electrolyte disturbance. This initial stage of treatment was followed by implementation of other treatments such as refeeding, physiotherapy, psychodynamic therapy and family therapy.

All patients underwent an exercise test to evaluate their exercise capacity after regaining a medically stable weight and after increasing to 25% of %BF. The exercise test was performed in an upright position on an electromagnetically braked cycle ergometer (STB-1400, Nihon Kohden Co. Ltd., Tokyo, Japan), using a ramp-type protocol (Figure 1). The exercise test was preceded by one minute of unloaded warm-up cranking, and then a linearly increasing work rate (20 watt/minute). The patients continued to exercise until reaching the limit of tolerance. Breath by breath oxygen uptake was measured using a Metabolic Measurement Cart/System equipped with a gas analyzer (MMC-2900C, Sensormedics Co. Ltd., Anaheim, CA). A 12-lead ECG and heart rate were monitored with a programmable ECG analyzer (PEC-1320, Nihon Kohden Co. Ltd., Tokyo, Japan) and recorded simultaneously with the measurement of breath-by-breath oxygen uptake. The anaerobic threshold (AT) was defined as the level of oxygen uptake at which carbon dioxide production and oxygen uptake were no longer linearly related (V-slope method) [10]. Lean body mass (LBM) was derived from body weight and %BF. Oxygen uptake was divided by the LBM in each patient for a comparison.

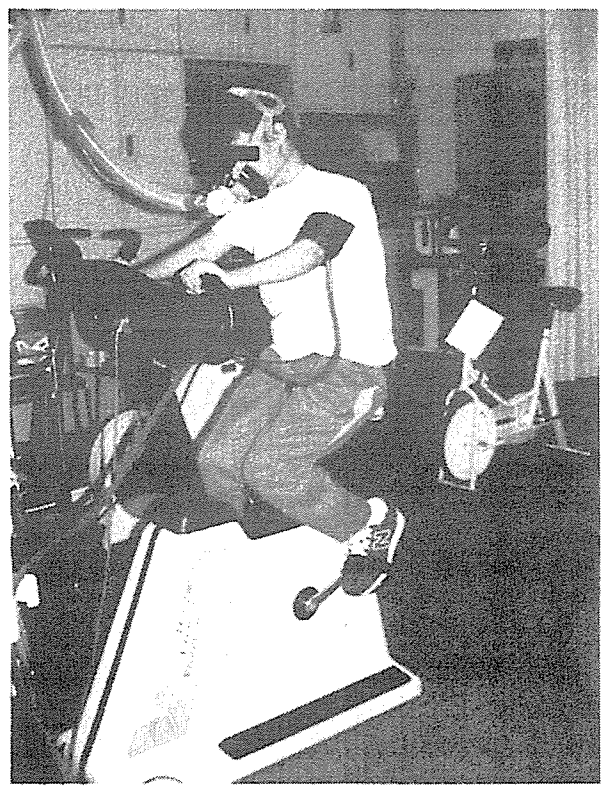

Figure 1. The exercise test was performed in an upright position on an electromagnetically braked bicycle ergometer after the subject regaining a medically stable weight and after increasing to 25% of percentage body fat of body weight (a 17-year-old female case).

In the nine patients of the exercise group, an exercise training program (riding a stationary bicycle) was individually prescribed for each patient, using the data from the exercise test. The patients were asked to exercise 30 minutes each time, five times a week, at their individual AT level, during their convalescent phase in the hospital. The exercise training, which included the initial and final 5 minutes of each 30 minute session as "warm-up" and "cool-down" periods, was monitored by an exercise physiologist or nursing staff. Exercise sessions were performed while chatting with other patients and nursing staff, or while listening to their favorite music. The exercise test and prescription of exercise training were restudied every 3 months for each patient in the exercise group. The duration of exercise training in the hospital ranged from 6 to 12 months (mean 10 months).

All patients' daily calorie intake remained the same throughout the inpatient treatment program. The meals were supervised by a physician or nursing staff. The exercise test was repeated one year after the initial exercise test in all patients.

Statistical comparisons between the baseline and the 1-year follow-up data were made by a paired t-test, or two way repeated measures of analysis of variance (ANOVA). The exercise and control group data were compared using an unpaired t-test. *P*-values less than 0.05 were considered significant.

Results

The two groups were not statistically different in their characteristics on admission regarding age, duration of anorexia nervosa, height, weight, or body mass index (BMI) (Table 1). The initial exercise test was performed on the 122nd to 235th (mean 176) day of hospitalization (the exercise group), and the 123rd to 643rd (mean 349) day of hospitalization (the control group) (p=0.084). All nine patients in the exercise group followed the exercise prescription exactly, and completed the program without any inappropriate responses to exercise. None of the patients in the two groups was overactive or relapsed during the observation period.

BMI and %BF

There were no significant differences in the BMI and %BF at the baseline between the exercise and control groups (Table 2). The BMI and %BF at the 1-year follow-up increased compared to the baseline values in both the exercise and control groups. The degree to which the BMI increased in the exercise group was higher than the control group.

Table 2. Body Mass Index and Percentage Body Fat at Baseline and at 1-year Follow-up

		baseline	**follow-up**	***p***
Body mass index	exercise	18.8±0.5	21.7±0.5†	p<0.001
	control	19.6±0.7	20.2±0.5†	NS
Percentage body fat	exercise	27.7±0.8	30.3±0.5	NS
	control	27.8±1.4	29.1±1.2	NS

† p=0.047; the exercise vs. the control group

Note: Values are mean±SE. NS, not significant.

Exercise Capacity

In the exercise group, the indices of exercise capacity (endurance time, oxygen uptake at AT, and peak oxygen uptake) used in the exercise test at the 1-year follow-up improved significantly compared with those at the baseline (Table 3). There was a significant difference in the peak oxygen uptake at the 1-year follow-up between the exercise and control groups. Heart rate at rest (Table 3), and heart rate at a given exercise intensity during the exercise test (Figure 2) at the 1-year follow-up significantly decreased compared with those at the baseline. In the control group, although all indices of exercise capacity tended to improve, these changes did not reach statistical significance.

Table 3. Parameter Values in the Exercise Test at Baseline and at 1-year Follow-up

		baseline	follow-up	*p*
HR (rest) (bpm)	exercise	105±5	93±5	p=0.008
	control	95±6	85±7	NS
HR (peak) (bpm)	exercise	190±3	189±3†	NS
	control	179±7	172±7†	NS
BP (rest) (mmHg)	exercise	113±5	117±4	NS
	control	109±4	108±3	NS
BP (peak) (mmHg)	exercise	172±6	175±8	NS
	control	169±8	168±9	NS
Endurance time (min)	exercise	5.6±0.3	8.0±0.5	p<0.001
	control	6.0±0.4	6.8±0.4	NS
VO_2 at AT (ml/LBM, kg/min)	exercise	15.7±1.1	23.0±1.4	p=0.015
	control	18.4±1.3	18.4±1.8	NS
Peak VO_2 (ml/LBM, kg/min)	exercise	31.8±1.3	46.4±2.2‡	p<0.001
	control	35.1±2.3	37.6±2.7‡	NS

† p=0.034, ‡: p=0.021; the exercise vs. the control group.

Note: Values are mean±SE.

HR, heart rate; NS, not significant; BP, systolic blood pressure; VO_2, oxygen uptake; AT, anaerobic threshold; LBM, lean body mass

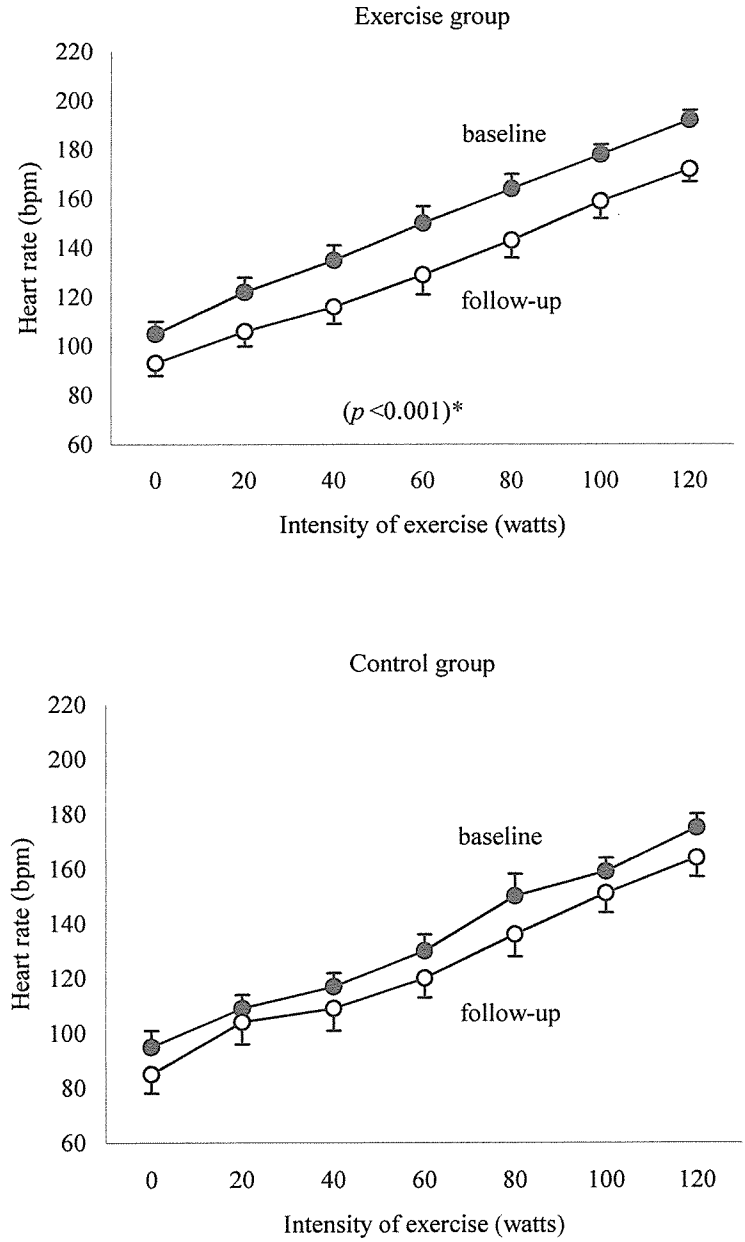

Figure 2. Mean response of heart rate during the exercise test. Vertical bars represent SE. *: There was a significant difference between the baseline and 1-year follow-up with a two-way repeated measures ANOVA. In the exercise group, heart rate at a given exercise intensity at the 1-year follow-up significantly decreased compared with that at the baseline.

Menarche

All the patients with secondary-amenorrhoea in the two groups recovered menstruation during the observation period. There was no significant difference in the total amenorrhoeic duration between the exercise and control groups (14±3 months versus 13±6 months) (p=0.959). Four of five pre-menarchal patients began to menstruate during the observation period, but the remaining one in the control group still had primary-amenorrhoea at the 1-year follow-up.

Discussion

In the exercise group, the indices of exercise capacity (endurance time, oxygen uptake at AT, peak oxygen uptake, and heart rate at a given exercise intensity) used in the exercise test at the 1-year follow-up improved significantly compared with those at the baseline. In the control group, although all indices of exercise capacity tended to improve, these changes did not reach statistical significance. The degree to which the BMI increased in the exercise group was higher than the control group. All patients with secondary-amenorrhoea in the two groups recovered menstruation during the observation period. There was no significant difference in the total amenorrhoeic duration between the exercise and control groups. None of the patients in the two groups was overactive or relapsed during the observation period.

Previous studies reported that young patients affected by anorexia nervosa showed an abnormal working capacity and abnormal cardiovascular responses to exercise [3, 4, 5]. Long-term malnourishment and restriction of physical activities for many months lead to abnormal exercise capacity in convalescent children and adolescents with anorexia nervosa. It is widely believed that physical activity may improve exercise capacity and the emotional disorders that often accompany serious and chronic health disorders, and may decrease the risk of initiating behaviors which may be detrimental to health. However, there is controversy about promoting or withholding exercise [6, 7, 8, 9]. Davis [6], McLaren [7], and Seigel [9] reported that excessive exercise may play a role as a causal factor of anorexia nervosa and might be associated with a poor evolution. On the other hand, a few studies have reported the issue of incorporating exercise into the treatment of anorexia nervosa. Beumont [11], Thien [12], and Touyz [13] demonstrated that the use of a supervised exercise program for patients with anorexia nervosa improved patients' quality of life and increased treatment compliance. Joyce [14], LaBan [15], and Seeman [16] suggested that exercise may be beneficial to bone formation in patients with anorexia nervosa. However, the use of prescribed exercise training aimed at enhancing exercise capacity in the treatment of anorexia nervosa has not been investigated physiologically. In this study, prescribed exercise training under supervision produced beneficial changes in exercise capacity, and did not have any adverse effects on weight regain or recovery of menstruation in convalescent children and adolescents with anorexia nervosa. The exercise program was useful in reducing emotional stress, which often accompanies long-term hospitalization, and was enjoyable by the patients. Further study is needed to evaluate the psychological aspects in patients with anorexia nervosa by structured interview, psychological scale or quality-of-life score.

Conclusion

The prescribed exercise training under supervision produced beneficial changes in exercise capacity, and did not have any adverse effects on weight regain or recovery of menstruation in convalescent children and adolescents with anorexia nervosa. The exercise program was useful in reducing emotional stress, which often accompanies long-term hospitalization, and was enjoyed by the patients.

Research report (2): Reduced Heart Rate Response to Exercise is an Important Parameter for the Early Recurrence Diagnosis of Anorexia Nervosa

Bradycardia has been observed in patients with anorexia nervosa [1]. Previous studies reported that an increase in parasympathetic nervous activity contributes to the bradycardia of anorexic patients [17, 18, 19, 20]. We reported that the bradycardia in anorexia nervosa may result from the relative predominance of parasympathetic nervous activity, using heart rate variability analysis as a measure of autonomic nervous system function [21]. The bradycardia improves with improvement in physical and mental recovery, but develops again in an early stage of recurrence of the pathological condition prior to weight loss and aggravation of other data. The bradycardia may be an important sign in the early diagnosis and recurrence diagnosis of anorexia nervosa [22]. In this study, changes in the heart rate at rest and during exercise were evaluated in association with those in the pathological condition during the clinical course in convalescent adolescents with anorexia nervosa.

Subjects and Methods

We investigated the relationship between changes in the heart rate at rest and during exercise and the clinical course in convalescent patients with anorexia nervosa. The subjects were three females (aged 17, 12, and 16 years) with a diagnosis of anorexia nervosa hospitalized at Keio University Hospital in Tokyo in 2001 (Table 4). Their diagnosis of anorexia nervosa was based on criteria outlined in the 4th ed. of the Diagnostic and Statistical Manual of Mental Disorders (DSM-4; American Psychiatric Association, 1994). Patients were excluded if they had an underlying cardiovascular or pulmonary disease, an inflammatory disease, or a chronic disease such as diabetes. All subjects satisfied the criteria for the restricting form of anorexia nervosa. Case 2 (a 12-year-old female) was pre-menarchal. Case 1 (a 17-year-old female) and Case 3 (a 16-year-old female) had secondary-amenorrhoea (the duration: 7 and 13 months). The initial stage of inpatient treatment for the three patients consisted of strict bed rest and treatment for dehydration and electrolyte disturbance. This initial stage of treatment was followed by refeeding, physiotherapy, psychodynamic therapy,

and family therapy. The three patients underwent an exercise test to evaluate their exercise capacity after regaining a medically stable weight and after increasing to 25% of percentage body fat of body weight (%BF) (Figure 1). An exercise training program (30 min of supervised stationary bicycle exercise at their individual anaerobic threshold (AT) level [10], five times a week) was prescribed for each patient, and carried out during their convalescent phase [2]. In the three patients, the heart rate at rest before the initiation of exercise training and that 25 minutes after the initiation of exercise training were recorded on each measurement, and the relationships between changes of the heart rate and the clinical course were evaluated. All patients' daily calorie intake remained the same throughout the inpatient treatment program. The meals were supervised by a physician or nursing staff.

Statistical comparisons between the baseline and the 2-months follow-up data were made by a paired t-test. *P*-values less than 0.05 were considered significant.

Table 4. Subject Characteristics on Admission (2)

	Case 1	Case 2	Case 3
Age (years)	17	12	16
Duration of anorexia nervosa (months)	29	1	8
Height (cm)	153.7	156.3	154.5
Weight (kg)	34.4	32.9	36.9
Body mass index	14.6	13.5	15.5

Results

Changes in Heart Rate before and during Exercise

In Case 1 (the 17-year-old patient) who showed steady physical and mental recovery after the initiation of exercise training, no significant changes were observed in the heart rate before or during exercise training during the clinical course (Figure 3) (Table 5). However, in Case 2 (the 12-year-old patient) (Figure 4) and Case 3 (the 16-year-old patient) (Figure 5), in whom exercise training was discontinued due to recurrence and aggravation of mental symptoms during the clinical course after regaining a medically stable weight, a definite decrease in the heart rate during exercise was observed in the early stage (Table 5). The heart rate before exercise markedly fluctuated daily, and detection of bradycardia in the early stage was difficult.

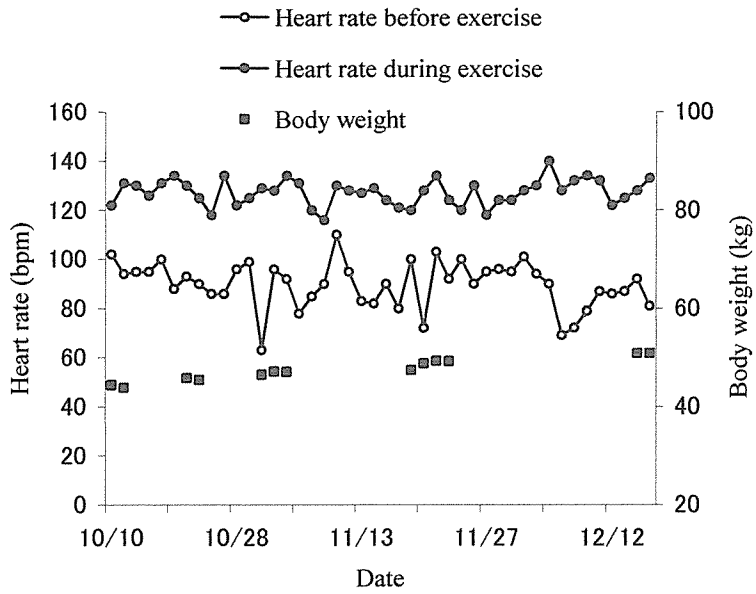

Figure 3. Changes in heart rate before exercise, heart rate during exercise, and body weight in Case 1 (a 17-year-old female recovery case). No significant changes were observed in the heart rate before or during exercise training during the clinical course.

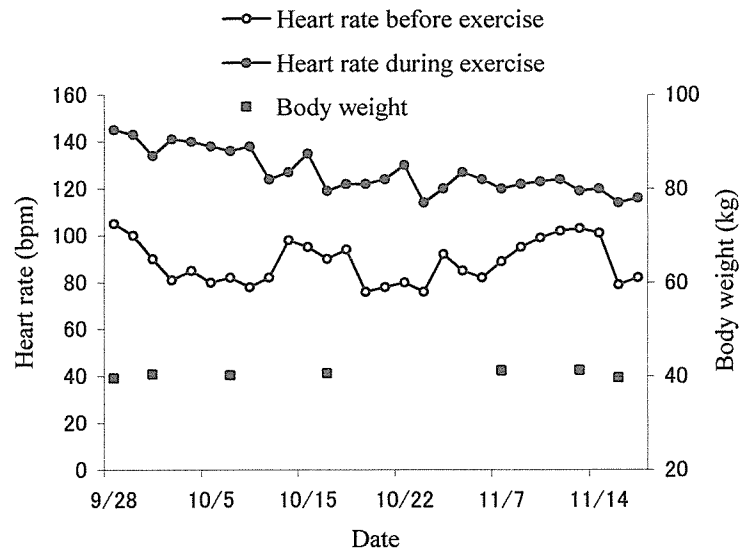

Figure 4. Changes in heart rate before exercise, heart rate during exercise, and body weight in Case 2 (a 12-year-old female recurrence case). A definite decrease in the heart rate during exercise training was observed in the early stage prior to weight loss. The heart rate before exercise markedly fluctuated, and detection of bradycardia in the early stage was difficult.

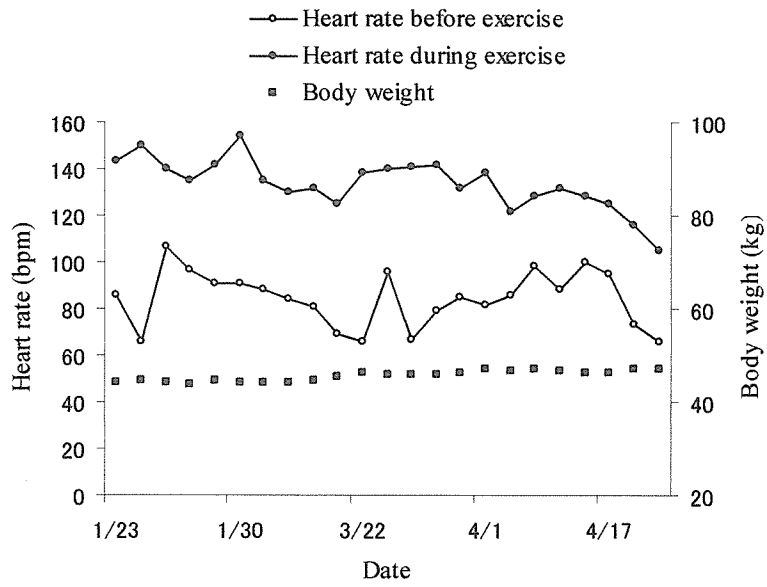

Figure 5. Changes in heart rate before exercise, heart rate during exercise, and body weight in Case 3 (a 16-year-old female recurrence case). A definite decrease in the heart rate during exercise training was observed in the early stage prior to weight loss. The heart rate before exercise markedly fluctuated, and detection of bradycardia in the early stage was difficult.

Table 5. Heart Rate before Exercise and during Exercise at Baseline and at 2-month Follow-up

		Case 1 (recovery)	Case 2 (recurrence)	Case 3 (recurrence)
Heart rate before exercise (bpm)	baseline	94±4	92±5	89±7
	follow-up	87±4	93±5	84±6
Heart rate during exercise (bpm)	baseline	130±3	141±2†	142±2†
	follow-up	128±4	119±2†	121±4†

† $p<0.05$; the baseline vs. the 2-months follow-up.
Note: Data were five-beat moving average. Values are mean±SE.

Discussion

In anorexia nervosa, a poor increase in heart rate during exercise is observed in the early stage of recurrence of the pathological condition during the clinical course in the convalescent phase. The detection of a reduced heart rate response to exercise is useful for the early recurrence diagnosis of anorexia nervosa. Bradycardia has been observed in patients with anorexia nervosa [1]. There have been some reports on the sympatho-parasympathetic nervous balance in anorexia nervosa. Rechlin [17], Petretta [18], Kollai [19], and Fabio [20] reported that an increase in parasympathetic nervous activity contributes to the bradycardia of

anorexic patients, using heart rate variability analysis. We reported that the bradycardia in anorexia nervosa may result from the relative predominance of parasympathetic nervous activity, using heart rate variability analysis as a measure of autonomic nervous system function [21]. The bradycardia improves with improvement in physical and mental recovery, but develops again in the early stage of recurrence of the pathological condition prior to weight loss and aggravation of other data. The bradycardia may be an important sign in the early diagnosis and recurrence diagnosis of anorexia nervosa [22]. We demonstrated that efficient screening for anorexia nervosa is possible in school health examinations by the combination of the analysis of growth curve patterns and heart rate as parameters [23]. However, the heart rate is markedly affected by surrounding environmental factors and mental tension and can be readily changed deliberately. Therefore, evaluation based on only the heart rate at rest has limitations. We have performed prescribed exercise training to improve exercise capacity in convalescent patients with anorexia nervosa, and obtained good results [2]. We have encountered patients showing a reduced heart rate response to exercise in the early stage of aggravation of the clinical course. There is a linear relationship between the heart rate during exercise and exercise intensity, and the heart rate during exercise is mainly determined by exercise intensity. In general, the release of parasympathetic nervous inhibition is closely involved in the increase in the heart rate during low-moderate intensity exercise, and sympathetic tension increases the heart rate during moderate-high intensity exercise [24]. It is speculated that evaluation of heart rate during exercise training at low-moderate intensity, in which the parasympathetic nerve is mainly involved in heart rate response to exercise, would be useful in detecting the relative predominance of parasympathetic nervous activity in patients with anorexia nervosa, and that the influences of environmental factors and mental tension on heart rate may be weaker during exercise than at rest. When the heart rate decreases during exercise at a certain intensity, the stroke volume of the heart increases to maintain cardiac output by the Frank-Starling mechanism. In patients with anorexia nervosa showing decreased myocardial weight due to long-term malnourishment and restriction of physical activities for many months, excessive exercise in the presence of reduced heart rate response to exercise may readily induce myocardial overloading or arrhythmia, and appropriate restriction of exercise is necessary. Detection of reduced heart rate responses to exercise or bradycardia at rest is a simple, useful method in the early recurrence diagnosis of anorexia nervosa and exercise management at school.

Conclusion

In anorexia nervosa, a poor increase in the heart rate during exercise is observed in the early stage of the recurrence of the pathological condition during the clinical course in the convalescent phase. The detection of reduced heart rate response to exercise is useful in the early recurrence diagnosis of anorexia nervosa.

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ORIGINAL RESEARCH PAPER

Influences of mothers' dieting behaviors on their junior high school daughters

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ABSTRACT. *We investigated the influences of mothers' dieting behaviors on their junior high school daughters. We assessed dieting behaviors and eating habits in 221 pairs of mothers and their junior high school daughters using questionnaires. The subjects were classified into an extraordinary-diet (Ex-D) group, who attempted to diet rapidly with unhealthy methods, a structured-diet (St-D) group, who attempted to diet gradually with healthy methods, and a non-diet (N-D) group, using the questionnaire scores.*

1) A significant correlation was observed in the distribution of dieting behavior groups between the mothers and their daughters. 2) The scores for dieting behavior of the mothers whose daughters were classified into the Ex-D group were significantly higher in several question items compared with those of the mothers whose daughters were classified into the N-D group. 3) The scores for eating consciousness of the mothers whose daughters were classified into the Ex-D group were significantly lower for the item "Cooking is a fun pastime" compared with those of the mothers whose daughters were classified into the St-D or N-D groups. 4) The number of experiences of conversation with daughters about diet for the mothers whose daughters were in the Ex-D group was significantly higher than that for the mothers whose daughters were classified into the N-D group.

The mothers' dieting behavior, eating consciousness, and number of conversations with daughters about diet influenced dieting behaviors in their junior high school daughters. Appropriate education of mothers would be useful to prevent their daughters' inappropriate diet.

(Eating Weight Disord. 10: 162-167, 2005).

Key words:
Dieting behavior, eating consciousness, conversation about diet, mother, daughter.

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INTRODUCTION

In recent years, patients who develop eating disorders during childhood have been markedly increasing, requiring measures in school health practice (1-5). Many studies have focused on the quality of family relationships and the role of mothers in understanding eating pathology in adolescent girls, and have reported that an encouragement to control body weight has been found to be associated with eating problems (6-9). We have reported that some mothers assisted their junior high school daughters to slim down (10). However, the influences of mothers' indirect messages on the dieting behavior of their daughters have not been studied systematically. Understanding these influences is important for providing appropriate eating education for the mothers in schools or community health centers.

The purpose of this study was to investigate the influence of mothers' dieting behaviors on their junior high school daughters.

SUBJECTS AND METHODS

A total of 221 pairs of mothers (aged 34 to 57 years, median 43 years) and their junior high school daughters (aged 12 to 15 years, median 14 years) were studied. The subjects were randomly recruited from a junior high school in Tokyo. Questionnaires about dieting behavior and eating consciousness were administered both to the mothers and their daughters. The questionnaire for the students was completed during class time by trained home-room teachers. The questionnaire for the mothers was collected directly from them by mail.

Assessment of dieting behavior

We used a modified Dieting Behavior Scale to assess the dieting behaviors of the subjects (10, 11). The modified Dieting

TABLE 1
Distribution of the dieting behavior groups.

		Daughters' dieting behavior group			Total
		Ex-D group	St-D group	N-D group	
Mothers' dieting behavior group	Ex-D group	20	14	36	40
	St-D group	4	3	25	32
	N-D group	15	17	87	119
Total		39	34	149	221

Spearman's rank correlation $p<0.01$

Values are numbers of subjects. Ex-D, Extraordinary Diet group; St-D, Structured Diet group; N-D, Non-dieting group

Behavior Scale consisted of 21 question items, and each item was rated on a four-point Likert scale from "0" (never) to "3" (always). The mothers and their daughters were classified into three groups using the scale: an extraordinary-diet (Ex-D) group, which scored "1 or more" on the following six questions: 1) eat calorie-calculated meals, 2) take a laxative, 3) eat low-calorie dietary food instead of meals, 4) follow a special diet method to lose weight rapidly in a short time, 5) eat only one food item reported to be effective in slimming as a substitute for meals during certain periods, and 6) skip meals; a structured-diet (St-D) group, which scored "0" on the above six items and scored "1 or more" on the remaining fifteen questions; and a non-dieting (N-D) group, which scored "0" on all questions items. The Ex-D group refers to eating behaviors that attempt to diet rapidly with unhealthy methods. The St-D group refers to dieting behaviors that attempt to diet gradually with healthy methods.

Assessment of eating consciousness

Eating consciousness of the mothers was assessed by Tomioka's scores (12). Tomioka's scores consisted of 24 items, and each item was rated on a four-point Likert scale from "0" (never) to "3" (always).

Assessment of desire to be slim

A desire to be slim in the mothers was assessed by a question, "Do you want to be slim?". The mothers selected "yes" or "no".

Assessment of experience of conversations with daughters about diet

Whether the mothers had experience of conversations with their daughters about diet or not was assessed by the question, "Have you had conversations with your daughter about diet?". The mothers selected "yes" or "no".

Statistical analysis

The mothers' scores for dieting behavior and scores for eating consciousness were compared among the daughters' dieting behavior groups using Scheffe's test one-way ANOVA. Differences in mean values were tested with Mann-Whitney's U test. Correlations between the distribution of dieting behavior groups in the mothers and those in their daughters were tested using Spearman's rank correlation. Experiences of conversation with their daughters about diet in the mothers were tested using Kruskal-Wallis test. We set the level of significance at $p<0.05$.

RESULTS

Distribution of dieting behavior groups (Table 1)

Distribution of dieting behavior groups in the mothers was N-D group: 54% (n=119), St-D group:15% (n=32), and Ex-D group 32% (n=70). Distribution in the daughters was N-D group:67% (n=148), St-D group:15% (n=34), and Ex-D group:18% (n=39). There was a significant correlation between the distribution of dieting behavior groups in the mothers and that in their daughters.

Scores for dieting behavior (Table 2)

The scores for dieting behavior of the mothers whose daughters were classified into the Ex-D group were significantly higher than those of the mothers whose daughters were classified into the N-D group for the following question items: "Reduce amount and frequency of sweet foods", "Reduce amount and frequency of high calorie foods", "Reduce amount and frequency of oily foods", "Reduce amount and frequency of greasy foods", "Restrict intake of calories each day", "Eat low-calorie dietary

TABLE 2
Scores for dieting behavior.

Question items about dieting behavior	Scores of the mothers: Daughters' dieting behavior group: Ex-D group (n=24)	St-D group (n=17)	N-D group (n=61)	total (n=102)	Scores of the daughters (n=73)
1. Reduce amount and frequency of sweet foods	1.92*	1.76	1.39*	1.58	1.78
2. Reduce amount and frequency of high calorie foods	1.88*	1.65	1.20*	1.43	1.04
3. Reduce amount and frequency of oily foods	1.75*	1.65	1.21*	1.41	1.26
4. Reduce amount and frequency of greasy foods	1.79*	1.50	1.33*	1.47	1.53
5. Cut down amount of dinner	1.00	0.76	0.82	0.85	0.67
6. Eat calorie-calculated meals	0.79	0.47	0.44	0.53	0.50
7. Consider own weight when eating something	1.00	0.88	0.77	0.84	1.11
8. Restrict intake of calories each day	1.04*	0.71	0.49*	0.66‡	0.40‡
9. Take a laxative	0.22	0.12	0.16	0.17‡	0.03‡
10. Eat nothing after dinner	1.50	1.82	1.43	1.51	1.55
11. Eat nothing 2~3 hours before sleeping	1.71	1.82	1.51	1.61‡	2.00‡
12. Eat low-calorie dietary food instead of a meal	0.70*	0.24	0.18*	0.31	0.45
13. Tolerate moderate eating	1.71*†	1.18†	1.26*	1.35	1.18
14. Follow a special diet method to lose weight rapidly in a short time	0.13	0.06	0.07	0.08	0.19
15. Don't eat foods that you think likely to contain fat	1.50*	1.06	1.02*	1.14‡	1.43‡
16. Reduce amount of food	1.46	1.18	1.21	1.26‡	0.96‡
17. Reduce number of snacks	1.46	1.88	1.52	1.56‡	1.95‡
18. Eat only one food item reported to be effective in slimming as a substitute for meals	0.25	0.00	0.03	0.08	0,08
19. Skip meals	0.25	0.18	0.13	0.17	0,28
20. Eliminate staple foods from meals	0.46	0.71	0.44	0.49‡	0.19‡
21. Eat so called "dietary foods" that are reported to be effective in slimming	0.54	0.59	0.46	0.50	0.56
Total	1.10	0.96	0.81	0.90	0.91

Values are mean scores of items. *,†$p<0.05$ P values were determined by Scheffe's test one-way ANOVA (among the daughters' dieting behavior groups). ‡$p<0.05$ P values were determined by Mann-Whitney's U test (between the mothers and the daughters). Ex-D, Extraordinary Diet group; St-D, Structured Diet group; N-D, Non-dieting group

food instead of a meal", "Tolerate moderate eating", and "Don't eat foods that you think likely to contain fat". The scores of the mothers whose daughters were classified into the Ex-D group were significantly higher than those of the mothers whose daughters were classified into the St-D group only for the item: "Tolerate moderate eating". The scores (total) of the mothers were significantly higher than those of their daughters for the items "Restrict intake of calories each day", "Take a laxative", "Reduce amount of food", and "Eliminate staple foods from meals". On the other hand, the scores (total) of the mothers were significantly lower than those of the daughters for the items: "Eat nothing 2~3 hours before sleeping", "Don't eat foods that you think likely to contain fat", and "Reduce number of snacks". Factor loading matrices for 21 items ranged from 0.39 to 0.89, except for 'Take a laxative' (0.23).

Scores for the eating consciousness of the mothers (Tables 3, 4)

The scores for the eating consciousness of the mothers whose daughters were in the Ex-D group were significantly lower than those of the mothers whose daughters were in the N-D group or St-D group for the item: "Cooking is a fun pas-

time". The scores of the mothers who had a desire to be slim were significantly lower than those of the other mothers for the following items: "Cook dishes which have been enjoyed elsewhere", "Cooking is a fun pastime", "Have the daughter assist the mother in cooking meals", "Have the daughter eat snacks between meals", and "Advise the daughter against leaving a dish half eaten". There was no significant correlation between the distribution of dieting behavior groups in the daughters and a desire to be slim in the mothers. Factor loading matrices for 24 items ranged from 0.39 to 0.81, and the cumulative contribution was 56% in the factor analysis.

Experience of conversations with daughters about diet (Table 5)

A total 157 mothers (71%) had experiences of conversation with their daughters about diet. There was a significant correlation between experience of conversations with daughters about diet for the mothers and the distribution of dieting behavior groups in the daughters.

DISCUSSION

There was a significant correlation between the distribution of dieting behavior groups in the mothers and that in their daughters. The scores for dieting behavior of the mothers whose daughters were classified into the Ex-D group were significantly higher than those of the mothers whose daughters were classified into the N-D group for eight of the 21 question items in the Dieting Behavior Scale. Our findings did not agree with Vincent's study (9), which reported that a mother's weight loss

TABLE 3

Scores for eating consciousness of the mothers.

Question items	Daughters' dieting behavior group			Do you want to be slim?	
	Ex-D group (n=39)	St-D group (n=34)	N-D group (n=148)	Yes (n=133)	No (n=88)
Factor 1: Eating enjoyably					
1. Love talking about food	1.92	2.06	2.06	2.02	2.07
2. Cook dishes which have been enjoyed elsewhere	1.38	1.50	1.39	1.30*	1.55*
3. Prefer well-known brand foods	1.28	1.50	1.35	1.35	1.37
4. Love eating with many people	1.85	2.00	2.01	1.90	2.10
5. Cooking is a fun pastime	1.49††	1.82†	1.81†	1.61*	1.98*
Factor 2: Safety and nutritional value of food					
6. Pay attention to food additives and quality	2.10	2.12	2.15	2.11	2.17
7. Use an organic vegetable and additive-free food	1.38	1.59	1.63	1.52	1.64
8. Consider a well-balanced diet	2.31	2.32	2.32	2.26	2.39
9. Consider the priority of nutritional values to a taste	1.56	1.35	1.53	1.51	1.52
10. Teach the daughter about nutrition and health	2.18	2.24	2.09	2.08	2.18
Factor 3: Having the daughter assist the mother in cooking					
11. Have the daughter assist the mother in cooking meals	1.13	1.18	1.16	1.08*	1.28*
12. Have the daughter assist the mother in preparing meals	1.56	1.53	1.41	1.38	1.59
13. Have the daughter cook meals for family by themselves	0.44	0.35	0.32	0.32	0.39
14. Have the daughter go on errands for food	1.05	0.94	0.94	0.92	1.01
15. Have the daughter assist the mother in clearing the table	1.44	1.59	1.41	1.37	1.56
Factor 4: Saving time cooking					
16. Use ready-made meals	0.56	0.76	0.62	0.62	0.67
17. Use retort pouches and instant foods	0.56	0.76	0.62	0.63	0.62
18. Prefer convenience in general cooking	0.77	0.59	0.54	0.64	0.52
19. Prefer handmade meals for the family	2.38	2.56	2.52	2.48	2.53
Factor 5: Bringing-up about eating					
20. Have the daughter take meals regularly	2.26	2.26	2.22	2.18	2.31
21. Have the daughter eat snacks between meals	1.67	1.53	1.61	1.44*	1.85*
22. Advise the daughter against leaving a dish half eaten	2.26	2.18	2.19	2.09*	2.37*
Factor 6: Eating with the family					
23. Plan meals to please the family.	2.28	2.44	2.37	2.35	2.40
24. Try to eat with all of the family.	2.33	2.47	2.43	2.38	2.48

Values are mean scores. †,††$p<0.05$ P values were determined by Scheffe's test one-way ANOVA (among the daughters' dieting behavior groups). *$p<0.05$ p values were determined by Mann-Whitney's U test (whether the mother has a desire to be slim or not). Ex-D, Extraordinary Diet group; St-D, Structured Diet group; N-D, Non-dieting group.

TABLE 4
Desire to be slim in the mothers.

	Daughters' dieting behavior group			
	Ex-D group	St-D group	N-D group	Total
Do you want to be slim?				
Yes	28	18	88	133
No	11	16	61	88
	39	34	149	221

Values are numbers of subjects. Ex-D, Extraordinary Diet group; St-D, Structured Diet group; N-D, Non-dieting group

behaviors were not associated with a daughter's weight loss behaviors. One of the likely explanations for the difference was the difference in age of the participant daughters (aged 12-15 years in our study and 7-10 years in Vincent's study). Further studies are needed to replicate our results in a variety of age-group daughters.

A standard method to investigate dieting behavior in mothers and their daughters has not yet been established. Previous studies reported that an inappropriate scale for investigating dieting behavior was not applicable in non-clinical subjects, especially adolescents and non-dieting subjects, because there was a fear that the dieting behavior questions had given them hints about abnormal dieting methods (13). Because of this, we assessed the dieting behaviors in the subjects using a new Dieting Behavior Scale, which was a modification of the original questionnaire for the survey of eating disorder risk (14, 15). Our previous study showed that the assessment of dieting behavior using the new modified scale provided useful information, and did not have any adverse effects on the eating behavior of the subjects (10).

There were differences between the mothers and their daughters in the dieting behavior characteristics. The mothers' dieting behaviors tended to include reducing the amount and calorific value of food, while the daughters' dieting behaviors tended to focus on the fat contained in food and eating times. These findings suggested that there was a difference between the mothers and their daughters in terms of diet.

The scores for eating consciousness of the mothers whose daughters were in the Ex-D group were significantly lower than those of the mothers whose daughters were in the N-D or St-D groups, for the item "Cooking is a fun pastime". The scores of the mothers who had a desire to be slim were significantly lower than those of the other mothers for several items. These findings suggest that mothers' eating consciousness affects their daughters' eating consciousness, and agrees with previous studies which reported that mothers' dieting concerns influence the degree to which they control their children's food intake, which itself is associated with an impairment in the child's capacity to self-regulate energy intake (16).

A total 71% of mothers had experience of conversations with their daughters about diet. There was a significant correlation between experience of conversations with daughters about diet in the mothers and the distribution

TABLE 5
Experience of conversations with the daughters about diet.

	Daughters' dieting behavior group			
	Ex-D group	St-D group	N-D group	Total
Have you had conversations with your daughter about diet?				
Yes	33	29	96	157
No	6	5	53	64
Total	39	34	149	221

Kruskal-Wallis test $p<0.01$

Values are numbers of subjects. Ex-D, Extraordinary Diet group; St-D, Structured Diet group; N-D, Non-dieting group

of dieting behavior groups in the daughters. Vincent showed that a mother's conversation about dieting and negative comments about a daughter's body were associated with the daughter's weight loss behaviors (9). Pike showed that mothers play a part in the transmission of the cultural values regarding weight, shape and appearance (8). Further investigation about the transmission mechanism details including nonverbal and unconscious mothers' messages is needed.

Study limitations

We studied only a limited number of subjects who were recruited from a junior high school. We are aware that further studies with a larger sample size subject population need to be carried out.

CONCLUSIONS

The mothers' dieting behavior, eating consciousness, and experience of conversations with their daughters about diet influenced dieting behaviors in their junior high school daughters. Appropriate education of the mothers would be useful in preventing inappropriate dieting behavior in their junior high school daughters.

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