The Relationship among Stress Response, Weight Management, and Physical Exercise in Japanese University Students

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Abstract: The aim of the present study was to investigate the relationship between stress response, gender, weight management, and physical exercise among Japanese university students. The participants were 411 university students (169 males, 242 females). All participants completed the Stress Response Scale and the European Health and Behavior Survey. T-test results showed that scores of females were consistently higher than those of males ($P < 0.05$). In the chi-square test, the proportion of females managing their weight (75.3%) was significantly higher than that of males (42.9%). In multiple regression analysis, the group managing their weight showed a higher stress score, and the group doing physical exercise showed a lower stress score. These results show that weight management through physical exercise reduces mental stress, making it the most beneficial method of weight management for the mental and physical wellbeing of youths.

Key words: Health behavior, physical activity, Stress Response Scale, youth.

1. Introduction

In Japan, the desire to be slender among adolescent females has become a problem. "Slender" is defined as having a body mass index (BMI) of less than 18.5, which is considered underweight; currently, 21.1% of Japanese females in their twenties fall into this category [1]. Females are more likely to take measures to reduce their body weight than males [2], even when they are already at a healthy body weight [3-5]. The influence of the mass media causes females to desire the slim figure of fashion models, who have an ideal BMI of 18.6 [6]. The reason females want to be slim seems to come from the aesthetic sense of wanting others to think they are cute, and thinking that being slim is more attractive and that slim people look better when they dress up [5]. It has also been reported that becoming slender is a means of satisfying

exhibitionism [7]. In other words, the goal of many females' body weight reduction is not to maintain a reasonable weight for health purposes, but to achieve a slim proportion because it is regarded as more physically attractive. However, menstrual irregularities such as menstrual disorder [8] and amenorrhea [9] that accompany excessive weight loss can lead to deteriorated health. Females who diet because they perceive themselves as fat often employ dietary restrictions as a weight reduction method and therefore have low nutrient intakes, with calcium, iron and vitamin B2 being considerably insufficient [10]. Additionally, females who want to be slender have more eating disorders compared with those who do not [11]. On the other hand, few females use physical exercise for weight reduction [4, 12], which can be a healthy method of losing weight when performed properly. Although the desire for slenderness is more prevalent among females, it has been recently reported that this desire is increasing among adolescent males

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[13], making it a public health issue for both males and females.

A survey of 558 Japanese university, college and vocational school students found that the number of students utilizing student counseling services is increasing and that the issues they receive counseling for are becoming more serious every year [14]. Regarding recent trends in student counseling, Kobayashi [15] reported that counseling contents encompass various areas, such as absenteeism, reclusive behavior, lack of knowledge, developmental disorders, alcoholism, stalking victims, and sexual harassment. In this context, university students are confronted with many challenges that affect their mental health. In addition, a previous study found that young Japanese adults consisting chiefly of university students had high average scores in the General Health Questionnaire [16], indicating that Japanese university students suffer from stress. There are concerns that unhealthy weight loss can put university students at a higher risk of mental and physical stress.

Previous studies found that physical exercise not only improves physical fitness, but also reduces stress [17, 18]. In addition, since physical exercise burns body fat, it can also contribute to weight reduction. However, it is doubtful that many Japanese adolescents combine dieting with physical exercise. A previous study found that many females working on reducing their body weight do not perform regular physical exercise [2].

We conducted a study that considered the influence of physical exercise when investigating the relationship between stress and weight management in adolescence. The goal of this study was to investigate the relationship among stress response, gender, weight management, and physical exercise among Japanese university students.

2. Method

2.1 Participants and Ethical Considerations

Four hundred and eleven Japanese university

students (169 males, 242 females) who volunteered to take part in our self-administered questionnaire. Participants were recruited from students enrolled in the “Health & Sports Science” lecture at Nishi-Kyushu University in Kyushu Prefecture. Prior to completing the questionnaire, all participants provided consent to participate in the study after receiving an oral explanation that (1) answering the questionnaire would not result in any disadvantage and (2) that any personal information collected would be protected.

2.2 Questionnaire Items

2.2.1 Stress Response Scale

Mental and physical stress responses were measured using Ozeki’s Stress Self-evaluation Scale for University Students [19]. This scale is comprised of 35 items divided into two parts: (i) mental stress response, with the five sub-items of “Depression,” “Anxiety,” “Anger,” “Emotional instability” and “Social withdrawal,” and (ii) physical stress response, with the two sub-items of “Physical fatigue” and “Autonomic nervous system response.” The participants evaluated their behaviors and mental and physical condition over the previous week by choosing one of four options (0, never; 1, sometimes; 2, usually; and 3, always). The scores for each of the seven sub-items range from 0 to 15, resulting in total sub-item scores ranging from 0 to 75 for mental stress response and 0 to 30 for physical stress response, and a total scale score ranging from 0 to 105. The higher the total scale scores, the more severe the stress response.

2.2.2 Weight Management and Physical Exercise

The European Health Behavior Survey [20], which was developed by Steptoe and Wardle at London University and was translated into Japanese by Tsuda et al. [21], was employed to examine the execution of healthy behavior. The two items of “Exercise” and “Dieting” in the “Practice of Positive Healthy Behavior” were used in this study. The item of “Exercise” asks whether or not the participant exercised in the past 2 weeks and that of “Dieting” inquires if he/she tried to

reduce their body weight (i.e. performed weight management) in the past 2 weeks. Participants were divided into two groups for comparison: a weight management group and a non-weight management group.

2.3 Statistical Procedure

Gender differences for the implementation of weight management were statistically tested using the chi-square test. Stress response was compared using Student's t-test by sub-item, gender and whether weight management was performed or not. The association between stress response and the factors of gender, weight management and physical exercise was examined using multiple regression analysis.

3. Results

3.1 Current State of Dieting Behavior

The results of the chi-square test for the implementation of weight management by gender indicated that significantly more females dieted than males (chi-square = 44.1), as shown in Fig. 1.

3.2 Current State of Stress Response

Table 1 shows the results of the comparison of stress response by gender for each sub-item using the t-test. A 5% significant difference was detected in mental stress response ($t_0 = -2.518$, $df = 408$, $P < 0.05$) and the

sub-items of "Depression" ($t_0 = -3.490$, $df = 407$, $P < 0.01$) and "Anger" ($t_0 = -2.415$, $df = 379$, $P < 0.05$)." A 5% significant difference was also detected in physical stress response ($t_0 = -2.622$, $df = 408$, $P < 0.01$), the sub-item of "Physical fatigue" ($t_0 = -3.379$, $df = 405$, $P < 0.01$), and in total stress response score ($t_0 = -2.734$, $df = 408$, $P < 0.01$). Additionally, the stress response scores of females were higher than those of males in all items showing a significant difference.

3.3 Stress Response in the Weight Management Group

Comparison of stress response between groups using the t-test showed significant differences in total stress response score ($t_0 = 2.075$, $df = 404$, $P < 0.05$), mental stress response ($t_0 = 2.065$, $df = 404$, $P < 0.05$), the mental stress response sub-item of "Social withdrawal" ($t_0 = 2.389$, $df = 372$, $P < 0.05$)," and the physical stress sub-item of "Physical fatigue" ($t_0 = 2.329$, $df = 401$, $P < 0.05$)" (Table 2). The scores of the weight management group were higher than those of the non-weight management group in all items showing a significant difference.

3.4 Stress Response and Associated Factors

For the purpose of investigating, the association between stress response and the factors of gender, weight management and physical exercise, multiple regression analysis was performed with the total stress response score and sub-item scores as dependent

Fig. 1 Relationship between gender and weight management.

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Table 1 Extent of stress response by gender.

Item	Gender	N	M	SD	t-value	df	P
Total of stress response	male	168	24.46	19.480	-2.734	408	**
	female	242	29.82	19.547			
(i) Mental stress response	male	168	17.43	14.893	-2.518	408	*
	female	242	21.24	15.150			
Depression	male	168	3.79	4.241	-3.490	407	**
	female	241	5.25	4.143			
Anxiety	male	168	3.73	3.477	-1.301	407	ns
	female	241	4.17	3.258			
Anger	male	168	3.80	3.868	-2.415	379	*
	female	241	4.78	4.236			
Emotionally unstable	male	167	3.65	3.529	-0.785	406	ns
	female	241	3.92	3.302			
Social withdrawal	male	167	2.62	3.139	-1.698	406	ns
	female	241	3.20	3.563			
(ii) Physical stress response	male	168	7.02	5.898	-2.622	408	**
	female	242	8.58	5.909			
Physical fatigue	male	167	4.99	3.847	-3.379	405	**
	female	240	6.24	3.531			
Autonomic nervous system response	male	167	2.07	2.977	-1.111	405	ns
	female	240	2.41	3.023			

t-test ** $P < 0.01$, * $P < 0.05$, ns $P \geq 0.05$.

Table 2 Extent of stress response in the weight management and non-weight management groups.

Item	Weight management	N	M	SD	t-value	df	P
Total of stress response	Do	251	29.15	20.49	2.075	404	*
	Do not	155	24.98	18.29			
(i) Mental stress response	Do	251	20.88	15.84	2.065	404	*
	Do not	155	17.68	13.96			
Depression	Do	251	4.95	4.24	1.698	403	ns
	Do not	154	4.21	4.25			
Anxiety	Do	251	4.18	3.45	1.464	403	ns
	Do not	154	3.68	3.23			
Anger	Do	251	4.64	4.26	1.751	403	ns
	Do not	154	3.90	3.83			
Emotionally unstable	Do	250	3.96	3.55	1.218	402	ns
	Do not	154	3.54	3.17			
Social withdrawal	Do	250	3.26	3.64	2.389	372	*
	Do not	154	2.47	2.96			
(ii) Physical stress response	Do	251	8.27	6.00	1.606	404	ns
	Do not	155	7.30	5.84			
Physical fatigue	Do	249	6.04	3.67	2.329	401	*
	Do not	154	5.16	3.71			
Autonomic nervous system response	Do	249	2.30	3.05	0.366	401	ns
	Do not	154	2.19	2.94			

t-test * $P < 0.05$, ns $P \geq 0.05$.

Table 3 Relationship among stress responses, gender, weight management and physical exercise.

Dependent variables	F-value	P	Explanatory variables (Standardized partial regression coefficient)					
			Gender	P	Weight management	P	Exercise	P
Total of stress response	6.99	**	-0.13	**	—		—	
(i) Mental stress response	4.73	**	—		0.11	*	-0.11	*
Depression	8.63	***	-0.15	**	—		-0.11	*
Anxiety	—		—		—		—	
Anger	5.89	*	-0.12	*	—		—	
Emotionally unstable	—		—		—		—	
Social withdrawal	5.28	**	—		0.12	*	-0.12	*
(ii) Physical stress response	6.30	*	-0.13	*	—		—	
Physical fatigue	10.63	**	-0.16	**	—		—	
Autonomic nervous system response	—		—		—		—	

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$.

variables. The results of multiple regression analysis are provided in Table 3. Significant regression formulas were detected in all dependent variables ($P < 0.05$) with the exception of the mental stress response sub-items of “Anxiety” and “Emotional instability”, and the physical stress response sub-item of “Autonomic nervous system response.” The regression coefficients derived from multiple regression analysis for gender were -0.13 for total stress response, -0.15 for “Depression,” -0.12 for “Anger,” -0.13 for physical stress response and -0.16 for “Physical fatigue,” indicating significant correlations in all independent variables ($P < 0.05$). In addition, the signs of these partial regression coefficients were all negative, showing that the stress response in females was high irrespective of weight management and physical exercise.

For weight management, significant association at the 5% level was found in mental stress response (partial regression coefficient = 0.11) and “Social withdrawal” (0.12). The positive signs of these partial regression coefficients indicate that participants who were dieting had high stress response regardless of gender and whether or not they exercised.

In physical exercise, there were significant relationships between stress response and the independent variables of mental stress response (-0.11), “Depression” (-0.11) and “Social withdrawal” (-0.12).

The negative signs of these partial regression coefficients allowed us to deduce that participants who did not perform any exercise showed high stress response regardless of gender and weight management.

4. Discussion

4.1 Actual Conditions of Dieting Behavior and Stress Response

Our finding that the rate of weight management was higher in females than in males was consistent with a previous investigation [2]. Moreover, the stress responses of “Social withdrawal” and “Physical fatigue” of the weight management group were higher than those of the non-weight management group. It seems that dieting behavior is partially related to the issue of mental health in young adulthood. Furthermore, a recent survey report on physical fitness and motor ability has led to concerns that many overweight and underweight people have insufficient physical fitness [22]. Decreased physical fitness may result from excessive weight management or slenderness, causing both high physical and mental stress responses.

4.2 Stress Response and Its Associated Factors

As a result of examining the association between stress response and weight management while considering the influence of gender and physical

exercise, we found that stress responses were higher in females than in males, higher in the weight management group than the non-weight management group, and higher in those who did not exercise than in those who did. Former studies have suggested that females are more likely to experience strong feelings of stress and have deteriorated mental health than males [23-25]. The results of the present study were consistent with these previous studies. Therefore, it is suggested that mental supports for females before, during and after adolescence are required.

The participants who had recently dieted showed high scores in the mental stress response sub-item of "Social withdrawal". Dieting behavior is motivated by satisfying one's self-assertive tendencies or recovering one's self-importance [7]. Moreover, adolescence is the period when individuals are most sensitive to how other people see and evaluate them [26]. It is thought that biased, negative thinking that one's own body is fat in spite of actually having a normal body proportion leads to self-denial and results in a strong tendency towards social withdrawal. Health education that provides correct and balanced information about healthy body proportions is required for adolescents to have a healthy body image and lifestyle.

Our finding that the stress responses among those who perform physical exercise were low for some sub-items is consistent with previous investigations [17, 18], indicating that physical exercise reduces stress. Physical exercise contributes to both mental and physical health. Guidance for choosing appropriate and healthy methods of weight management that incorporate physical exercise are required for all students, including those who need to reduce their body weight and those with a biased body image.

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