MLQ-5X has some merit because it has been evaluated and used successfully all over the world. Controls have been implemented and to a great extent the numbered questions have validity. Thus, discrepancies will likely be scant, and while the test is a good one in general, it is also likely that some people will fall through the cracks. Therefore, the text should always be used in conjunction with an interview as well as alternative evaluating methods.

While the transactional leadership factors have been discussed in the leadership literature for at least fifty years, little attention in the aggregate had been paid to assessing the transformational components, at least up until the last 20 years. Results of the current report potentially offer a more comprehensive survey tool for measuring leadership styles, now it can be refined and improved upon in subsequent research.

[Keywords] Sport Leadership, Multifactor Leadership Questionnaire, Transformational Leadership, Transactional Leadership, MLQ-5X

1. Introduction

In sports, an athlete's performance plays a very important role in winning or losing, but the coach's strategy and his/her leadership make it possible for an athlete to achieve the best performance[1][2]. Therefore, athletes should be adequately directed by coaches, giving them a substantial influence on the athletes. However, the level of influence is unknown, along with the expectations of what athletes want from coaches and how do coaches identify themselves[3][4][5][6][7]. Since the coach's role is considered to be a highly complex but systematic process, coaches in most situations must complete a variety of tasks such as planning practices and game strategies, organizational tasks and mentoring athletes which does in fact include more than teaching essential skills and tactics [8][9][10][11].

The leadership behaviors of athletic directors have been determined by coaches' ratings on the Multifactor Leadership Questionnaire(MLQ), which was developed by Bass in 1985[12]. The MLQ measures the degree of transactional and transformational leadership exhibited by the subjects[13]. Since the instrument proposed by Bass(1985) for the purpose of assessing transactional and transformational leadership, it has been modified and revised several times due to the problems reported by a number of authors who conduct a research on transformational leadership behavior with the use of the MLQ[12]. Consequently, there are several revised versions of the MLQ appearing in the former studies[14].

2. Multifactor Leadership Questionnaire

The Multifactor Leadership Questionnaire(MLQ) has been used extensively in the past 20 years. The MLQ is originated from the development of Bass' six-factor leadership model. The development of Bass' six-factor leadership model was originally based on preliminary results obtained by surveying 198 US army field grade officers, who were each

asked to rate their respective superior officers using the MLQ and the six-factor model merges attributed charisma, charismatic behavior and inspirational leadership into a single factor of charisma[14]. Having a clear understanding of the six-factor model might be advantageous for efficiently conducting the research study with the use of the MLQ. Avolio, Bass and Jung(1999) reported the six-factors and their operational definitions in their study that reexamined the components of transformational and transactional leadership using the MLQ[14].

The revised MLQ-5X measures transformational, transactional, and non-transactional leadership behavior as well as outcomes of leadership, such as Effort, Effectiveness, and Satisfaction.

Transformational leader can produce high levels of subordinate effort and performance that went beyond what would occur with a transactional approach. From a similar perspective, transformational leaders encourage their followers to do more than the minimum requirements, and leads to a higher job performance and job satisfaction among employees in organizations[3]. Transactional leaders clarify for their follower's responsibilities and the leadership theory is based on an exchange process in which the leader provide rewards in return for the subordinate's efforts and performance. Transactional leadership occurs when followers are moved to fulfill their roles as set forth with the leader in exchange for reward or the avoidance of punishment[15].

2.1. Purpose and nature of the test(MLQ-5X)

The MLQ-5X investigates relationships between these leader styles and work unit effectiveness and satisfaction. In its most recent version, the MLQ-5X has been designed to test a full range of leadership styles ranging from charismatic to avoidant and laissez-faire[16]. There are 7 dimensions in the range of leadership styles. The first four factors (idealized influence, inspirational motivation, intellectual stimulation, individualized consideration) are identified as transformational leadership factors, while contingent reward

and management by exception (active and passive) are categorized as transactional leadership factors. Laissez-faire leadership or an absence of leadership is included to embody the entire range of leadership styles.

Bass(1999) argued that transformational leadership generates greater follower effectiveness and satisfaction than transactional leadership[3], and Bass and Avolio(2000), found that the most effective leaders encompass some transactional but more transformational characteristics[16]. In support of this, Lawe, Kroeck, and Sivasubramaniam(1996)'s analysis of 33 independent MLQ-based studies from America, New Zealand, Canada, Japan, Singapore, and India concluded that there are strong positive correlations between all transformational leadership components and objective and subjective performance measures. Transactional, contingent reward leadership was less positively correlated with performance; and passive, management by exception leadership was negatively correlated with performance.

Numerous refinements and rigorous testing have shown the MLQ-5X to be valid and reliable in many studies[16]. A brief description of the full range of leadership dimensions measured by the MLQ-5X is as follows:

- Idealized Influence(charisma):

Leaders with idealized influence become role models as followers identify with and want to emulate them. These leaders are admired, respected and trusted and are perceived as having extraordinary capabilities, persistence and determination[7][15][16].

- Inspirational Motivation:

Leaders who create inspirational motivation paint a clear vision for the followers' future state and create the momentum to reach that vision through the arousal of team spirit. These leaders provide meaning, challenge, clearly communicated expectations, and a commitment to set goals[7][15][16].

- Intellectual Stimulation:

Leaders who exhibit intellectual stimulation encourage followers to be innovative

and creative by getting followers to readdress old problems in new ways, think outside the square and regularly examine old assumptions to see if they are still viable[7][15][16].

- Individualized Consideration:

A leader who shows individual consideration treats each follower as an individual and considers their individual needs, abilities and aspirations. They help individuals to develop their strong points and spend time training and guiding people[7][15][16].

- Contingent Reward:

Contingent reward highlights a relationship between leaders and followers that stresses exchange, with the leader facilitating the achievement of this process. Reinforcement of this process is generally positive[7][15][16].

- Management by Exception:

Active management by exception involves a leader who actively monitors followers to safeguard against mistakes and takes action when mistakes occur. Passive management by exception involves a leader who only intervenes to take corrective action when things go wrong. Reinforcement of this process is generally negative with the use of criticism and negative feedback[7][15][16].

- Laissez-faire:

This is the avoidance or absence of leadership where the leader avoids getting involved altogether. No attempt is made at problem solving or at motivating followers, and decisions are often delayed[7][15][16].

2.2. The intended uses and populations

Since the principles of transformational and transactional leadership have considerable generality, the MLQ-5X can be applied to various ranges of study from military, business organizations, educational institutions, government agencies, hospital, and sport organizations. This fact indicates that the applicability of the MLQ-5X is extensive and the credibility of the MLQ-5X may be high[17].

The populations for the MLQ-5X could be any groups or teams such as military to enhance positive training effects, sport teams to make strong relationship between coaches and players, business firms, or bank managers to predict long-term branch market share and customer satisfaction. Especially, the MLQ-5X for teams is often regarded as a good source since it provides valuable feedback to the whole team about how its members see the group performing leadership functions[16] [17].

3. Practical Issues

3.1. Administration

Self-administration method is used to obtain a response from potential research subjects. In particular, although there is no time limitation in administering the MLQ-5X, a researcher may provide 15 to 20 minutes to answer all forty-five items of the MLQ-5X questions.

When using the MLQ-5X questionnaire, subjects are asked to indicate on a 5-point Likert type scale(0~4) how frequently each of the 45 descriptive statements fits themselves. Subjects can answer with blank if an item is irrelevant, or if they are unsure or do not know the answer.

Table 1. 5-Point Likert Scale used in MLQ-5X.

Not at all	Once in a while	Some-times	Fairly often	Frequently, if not always
0	1	2	3	4

3.2. Scoring

Usually, the researchers using MLQ questionnaire use relatively simple hand-scoring. The MLQ-5X scale scores are average scores for the items on the scale. The score can be derived by summing the items and dividing by the number of items that make up the scale. All of the leadership style scales have four items, extra effort has three items, effectiveness has four items, and satisfaction has two items.

3.3. Examiner qualifications

The examiner should provide the purpose and nature of test clearly, and also explain the overall test procedures. The most important aspect for examiner qualifications is that the examiner should not be the manager or leader of the test takers. Since one dimension of questionnaire is asked about their leader, the test should guarantee the anonymity of test takers. To provide the anonymity and confidential, the examiner should be a person who is not related to the group or organization.

3.4 Evaluation and critique

A cover sheet should be attached to each questionnaire by clarifying the nature of the study and the responsibility of each of the parties. Guarantying anonymity of all participants is important factor that would affect the result of study. Researchers should also provide the contact details to safeguard participants form harm caused by any issues that may have arisen due to the research.

The MLQ-5X looks at transformational, transactional and non-leadership behaviors and evaluates each of these with various criteria. In reading the test results, each question is carefully evaluated. Some of the questions are very specific and require the test taker to choose from ambiguous answers such as "sometimes," "fairly often," etc. Many of the questions address various habits and behaviors as well as thinking processes. One question is "I articulate an attractive future that gets the attention and stimulates the imagination of my associates(Inspirational motivation)." The MLQ-5X is not a test requiring a creative answer. In other words, what plays into an individual's leadership is not just ideation but also the behavior of the individual. Performance becomes important[2].

Another question is: "I show my associates and followers that I understand their capabilities, needs and desires, and work to develop each of them to their full potential(Individualized consideration)." The answer is whether or not the individual actually does implement such techniques or just feels that he should.

At the same time, there is no box to check which might suggest another alternative[2].

4. Technical Issues

4.1. Norming, scaling, equating

Depending on the design of a research study, a norm group can be established in order to compare one another with regard to those types of leadership behaviors. Norm group may vary on the basis of what a researcher is interested in. In other words, a researcher may assign a certain group of individuals as a norm group based on their leadership characteristics. If I want to study the leadership characteristics of a certain sport context, all leader(employer) and followers (employees) can be a norm group for my study.

Since the Multifactor Leadership Questionnaire(MLQ-5X) is a multirater assessment, several people rate the target norm group. If I want to create a norm for my organization, I can indicate two norms; for example, the particular group for a workshop as well as my corporate name for comparison across the whole corporation. If I only need each individual compared to others in my organization, I just use one norm.

The Multifactor Leadership Questionnaire uses 5-point likert scale(0: Not at all ~ 4: Frequently).

4.2. Reliability

The MLQ-5X has excellent reliability and has been used extensively worldwide. It has been shown to be strongly predictive of leader performance across a broad range of organizations[17]. Bass & Avolio(2000) reported that the alpha reliability coefficient for the total items and for each leadership factor scale range from .74 to .94[16]. According to Nunnally and Bernstein(1994), an internal consistency(Cronbach's alpha) greater than .70 is reasonably reliable[18]. In addition, there was a statistically significant intercorrelation among the 4 transformational scales(Pearson's correlation coefficient = .95).

4.3. Validity

The initial conceptualization of the transactional and transformational leadership model presented by Bass(1985) included six leadership factors(Charisma, Inspirational, Intellectual Stimulation, Individualized Consideration, Contingent Reward, Management-by-Exception, and Laissez-Faire)[12]. Evidence for a five-factor structure combining Charisma and Inspirational leadership was presented by Bycio, Hackett, and Allen(1995) for the earliest version of the Multifactor Leadership Questionnaire(MLQ Form 1) used by Bass(1985)[19]. However, Bycio et al. (1995) noted some reservations regarding their findings indicating that,

“Although the overall confirmatory factor analysis fit indices tended to support the existence of five leadership components, the transformational factors were highly correlated, and more important, they generally did not have strong differential relationship with the outcome variables(p. 474)[19].”

However, a great deal of revision in the MLQ has occurred since 1985. Since the original 6-factor model was proposed by Bass (1985), several additional factors have been uncovered through subsequent research using revised versions of the MLQ[20]. One of these factors provides for attributions regarding the leader's transformational style, and is based on distinguishing between idealized charismatic behaviors and attributions. Management-by-Exception is divided into Management-by-Exception-Active(MBEA) and Management-by-Exception-Passive(MBEP). Thus, nine factor scores were obtained for MLQ-5X. Six had been used previously in MLQ-5R and three were newly created[16].

The earlier version of the Multifactor Leadership Questionnaire(MLQ-5R) was used to measure transformational, transactional, and non-transactional/laissez-faire leadership. It has been criticized by several authors for an inadequate discriminant validity among the factors comprising the survey, for including behavioral and impact items in the same survey scales, and because the factor structure initially proposed by Bass(1985) sometimes

has failed to be replicated in subsequent empirical research[21][22]. Bass and Avolio (1993), following their review of prior empirical studies completed on the MLQ[23], concluded that:

“The original factor structure presented by Bass(1985) does still represent conceptually and in many instances empirically, the factors of transformational, transactional and laissez-faire leadership. But already we see that the structure is more complex than originally proposed. Further refinements are in the offing(p. 61)[23].”

In last MLQ technical manual[24], it can be summarized preliminary results of a comprehensive validation study that was undertaken to develop some refinements of the MLQ. That manual addressed some of the original concerns raised by Yukl(1999) and Smith and Peterson(1988) regarding the psychometric problems with earlier version of the MLQ[21][22]. Results presented in that earlier technical manual were based on a portion of the sample reported in the present technical report.

The MLQ-5X was developed in response to substantive criticism of its predecessor the MLQ-5R survey[16]. The criticism concerned the high correlations among the transformational scales, as well as between the transformational leadership scales and contingent reward; the mixing of behaviors, impact and outcomes within a single leadership scale, and distinguishing between behaviorally-based charismatic leadership[referred to as idealized influence(behaviors)], versus an attribution or impact on followers referred to as idealized influence, or elsewhere as “attributed charisma”[25].

In a cross-validation examination with nine samples[American undergraduate students(N=162), U.S. government research agency(N=66), U.S. Army(N=2020), Scottish gas firm(N=99), U.S. business firm(N=1,326), Taiwanese & American undergraduate students(N=254), U.S. nursing school(N=45)] by using construct factor analysis, it has proved to have good construct validity[16].

4.4. Evaluation and critique

The MLQ test has some strengths and weaknesses in respect to its potential practical application, design and validity[2]. Because of excellent validity and reliability, the MLQ-5X has been used comprehensively worldwide. However, since the MLQ-5X has not been used many times in the sport organization studies, an internal reliability can be issued in the field of sport.

It may be used to test potential leaders or manager applicants in a variety of situations. In this way, because of the validity of the test, one can say that truly unsuitable individuals will not be placed in management positions. Positive attributes of the test include widely accepted notions. When finding leaders who demonstrate transformational qualities, one should be reminded that transformational leadership is positively correlated with role clarity[26]. Hence, when associates are chosen with the help of the test, it adds to the smooth running of a corporation.

The MLQ-5X relies heavily on honesty and self-evaluation. By the time someone is in a management position, he or she usually has a college degree, and has some life experience. Some of the questions suggest that one answer is better than another. Even if an individual test taker is honest, their self-evaluation may slant to the preferred choice. The preferred choice can sometimes be rather obvious.

Since the MLQ-5X has been evaluated and used successfully all over the world, one has to assume that it has some merit. Controls have been implemented and to a great extent the numbered questions have validity. Thus, discrepancies will likely be scant, and while the test is a good one in general, it is also likely that some people will fall through the cracks. Therefore, the text should always be used in conjunction with an interview as well as alternative evaluating methods.

Brown and Trevino(2002) explain: "Although much has been said about the importance of the ethical dimension of leadership, the construct had never been precisely defined or adequately measured"(p.D1)[27].

It is hard to really measure ethical qualities in terms of leadership.

5. Conclusion

Although the MLQ-5X has been used for long time and in various areas of study, and updated several times, it still has some questionable aspects and issues. Since the concept of transformational and transactional leadership is relatively not clear or there is no straight line to divide between them, for example, some people have trouble with conceptual questions as opposed to having to deal with the concrete. When statements or questions may be interpreted in a variety of ways, some will not do well on the test. Thus, the result may not clearly indicate the type of leader the individual might be but rather, how well the person is at test taking[28].

While the transactional leadership factors have been discussed in the leadership literature for at least fifty years[29], little attention in the aggregate had been paid to assessing the transformational components, at least up until the last 20 years. Results of the current report potentially offer a more comprehensive survey tool for measuring leadership styles, now it can be refined and improved upon in subsequent research.

Despite of its popularity and fame, the MLQ-5X has not been used many times in the field of sports compared to other research area. The sport organizations need a strong leadership more than any other fields because strong leadership can make players to chain with coaches that results in team winnings.

Cross-cultural research should consider the possibility of differently interpreting the concept of leadership or test because of different culture. It needs to be developed in terms of the test as well as concept based on the various cultures.

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