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Psychological workload and body weight: is there an association? A review of the literature

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Background	According to Karasek's Demand/Control Model, workload can be conceptualized as job strain, a combination of psychological job demands and control in the job. High job strain may result from high job demands combined with low job control.
Aim	To give an overview of the literature on the association between obesity and psychological workload.
Method	We carried out a review of the associations between psychological workload and body weight in men and women. In total, 10 cross-sectional studies were identified.
Results	The review showed little evidence of a general association between psychological workload and body mass index. Only weak positive associations were found, and only between elements of psychological workload and overall body weight. For body fat distribution, two out of three studies showed a positive association in men, but the associations became insignificant after adjustment for education. For women, there was no evidence of a consistent association.
Conclusion	The reviewed articles were not supportive of any associations between psychological workload and either general or abdominal obesity. Future epidemiological studies in this field should be prospective or experimental, and should examine how chronic work stress affects eating and to what extent initial body weight is a predictor for individual differences in perceived psychological workload.
Key words	Body mass index; body weight; job control; job demands; job strain; psychological workload; review; waist hip ratio.
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Introduction

The health of people who work is generally better than that of people who do not work [1]. However, the experience of the burden of workload may, in itself, or via unhealthy behaviours, lead to adverse health outcomes, including weight gain.

Improved organization might reduce pressure and pace of work, whilst working in smaller teams may give a better overview of the work and fewer interruptions [1]. Such small teams may increase influence and allow a deeper understanding of the job. In 1979, Karasek introduced his Job Demand/Control Model [1]. According to this model, high work stress is conceptualized by high job strain, a combination of high psychological job demands and low influence in the job. According to Karasek's psychological demands and decision latitudes model, job strain was divided into four categories: high-strain jobs, low-strain jobs, active jobs and passive jobs.

The model is based on psychological demands of work, skill use and task control.

Psychological job demands refer to quantitative workload, such as pace of work, time pressure, speed in work, attention and concentration in work [1]. Decision latitude refers to a person's ability to control or exert influence over work activities. It consists of a combination of skill

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discretion and decision authority. Skill discretion is the variety of tasks given as a possibility to keep learning new things, and the expertise to take initiatives. Decision authority is the freedom to make decisions in the job [1]. In most studies, data on psychological workload comes from questionnaires. Since Karasek introduced his Job Demand/Control Model [1] as a tool for measuring workload, a number of studies have shown associations between psychological workload and an increase in cardiovascular risk factors [2–11]. Only a few cross-sectional studies have addressed the issue of body weight and psychological work conditions in different work groups, such as hospital personnel, school teachers, bus drivers, subway drivers, fabric workers, bank personnel, and those who work in private insurance companies, and public and semi-public organizations [2–7,10–15].

In this context, women in certain jobs, such as nursing and teaching, have been found to react to work stress by changing food intake in different ways. Greeno and Wing [16] discussed acute and chronic stressors within the specific topic of stress and eating. The Individual-difference Model indicates that there are two ways in which stress may influence eating, resulting in either eating or not eating [16].

Additionally, reactions may depend on gender. Greeno and Wing [16] compared obese and normal-weight men and women to determine whether their eating was affected by stress, and found that women were more prone to stress-induced eating than men.

The present paper gives an overview of results from the literature on obesity and psychological workload.

Methods

A systematic search was carried out using Medline from 1966 onwards and PsycINFO from 1989. Furthermore, sociological periodicals were screened for abstracts from the period 1986–2001.

Medical Subject Headings, or MESH terms, were used in a combined search by means of the Boolean operators AND/OR/NOT. The search included different MESH words about work conditions in combination with MESH words on body weight and weight change. The MESH words were: working conditions OR workload OR work/job stress OR job strain (work demand/work control) OR job influence OR job satisfaction OR occupational status OR work schedule tolerance AND body weight OR weight OR weight change OR weight gain OR BMI OR weight cycling OR obesity.

Results

Fifty-seven international original articles were identified. Some articles used the anthropometrics measure body mass index (BMI), others waist hip ratios (WHR). In total, 10 articles fulfilled the criteria and reported results for associations between psychological workload and body weight.

In general, the associations between job strain and general obesity as well as abdominal obesity were inconsistent [2–5,7,10,12,14,15,17]. One study only examined associations between change in BMI and simultaneous change in psychological workload [17]. However, to our knowledge, no true prospective studies, examining the association between psychological workload and subsequent weight change, have been carried out.

Associations between psychological workload and BMI in men

In total, eight studies have examined associations between elements of psychological workload and body weight in men, as shown in Table 1. Most of the studies have examined associations between BMI and job demands, job latitudes and job strain, and generally associations were found to be insignificant. For instance, among the six studies examining associations between BMI and job latitudes, only one found a significant positive association [12]. One out of seven studies found a significant association between BMI and objective job strain [4].

In 1986, Kornitzer and Kittel [10] were among the first to examine associations between job stress and coronary risk factors, including BMI, in men. They used data from two cohort studies in Belgium starting in 1965. The data included information on psychological workload and measured weight and height among a total of 3179 middle-aged males. They found no association between psychological workload and BMI.

Netterstrøm *et al.* [4], using data from the Danish WHO Monica project, observed that objective but not subjective job strain, based on a score for job classification defined by Karasek's Job Demand/Control Model, was significantly associated with BMI. A total of 1504 employed men and 1209 employed women participated in this cross-sectional study. Questionnaires on working, social- and health conditions were filled in by all participants, who also undertook a clinical examination, and they were subsequently classified into two workload groups: high versus low job demands.

Finally, Georges *et al.* [12], who examined data from the HHANES survey, found a borderline significant association ($P = 0.057$) between BMI and job demands. In this study, occupational data were available from a total of 1377 Hispanic men. The anthropometric data recorded were obesity, measured as BMI, and central body fat distribution, measured as WHR. The relative sample weight, i.e. the individual weight divided by mean sample weight, was also used. The occupational data were recorded according to Karasek's job characteristics:

Table 1. Cross-sectional studies: workload men–overall obesity

Study ref.	*n*	Population	Measurement of obesity	Adjustment	Association with obesity and psychological job demands	Association with obesity and job latitudes (skill discretion and decision authority)	Association with obesity and job strain
[10]	3179	White collar worker/banker	BMI[a]	No			NS
[12]	1377	Adult hispanic	BMI[a]	Age, smoking	NS ($P = 0.057$)	NS	NS
				Age, smoking, education	+ ($P = 0.01$)	+ ($P = 0.046$)	+ ($P = 0.027$)
[4]	748	Employed	BMI[b]	Age, sex[c]			NS
				Age, sex[d]			+ ($P < 0.001$)
[2]	1872	Employed	BMI[a]	No	NS	NS	NS
				Age, demography, work condition, education	NS	NS	NS
[17]	258	Employed	BMI[a]	No	NS	NS	NS
				Age, demography, work condition, physical activity, education	NS	NS	NS
[3]	746	Employed	BMI[a]	No			NS
				Age			NS
[7]	58	Schoolteachers	BMI[a]	No		NS	
[14]	3531	White collar workers	BMI[a]	No	NS	NS	NS
				Age, personality, social support, physical activity, education	NS	NS	NS

+, positive association; NS, no significant association.

[a]Measured.

[b]Self-reported.

[c]Subjective assessed psychological workload.

[d]Objective assessed psychological workload.

psychological demands and decision latitudes within skill decision and decision authority. The authors hypothesized that men in high-strain jobs would be more obese than others. The association for job latitudes and job strain were insignificant. After adjustment for education the findings showed significant associations for job strain within the elements of both job demands and job latitudes.

In contrast, other studies demonstrated no associations between job control/job demands/social support or job strain. Thus, in 1997, Hellerstedt and Jeffery [2] studied associations between job strain and health behaviours, including BMI, among 3843 male workers. No significant associations between job strain and BMI could be detected, although Karasek's job content instrument was used and the study represented 32 worksites and a variety of workers.

Likewise, Brisson *et al.* [14], in a Canadian cross-sectional study, were unable to find any associations between psychological job factors such as job strain and BMI. In addition to 3464 women, this large sample consisted of 3531 men employed as white collar workers in 21 organizations. Psychological demands and decision latitudes at work were measured using Karasek's 18-item questionnaire. Also, Kornitzer and Kittel [10], Steptoe *et al.* [7] and Jönsson *et al.* [3] were unable to find significant associations between psychological job stress and BMI in men.

Only one study [17] attempted to describe associations between simultaneous change in job strain and change in body weight. This study used two cross-sectional samples with overlap of participants from one cross-sectional sample to another, examining subgroups 3–4 years apart. Rather than examining associations in a strictly prospective manner, the authors explored associations in a cross-sectional fashion; and possible associations between psychological job strain at baseline and subsequent body weight change from time 1 to time 2 were not analysed. Participants were men, aged 30–60 years, from nine public and private worksites in New York City. In total, 285 completed questionnaires in 1988–1991 and 202 males participated in 1991–1995. Neither of the cross-sectional analyses showed significant associations between psychological workload and body weight.

After an average of 3.1 years of follow-up results in 1988 to the measurements in 1991, there was an increase in job decision latitudes, but changes in job characteristics were not associated with simultaneous changes in body weight.

For these six reviewed studies where no associations

Table 2. Cross-sectional studies: workload women–overall obesity

Study ref.	*n*	Population	Measurement of obesity	Adjustment	Obesity–workload association:		
					Job demands	Job latitudes	Job strain
[4]	756	Employed	BMI[b]	Age, sex[c]			NS
				Age, sex[d]			$P < 0.001$
[5]	56	Hospital personnel	BMI[b]	No			– ($P < 0.05$)
[2]	1971	Employed	BMI[a]	No	NS	+ ($P < 0.05$)	+ ($P < 0.05$)
				Age, demography, work condition, education	+ ($P < 0.005$)	NS	NS
[13]	33 689	Nurses	BMI[b]	No			– ($P < 0.005$)
	13 268	Excluded nurses		Age, demography, work conditions, smoking, physical activity, alcohol status, education			– ($P < 0.005$)
[3]	872	Employed	BMI[a]	No			NS
				Age			NS
[7]	98	School teachers	BMI[a]	No		+ (P 0.010)	
[14]	3464	White collar workers	BMI[a]	No	NS	NS	NS
				Age, personality, social support, physical activity, education	NS	NS	NS

+, positive association; NS, no significant association; –, negative (inverse) association.

[a]Measured.

[b]Self-reported.

[c]Subjective assessed psychological workload.

[d]Objective assessed psychological workload.

were found, the analyses were adjusted for age, demography, work conditions and education. However, both crude and adjusted analyses gave insignificant associations between BMI and psychological workload.

Associations between psychological workload and BMI in women

As indicated in Table 2, only two out of seven studies found that women with high job strain had higher BMI than other women [2,4]. In one of the larger studies [2], a positive association between overall obesity and high-strain work within the elements of job strain and job latitudes was found. After adjustment for age, demography, work condition and education the associations for job strain and job latitudes disappeared, but the association between psychological job demands and BMI became significant. In addition, Netterstrøm *et al.* [4] found positive associations between objective, but not subjective job strain, and BMI in women. In the study of Steptoe *et al.* [7], a significant association between job latitudes and BMI was found among female school teachers.

These results are contrasted by findings by both Amick *et al.* [13] and Theorell *et al.* [5], who reported inverse associations. However, associations between psychological workload and body weight were not the primary focus of these studies. The study by Amick *et al.* [13] included participants from the American Nurse Health Study from 1998, and showed that nurses with high-strain job had a slightly lower BMI than those with low-strain job. About 33 689 nurses were included in this study, and nurses returned questionnaires including Karasek's job content questions and the SF-36 measured health status.

The study by Theorell *et al.* [5] included a sample of 56 female hospital personnel in Sweden, who gave answers to a standardized questionnaire about psychological job demands and decision latitudes.

In the Swedish Monica Project [3], using information from postal questionnaires, clinical measures of height, weight and waist to hip circumference among 872 females were taken. No associations between low job strain and overall obesity were found. The large Canadian study from Brisson *et al.* [14] also found no associations between psychological job strain and BMI. As for the men, adjustment for age, personality, social support, physical activity and education only altered associations marginally.

Associations between psychological workload and waist hip ratio in men and women

In total, three studies [3,7,12] have addressed the

Table 3. Cross-sectional studies: workload men and women–abdominal obesity

Study ref.	*n*	Population	Measurement of obesity	Adjustment	Obesity–workload association:		
					Job demands	Job latitudes	Job strain
Men							
[12]	1377	Adult Hispanic	Age, smoking	Waist circumference	+ ($P < 0.055$)	+ ($P < 0.003$)	+ ($P = 0.036$)
			Age, smoking	Education		NS	NS
[3]	746	Employed	Age	Waist and hip circumference			+ ($P = 0.025$)
[7]	58	School teachers	Age, weight	Waist circumference		NS	
Women							
[3]	872	Employed	Age	WHR			NS
[7]	98	School teachers	Age, weight	Waist circumference		+ ($P < 0.017$)	

+, Positive association; NS, no significant association.

question of associations between psychological workload and abdominal obesity. Georges *et al.* [12] were the first to examine the relationship between psychological job strain and body fat distribution in a sample of Hispanic males, who answered a questionnaire on job stress. The anthropometric measurements recorded were obesity, measured as BMI, and central body fat distribution, measured as WHR. The occupational data consisted of Karasek's job characteristics. Georges found that men with a high-strain job had a more central body fat distribution than men with low job strain. Also, the other elements of job strain, job demands and job latitudes were found to be significantly associated with abdominal obesity. However, after adjustment for education the findings became insignificant.

In the study of Jönsson *et al.* [3], associations between psychological job strain and the WHR were found to be significant in men, even if associations between BMI and either job demands or job latitudes were found to be insignificant.

In women, on the other hand, only one out of two studies have found a significant association between job latitudes and WHR. With regard to associations between abdominal obesity and job demands or job latitudes, these associations were not significant for either men or women.

Finally, Steptoe *et al.* [7] examined associations between psychological workload assessed by Karasek's questionnaire and WHR for both men and women. In these studies, 58 male and 98 female school teachers participated. The associations were positive and significant for women, but not for men [7].

Discussion

Main findings

This review includes information from 10 published cross-sectional studies addressing the question of whether an association between psychological workload and body weight or fat distribution exists. For men, in general, no evidence for an association between BMI and psychological workload was found, since only weak and inconsistent associations between elements of psychological workload and overall body weight were indicated.

The few positive associations between single elements of psychological workload in general and BMI found in men [4,12] were seen in the smaller studies only. In contrast, in the larger of the studies [2,10,14,17], no associations between psychological workload and BMI were found for the male workers. Similarly, among the seven cross- sectional studies that included women, the evidence for an association was not suggestive.

For body fat distribution, two of three studies found significant association between WHR and psychological workload in men [3,12], but results changed for one of these studies after adjustment for education. Hence, results are inconsistent and not generally suggestive of an association.

Similarly, in women, results are inconsistent and not supportive of an association.

The lack of agreement from the different studies may depend on several factors. First, in some of the studies the associations between workload and BMI was not the primary focus. Secondly, since the working population is healthier than the general population, it is possible that the variation in BMI was too small to detect consistent associations. Thirdly, in the two studies of Theorell *et al.* [5] and Amick *et al.* [13] showing the inverse significant association between job strain and BMI in women, the BMI measure was self-reported, and may not be valid.

Finally, in the study of Netterstrøm *et al.* [4], the authors suspected that the discrepancy between results from the subjective and objective classification of workload might have resulted from selection bias, since, contrary to expectations, nurses and teachers placed their

subjective measurements in the highest workload group. It appeared that the congruence for the classification between the two groups of workload was low. Hence, in some of the studies, the internal validity may have been low.

Psychological workload and BMI among men and women

According to Karasek, workload/job strain is defined by its two parameters—job demands and job latitudes. In most studies included in this review, both job demands and job latitudes were measured, but associations with obesity were inconsistent and different for men and women. This is evident from the present review and exemplified by the findings from a Swedish study [18], where strain, measured as the experience of overtime, was found to be a stressor for women, but in men it turned out to be a protector against stress. It is possible that a difference to the response to job strain may translate to obesity in different ways in men and women, but the evidence is not substantial.

Psychological workload and WHR among men and women

An association between elements of job strain and abdominal obesity was found in two of three studies in men, even if it is not stable after the inclusion of education as a covariate. Rosmond and Björntorp [19] have proposed that middle-aged Swedish men may have a higher cortisol level in relation to perceived stress, and that this, in turn, may lead to increased visceral obesity. However, more research is needed to address this issue.

Level of education may be related to the experience of job strain and hence may influence the association with both BMI and WHR. However, no clear trend in results could be detected, whether education was included as a covariate or not. Residual confounding from education is likely to play a role in the discrepancy of the results.

Stress-induced eating and weight change

A number of studies have suggested that a stressful job may promote unhealthy behaviours and that such behaviours are different for men and women [15,18]. According to Greeno and Wing [16] some women may react to stress by overeating, which subsequently leads to a high BMI. For instance when feeling stressed more women than men seem to react by overeating. On the other hand, men may increase alcohol use when feeling overloaded [20]. Results from cross-sectional studies suggest that women experience work stress more often than men [15,16,18]. Women may have lower job control than men, because work stress may be moderated by different factors, for instance intrinsic stress reactivity, in men and women.

However, it has also been proposed by Greeno and Wing [16] that some normal-weight individuals decrease their eating when stressed, while others increase eating. On the other hand, eating by obese individuals seems unaffected by stress [16]. Greeno and Wing's Individual-difference Model indicates that eating habits will separate obese from normal-weight people in their response to stress. Hence, the fact that there was only marginal support of an association between psychological workload and obesity may be due to different eating patterns among normal-weight individuals and obese individuals in relation to stress. It may also be possible that some occupations may attract overweight/obese individuals and may stimulate continued weight gain.

Limitations

It is important to notice that a number of the revised studies may not have had sufficient power to detect associations, and that larger numbers or data sets with objectively measured workload may have given different, or more significant results. However, the studies reviewed were generally large, and the one study that did include objectively measured workload [4] was not suggestive of an association.

Future research

All studies included in this review were cross-sectional, and hence there is no possibility of assessing a directional relationship between psychological workload and BMI. Results were generally inconsistent, but prospective observational studies may give clearer results. Hence, longitudinal studies are needed to address the question of whether psychological workload has consequences for subsequent weight gain. Such studies should preferably provide information not only on type of workload, but also on intensity and duration of workload in relation to body weight and weight change. Furthermore, more in-depth studies examining how chronic work stress affects eating habits are needed, in order to understand why increased work stress might lead to a decrease in BMI for some women and an increase in BMI for other women.

Most studies reviewed, even if cross-sectional, were focused on assessing the unidirectional relation between high psychological workload and obesity based on the assumption that high workload would lead to obesity and not vice versa. Hence, future research may address whether, in prospective analysis, initial body weight is a predictor of individual differences in perceived psychological workload or even stress-induced eating. Finally, other lifestyle factors may influence coping with a high psychological workload and modify the expression of such workload on the development of obesity. Physical activity is one such potential effect modifier—subjects

who are physically active may find it easier to cope with the same high workload than people who are inactive. Finally, a familial predisposition to obesity may make certain subjects vulnerable to weight gain when exposed to high job strain.

Conclusion

We reviewed the available published literature on associations between psychological workload and obesity. In total, 10 papers were retrieved which, in general, were not supportive of an association between psychological workload and either general obesity or abdominal obesity.

Future longitudinal studies taking type, duration and intensity of psychological workload into account are needed.

References

1. Karasek R, Theorell T. *Healthy Work—Stress, Productivity and the Reconstruction of Working Life*. New York: Basic Books, 1990; 1–381.
2. Hellerstedt WL, Jeffery RW. The association of job strain and health behaviors in men and women. *Int J Epidemiol* 1997; **25:** 575–583.
3. Jönsson D, Rosenberg A, Dotevall A, Lappas G, Wilhelmsen L. Job control, job demands and social support at work in relation to cardiovascular risk factors in Monica 1995, Göteborg. *J Cardiovasc Risk* 1999;**6:**379–385.
4. Netterstrøm B, Kristensen TS, Damsgaard MT, Olsen O, Sjøl A. Arbejdsbelastning og kardiovasculære risikofaktorer. *Ugeskr Laeger* 1993;**155:**1206–1210.
5. Theorell T, Ahlberg-Hulten G, Jodko M, Sigala F, De la Torre B. Influence of job strain and emotion on blood pressure in female hospital personnel during workhours. *Scand J Work Environ Health* 1993;**19:**313–318.
6. Steptoe A, Cropley M. Persistent high job demands and reactivity to mental stress predict future ambulatory blood pressure. *J Hypertens* 2000;**18:**581–586.
7. Steptoe A, Cropley M, Griffith J, Joekes K. The influence of abdominal obesity and chronic work stress on ambulatory blood pressure in men and women. *Int J Obes* 1999;**23:**1184–1191.
8. McCann BS, Warnick GR, Knopp RH. Changes in plasma lipids and dietary intake accompanying shifts in percieved workload and stress. *Psychosom Med* 1990;**52:**97–108.
9. Undén A, Orth-Gomér K, Elofsson S. Cardiovascular effects of social support in the work place: twenty-four-hour ECG monitoring of men and women. *Psychosom Med* 1991;**53:**50–60.
10. Kornitzer M, Kittel F. How does stress exert its effects—smoking, diet and obesity, physical activity? *Postgrad Med J* 1986;**62:**695–696.
11. Weidner G, Boughal T, Conner SL, Mendell NR, Pieper C. Relationship of job strain to standard coronary risk factors and psychological characteristics in women and men of the family heart study. *Health Psychol* 1997;**16:**239–247.
12. Georges E, Wear ML, Mueller WH. Body fat distribution and job stress in Mexican–American men of the Hispanic Health and Nutrition Examination Survey. *Am J Human Biol* 1992;**4:**657–667.
13. Amick B, Kawachi I, Coakley EH, Lemer D, Levine S, Colditz G. Relationship of job strain and iso-strain to health status in a cohort of women in the United States. *Scand J Work Environ Health* 1998;**24:**54–61.
14. Brisson C, Larocque B, Moisan J, Vézina M, Dagenis GR. Psychological factors at work, smoking, sedentary behavior, and body mass index: a prevalence study among 6995 white collar workers. *J Occup Environ Med* 2000;**42:**40–46.
15. Cheng Y, Kawachi I, Coakley EH, Schwartz J, Colditz G. Association between psychosocial work characteristics and health functioning in American women: prospective study. *Br Med J* 2000;**320:**1432–1436.
16. Greeno C, Wing RR. Stress-induced eating. *Psychol Bull* 1994;**115:**444–464.
17. Landsbergis PA, Schnall PL, Deitz DK, Warren K, Pickering TG, Schwartz JE. Job strain and health behaviours: results of a prospective study. *Am J Health Promot* 1998;**12:**237–245.
18. Krantz G, Östergren P. Common symptoms in middle aged women: their relation to employment status, psychosocial work conditions and social support in a Swedish setting. *J Epidemiol Community Health* 2000;**54:**192–199.
19. Rosmond R, Björntorp P. Occupational status, cortisol secretory pattern, and visceral obesity in middle-aged men. *Obes Res* 2000;**8:**445–450.
20. Vasse RM, Nijhuis FJN, Kok G. Associations between work stress, alcohol consumption and sickness absence. *Addiction* 1998;**93:**231–241.