

Eating Attitudes, Weight Concerns, Dietary Intake, and Menstruation Among Korean Female Elite Athletes

Dae Taek Lee[§]

Kim Chang Kew Exercise Physiology Laboratory, Kookmin University, Seoul 136-702, Korea

To examine the eating attitudes, weight concerns, dietary intake, and menstrual function of Korean female elite athletes, 109 subjects in seven sports disciplines (rhythmic gymnastics, synchronized swimming, badminton, volleyball, Taekwondo, field hockey, and soccer) responded to a questionnaire consisted of three parts; eating attitudes and behavior (Eating Attitude Test-26; EAT26), body weight perception (Body Dissatisfaction Index: BDI) and weight control behavior, and menstrual history and status. They also recorded three-day dietary intake. Body weight (43.6 ± 4.3 kg) and body mass index (16.7 ± 1.4 kg/m²) in rhythmic gymnasts were lower than those in other athletes ($P < 0.05$). EAT26 scores were not different among sport events (12.3 ± 6.5 total), however, eating disturbances (EAT26 score ≥ 20) were highly prevalent in aesthetic athletes (30%) than in others (5%). More than half of the athletes perceived themselves overweight and four fifth of the athletes desired to reduce weight about 4.4 kg. The gymnasts consumed the lowest caloric intake (1028 ± 371) while the volleyball players did the highest (2995 ± 342 kcal/d) ($P < 0.05$). The BDI score was not different among sport events. Three fourth of the athletes experienced weight control, and the most frequently used weight reduction method was exercise followed by using rubber suits, diet, and sauna. About 40% of the subjects reported irregular menstrual cycles, but menstrual dysfunction (≤ 6 menses/yr) was only 5%. Generally, the Korean female elite athletes desired to reduce weight from their current body weight. No differences in eating attitude and body dissatisfaction were noticed among athletic disciplines. However, eating disturbances were highly prevalent in aesthetic athletes who also reported much less energy intake than the recommend daily energy intake. It appeared that weight reduction methods were not properly practiced in these population. Menstrual dysfunction was minimally reported.

Key words : Body image, Weight management, Weight perception, Eating behavior

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INTRODUCTION

Female athletes are often exposed to risk for developing eating disturbances probably due to a personal desire for weight reduction and weight control requirements of a sport. Improper weight reduction and disturbed eating behavior have been known to be associated with menstrual disturbances and physiological instability such as osteoporosis.^{1,2)} Scientists postulated that an improper dietary intake and drive for thinness in women may result in three major health concerns including eating disorders, amenorrhea, and premature osteoporosis³⁻⁷⁾ known as the female athlete triad.⁸⁾

Prevalence of clinically diagnosed eating disorders in the female athletes has been reported between 4-22%.⁹⁻¹¹⁾ In particular, higher incidences have been assumed in

athletes emphasizing aesthetic aspects. However, studies conducted on female athletes in various sports indicated that eating disturbances might not be limited for athletes of the slim body desired and/or weight control required sports. But it was widely spread among female athletes including endurance runners,^{12,13)} field hockey players,³⁾ gymnasts,⁵⁾ ice skaters,¹⁴⁾ swimmers,¹⁵⁾ and rowers,⁶⁾ and the prevalence varied widely from study to study.

In recent years, the participation in competitive sports in female athletes has been grown rapidly, and this case was not exclusive in the western communities but similar in the developing countries. For instance, numbers of female athletes in the Korean athletic community have been expanded enormously and their performance has improved to the international level. In addition, the desire for thinness and perception of body weight in the general population have been changed drastically in the country.¹⁶⁾ However, the eating disturbances and weight concerns and menstrual function of the Korean female

[§] To whom correspondence should be addressed.
(E-mail : dilee@kookmin.ac.kr)

athletes have not been systematically investigated up to date. Thus, the purpose of this study was to examine the eating attitudes and weight concerns and to estimate the prevalence of eating disturbances and menstrual dysfunctions among Korean female elite athletes. Since disturbed eating behavior and weight concerns may result in negative health consequences in this population, the information acquired from the present study was expected to be used in establishing a guideline of safety for this population.

METHODS

1. Subjects

The subjects consisted of 109 elite female athletes currently active in seven sports disciplines; rhythmic gymnastics (national team, n=10), synchronized swimming (national team, n=6), badminton (national caliber, n=4), volleyball (senior high school national champion, n=11), Taekwondo (national caliber, n=7), field hockey (national caliber, n=15), and soccer (national teams and collegiate level, n=56). To include elite athletes, only national team members and collegiate elite players were recruited. Before the participation, the purpose of this study was thoroughly explained to athletes, who then voluntarily participated. The subjects' physical characteristics and athletic experience were shown in Table 1.

2. Instruments

A questionnaire was developed to meet the goal of this study. The questionnaire consisted of three parts; 1) eating attitudes and behavior, 2) body weight perception and weight control behavior, and 3) menstrual history. The eating attitudes and body dissatisfaction were assessed by the Eating Attitude Test-26 (EAT26).¹⁷⁾ The EAT26 included three subscales: dieting, bulimia and food preoccupation, and oral control. The EAT26 score

≥ 20 was considered to be an indication of being "at risk" for disordered eating.¹⁸⁾ Whether they consumed an adequate dietary intake and whether they used any supplementations were also asked.

Questions on the body weight perception on a 7-point scale (from 1, extremely underweight, to 7, extremely overweight) and the body figure satisfaction on a 7-point scale (from 1, very much satisfied, to 7, very much dissatisfied) were asked. In addition, the Body Dissatisfaction Index (BDI), one of the subscale of the Eating Disorder Inventory¹⁸⁾ was added. The desire for a weight change and the amount of weight changes were assessed. Weight control experiences and methods and/or techniques for weight change were also assessed.

Daily dietary intake was recorded by the subjects in four sports including rhythmic gymnastics, synchronized swimming, soccer, and volleyball for three consecutive days (two weekdays and one weekend day). They were encouraged to record immediately after their meal and snacks instead of relying upon their memories. The total caloric intake and the contribution of protein, fat, and carbohydrate for total calorie were analyzed (CAN-pro 2.0, The Korean Nutrition Society). For assessing menstrual function, questions on age of menarche, regularity and frequency of menstrual cycles were asked.

3. Statistical Analyses

Analyzed data were expressed in means and standard deviation. Comparisons among sports events were made using one-way analysis of variance. When a significant *F* ratio was found, Tuckey's post hoc test was employed. Chi-square was utilized for non-parametric analyses. The body weight perception and body figure satisfaction were reduced from the 7-point scale to 3 categories such as underweight, about average, and overweight, and satisfy, so-so, and dissatisfy, respectively. Significance was considered when $P < 0.05$.

Table 1. Subjects' Physical Characteristics and Athletic Experience

	Rhythmic Gymnastics (n=10)	Synchronized Swimming (n=6)	Badminton (n=4)	Volleyball (n=11)	Taekwondo (n=7)	Field Hockey (n=15)	Soccer (n=56)	Total (n=109)
Age (yrs)	17.1± 0.6	18.0± 2.1	20.3± 1.5	17.0± 1.2	20.1± 1.1	20.4± 1.5	21.4± 2.7	20.1± 2.8
Weight (Wt)	43.6± 4.3	53.5± 2.7* [†]	63.0± 2.4*	66.5± 4.3*	61.7± 6.0*	59.1± 4.4* [†]	57.8± 5.0* [†]	57.8± 7.2
Height (Ht)	161.7± 6.2 [†]	164.8± 3.5 [†]	169.0± 2.6	176.8± 4.4	168.3± 5.7	163.9± 4.6 [†]	165.4± 4.9 [†]	166.3± 6.2
BMI (kg/m ²)	16.7± 1.4	19.7± 0.6*	22.1± 0.7*	21.3± 1.4*	21.8± 2.2*	22.0± 1.5*	21.1± 1.2*	20.8± 1.9
Athletic Experience (mo)	79.2±27.2	120.0±13.1	132.0±17.0	64.0±17.6	114.9±28.4	101.6±24.4	91.8±32.7	93.9±31.8

*; significant compared to rhythmic gymnastics, [†]; significant compared to volleyball ($P < 0.05$, ANOVA)

RESULTS

Body weight and body mass index in rhythmic gymnasts were significantly lower than those in all other athletes ($P < 0.05$, Table 1). Volleyball players were taller and heav-

ier than rhythmic gymnasts, synchronized swimmers, field hockey players, and soccer players ($P < 0.05$). According to the National Survey of Physical Anthropometry for Standard,¹⁹⁾ the average Korean female height and weight of 20-24 years were 160.7±4.9 cm and 53.5±7.1 kg, re-

Table 2. Eating Attitudes and Dietary Behavior

	Rhythmic Gymnastics	Synchronized Swimming	Badminton	Volleyball	Taekwondo	Field Hockey	Soccer	Total
EAT26								
Total	11.5±7.1	15.8±6.7	11.3±5.3	12.3±5.5	9.0±6.3	10.9±4.7	10.9±7.6	12.3±6.5
Dieting	8.3±6.1	11.0±3.7	6.8±3.0	7.6±4.6	6.0±4.7	7.9±4.0	6.9±5.9	7.4±5.3
Oral Control	2.0±1.2	2.7±1.5	2.5±3.4	2.3±2.4	2.0±2.2	1.1±1.1	2.6±1.5	2.3±2.2
Bulimia and food preoccupation	1.2±1.6	2.2±1.8	2.0±2.8	2.4±1.9	1.0±1.9	2.0±1.9	1.5±1.9	1.7±1.9
% with EAT26 ≥20	40.0% (4)	34.0% (2)	0.0% (0)	9.1% (1)	14.3% (1)	0.0% (0)	7.3% (3)	10.1% (11)
Adequate dietary intake								
Yes	60.0% (6)	16.7% (1)	25.0% (1)	44.4% (4)	57.1% (4)	71.4% (10)	68.5% (37)	60.6% (63)
No	40.0% (4)	83.3% (5)	75.0% (3)	55.6% (5)	42.9% (3)	28.6% (4)	31.5% (17)	39.4% (41)
Supplement use								
Yes	30.0% (3)	33.3% (2)	25.0% (1)	63.6% (7)	71.4% (5)	20.0% (3)	53.6% (30)	46.8% (51)
No	70.0% (7)	66.7% (4)	75.0% (3)	36.4% (4)	28.6% (2)	80.0% (12)	46.4% (26)	53.2% (58)

Values in parentheses are number.

Table 3. Desire to Weight Variation, Weight Perception, Body Image, and Weight Control Experience and Methods

	Rhythmic Gymnastics	Synchronized Swimming	Badminton	Volleyball	Taekwondo	Field Hockey	Soccer	Total
Desire to lose weight								
Yes	77.8% (7)	100% (6)	100% (4)	90.9% (10)	85.7% (6)	93.3% (14)	72.7% (40)	81.3% (87)
No	22.2% (2)	0.0% (0)	0.0% (0)	9.1% (1)	14.3% (1)	6.7% (1)	27.3% (15)	18.7% (20)
Desired amount of weight loss (kg)	3.4±1.7	3.3±1.4	6.3±3.2	6.5±2.3	4.8±2.6	6.0±2.6	3.5±1.5	4.4±2.3
Weight perception								
underweight	44.4% (4)	0.0% (0)	0.0% (0)	18.2% (2)	28.6% (2)	0.0% (0)	5.4% (3)	10.2% (11)
about average	22.2% (2)	33.3% (2)	0.0% (0)	18.2% (2)	14.3% (1)	20.0% (3)	46.4% (26)	33.3% (36)
overweight	33.3% (3)	66.7% (4)	100% (4)	63.7% (7)	57.2% (4)	80.0% (12)	48.2% (27)	56.5% (61)
Body shape								
satisfy	10.0% (1)	0.0% (0)	0.0% (0)	40.0% (4)	14.3% (1)	6.7% (1)	9.0% (5)	11.2% (12)
so so	40.0% (4)	0.0% (0)	0.0% (0)	10.0% (1)	14.3% (1)	20.0% (3)	25.0% (14)	21.5% (23)
dissatisfy	50.0% (5)	100% (6)	100% (4)	50.0% (5)	71.5% (5)	73.3% (10)	66.1% (37)	67.3% (72)
Weight control experience								
Yes	100% (10)	100% (6)	100% (4)	63.6% (7)	85.7% (6)	73.3% (11)	70.4% (38)	76.6% (82)
No	0.0% (0)	0.0% (0)	0.0% (0)	36.4% (4)	14.3% (1)	26.7% (4)	29.6% (16)	23.4% (25)
BDI	13.9±7.8	15.3±3.0	19.3±2.4 ^s	16.6±6.6 ^s	9.3±6.4	17.6±5.4 ^s	9.4±5.1	11.3±6.8
Weight control methods								
(multiple choices)								
exercise	10	5	4	8	7	10	48	84.4% (92)
dieting	9	3	3	3	4	-	14	33.0% (36)
fasting	2	4	-	2	2	-	1	10.1% (11)
sauna	4	6	-	-	4	4	8	23.9% (26)
diuretics	-	1	-	1	-	-	-	1.8% (2)
rubber suit	9	4	3	5	5	8	27	56.0% (61)
sleep restriction	-	1	-	1	-	-	1	2.8% (3)

Values in parentheses are number.

s ; significant compared to soccer ($P < 0.05$, ANOVA)

spectively, indicating the female athletes in this study were taller and heavier than the standard.

The EAT26 scores were not different among athletic disciplines (Table 2). However, the prevalence of EAT26 score ≥ 20 was much higher in aesthetic athletes (rhythmic gymnasts and synchronized swimmers) than in other athletes. The EAT26 subscales such as dieting, oral control, and bulimia and food preoccupation were not different among the sport events. Whether they practiced an adequate dietary intake was asked, more than 60% of all athletes responded positively. Regarding the supplement usage other than regular meals, about half of them responded to 'yes' and most of the supplement reported was vitamins and minerals.

The daily energy intake was 1029 ± 371 (23.6 ± 8.5 normalized by weight), 1720 ± 593 (32.1 ± 11.1), 2114 ± 353 (36.6 ± 6.1), and 2995 ± 342 (45.0 ± 5.1) kcal/d for athletes of rhythmic gymnastics, synchronized swimming, soccer, and volleyball, respectively. The gymnasts consumed less calories and the volleyball players did greater than other players ($P < 0.05$). The dietary composition of protein:fat:carbohydrate was $13 \pm 2:13 \pm 3:74 \pm 4$, $15 \pm 2:20 \pm 4:65 \pm 5$, $15 \pm 2:29 \pm 3:56 \pm 4$, and $16 \pm 2:14 \pm 2:70 \pm 3$ for athletes of rhythmic gymnastics, synchronized swimming, soccer, and volleyball, respectively. While no differences were found in caloric contribution of protein among groups, the caloric intake from fat was higher in the soccer players and the synchronized swimmers than in other two athletes ($P < 0.05$). On the other hand, the gymnasts and volleyball players relied on carbohydrate for more than 70% of their dietary intake and this was higher than other two groups ($P < 0.05$).

Approximately four fifth of the female athletes desired to lose weight, and the amount of weight loss in those who desired to lose weight was 4.4 kg (Table 3). More than half of the athletes perceived themselves as overweight and did not satisfy with their body shape.

About one out of ten athletes perceived themselves underweight and satisfied with their body shape. The BDI score in soccer players was lower than those in badminton, volleyball and field hockey players ($P < 0.05$). Three fourth of the athletes experienced weight control. The most frequently used weight control method was exercise followed by usage of rubber suits. Dieting and sweating in a sauna were also popular weight reduction methods in this population.

When weight perception was cross-tabulated with desire of weight reduction ('yes' or 'no'), the distribution of respondents was statistically different ($P < 0.001$, Chi-square, Table 4). But no significance was found between weight perception and weight control experience.

The average age of menarche of all subjects was 14.5 years (Table 5). About 40% of the subjects reported irregularity of their menstrual cycle, and the prevalence of the irregularity was most frequently reported in rhythmic gymnastics and volleyball. The BMI of those who reported equal or less than 6 times of menstruation per year was 18.8 ± 2.3 kg/m², which was lower than that of those who menstruated equal or more than 12 times per year (21.2 ± 1.4 kg/m²) ($P < 0.05$).

Table 4. Frequencies between Weight Perception and Desire of Weight Reduction, and Weight Control Experience

	Weight Perception		
	Underweight	About Average	Overweight
<u>Desire of Weight Reduction</u>			
Yes*	3.7% (4)	23.9% (26)	52.3% (57)
No	6.4% (7)	8.3% (9)	3.7% (4)
<u>Weight Control Experience</u>			
Yes	6.4% (7)	22.9% (25)	45.0% (49)
No	2.8% (3)	10.1% (11)	10.1% (11)

Values in parentheses are number.

* : significant at $P < 0.001$ (Chi-square)

Table 5. Reported Menarche, Menstrual Cycle Regularity, and Menstrual Frequency per Year

	Rhythmic Gymnastics	Synchronized Swimming	Badminton	Volleyball	Taekwondo	Field Hockey	Soccer	Total
Age of menarche (yrs)	15.5 \pm 0.8	15.0 \pm 0.6	15.3 \pm 1.0	13.8 \pm 1.7	15.2 \pm 2.3	13.8 \pm 1.5	14.6 \pm 1.4	14.5 \pm 1.5
<u>Menstrual cycle regularity</u>								
Yes	14.3% (1)	50.0% (5)	50.0% (2)	36.4% (4)	57.1% (4)	80.0% (12)	63.6% (35)	57.8% (63)
No	85.7% (6)	50.0% (5)	50.0% (2)	63.6% (7)	42.9% (3)	20.0% (3)	36.4% (20)	42.2% (46)
<u>Menstrual cycle</u>								
≥ 12 /yr	-	33.4% (2)	50.0% (2)	18.2% (2)	28.6% (2)	-	30.4% (17)	22.9% (25)
7-11/yr	30.0% (3)	-	25.0% (1)	27.3% (3)	28.6% (2)	13.4% (2)	14.3% (8)	17.4% (19)
≤ 6 /yr	20.0% (2)	-	-	9.1% (1)	-	-	3.6% (2)	4.6% (5)
not reported	50.0% (5)	66.6% (4)	25.0% (1)	45.5% (5)	42.9% (3)	86.7% (13)	51.8% (29)	55.1% (60)

Values in parentheses are number.

DISCUSSION

The present study reported the eating attitudes, weight perception, and menstrual function in Korean female elite athletes who were known to be internationally competitive. Many studies examined eating behaviors and attitudes in various athlete groups and races, however, no studies were conducted investigating the Korean female athletes of various disciplines of sports in particular.

1. Eating Attitude

In the present study, approximately 10% of the Korean elite female athletes showed disturbed eating behaviors, which was somewhat lower than the previously reported ranging from 15 to 62%^{4,11,12}. Although discrepancies of prevalence among studies may be related to the instruments and methods employed, the general impression in the present study was that the disordered eating behavior in Korean female athletes appeared to be less serious than those of the western counterparts.

Nonetheless, some Korean female athletes participating in aesthetic events such as rhythmic gymnastics and synchronized swimming have showed high prevalence of eating disturbance. Also, the rate was higher than not only the other discipline of sports but a group of Korean collegiate females (18%).¹⁶ Studies examining the relationships between athletic discipline and prevalence of eating disturbances also showed diverse outcomes. While aesthetic female athletes were reportedly exposed more at risk than non-athlete groups in eating attitude,²⁰⁻²² others found a similar risk rate between athletes and non-athletes.²³ It should be emphasized that the present subjects responded differently according to sport discipline. When considering it as a whole female group, a small percentage of subjects showed eating disturbances. Thus, a selective monitoring based on sport discipline should be accounted.

Reports on the subscales of EAT26 such as dieting, oral control, and bulimia and food preoccupation in the elite female athletes were rather limited.²⁴ Amongst the Korean female elite athletes, no differences were found in each subscale. Considering small variations of EAT26 scores among groups and relatively lower scores than other studies, it may be less sensitively reflected to the subscale of EAT26 and/or the scores of those subscales were actually lower than other studies.²⁴ In any situation, the Korean female athletes showed less problematic than the western counterparts.

2. Weight Concerns

The prevalence of weight control experience was three quarters of the respondents, and this value was much higher than those previously reported (29-58%) in the western female athletes.^{22,25} The present subjects perceived themselves as overweight and dissatisfied with their bodies, and subsequently, most of the athletes desired to lose weight. It appeared that weight perception was related to the desire for weight reduction but not to the weight control experience, indicating that actual weight control trials in this population were influenced by other factors as well.

One concern was that among the frequently used weight reduction methods, the utilization of rubber suits and sauna were the second and the fourth popular methods, respectively. It has been recognized that a rapid weight reduction is harmful not only for athlete's general health but their exercise performances. Many studies reported wide ranges of prevalence (0-62%) in rapid weight reduction practices in the U. S.,⁵ Norwegian,²² and Finnish athletes.²⁵ Also, it could be easily observed in the weight-class athletes.^{6,26} The finding of high usage of rubber suits and sweating in a sauna was partially considered to be traditional and cultural as this was readily available in their training facilities. In general, the Korean athletes predominantly believe that the drainage of sweat is the most efficient and rapid weight reduction method, and subsequently employing exercise, rubber suits, and sauna. In addition, they normally learn those techniques from their senior players.

One characteristic of weight reduction pattern in Korean female elite athletes was a minimally spread usage of the diet pill, cigarette, laxative, and/or vomiting. While the prevalence of these weight reduction methods was often reported in the athletes of western countries, these methods were of concern by the several authorities.

3. Dietary Intake

It would be expected that athletes in aesthetic sports should be lighter and leaner. According to the National Survey of Physical Anthropometry for Standard,¹⁹ the gymnasts and the synchronized swimmers were lighter and taller than the age-matched general population. Based on the Recommended Dietary Allowances for Koreans,²⁷ the average energy intake of the aesthetic athletes was less than the recommendation of 2100 kcal/d or 39 kcal/kg/d for the age-matched female. Also, the value of Korean athletes was less than that of the western counterparts.²⁸ Since it is likely that these athletes

expand significantly more energy during their physical activities and training sessions, they may be even further below the average recommendations for energy intake.

It has been suggested that respondents may underreport or restrict the food intake during the periods of recording energy intake,²⁹⁾ especially in those who were amenorrheic athletes.³⁰⁾ However, this was not always the case.²⁸⁾ In the present study, in any cases whether restricting food temporarily or in a long term, the health consequences of restricting energy intake too drastically should be well emphasized as that it is important to monitor these athletes for eating disturbances.

4. Menstrual Function

The effect of exercise training on menstrual dysfunction has been extensively documented.³¹⁾ The prevalence of amenorrhea in athletes was generally much higher^{12,13,22,25,32,33)} than that in control groups (2-5%).³⁴⁾ Several factors have been suggested attributing athletic amenorrhea, including lower body fat content,³⁵⁾ weight loss,³⁶⁾ energy deficiency,³⁷⁾ insufficient dietary intake,³⁴⁾ stress,³⁸⁾ and hormonal changes.^{39,40)} In the present study, less than 5% of the female athletes reported equal or less than six times of menstruation per year, which was much lower than that in the previous reports.

The reported prevalence of disturbed menstrual cycle in athletes and/or exercising women was rather broad (6-79%), and this variance may be due to diverse definitions of amenorrhea and menstrual dysfunction. Without a firm consensus, however, previous studies reported higher prevalence of menstrual dysfunction in lean aesthetic athletes.^{22,25)} One finding of this study was that the body mass index of those who menstruated less than 6 times per year was significantly lower than those who did on the regular basis. Shangold & Levine¹³⁾ reported that amenorrheic women were lighter and had lower weight/height ratio than regularly menstruating women who participated in a marathon race. This tendency was also observed in Olympic marathon runners as amenorrheic runners were lighter and leaner.³³⁾ The etiology of secondary amenorrhea is not clearly understood up to date, but the result of this study supported the notion that less body weight was associated with menstrual dysfunction.

CONCLUSION

In general, the Korean female elite athletes desired to reduce weight from their current body weight. No

differences in eating attitude and body dissatisfaction were noticed among athletic disciplines. However, eating disturbances were highly prevalent in aesthetic athletes than in others. Gymnasts and synchronized swimmers reported much less energy intake than the recommend daily energy intake. It appeared that weight reduction methods were not properly practiced in these population. Menstrual dysfunction was minimally reported.

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