

ORIGINAL RESEARCH

Changes in physical activity and eating behavior after coronavirus pandemic: an online survey of elite Korean male athletes

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Abstract

The coronavirus disease 2019 (COVID-19) limits the physical activities of sports players. This study aimed to examine the activities and eating habits of elite adult athletes before and after the coronavirus disease (COVID-19) pandemic to establish a database. This study investigated the impact of the COVID-19 pandemic on the activity levels and dietary patterns of 776 elite adult athletes in 22 sports. A total of 36 questions included items on demographic factors and physical activity, sleep and eating habits before and after COVID-19 (April 2021–December 2021). Statistical analyses were performed using the SPSS software (version 25.0, Windows). Additionally, paired sample *t*-tests were used. Statistical significance was set at $p < 0.05$. After COVID-19, both vigorous and moderate activities decreased across almost all sports. Sitting and lying down showed an increasing trend, and some sports saw an increase in the diet of their players. Finally, participation in all sports significantly decreased. It is important for athletes to find the best way to maintain their physical, physiological and psychological states after COVID-19 to return close to their original abilities. Moreover, this study will help prepare for other infectious diseases after COVID-19.

Keywords

COVID-19; Physical activity change; Eating behavior change; Elite athlete; Online survey; Rehabilitation

1. Introduction

In late 2019, the emergence of a novel coronavirus strain, subsequently designated as coronavirus disease 2019 (COVID-19), prompted a global pandemic declaration by the World Health Organization (WHO) [1]. To mitigate the spread of COVID-19, many countries around the world have discouraged human interaction and banned international and domestic travel, restricting movement between regions. The movement bans and restriction orders were effective in reducing infectious diseases but resulted in various consequences for society as a whole, including economic and political turmoil, as well as changes in labor forms [2].

COVID-19 uses the same cell receptors as severe acute respiratory syndrome (SARS) to enter the body and is distantly related to Middle East respiratory syndrome (MERS). It is mainly transmitted via droplets produced by coughing, sneezing and other secretion- and aerosol-producing movements, especially among individuals in close contact [3]. Therefore, the risk of acquiring COVID-19 limits physical activities and sports that require close contact.

Elite Korean athletes are typically younger than the general population, which decreases their risk of serious illness or death [4]. However, elite athletes are not exempt from being

infected by COVID-19. Preventing the spread of COVID-19 among this population is essential to protect other individuals at high death risk and slow down the pandemic to prevent the healthcare system from exceeding its capacity. Sports leagues in South Korea were suspended or canceled in response to the pandemic, including the postponement of the Tokyo 2020 Olympic and Paralympic Games, highlighting the global scale of disruptions. Awareness among sports management professionals regarding COVID-19 prevention strategies is essential for injury prevention and the safe resumption of training and competition.

Notably, according to Sung's [5] research, the eating habits of elite athletes have often changed since the COVID-19 pandemic; in the case of weight-loss athletes, their eating habits have decreased, and their weight-loss strategies have changed. Physical activity and diet are essential components of athletic performance. However, research on athletes' training and dietary behaviors during the pandemic is predominantly Western-centric, indicating a gap in Asian-focused research, particularly in South Korea.

Therefore, this study aimed to evaluate changes in activities and eating habits before and after COVID-19 in elite adult athletes and to build a database of these changes. In addition, with a focus on maintaining performance, we would like to

prepare for any future pandemic by proposing strategies for the successful reintegration of athletes after the pandemic.

2. Materials and methods

2.1 Participants

The research questionnaires were randomly distributed to 2500 healthy adult elite athletes registered with the Korean Sports and Olympic Committee, of these 1296 questionnaires were collected with a 51.1% response rate (rejected questionnaires: 1214). The study enlisted 776 elite adult athletes aged 20 years and above, with a minimum of seven years of registration with the Korean Sport & Olympic Committee. The deadline for responding to the survey was nine months (April–December). Using a simple random sampling approach, the questionnaire was disseminated online through both the organizational secretariat and team coaches representing each sport. This study encompasses 22 sports categories, including individual sports, record-based sports, ball sports, racket sports, combat sports and winter sports. The detailed demographic profiles of the participants are presented in Table 1.

2.2 Data privacy of participation

To uphold anonymity and confidentiality using Google's privacy policy (policies.google.com/privacy?hl=en), participants were prohibited from disclosing their names or contact information. Moreover, the participants had the freedom to discontinue their involvement at any point before submission, with responses not being saved in such instances. Data submission occurred solely upon clicking the designated "Submit" button. Following the completion of the survey, participants were reaffirmed for their voluntary consent to participate in this anonymous study.

2.3 Survey questionnaires

The questionnaire employed in this study was crafted through the adaptation and supplementation of questions utilized in a prior investigation, tailored to align with the specific variables pertinent to this study. Comprising a total of 36 subjective inquiries necessitating concise responses, the questionnaire encompassed 12 queries concerning demographic factors, 16 pertaining to physical activity, sleep patterns and sedentary behaviors pre and post-COVID-19 infection, and 8 focusing on dietary habits. The demographic questions, originally comprised of 12 items, were drawn from a previous study and subsequently adjusted and expanded to better suit the subject matter and scope of the present research.

The 16 inquiries pertaining to physical activity, adapted from the International Physical Activity Questionnaire-Short Form (IPAQ-SF), and sleep patterns, derived from the Pittsburgh Sleep Quality Index, were tailored to align with the specific subject matter and context of this study. The questionnaire structure drew upon established methodologies outlined in previous research studies [6–9], with modifications and additions made to address the unique circumstances and variables pertinent to this investigation. Additionally, the six queries concerning eating behaviors, focusing on breakfast, lunch and

TABLE 1. The demographic characteristics of the participants.

Variables	n	%
Institution		
College team	21	2.7
University team	385	49.6
Professional team	370	47.7
Age (yr)		
20–25	564	72.8
26–30	107	13.9
31–35	68	8.8
>36	35	4.5
Hight (cm)		
<160	54	7.0
161–170	213	27.5
171–180	415	53.4
>181	94	12.1
Weight (kg)		
<55	52	6.7
56–65	112	14.4
66–75	350	45.1
76–85	201	25.9
>86	61	7.9
Career (yr)		
7	145	18.7
8–12	348	44.8
>13	283	36.5
Sports		
Individual sports	76	9.8
Record sports	125	16.1
Racket sports	199	25.6
Ball sports	258	33.2
Combat sports	73	9.5
Winter sports	45	5.8
Winning Career		
International	98	12.6
National	672	86.6
None	6	0.8
Marital status		
Single	234	30.2
Married	221	28.5
Living as couple	321	41.3
Smoking status		
Smoking	210	27.1
None	566	72.9
Drink status		
Drink	624	80.4
None	152	19.6
Health state		
Healthy	143	18.4
Injuries	594	76.5
With risk factors for disease	39	5.1
Total	776	100.0

dinner patterns, were adjusted and expanded based on previous research [7, 8], ensuring relevance and applicability to the subject and context under scrutiny.

2.4 Validation of feasibility and reliability of survey questionnaires

The questions utilized in this study have previously demonstrated validity in earlier investigations [9, 10]. Consequently, for this study, a content validity verification focusing on translation accuracy was conducted. This assessment engaged professors and researchers specializing in exercise physiology, sports nutrition, exercise prescription and training methodology, alongside a panel of experts comprising coaches and athletes. Their evaluation ensured the appropriateness of the measurement methods and concepts encapsulated within the questionnaire.

Furthermore, the questionnaire's reliability was assessed through a preliminary trial run conducted with researchers before the commencement of actual data collection. Following the computation of Cronbach's alpha coefficient, all values exceeded the threshold of 0.7, signifying robust reliability for the survey instrument, with coefficients ranging notably between 0.84 and 0.96.

2.5 Statistical analysis

Statistical analyses were performed utilizing SPSS software (version 25.0, Windows, IBM Corp., Armonk, NY, USA). Data are expressed as mean \pm standard deviation (SD) values. Descriptive statistics were employed to delineate the distribution of responses for each questionnaire item, providing means and standard deviations for individual queries. Changes in physical activity, sleep patterns, eating habits and weight among athletes before and after COVID-19 infection were assessed using paired samples *t*-tests. Statistical significance was determined at $p < 0.05$.

3. Results

3.1 Changes in vigorous activity after COVID-19

After COVID-19 infection, the amount of vigorous activity decreased across all sports. Statistical differences were observed across all sports, except for Individual sports and record sports, with strong differences seen in ball sports and sports total ($p < 0.001$).

Vigorous activity times were also found to have decreased after COVID-19 infection record sports ($p < 0.003$), combat sports ($p = 0.002$) and sports total ($p < 0.001$) showed statistically significant differences (Table 2).

3.2 Changes in moderate activity after COVID-19

After COVID-19 infection, the number of also decreased across all sports with statistically significant differences observed in all sports, except for winter sports.

In terms of moderate activity time, moderate activities also decreased across record sports ($p < 0.001$), combat sports ($p =$

0.003) and sports total ($p = 0.005$) with statistically significant differences.

3.3 Changes in light activity after COVID-19

After COVID-19 infection, the number of light activities only winter sports ($p = 0.009$) showed statistically significant differences.

Low activity time decreased across all sports, except for racket, ball sports and winter sports. Individual sports ($p = 0.035$), record sports ($p = 0.001$), combat sports ($p = 0.025$) and sports total ($p < 0.001$) showed statistically significant differences (Table 2).

3.4 Changes in sitting time after COVID-19

Time spent sitting after COVID-19 infection increased across all sports, except for in combat sports and ball sports. In addition, individual sports ($p = 0.035$), record sports ($p = 0.032$), racket sports ($p < 0.001$), combat sports ($p < 0.001$) and sports total ($p < 0.001$) indicated statistically significant differences (Table 3).

3.5 Changes in lying time after COVID-19

In terms of time spent lying, it was confirmed that it increased across all sports, except for racket sports and winter sports. However, except for ball sports ($p = 0.026$) and sports total ($p = 0.023$), there were no statistically significant differences observed (Table 3).

3.6 Changes in eating behaviors after COVID-19

The number of breakfast meals consumed decreased across all sports, except for in ball sports and winter sports. Among them, racket sports ($p = 0.024$), combat sports ($p = 0.025$) and sports total ($p = 0.003$) showed statistically significant differences (Table 3).

3.7 Changes in number of competitions after COVID-19

After COVID-19 infection, it was confirmed that the number of competitions decreased across all sports. Individual sports ($p < 0.001$), record sports ($p < 0.001$), ball sports ($p = 0.017$), racket sports ($p < 0.001$), combat sports ($p < 0.001$), winter sports ($p < 0.001$) and sports total ($p < 0.001$) showed statistically significant differences (Table 3).

4. Discussion

This study aimed to establish a comprehensive database of elite athletes by assessing their pre- and post-COVID-19 activity levels, dietary behaviors and engagement in competitions, with the ultimate goal of proposing strategies for their success post-pandemic.

The landscape of physical activity participation is significantly influenced by government policies related to COVID-19, reflecting regional variations shaped by socioeconomic factors [10]. Prior research has consistently indicated a global

TABLE 2. Changes in physical activity after COVID-19.

Variables	Sports	Pre COVID-19	Post COVID-19	<i>t</i>	<i>p</i>
Vigorous activity raps/wk					
	Individual sports	3.58 ± 2.11	3.32 ± 2.50	0.970	0.335
	Record sports	5.30 ± 1.83	5.13 ± 2.18	1.314	0.191
	Ball sports	4.98 ± 2.02	4.60 ± 1.93	4.429	<0.001
	Racket sports	5.26 ± 2.87	4.84 ± 2.74	2.509	0.013
	Combat sports	4.77 ± 2.00	4.11 ± 1.72	2.973	0.004
	Winter sports	4.16 ± 1.47	3.53 ± 1.24	5.229	<0.001
	Sports total	4.92 ± 2.33	4.52 ± 2.33	5.427	<0.001
Vigorous activity min/d					
	Individual sports	124.98 ± 105.65	113.86 ± 112.67	1.259	0.212
	Record sports	229.11 ± 127.77	202.83 ± 108.41	3.040	0.003
	Ball sports	190.08 ± 112.80	192.66 ± 120.05	-0.279	0.781
	Racket sports	206.58 ± 105.83	199.43 ± 110.65	1.264	0.207
	Combat sports	239.76 ± 149.68	183.13 ± 130.53	3.264	0.002
	Winter sports	128.08 ± 58.56	113.51 ± 40.39	1.878	0.670
	Sports total	196.67 ± 118.86	182.77 ± 115.67	3.957	<0.001
Moderate activity raps/wk					
	Individual sports	5.59 ± 5.81	3.62 ± 2.31	2.878	0.005
	Record sports	8.73 ± 7.90	3.79 ± 1.92	6.582	<0.001
	Ball sports	5.20 ± 3.55	4.48 ± 1.78	2.871	0.005
	Racket sports	8.00 ± 7.29	3.64 ± 1.74	9.448	<0.001
	Combat sports	8.00 ± 7.33	3.61 ± 1.73	4.642	<0.001
	Winter sports	4.89 ± 3.76	3.80 ± 1.56	1.863	0.069
	Sports total	7.17 ± 6.67	3.92 ± 1.92	12.669	<0.001
Moderate activity min/d					
	Individual sports	144.12 ± 112.66	107.09 ± 107.04	4.654	<0.001
	Record sports	164.66 ± 96.86	159.83 ± 100.08	0.637	0.525
	Ball sports	172.05 ± 108.31	171.96 ± 100.64	0.015	0.988
	Racket sports	171.74 ± 117.91	155.24 ± 101.28	2.954	0.003
	Combat sports	173.64 ± 139.67	162.68 ± 136.85	0.475	0.636
	Winter sports	133.36 ± 54.14	136.70 ± 68.82	-0.417	0.679
	Sports total	165.60 ± 111.05	155.27 ± 104.83	2.830	0.005
Light activity raps/wk					
	Individual sports	3.91 ± 2.85	3.76 ± 3.58	0.443	0.660
	Record sports	3.10 ± 2.42	2.86 ± 2.28	1.174	0.243
	Ball sports	3.77 ± 2.35	3.83 ± 2.32	-0.428	0.669
	Racket sports	2.99 ± 2.54	3.11 ± 2.53	-1.163	0.246
	Combat sports	3.73 ± 2.48	4.04 ± 2.50	-1.646	0.105
	Winter sports	4.53 ± 3.26	3.31 ± 1.60	2.713	0.009
	Sports total	3.41 ± 2.52	3.47 ± 2.59	0.731	0.465
Light activity min/d					
	Individual sports	142.41 ± 158.43	100.70 ± 131.18	2.166	0.035
	Record sports	128.69 ± 99.49	108.35 ± 96.91	3.365	0.001
	Ball sports	138.13 ± 120.25	127.00 ± 102.25	1.387	0.167
	Racket sports	125.43 ± 128.91	127.09 ± 114.52	0.217	0.829
	Combat sports	106.07 ± 110.76	150.00 ± 138.29	2.294	0.025
	Winter sports	94.10 ± 58.96	94.57 ± 42.01	-0.054	0.957
	Sports total	116.68 ± 111.86	131.87 ± 118.60	3.515	<0.001

TABLE 3. Changes in daily activity and eating behaviors and the number of competitions after COVID-19.

Variables	Sports	Pre COVID-19	Post COVID-19	<i>t</i>	<i>p</i>
Sitting min/d					
	Individual sports	178.02 ± 116.09	223.28 ± 137.49	2.918	0.035
	Record sports	154.38 ± 103.97	173.30 ± 104.21	2.177	0.032
	Ball sports	209.04 ± 123.63	206.46 ± 113.41	0.458	0.648
	Racket sports	158.84 ± 121.24	214.44 ± 122.21	6.891	<0.001
	Combat sports	150.13 ± 109.21	170.76 ± 87.93	1.987	0.051
	Winter sports	177.72 ± 114.99	196.95 ± 118.12	1.266	0.212
	Sports total	172.46 ± 116.15	202.14 ± 119.44	7.432	<0.001
Lying min/d					
	Individual sports	427.93 ± 191.78	454.29 ± 174.56	-2.474	0.016
	Record sports	551.70 ± 158.57	541.43 ± 161.74	-1.469	0.145
	Ball sports	459.94 ± 163.67	469.53 ± 167.75	-2.244	0.026
	Racket sports	522.44 ± 156.86	520.00 ± 155.05	0.441	0.660
	Combat sports	415.10 ± 150.91	412.65 ± 142.63	0.292	0.771
	Winter sports	437.50 ± 217.03	434.32 ± 216.09	0.426	0.672
	Sports total	482.84 ± 116.15	489.45 ± 173.94	-2.287	0.023
Breakfast d/wk					
	Individual sports	2.33 ± 2.66	2.06 ± 2.65	2.721	0.008
	Record sports	4.62 ± 2.38	4.46 ± 2.74	1.073	0.286
	Ball sports	4.99 ± 2.50	5.03 ± 2.43	-0.486	0.627
	Racket sports	2.93 ± 2.52	2.72 ± 2.51	2.265	0.024
	Combat sports	4.25 ± 2.46	3.52 ± 2.51	2.300	0.025
	Winter sports	5.91 ± 0.89	5.91 ± 1.09	0.000	1.000
	Sports total	4.01 ± 2.65	3.83 ± 2.74	3.019	0.003
Lunch d/wk					
	Individual sports	6.56 ± 1.25	6.44 ± 1.39	1.155	0.252
	Record sports	6.50 ± 1.40	6.62 ± 1.22	-1.794	0.075
	Ball sports	6.23 ± 1.52	6.15 ± 1.64	-0.246	0.806
	Racket sports	6.93 ± 0.34	6.91 ± 0.29	1.287	0.199
	Combat sports	6.94 ± 0.33	6.91 ± 0.28	0.532	0.597
	Winter sports	6.63 ± 0.92	6.83 ± 0.38	-1.544	0.130
	Sports total	6.49 ± 2.74	6.49 ± 1.26	0.188	0.851
Dinner d/wk					
	Individual sports	6.69 ± 0.75	6.49 ± 1.15	1.710	0.092
	Record sports	6.76 ± 0.66	6.70 ± 0.87	1.090	0.278
	Ball sports	6.50 ± 1.29	6.63 ± 0.85	-1.445	0.150
	Racket sports	6.60 ± 0.88	6.52 ± 1.07	2.148	0.033
	Combat sports	6.15 ± 1.60	6.59 ± 0.73	-2.526	0.014
	Winter sports	6.41 ± 0.83	6.46 ± 0.83	-1.430	0.160
	Sports total	6.56 ± 1.05	6.56 ± 1.05	-0.478	0.633
Competition a year					
	Individual sports	5.57 ± 2.89	3.63 ± 2.56	6.755	<0.001
	Record sports	5.15 ± 2.40	3.22 ± 2.16	7.682	<0.001
	Ball sports	5.64 ± 6.12	4.64 ± 4.22	-2.423	0.017
	Racket sports	5.41 ± 2.35	3.94 ± 2.32	8.959	<0.001
	Combat sports	7.31 ± 5.35	4.60 ± 2.39	4.100	<0.001
	Winter sports	10.48 ± 8.55	5.48 ± 3.68	3.865	<0.001
	Sports total	5.68 ± 4.10	4.33 ± 3.77	7.973	<0.001

decrease in vigorous and moderate physical activities since the onset of the COVID-19 pandemic, underscoring the substantial impact of restrictions on sports and other physical activities [11].

COVID-19 quarantine measures also apply to sports facilities [12], and social distancing for infection prevention continues to be implemented worldwide, including in Korea. As such, the prohibition of the use of training facilities and multi-person gatherings is also considered to be the cause of the decrease in the activity of elite athletes. In addition, owing to the unique characteristics of elite athletes who participate in vigorous physical activity, it is believed that the time spent participating in vigorous and moderate physical activity has significantly decreased compared with ordinary people. In contrast, low-intensity physical activity increased across all sports compared with before the COVID-19 pandemic. Currently, elite athletes are limited in terms of physical activity, as the main mode of training is limited to individual rather than group training.

This is the first time since World War II that elite players have been forced to stop all of their training and competitions. Under the special circumstances of the COVID-19 pandemic, most elite athletes train alone at home without a coach or leader [11]. Although some elite teams abroad offer their athletes home-based training programs and trainer-led online training programs [1, 13, 14], it is difficult to provide training equivalent to normal circumstances without professional sports facilities, especially when implementing training and strategies specific to particular sports [15].

The situation in South Korea is alarming. The evolving face-to-face reality that arrived sooner owing to the COVID-19 pandemic is a new online era that has never existed before [16]. Most elite athletes in Korea exercise alone, with many of them performing the exercises inaccurately [17]. Athletes who exercise at home because of the risk of COVID-19 infection are likely to be more exposed to certain levels of training interruptions due to insufficient or inappropriate training stimuli (*i.e.*, partial or total loss of morphological and physiological adaptations). In other words, the lack of accurate training information is believed to have increased low-intensity physical activity. Therefore, safer face-to-face training measures and online training programs should be implemented to maintain training with more controlled conditions for elite athletes.

The sitting time for elite athletes increased by an average of 120 min, and this could be attributed to the increase in time spent at home due to the risk of COVID-19 transmission [9]. Online learning in a non-face-to-face environment is also responsible for increasing sitting time [18].

In addition, the socioecological model [19] reported that social or environmental barriers last less physical activity time than the variables that promote inactive lifestyles (social isolation, loneliness) [20, 21]. Therefore, involuntary long-term stays due to COVID-19 may encourage sedentary behavior, which is consistent with the findings of this study.

In terms of time spent lying down, an increase was seen compared with before the COVID-19 infection, except for ball game athletes, but this difference was not significant. This is seen as a result of players living in compliance with basic sleeping hours, even without training, owing to the regular

lifestyles of elite athletes.

Changes in eating habits among athletes have been observed since the onset of the COVID-19 pandemic, with individual sports participants reporting an increased frequency of meals, including breakfast, lunch and dinner. Similarly, athletes who engaged in almost all sports exhibited an increase in meal consumption. Preliminary investigations suggest a positive correlation between prolonged periods of home confinement due to COVID-19 transmission concerns and increased meal frequency and quantity [22–24]. This trend may be attributed to emotional factors. Furthermore, reduced physical activity and diminished social interactions have been linked to increased appetite. Conversely, certain sports disciplines such as combat sports have demonstrated a decline in food intake. This decrease could be attributed to the inherent weight management focus in these sports, with the cessation of training likely contributing to reduced food consumption. Additionally, this study elucidated alterations in athletes' daily routines, aligning with recent findings suggesting a substantial impact of COVID-19 on global lifestyles [10, 25, 26].

5. Study limitations

This study is limited to elite Korean athletes. It was conducted only through an online survey (once during the pre- and post-lockdown periods) and did not require participants' personal information. As a result, there is a possibility of insincere and duplicate responses from the respondents. Each questionnaire asked about their physical activities for the past seven days and did not include periods, such as two weeks or one month in detail. Finally, the physical activities of elite athletes were not classified into daily and professional physical activities but only intensified. In this case, an error may occur in the "low-level activity" part.

6. Practical applications

We aimed to establish a database of elite adult athletes and identify their physical activity, eating habits and participation in competitions. Through comparisons with cases abroad, this study aims to suggest methods for the successful reintegration of players with maintained performance levels after COVID-19. Leaders and athletes will be able to use this study to help in establishing athletic programs and return timelines. Typically, it is possible to adjust a new training schedule and set the training intensity by identifying insufficient exercise time. Based on this study, it is possible to understand players' eating habits outside the season and analyze the differences in their activities. Finally, data will be available to prevent and prepare for the upcoming global pandemic, and preemptive prevention will allow athletes to maintain their performance and ensure safe returns.

7. Conclusions

Although there are indications of improvement in the COVID-19 pandemic, a definitive resolution remains uncertain, exerting continued influence on various aspects of athletes' lives. Athletes are facing unprecedented challenges because of the

prolonged duration of the pandemic, necessitating them to make adjustments in their lifestyles. Maintaining peak performance amid disrupted training regimens presents a significant challenge, emphasizing the need for athletes to adapt strategies to preserve their physical, physiological and psychological well-being. Consequently, athletes must gain insight into their current physical state, prioritize training efforts and maintain healthy habits. Leaders within an athletic community must remain vigilant when monitoring shifts in athletes' daily routines and dietary habits. Furthermore, the adoption and promotion of remote educational methods are indispensable to ensure the continuous dissemination of accurate training information to athletes throughout the COVID-19 pandemic. Therefore, a comprehensive understanding of how elite athletes navigate and respond to the pandemic is imperative for their effective management and resilience.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

JYS—contributed to the overall planning of the research, data acquisition, analysis and interpretation and major drafting and revision of manuscript submission. HRL—contributed to data acquisition, analysis and interpretation and major drafting and revision of manuscript submission. DRL—contributed to the anatomical and clinical opinion for conception, overall organization and direct supervision of the research. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was conducted according to the guidelines of the Declaration of Helsinki. This study was also approved by the research ethics committee of Yongin University (approval no. 2-1040966-AB-N-01-2106-HSR-227-2). Written informed consent was obtained from all subjects. Survey participants were provided with the assurance that their responses would be exclusively utilized for research purposes and they explicitly consented to participate.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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