



## **Editorial**

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### **Does higher energy intake explain weight gain and increased metabolic risks among shift workers?**

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## *Does higher energy intake explain weight gain and increased metabolic risks among shift workers?*

Working in shifts, especially if night shifts are included, is associated with many adverse health effects varying from gastrointestinal disturbances to cardiovascular diseases, metabolic syndrome, and type 2 diabetes (1–4). The exact mechanisms for these associations are not firmly established (5). Short-term sleep restriction is known to induce insulin resistance and, for example, disturbances in fat metabolism (6), and shift workers are known to suffer from sleep loss. It is plausible that lifestyle factors related to shift work play a role as well. The accumulation of body fat leading to overweight and obesity is one of the key factors behind the development of metabolic disturbances in general population, and we can assume it to be so also among shift workers (7). There seems to be even a dose–response association, with an increasing trend in weight with increasing duration of shift work (8). But what exactly is it in shift work that predisposes those who do it to weight gain? And can we do something about it?

In their systematic review of longitudinal studies, Van Drongelen et al (9) found a strong evidence for a crude association between shift work exposure and body weight increase; however the confounder-adjusted associations were found to be inconclusive. This indicates that it is not shift work per se but other factors related to or associated with shift work that lead to body fat accumulation.

On the other hand, in a recent systematic review, Bonham et al (10) concluded that energy intake does not differ between day and shift workers, and suggest that other factors such as circadian misalignment, meal timing, food choice and diurnal variation of energy metabolism at night may be responsible for the increased rates of obesity observed among shift workers. In general, only minor differences in nutrient intake between day and shift workers have been identified, and the results have been somewhat conflicting. It has been suggested that shift workers have more eating events per day than day workers (11), and it seems that shift workers make more unfavorable food choices than day workers do, preferring snack foods and sugary drinks (11, 12). In a recent study, shift working men were less likely to consume vegetables and fruits daily and women had higher intake of saturated fat compared with day workers (13).

In a paper by Hulsegge et al (14) in this issue, shift workers were found to have a higher energy intake than day workers (56 kcal/d) and a slightly higher consumption of grains, dairy products, meat and fish and lower consumption of cakes and biscuits. No difference in savory snacks, sweets, soft drinks or juices were found. The difference in energy intake was largest for shift workers with  $\geq 5$  night shifts/month, who consumed 103 kcal/d more than day workers. The authors conclude that shift and day workers' dietary quality is the same, but suggest that a higher energy intake among shift workers may be one of the causes of shift-work-induced overweight, obesity, and other adverse health outcomes; a reasonable suggestion if we acknowledge as fact that overweight indeed develops as a result of positive energy balance.

The study included a relatively large population-based sample of 683 and 7173 shift and day workers, respectively from the original cohort of 40 010 men and women. The analyses were cross-sectional, with dietary data collection based on a 178-item semi-quantitative food frequency questionnaire for the past year diet and retrospective data collection on work schedule 14–20 years earlier. The analyses were adjusted for several confounders, including age, sex, smoking, physical activity, and body mass index (BMI). No differences were presented for clinical risk factors, except that shift workers had slightly higher BMI compared with day workers. BMI is a crude measure of body adiposity, but does not tell anything about the actual body size, which is the most important predictor of energy expenditure (15). Due to the study's cross-sectional study design, we do not know if the workers were eating more calories because

they had higher BMI or if they had higher BMI because they were eating more calories. Furthermore, level of physical activity was estimated with a short questionnaire, including one question about type of work (sedentary, standing, physical, or heavy manual). This simple categorization may not be able to fully adjust for differing energy needs in different occupations.

Therefore, Hulsege et al's conclusion that "...future studies need to confirm that shift workers indeed have a higher energy intake than day workers independent of energy requirements" is justified. Another important point in future studies is to use reliable and valid methods for dietary data collection. A review by Lowden et al (16) evaluated the results of shift workers' dietary intake studies since 1967. They highlighted several shortcomings of dietary studies among shift workers, including unreliable methods used for nutrition research.

Shift work can change food timing while a healthy diet can be difficult to maintain especially if the facilities for eating outside the normal working hours are not well organized and healthy food choices are not available. Having catering services in worksites may be associated with healthier eating habits (17). If and when food frequency questionnaires are used, they should specifically be designed to capture the typical nutritional features in shift work, such as the irregularities in dietary patterns. Food diaries collected for a sufficient number of days can still be regarded as the most reliable way of collecting data on both the pattern and composition of diet. They are not bound by fixed food items, dish compositions, and portion sizes but allow free, real-time recording of meals and snacks, without the need for retrospection and food-item classification.

Can we improve shift worker's diet? Nutrition advice should be a standard part of the shift workers' lifestyle counselling in occupational healthcare and the obligatory health check-ups demanded by national legislation in many countries (18). Whether or not shift work in general predisposes individuals to poor food choices or increased energy intake is not definitively proven. Either way, every shift worker should be considered individually and lifestyle counselling based on personal situation and estimation of individual risk factors for metabolic and other chronic diseases should be provided.

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