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Short Communication

Obesity Has an Inverse Relationship with a Depressive State

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Introduction

Many studies have endeavored to determine the association between obesity and depression. Some questionnaire surveys found that obese people have increased risk for depression[1–4]. Others showed decreased risk for depression in obese people, which indicated that depression was inversely related to obesity[5, 6], especially in middle-aged men[7]. There are also reports showing no effect of obesity on the risk of depression[8, 9]. On this relationship, sex difference should also be considered[10, 11], as some discrepancies between obesity and depression exist on the relationship. Most of these reports were cross sectional studies except for studies by Roberts *et al.* and DiPietro *et al.*

Although the cause-effect relationship is complex, the authors analyzed two sets of data on male workers in different companies by means of two different depression questionnaires and observed the association between obesity and depression. Furthermore, shift working in a company is also considered. A longitudinal study in this company was also conducted 6 months later to check the association between changes in body mass index (BMI) and depression. These methods will add information on the discrepancy of the association between obesity and depression in past researches.

Subjects and Methods

Age, BMI and the Todai Health Index (THI) depression scale score of 3,531 male workers in a dairy product company were analyzed. Age, BMI and the Zung Self-Rating Depression Scales (SDS) Index, which was calculated by multiplying the SDS by 1.25, for 3,188 male workers in a railroad transportation company were analyzed. The effective response rates were 88.3% and 91.1% in a dairy product and a railroad transportation company, respectively.

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THI depression scale (THI-D) consisted of 10 items with three selections, “Yes”, “Neutral”, and “No”, which were scored as 3, 2, and 1, respectively. The sum of scores for each 10 items is the THI-D score or scale score for depression in the THI. Therefore, the THI-D score ranges from 10 to 30. The SDS index was calculated by totaling the scores for 20 items, where each item was scored from 1 to 4. The result was multiplied by 1.25 to make a maximum point become 100. The Quetlet index (weight in kilograms divided by height in meters squared) was used as the BMI.

Subjects were categorized into four groups with cut-off points for BMI scores at 20, 25 and 28. Borderline data were categorized into a higher class. The authors adopted a BMI of 28 from the recent precise research conducted by Stevens *et al.*[12]. They presented the age specific BMI associated with a 50% increase in mortality corresponding to a BMI of 21. The cut-off value was a BMI of 28. That is why the authors modified the international cut-off point between obesity 1 and 2 to be 30. Other cut-off values were not changed.

Six months later, the authors conducted a survey to check the test-retest reliability of data for subjects in a railroad transportation company. As the consistency of the association was recognized, repetition of the results was avoided. Instead, the authors tentatively calculated the association between the changes in BMI and SDSI. The target number of subjects decreased to 1,328. Pearson’s moment correlation coefficient was calculated.

As the distribution of the depression score was logarithmic normal, the data were converted into logarithms in the subsequent analysis. As the depressive state is slightly related to aging, the analysis of variance among different BMI categories was conducted controlling the age. Education, marital status, social isolation, social support, chronic medical conditions, functional impairment, life events, and financial strain could not be used for the analysis, but smoking habit, alcohol drinking, and exercise could be used for the adjustment on male workers in a dairy product company.

Multiple comparisons were made with Tukey’s method if the analysis of variance was significant. The analysis was performed with the SPSS 10.0J software package for Windows.

Results

The mean scores for THI-D and SDSI decreased significantly as the BMI increased (Table 1).

For transportation workers, there was a significant inverse association between BMI and the mean SDSI score among daytime and shift workers, respectively (Table 2). Namely, obese subjects have lower SDS scores in a trend test.

The relationship between the change in the SDS depression score and that of BMI in six months was

Table 1. Mean depression score for four classes of BMI measured by the two depression questionnaires, SDS and THI-D

	SDS			THI-D	
	n	GM, GSD		n	GM, GSD
BMI<20	310	39.8, 1.27 ***		441	15.9, 1.28
20<=BMI<25	2111	38.5, 1.27 **	*	2325	15.3, 1.28 *
25<=BMI<28	622	38.1, 1.27 *		635	15.1, 1.28 **
BMI>=28	145	35.9, 1.27		130	14.6, 1.28 **

GM; geometric mean, GSD; geometric standard deviation, SDS; Zung Self-rating Depression Scales, THI-D; Todai Health Index depression scale. *; p<0.05, **; p<0.01, ***; p<0.001 against the underlined value by means of Tukey's multiple comparisons. Age, smoking habit, alcohol drinking, and exercise were controlled for the analysis of covariance on SDS. Significant levels of linear trend test on SDS and THI-D were p<0.001 and p=0.001, respectively. There was no significant interaction between BMI and covariates.

Table 2. Mean SDS depression score for four classes of BMI in daytime and shift workers in a railroad transportation company

	Daytime worker		Shift worker	
	n	GM, GSD	n	GM, GSD
BMI<20	144	38.9, 1.26 †	165	40.5, 1.28
20<=BMI<25	901	38.5, 1.26 †	1194	38.5, 1.28
25<=BMI<28	290	38.8, 1.26 †	329	37.3, 1.28 **
BMI>=28	58	35.6, 1.26	87	36.1, 1.28 **

GM; geometric mean, GSD; geometric standard deviation, SDS; Zung Self-rating Depression Scales. †; p<0.1, **; p<0.01 against the underlined value by means of Tukey's multiple comparisons. Age, smoking habit, alcohol drinking, and exercise was controlled for the analysis of covariance. Significant levels of linear trend test were both p<0.001 in daytime workers and in shift workers. There was no significant interaction between BMI and covariates.

evaluated by using our data (Fig. 1). There was no relationship between the changed scores for the two parameters.

Discussion

THI-D was developed as a general health questionnaire to replace the Cornell Medical Index. In contrast, SDSI was developed to detect outpatients in a depressive state. The authors recently reported that THI-D is valid for use not only in epidemiological surveys but also in monitoring the severity of the depressive state[13]. Although two different questionnaires were used in two workers' group, an inverse relationship between BMI and depression was recognized. In these occupational settings, the consistency of the association on "jolly fat" phenomena was confirmed. The association was recognized only in male subjects, and there was no association between BMI and depression in females in a dairy product company.

About the relationship between two indicators, some of the obese persons are more likely to diet and to experience particular physical problem, which might be associated with depression.

The authors summarized the past papers on the relationship between obesity and depression (Table 3). Roberts *et al.* conducted an epidemiologic follow up study on community inhabitants[1]. They clarified the role of obesity as a risk for depression. The same conclusion was also presented by some other authors[2–4]. In contrast, some researchers showed a decreased risk of depression among the obese[5–7]. Among them, Crisp *et al.* used the data on subjects in the workplace. The result was the same as ours. The subjects of past studies conducted in

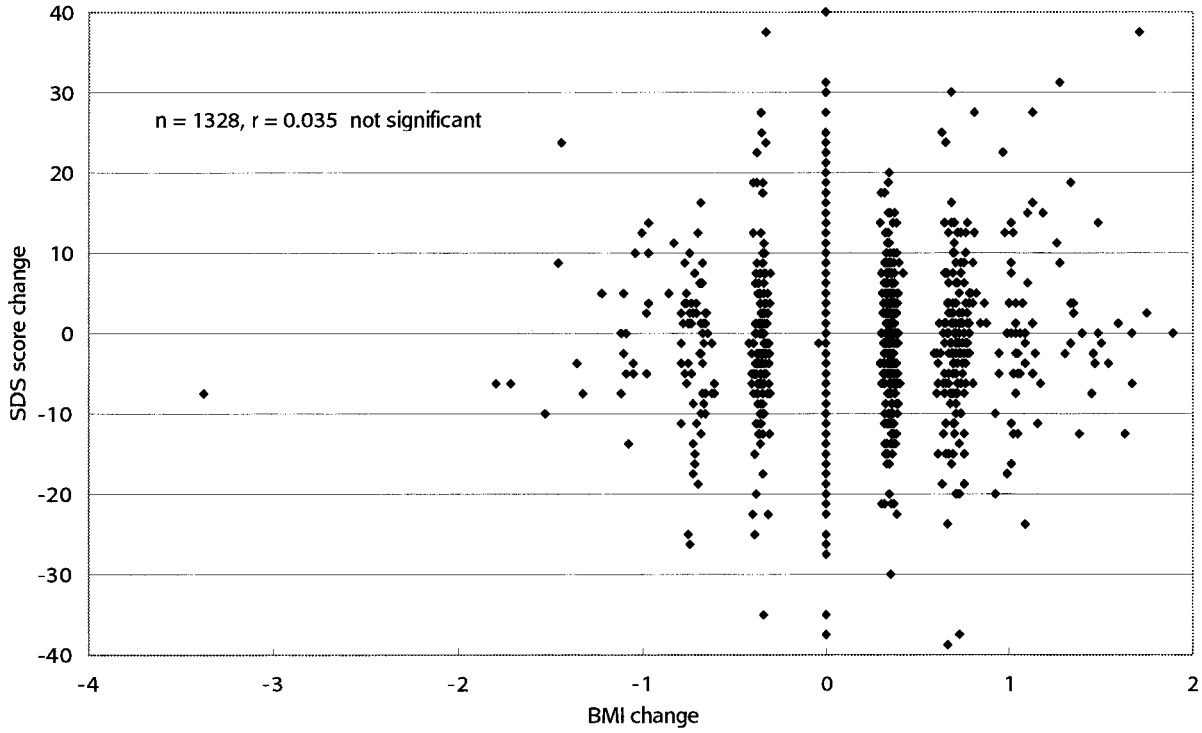

Fig. 1. The relationship between the change in BMI and that in the SDS score for 6 months.

Table 3. The past references on the association between obesity and depression

References	Generation (Young, Middle, Old)	Research field (Inhabitant, Worker)	Sex (Male, Female)	Method (Cross sectional, Follow up)
Roberts 2000, ↑	M & O	I	M & F	F
Katz 2000, ↑	M	I, Clinic	M & F	C
Ross 1994, ↑	Y, M & O	I	M & F	C
Istvan 1992, ↑	Y, M & O	I	F	C
Carpenter 2000, ↓ ↑	Y, M & O	I	M (↓) & F (↑)	C
DiPietro 1992, ↑ ↓	Y, M & O	I	M (↑) & F (↓)	F
Palinkas 1996, ↓	M & O	I	M	C
Crisp 1980, ↓	M & O	W	M	C
Crisp 1976, ↓	M	I	M & F	C
Herpertz 2000, ×	M & O	Clinic (DM type 2)	M & F	C
Friedman 1995, ×				Review

↓; Jolly fat (Obese subjects were less depressive), ↑; Obese subjects were more depressive, ×; No association.

western countries had higher average BMIs than in our study. It is possible that decrease in the depression score as BMI increases would be changed if many obese subjects whose BMI is 28 or higher were included in this study.

The authors previously reported that the factor structure of SDS items of night-shift workers was similar to that of daytime workers[14]. This result partly supports the theory that the contribution of the job schedule to the association between BMI and depression is relatively small.

When the relationship between the change in the amount of depression and obesity in six months was evaluated, there was no relationship between them. This suggests that a short-term change in BMI may not be caused by a change in the depressive state.

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