

## Article

# The Relationship between Sense of Coherence, Stress, Body Image Satisfaction and Eating Behavior in Japanese and Austrian Students

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**Abstract:** Background: Restrained, emotional, and external eating are related to obesity and eating disorders. A salutogenic model has confirmed sense of coherence (SOC) as a health resource that moderates stress and helps limit the occurrence of overweightness and eating disorders. This study aimed to examine the relationship between SOC, social support, stress, body image satisfaction (BIS) and eating behaviors in different cultural environments. Methods: A total of 371 Austrian (161 men, 210 women) and 398 Japanese (226 men, 172 women) university students participated. The SOC-13 scale, Multidimensional Scale of Perceived Social Support, Dutch Eating Behavior Questionnaire, BMI-Based Silhouette Matching Test and an analogue single-stress item were used as measurements. Results: SOC negatively affected all three types of eating in Austrian students (men:  $\beta = -0.227$  to  $-0.215$ ; women:  $\beta = -0.262$  to  $-0.214$ ). In Japanese students, SOC negatively affected external eating in both sexes (men:  $\beta = -0.150$ ; women:  $\beta = -0.198$ ) and emotional eating ( $\beta = -0.187$ ) in men. BIS indicated that the desire to become slim predicted restrained eating, women's emotional eating, and men's and Austrian women's external eating. Stress was only predictive of emotional eating in Japanese men. Conclusions: This study found that SOC, BIS and stress might be valuable factors regulating eating behavior in a cultural context. However, the relationship between SOC, BIS, stress and eating behavior differs between cultures.

**Keywords:** sense of coherence; restrained eating; emotional eating; external eating; body image satisfaction; cross-culture

## 1. Introduction

Three eating behaviors, emotional eating (EME), external eating (EXE) and restrained eating (RE), are often associated with dieting, weight gain and binge eating. The work of Van Strien et al. explained EME using psychosomatic theory [1], which states that obesity is not usually caused by organic disorders, but results from overeating due to emotional disturbances. EXE refers to the externality theory, suggesting that some people show strong responsiveness to external salient food cues [2]. RE is explained by restraint theory, which suggests that people eat less when they desire to lose or maintain

body weight [3]. Evidence suggests that EME and EXE are related to obesity and eating disorders such as binge eating and bulimia [4]. With regard to RE, restrained eaters eat less than unrestrained eaters under controlled experimental conditions favoring self-control. Dietary restraint is also associated with a tendency toward disinhibition under conditions favoring loss of self-control, for example, after consuming a preload [5–7].

Based on the relationship between these three eating behaviors, the Dutch Eating Behavior Questionnaire (DEBQ) was developed [8]. Many studies have used the DEBQ to investigate eating behaviors and their influencing factors. For example, body image and stress were reported as risk factors for abnormal eating attitudes, suggesting that body image is the key factor that predicts emotional eating. [9]. However, the stress effect on emotional and restrained eating differed depending on the type of stressor (ego-threat, cognitive demand) [10]. Emotional overeating impaired self-regulation of eating [11]. Therefore, stress reduction and an improved satisfaction with body image might be effective strategies for regulating eating behavior. Previous studies found risk factors, and indicated a resulting reduction in health e.g., [12,13]. A salutogenic model of health has been considered as a theoretical framework for developing health promotion programs [14]. The salutogenic model stresses sense of coherence (SOC) as an internal resource, and social support as an external resource, to cope with stress and promote health [15]. People with a high SOC view challenges as predictable, understandable, worthy of engagement, and surmountable. The World Health Organization (WHO) cites the salutogenic approach as an example in the context of health promotional development, and has adopted this approach to improve public health in different countries [14] and to promote healthy eating behavior [16]. This concept was developed decades ago and has recently received increased attention. Examining the effectiveness of SOC with regard to eating behavior substantiates the salutogenic approach. This approach can shed light on new ways of modifying eating habits.

Eating disorders are no longer highly specific to European women [17–19]. Obesity is a global health issue, not only in Western countries but also in Asian countries, where cases of obesity are as frequent as instances of being underweight [20]. Western culture has predominantly accepted sociocultural causes for eating disorders and obesity. In this sense, “culture” is recognized as essential in the etiologies of eating disorders and obesity [21]. In 2018, according to WHO reports, 54.3% of the population was overweight and the rate of obesity was 20.1% in Austria. In Japan, 27.2% of the population was overweight and the rate of obesity was 4.3%. Although these rates have increased in both countries, the obesity rate in Japan remains lower than in Austria. This may be due to different eating behaviors in the two countries [22].

The aim of this study is to compare three eating behaviors (RE, EME and EXE) in two countries with different cultures and to examine the relationships between these behaviors and four individual and social factors: SOC, social support, body image satisfaction (BIS) and stress. We hypothesize that SOC, BIS, social support and stress are negatively correlated with RE, EME and EXE in both countries, although the effects of these factors may differ.

## 2. Materials and Methods

### 2.1. Participants

Data were collected from 769 students enrolled at universities in Austria and Japan. In total, 371 Austrian students (161 men; 210 women) and 398 Japanese students (226 men; 172 women) participated in the study. The Austrian students' mean age was 22.0 ( $\pm$  2.6) years, and the Japanese students' mean age was 18.9 ( $\pm$  1.2) years. Participants provided their height and weight. Body mass index (BMI) was calculated based on height and weight. Table 1 shows the BMI distribution, based on the criteria of the WHO and the Japan Society for the Study of Obesity (JASSO) [23,24]. In total, 18.0% of Austrian men, 5.7% of Japanese men, 4.3% of Austrian women, and 4.1% of Japanese women were categorized as obese (BMI  $\geq$  25). Furthermore, 19.8% of Japanese women, 10.5% of Austrian women, 1.2% of Austrian men and 11.9% of Japanese men were underweight (BMI < 18.5). Data were collected

during approximately the same year and months in Japan and Austria. The surveys were completely anonymous and voluntary. Both the Karl-Franzens University Graz (GZ39/36/63) and the Graduate School of Human Development and Environment of Kobe University (No. 70) approved the study, in accordance with the ethical principles of the Declaration of Helsinki.

**Table 1.** Distribution of underweight, normal weight, and obesity.

BMI			<18.5	18.5≥--<25	25≥--<30	30≥--<35 35≥--<40	Total
World Health Organization		Underweight	Normal Weight	Pre-Obesity	Obesity Class I Obesity Class II		
Japan Society for the Study of Obesity				Obesity Class 1	Obesity Class 2 Obesity Class 3		
Austrian	Men	N	2	130	23	6	161
		%	1.2	80.7	14.3	3.7	100.0
	Women	N	22	179	9	0	210
		%	10.5	85.2	4.3	0.0	100.0
Japanese	Men	N	27	186	12	1	226
		%	11.9	82.3	5.3	0.4	100.0
	Women	N	34	131	7	0	172
		%	19.8	76.2	4.1	0.0	100.0

## 2.2. Measurements

### 2.2.1. Sense of Coherence (SOC) Scale

SOC was measured via 13 items. The SOC scale has been validated for both Japanese [25] and German-speaking populations [26]. The items are rated on a 7-point Likert scale, with higher scores indicating a stronger SOC. Cronbach's alpha coefficient was 0.70 for both the Austrian and Japanese populations.

### 2.2.2. Dutch Eating Behavior Questionnaire (DEBQ)

Validated Japanese [22,27] and German [28] versions of the DEBQ were used to assess eating behavior. The questionnaire contains 33 items, including three subscales, RE (10 items), EME (13 items) and EXE (10 items), rated on a 5-point Likert scale [8]. Cronbach's alpha coefficients ranged from 0.74 to 0.76 for the Austrian populations and 0.80 to 0.94 for the Japanese populations.

### 2.2.3. Multidimensional Scale of Perceived Social Support (MSPSS)

This scale (12 items) subjectively evaluates social support from family, friends, and significant others. Each item is rated on a 7-point response scale, with higher scores indicating stronger perceived social support. The scale has good internal reliability, and factor analysis confirmed the three subscale structures [29]. Cronbach's alpha coefficients ranged from 0.93 to 0.97 for the Austrian populations and 0.90 to 0.91 for the Japanese populations.

### 2.2.4. Stress

The degree of stress was assessed on a linear analogue self-assessment scale from 0% (no stress) to 100% (extreme stress).

### 2.2.5. Ideal and Real Body Image Difference (Body Image Satisfaction (BIS))

The participants were asked about their perceptions of ideal and real body images, based on the Body Mass Index-Based Silhouette Matching Test (BMI-SMT) [30]. The BMI-SMT uses silhouettes that match BMI values on a 27-item interval scale. The differences between ideal and real BMI-based silhouettes are estimated and imply body image satisfaction (BIS). Greater differences indicate greater

dissatisfaction with body image; negative scores suggest a desire to be slimmer, and positive scores suggest a desire to be more muscular.

### 2.3. Statistical Analyses

We calculated the mean value and standard division of each sub-scale. To analyze the effects of country and gender, ANOVAs were performed with adjustments for age, because of the age difference between the two countries. Bonferroni's multiple comparison was performed for effects with significant country  $\times$  gender interaction.

Simple analyses were conducted with Pearson's correlations. To compare the effects of SOC, social support, BIS and stress on eating behavior, multiple linear regression analyses were conducted separately, by country and gender. The three eating behaviors were included as dependent variables. SOC, social support, stress and BIS were included as predictor variables. All reported significance levels were  $p < 0.05$ . The data were analyzed using IBM SPSS Statistics, version 21.0.

## 3. Results

### 3.1. The Effects of Country and Gender

Table 2 presents the ANOVA results by country and sex. Japanese students showed higher RE and EXE scores, but Austrian students scored higher for BIS, SOC, and social support in all three areas (significant others, family, friends). The average stress level did not differ between countries. Men and women differed on all three eating behavior scales. Female students reported higher RE, EXE and EME scores than male students. Women also reported more social support and stress than men. A significant interaction indicated that Japanese men experienced more stress than did Austrian men, while this was reversed for women; Austrian women reported more stress than did Japanese women. For BIS, the interaction showed that Japanese men wanted stronger, more muscular bodies (positive difference between ideal BMI and real BMI), but all other groups wanted to be slimmer, particularly women, with Japanese women showing the strongest desire to be slimmer (negative difference between ideal BMI and real BMI).

### 3.2. Relationship among Variables

Table 3 show the correlations between all variables for Austrian and Japanese students. In Austrian women, the correlations fit the hypotheses: all three eating behavior scales were associated with BIS and SOC, but, unexpectedly, stress and social support were unrelated. In Austrian male students, the relationship was somewhat weaker, and, among Japanese students, neither women nor men showed distinct associations. For Japanese students, stress was negatively related to SOC and social support in women, but eating behavior and BIS were only weakly associated.

Table 4 show the regression analysis results with the eating scales (RE, EME, and EXE) as the criteria. In general, only SOC and BIS predicted eating behavior. Stress was only related to EME in Japanese male students. SOC was negatively correlated with RE in male and female Austrian students, but not in Japanese students, while BIS was negatively associated with RE in all groups. Negative SOC beta values predicted EME in Austrian men and women and in Japanese men but not in Japanese women. BIS was related to EME only in Austrian and Japanese women, and to stress solely in Japanese men. EXE was negatively associated with SOC in both Japanese and Austrian men and women. BIS predicted EXE in Austrian men and women and Japanese men.

**Table 2.** Mean values and ANOVA results.

		Country	Gender	M	SD	Country		Gender		Country * Gender	
						F	p	F	p	F	p
Eating Behavior	Restrained eating (RE)	Austria	Men	1.99	0.47	14.41	J>A ***	36.52	W>M ***	0.17	n.s.
			Women	2.46	0.57						
		Japan	Men	2.38	0.79						
			Women	2.79	0.80						
	Emotional eating (EME)	Austria	Men	2.22	0.46	1.51	n.s.	59.42	W>M ***	0.05	n.s.
			Women	2.60	0.47						
		Japan	Men	2.24	0.85						
			Women	2.66	0.92						
	External eating (EXE)	Austria	Men	2.03	0.51	410.76	J>A ***	135.04	W>M ***	0.07	n.s.
			Women	2.54	0.52						
		Japan	Men	3.12	0.66						
			Women	3.61	0.64						
Degree of Stress		Austria	Men	48.94	27.4	0.53	n.s.	5.96	W>M *	15.81	JM>AM *** AW>JW *** AW>AM ***
			Women	58.79	22.8						
		Japan	Men	50.49	25.1						
			Women	48.37	23.8						
Ideal and Real Body Image Difference (BIS)		Austria	Men	−0.30	3.05	13.72	A>J ***	129.28	M>W ***	17.51	AW>JW *** AM>AW *** JM>JW ***
			Women	−2.08	2.56						
		Japan	Men	0.24	4.88						
			Women	−4.05	3.78						
Sense of Coherence (SOC)		Austria	Men	4.75	0.75	212.68	A>J ***	0.00	n.s.	0.38	n.s.
			Women	4.71	0.64						
		Japan	Men	3.77	0.69						
			Women	3.80	0.68						
Social Support	Significant others	Austria	Men	6.16	1.30	128.67	A>J ***	30.89	W>M ***	1.20	n.s.
			Women	6.57	1.16						
		Japan	Men	4.65	1.38						
			Women	5.28	1.31						
	Family	Austria	Men	6.09	1.29	77.05	A>J ***	4.18	W>M *	0.87	n.s.
			Women	6.21	1.33						
		Japan	Men	4.97	1.34						
			Women	5.25	1.29						
	Friends	Austria	Men	5.99	1.37	135.29	A>J ***	23.71	W>M ***	0.86	n.s.
			Women	6.39	1.14						
		Japan	Men	4.68	1.31						
			Women	5.21	1.29						

Adjusted variable: Age; \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ . A: Austria, J: Japan, M: men, W: women, AM: Austrian men, AW: Austrian women, JM: Japanese men, JW: Japanese women. BIS: body image satisfaction.

Table 3. Correlation between variables.

		Eating Behavior												Social Support					
		RE		EME		EXE		Stress		BIS		SOC		Significant		Family		Friends	
(a)																			
Eating Behavior																			
Austrian	RE	-		0.749	***	0.763	***	0.128		-0.209	**	-0.194	*	0.028		0.012		0.043	
	EME	0.797	***	-		0.747	***	0.143		-0.05		-0.231	**	-0.070		-0.006		-0.008	
	EXE	0.774	***	0.746	***	-		0.127		-0.217	**	-0.224	**	-0.055		-0.025		-0.084	
	Stress	-0.041		0.047		0.03		-		-0.178	*	-0.055		0.115		0.07		0.059	
	BIS	-0.362	***	-0.302	***	-0.261	***	-0.035		-		-0.037		-0.102		-0.142		-0.042	
	SOC	-0.297	***	-0.305	***	-0.264	***	-0.078		0.185	**	-		0.28	***	0.264	**	0.255	**
	Social Support																		
Significant	0.007		0.018		-0.006		0.01		0		0.123		-		0.651	***	0.772	***	
Family	-0.092		-0.057		-0.099		-0.038		0.112		0.219	**	0.713	***	-		0.717	***	
Friends	-0.057		-0.012		-0.068		0.005		0.039		0.141	*	0.856	***	0.703	***	-		
(b)																			
Eating Behavior																			
Japanese	RE	-		0.362	***	0.09		0.042		-0.346	***	-0.027		-0.045		-0.032		-0.078	
	EME	0.119		-		0.381	***	0.221	**	-0.084		-0.220	**	-0.067		-0.035		-0.055	
	EXE	0.032		0.556	***	-		0.043		-0.117		-0.068		0.143	*	0.179	**	0.149	*
	Stress	0.095		0.206	**	0.004		-		-0.086		-0.282	***	-0.091		-0.074		-0.081	
	BIS	-0.160	*	-0.214	**	-0.086		-0.091		-		-0.032		0.036		0.097		0.026	
	SOC	-0.027		-0.172	*	-0.139		-0.382	***	0.114		-		0.332	***	0.247	***	0.382	***
	Social Support																		
Significant	0.078		-0.050		0.183	*	-0.201	**	0.097		0.183	*	-		0.701	***	0.817	***	
Family	0.046		-0.087		0.073		-0.188	*	0.129		0.156	*	0.662	***	-		0.643	***	
Friends	0.015		-0.019		0.204	**	-0.202	**	0.14		0.233	**	0.822	***	0.623	***	-		

(a) above: men(n = 161), below: women(n = 210) \*: p < 0.05, \*\*: p < 0.01, \*\*\*: p < 0.001. BIS: body image satisfaction, SOC: sense of coherence, RE: restrained eating, EME: emotional eating, EXE: external eating. Significant: Significant others. (b) above: men(n = 226), below: women(n = 172). \*: p < 0.05, \*\*: p < 0.01, \*\*\*: p < 0.001. BIS: body image satisfaction, SOC: sense of coherence, RE: restrained eating, EME: emotional eating, EXE: external eating. Significant: Significant others.

**Table 4.** Multiple regression analysis with eating behaviors as the dependent variables.

			Restrained Eating				Emotional Eating				External Eating			
			Men		Women		Men		Women		Men		Women	
Austrian	Social Support	SOC	−0.215	**	−0.239	***	−0.227	**	−0.262	***	−0.222	**	−0.214	**
		Significant others	−0.005		0.191		−0.153		0.079		0.008		0.198	
		Family	−0.054		−0.043		0.052		−0.007		0.055		−0.059	
		Friends	0.127		−0.145		0.121		−0.028		−0.086		−0.157	
		Stress	0.076		−0.074		0.131		0.017		0.079		0.002	
	BIS		−0.206	*	−0.311	***	−0.039		−0.251	***	−0.206	**	−0.208	**
		R <sup>2</sup>	0.1		0.2		0.08		0.16		0.11		0.13	
Japanese			Men		Women		Men		Women		Men		Women	
	Social Support	SOC	−0.014		0.022		−0.187	*	−0.105		−0.150	*	−0.198	*
		Significant others	0.037		0.19		−0.061		−0.066		−0.006		0.078	
		Family	0.067		0.035		0.035		−0.075		0.164	†	−0.100	
		Friends	−0.136		−0.124		0.059		0.165		0.111		0.255	†
		Stress	0.005		−0.109		0.163	*	0.155		0.009		−0.032	
	BIS		−0.350	***	−0.158	*	−0.079		−0.195	*	−0.140	*	−0.097	
		R <sup>2</sup>	0.13		0.05		0.08		0.1		0.07		0.1	

\*\*\*:  $p < 0.001$ , \*\*:  $p < 0.01$ , \*:  $p < 0.05$ , † < 0.10. BIS: body image satisfaction, SOC: sense of coherence, Significant: Significant others.

#### 4. Discussion

The main findings of this study indicate that SOC and BIS pertain negatively to RE, EME, and EXE with the appearance of culture and gender differences. In particular, SOC negatively predicts RE, EME, and EXE, particularly in Austrian students. For Japanese students, the relationship between SOC and eating behaviors seems to be less pronounced.

Japanese students had higher scores for RE and EXE but did not differ in EME. Not all eating behaviors reflect disordered eating, *per se*, but some eating behaviors seem to be associated with occasional overeating and moderate overweightness, such as restrained and emotional eating [31]. High RE values do not differentiate between successful and unsuccessful restrained eaters [7,32]. Considering the higher percentage of underweight Japanese students, RE seems to be a highly and successfully practiced eating behavior in Japan, independent of SOC and social support. Only BIS predicts RE in Japanese students, whereas SOC seems to be a source of eating regulation, in addition to BIS, in Austrian students. However, considering the higher rate of overweight students in Austria, this regulation is less successful for Austrian students than for Japanese students. SOC predicted EME in both male and female Austrian students and in Japanese male students, but not in Japanese female students. In the Japanese student sample, BIS was a significant predictor in women but not men, and stress was another predictor of EME. EXE was related to SOC in both countries, and BIS helped predict EXE in Austrian men and women and Japanese men but not in Japanese women. Stress correlated negatively and SOC correlated positively with social support among Japanese women; however, both variables disappeared as predictors of eating behavior in Japanese women, and seemed to be coping resources.

A previous study with Dutch subjects found that being female and having a strong SOC, a flexible RE, and self-efficacy promoted healthy eating practices [33]. The work of Speirs et al. suggested that a higher SOC is expected to prevent unhealthy eating practices and foster healthy eating behaviors in children [14]. This study found that SOC tended to prevent unhealthy eating behaviors.

In this investigation of two cultures, we examined the association between SOC and eating behaviors, based on a salutogenic model. SOC indicates the extent to which an individual has a pervasive and enduring, yet dynamic, feeling of confidence that the environment is predictable and that things will work out as well as can reasonably be expected. SOC contains aspects of optimism and control and represents the ability to cope with stressful events and find them meaningful [15]. A previous study reported that a strong SOC may confer some resilience against chronic diseases [34]. The results of the present study suggest that a high SOC might prevent RE, EME, and EXE in Austrian subjects. In contrast, SOC affected EXE in Japanese men and women and EME in Japanese men. SOC and stress were strongly associated in Japanese students and had a more indirect association with eating behaviors. In Austrian students, SOC, stress and social support were weakly correlated, while SOC was more strongly correlated with eating behaviors.

A higher SOC has been reported to relate to less perceived stress and a lower stress response [35]. Some studies have reported that obesity and eating disorders are caused by stressful situations [36]. Controlling stress is therefore necessary to maintain healthy eating behaviors. Because the degree of stress affected EME in Japanese men in the present study, we suggest that improving SOC might be effective in reducing EME via stress reduction. Social support, as an external health factor resource, was not directly related to the three eating behaviors but was correlated with SOC in this study. Social support seems to be associated with eating behaviors via SOC-mediated effects. This finding is in line with the results of our previous study, which showed that eating behavior was associated with interpersonal relationships [37].

Overall, as expected, the results supported the hypothesis that SOC affects eating behaviors and overweight-related eating behaviors more directly in Austrian students, whereas SOC relates to stress reduction in Japanese students and indirectly relates to eating habits.

It is important to note that cultural and gender-based differences were observed between variables in this study. The obesity rate was lower in women than in men, and the desire to become slim



and RE were more prevalent in women than in men. Ideal body images are affected by cultural expectations, which often lead women to want to become thinner. Such a cultural context fosters restrained eating behaviors in women, and the degree to which women desire to become slimmer predicts RE. Conversely, the structure of the relationship between the desire to get slimmer and EME or EXE may differ by country and gender. In women, the desire to be slim was positively related to EME, while in Austrian and Japanese men, the desire to be slim was related to EXE. This result is in line with theories related to the DEBQ. Both EXE and EME are regarded as consequences of intense RE. Small positive differences between ideal and real body images were found among Japanese men, because young men are mainly concerned with gaining muscle rather than becoming slim [38]. Our results show that the highest rate of thinness was in Japanese women, and the desire to become slimmer might control EXE. These results support our previous findings [22].

A strength of this study is that it investigated a homogeneous group; all participants were university students. Additionally, all variables were investigated in their respective cultural groups using the same methodology in both Western and Asian countries [39].

However, this study had some limitations. First, we used one analogue scale to measure the degree of stress, to avoid a severe burden on the participants. A more sophisticated measure of stress should be used in future studies. A negative relationship was found between stress and resilience in Japanese students. In Austrian students, this negative relationship was weak and not significant. In Austria, the validity of the stress scale is insufficient. In the future, it is necessary to use a more validated stress scale and examine the relationship with eating behavior. Second, the national higher educational systems differ in these two cultures. For example, in Japan, approximately 50% of high school students enter a university after graduating high school, whereas Austria has a more flexible higher education system. This difference is reflected in the significant difference between the participants' mean ages, but these small age differences did not influence our results. Third, some limitations might be a result of different effects and the importance of social support. The work of Kim et al. reported that Asians and Asian-Americans are more reluctant to ask for support from others, but are more likely to use and benefit from forms of support that do not involve explicit disclosure [40]. Japanese female students' social support from family, friends and significant others was highly negatively correlated with stress, as with SOC, while in Austrians, this relationship was missing, although they endorsed receiving more social support. Another aspect contributing to the cultural differences might be response style differences between Japanese and Austrian students. The work of Harzing et al. showed that Asians preferred middle rather than extreme categories on rating scales, in comparison with Western respondents [41]. Using a coherent sample and harmonized measurements in both German and Japanese may have reduced this bias.

Despite these limitations, we conclude that SOC, BIS and stress are essential factors that regulate eating behavior in Japan and Austria, with a relationship to body weight. However, the relationships showed specific patterns. The relationships between SOC and eating practices in Austrian and Japanese populations must be further examined. Exploring these mechanisms will be relevant to fostering the development of programs to change eating behaviors, because culture is an important external resource for health promotion.

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## References

1. Kaplan, H.I.; Kaplan, H.S. The psychosomatic concept of obesity. *J. Ner. Ment. Dis.* **1957**, *125*, 181–201. [CrossRef] [PubMed]
2. Schachter, S. Some extraordinary facts about obese humans and rats. *Am. Psychol.* **1971**, *26*, 129–144. [CrossRef]
3. Herman, C.P.; Mack, D. Restrained and unrestrained eating. *J. Pers.* **1975**, *43*, 647–660. [CrossRef]
4. Polivy, J.; Herman, C.P. Dieting and bingeing: A causal analysis. *Am. Psychol.* **1985**, *40*, 193–201. [CrossRef]
5. Johnson, F.; Pratt, M.; Wardle, J. Dietary restraint and self-regulation in eating behavior. *Int. J. Obes.* **2012**, *36*, 665–674. [CrossRef]
6. Meule, A.; Vögele, C. The psychology of eating. *Front. Psychol.* **2013**, *4*, 215. [CrossRef]
7. Van Strien, T.; Engels, R.C.; van Staveren, W.; Herman, C.P. The validity of dietary restraint scales: Comment on Stice et al. (2004). *Psychol. Assess.* **2006**, *18*, 89–94. [CrossRef]
8. Van Strien, T.; Frijters, J.E.R.; Bergers, G.P.A.; Defares, P.B. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *Int. J. Eat. Disord.* **1986**, *5*, 295–315. [CrossRef]
9. Wallis, D.J.; Hetherington, M.M. Stress and eating: The effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite* **2004**, *43*, 39–46. [CrossRef] [PubMed]
10. Jonson, F.; Wardle, J. Dietary restraint, body dissatisfaction, and psychological distress: A prospective analysis. *J. Abnorm. Psychol.* **2005**, *114*, 119–125. [CrossRef] [PubMed]
11. Kliemann, N.; Beeken, R.J.; Wardle, J.; Johnson, F. Development and validation of the self-regulation of eating behaviour questionnaire for adults. *Int. J. Behav. Nutr. Phys. Act.* **2016**, *13*, 87. [CrossRef] [PubMed]
12. Eriksson, M.; Lindström, B.A. Salutogenic interpretation of the Ottawa Charter. *Health Promot. Int.* **2008**, *23*, 190–199. [CrossRef] [PubMed]
13. Freyer-Adam, J.; Gaertner, B.; Tobschall, S.; John, U. Health risk factors and self-rated health among job-seekers. *Public Health.* **2011**, *11*, 2–9. [CrossRef] [PubMed]
14. Borusiak, P.; Bouikidis, A.; Liersch, R.; Russell, J.B. Cardiovascular effects in adolescents while they are plying video games: A potential health risk factor? *Psychophysiology* **2007**, *45*, 327–332. [CrossRef] [PubMed]
15. Antonovsky, H.; Sagy, S. The development of a sense of coherence and its impact on responses to stress situations. *J. Soc. Psychol.* **1986**, *126*, 213–225. [PubMed]
16. Speirs, K.E.; Hayes, J.T.; Musaad, S.; VanBrackle, A.; Sigman-Grant, M. Is family sense of coherence a protective factor against the obesogenic environment? *Appetite* **2016**, *99*, 268–276. [CrossRef]
17. Bryant-Waugh, R.; Lask, B. Anorexia nervosa in a group of Asian children living in Britain. *Br. J. Psychiatry* **1991**, *158*, 229–233. [CrossRef]
18. Pike, K.M.; Borovoy, A. The rise of eating disorders in Japan: Issues of culture and limitations of the model of “Westernization”. *Cult. Med. Psychiatry* **2004**, *28*, 493–531. [CrossRef]
19. Agüera, Z.; Brewin, N.; Chen, J.; Granero, R.; Kang, Q.; Fernandez-Aranda, F.; Arcelus, J. Eating symptomatology and general psychopathology in patients with anorexia nervosa from China, UK and Spain: A cross-cultural study examining the role of social attitudes. *PLoS ONE* **2017**, *12*, e0173781. [CrossRef]
20. NCD Risk Factor Collaboration. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents and adults. *Lancet* **2016**, *387*, 1377–1396.
21. Littlewood, R. Commentary: Globalization, culture, body image, and eating disorders. *Cult. Med. Psychiatry* **2004**, *28*, 597–602. [CrossRef] [PubMed]
22. Kato, Y.; Roth, R. The Difference of Eating Behavior between Austrian and Japanese University Students. *J. Yasuda Women's Univ.* **2009**, *37*, 209–220.
23. Kanazawa, M.; Yoshiike, N.; Osaka, T.; Numba, Y.; Zimmet, P.; Inoue, S. Criteria and classification of obesity in Japan and Asia-Oceania. *Asia Pac. J. Clin. Nutr.* **2002**, *11*, 732–737. [CrossRef]
24. World Health Organization (WHO). Body Mass Index-BMI. 2019. Available online: <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi> (accessed on 31 May 2019).
25. Yamasaki, Y. SOC, a theory on salutogenesis and health promoting ability from newly developed view points for health. *Qual. Nurs.* **1999**, *5*, 825–832.

26. Singer, S.; Brähler, E. *The “Sense of Coherence Scale” Test Manual for the German Version*; Vandenhoeck & Ruprecht: Göttingen, Germany, 2014.
27. Imada, S. Psychological Studies about Eating Behavior (3): A Japanese version of the Dutch Eating Behavior Questionnaire (DEBQ). *J. Hiroshima Shudo Univ.* **1994**, *34*, 281–291.
28. Grunert, S.C. Ein Inventar zur Erfassung von Selbstaussagen zum Ernährungsverhalten. *Diagnostica* **1989**, *35*, 167–179.
29. Zimet, G.D.; Dahlem, N.W.; Zimet, S.G.; Farley, G.K. The multidimensional scale of perceived social support. *J. Pers. Assess.* **1988**, *52*, 30–41. [[CrossRef](#)]
30. Peterson, M.; Ellenberg, D.; Crossan, S. Body-image perceptions: Reliability of a BMI-based Silhouette Matching Test. *Am. J. Health Behav.* **2003**, *27*, 355–363. [[CrossRef](#)]
31. Macht, M.; Simons, G. Emotional Eating. In *Emotion Regulation and Well-Being*; Nyklicek, A., Vingerhoets, A., Zeelenberg, M., Eds.; Springer: New York, NY, USA, 2011; pp. 281–295.
32. Meule, A. Cultural Reflections on Restrained Eating. *Front. Psychol.* **2016**, *7*, 205. [[CrossRef](#)]
33. Swan, E.; Bouwman, L.; Hiddink, G.J.; Aarts, N.; Koelen, M. Profiling healthy eaters. Determining factors that predict healthy eating practices among Dutch adults. *Appetite* **2015**, *89*, 122–130. [[CrossRef](#)]
34. Surtees, P.; Wainwright, N.; Luben, R.; Khaw, K.T.; Day, N. Sense of coherence and mortality in men and women in the EPIC-Norfolk United Kingdom prospective cohort study. *Am. J. Epidemiol.* **2003**, *158*, 1202–1209. [[CrossRef](#)] [[PubMed](#)]
35. Urakawa, K.; Yokoyama, K.; Itoh, H. Sense of coherence is associated with reduced psychological responses to job stressors among Japanese factory workers. *BMC Res. Notes* **2012**, *5*, 247. [[CrossRef](#)] [[PubMed](#)]
36. Nishitani, N.; Sakakibara, H. Relationship of obesity to job stress and eating behavior in Men Japanese workers. *Int. J. Obes.* **2006**, *30*, 528–533. [[CrossRef](#)] [[PubMed](#)]
37. Kato, Y.; Hamasaki, T.; Sato, S.; Ando, Y. Relationship between the attitudes towards improving eating habits and prevalence of metabolic syndrome—Data from the 2005 National Health and Nutrition Survey and the Comprehensive Survey of Living Conditions. *Jpn. Soc. Public Health* **2014**, *61*, 385–395.
38. McCreary, D.R.; Sasse, D.K.; Saucier, D.M.; Dorsch, K.D. Measuring the Drive for Muscularity: Factorial Validity of the Drive for Muscularity Scale in Men and Women. *Psychol. Men Masculinity* **2004**, *5*, 49–58. [[CrossRef](#)]
39. Soh, N.L.; Touyz, S.W.; Surgenor, L.J. Eating and Body Image Disturbances Across Cultures: A Review. *Eur. Eat. Disord. Rev.* **2006**, *14*, 54–65. [[CrossRef](#)]
40. Kim, H.S.; Sherman, D.K.; Taylor, S.E. Culture and social support. *Am. Psychol.* **2008**, *63*, 518–526. [[CrossRef](#)]
41. Harzing, A.-W.; Brown, M.; Köster, K.; Zhao, S. Response style differences in cross-national research. Dispositional and situational determinants. *Manag. Int. Rev.* **2012**, *52*, 341–363. [[CrossRef](#)]



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