Lifestyle interventions for obese women before and during pregnancy: The effect on pregnancy outcomes
Ruifrok, A.E.

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Does body mass index influence sick leave before, during and after pregnancy?
Does body mass index influence sick leave before, during and after pregnancy?

A.E. Ruifrok
S.G.M. Stomp-van den Berg
W. van Mechelen
B.W.J. Mol
C.J.M. de Groot
M.N.M. van Poppel

Submitted
Abstract

Objective
To evaluate the relationship between body mass index (BMI) and sick leave before and during pregnancy, as well as one year postpartum.

Methods
We studied employed pregnant women (n=490) with the intention to return to work after maternity leave. Pre-pregnancy BMI and BMI at the end of pregnancy were based on self-reported data. The number of sick leave days due to all causes one year before and during pregnancy and one year postpartum was assessed from company sick leave registrations. Sick leave was dichotomised in two ways: no sick leave versus any sick leave, and sick leave <11 days versus sick leave ≥11 days. Logistic regression analyses were performed to determine the association between BMI groups and sick leave, adjusted for age, parity, hours worked and type of work.

Results
The risk of pre-pregnancy sick leave was significantly higher in obese women compared to normal weight women (OR 2.8, CI 1.4 to 5.8, p=0.006). The risk of sick leave during pregnancy was significantly higher in overweight women compared to normal weight women (OR 2.0, CI 1.2 to 3.3, p=0.01). In the year postpartum no significant statistical differences were found.

Conclusion
We found an increased risk for pre-pregnancy sick leave and sick leave during pregnancy for obese and overweight women, respectively. Sick leave should be included in cost-effectiveness studies of interventions for weight reduction in pregnancy.
**Introduction**

Worldwide, women of childbearing age are a vital part of the working population. During pregnancy and after childbirth, women can experience a myriad of physical and mental health problems that can interfere with their ability to work,

and sick leave in this period is common. In pregnancy, between 51% to 75% of pregnant women report any sick leave.

Also in the postpartum period, many women take sick leave. A Dutch study described that 29% of working women were absent due to health problems for two weeks or more immediately after maternity leave, which is 12-16 weeks postpartum in the Netherlands.

Important reasons for sick leave during pregnancy and postpartum are pregnancy complications, fatigue, musculoskeletal disorders and mental health problems. Overweight and obesity are related to many of these health problems.

Obesity is also associated with an increased risk of obstetrical, maternal and foetal complications.

Many studies have investigated the association between obesity status and sick leave not during pregnancy. The results indicate that obese employees have an increased risk of sick leave compared to normal weight employees, especially long-term sick leave.

Given the association between obesity and pregnancy complications and obesity and sick leave in general, one might expect that obese pregnant women would have an increased risk of sick leave. However, to date, the relationship BMI index and sick leave in pregnant women has not been investigated. In this paper we evaluate the effect of BMI on sick leave one year before pregnancy, during pregnancy and one year postpartum.

**Methods**

**Study design**

Data from the Mom@Work study were used. In this study, participants were followed from the moment that they submitted the request for maternity leave until 52 weeks postpartum, from January 1, 2004 till March 31, 2006. Data from this study were used to analyse the relationship between BMI and sick leave before, during, and after pregnancy. The Medical Ethics Committee of VU University Medical Centre at Amsterdam, The Netherlands approved the study design, study protocol, and informed consent procedure. Participants received five questionnaires during the course of the study. The first questionnaire was sent at baseline (around 16 weeks of gestation), and the last questionnaire at 52 weeks postpartum.

**Participants**

The trial consisted of pregnant women without BMI restrictions. A complete description of the inclusion and exclusion criteria have been published in Stomp-van den Berg et al.

The recruitment procedure consisted of two steps: 1) recruitment
of companies; and 2) recruitment of pregnant workers within these companies. For practical reasons, recruitment was aimed at large companies with a predominantly female workforce. Based on reports of higher sick leave rates before and after maternity leave in the health care sector (2), health care providers (e.g. hospitals, home health and occupational health service companies) were over-sampled. Within each participating company, the recruitment procedure was initiated by the human resource departments. When pregnant workers submitted requests for maternity leave, they received an information package about the study. If a woman returned a completed ‘yes’ response card, then researchers contacted her to verify eligibility, obtain informed consent and conduct the baseline measurement.

All participants were between the ages 18 and 45 with a minimum employment of 12 hours per week and intending to return to work after maternity leave. For this paper, we excluded women with a twin pregnancy from the analyses.

Sick leave
Sick leave data were provided by occupational health service providers (OHSP) or companies. In The Netherlands, every pregnant employee has the right to receive paid maternity leave, also called pregnancy and delivery leave. The total duration of this leave is 16 weeks, divided over four to six weeks before the expected delivery date and 10–12 weeks thereafter. Pre-pregnancy sick leave was measured one year before the start of pregnancy. Sick leave during pregnancy was measured from the start of pregnancy until the start of maternity leave (on average a period of 35 weeks). Sick leave one year postpartum was measured from the end of maternity leave until one year after delivery.

BMI
In the baseline questionnaires women were asked about their pre-pregnancy weight and height. Six weeks postpartum, they reported their weight at the end of pregnancy and current weight. At 52 weeks postpartum, they also reported their current weight. BMI was calculated as weight (kg)/height$^2$ (m). BMI was divided using the WHO criteria; underweight (<18.5 kg/m$^2$), normal weight (≥18.5 - 25 kg/m$^2$), overweight (≥25 - 30 kg/m$^2$) and obese (≥30 kg/m$^2$).

Covariates
Race/ethnicity was derived from the country of birth of the participant’s parents. An individual was considered to be white European if both parents were born in Europe. Gestational age at delivery was self-reported.

Statistical analysis
The maternal characteristics of the study are presented as means and standard deviations for continuous variables, and as percentages for ordinal variables.
For the outcome sick leave, standard logistic regression analysis was used to test the association with BMI. Two ways of dividing episodes of sick leave were used. In model 1 ‘no sick leave’ (0 calendar days) was compared to ‘any sick leave’ (≥1 calendar days). Model 2 compared ‘short-term’ sick leave (0-10 calendar days) to ‘longer-term’ sick leave (≥11 calendar days). The division < versus ≥11 calendar days was chosen to compare women in the upper quartile of sick leave with women in the other quartiles. Regression models were controlled for age, parity, hours worked per week and predominant type of work.

All analyses were performed using SPSS 20.0 (Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL, USA) for windows, and the level of significance was set to <0.05.

Results

Baseline characteristics
A total of 598 women working at 15 different companies were included in the study. Of these women, 527 completed both baseline and late pregnancy data collection. Data on BMI and sick leave were available for 490 women with a single pregnancy, and these women comprised the study sample for the analyses. The baseline characteristics of the study population are presented in Table 1.

BMI and Sick leave
BMI and sick leave data are presented in Table 1. The average BMI pre-pregnancy was 23.8 kg/m² (SD 3.8), of which 3.7% (N=18) underweight, 64.9% (N=318) normal weight, 24.5% (N=120) overweight and 4.9% (N=34) obese women. The average weight increase during pregnancy was 14 kg (SD 5.7). BMI at the end of pregnancy increased to an average of 28.7 kg/m² (SD 4.0). One year postpartum mean BMI was 24.8 kg/m² (SD 3.9).

Sick leave measured in the year before pregnancy showed a median of 5 (range 0 to 41.8) calendar days. The median sick leave during pregnancy was 7.5 (range 0 to 80) calendar days. Sick leave in the year after pregnancy (measured from the end of maternity leave) showed a median of 4 (0 to 41) calendar days.

Association between Sick leave and BMI
Table 2 gives an overview of the results of the logistic regression models in which the association between BMI and sick leave was assessed.

The risk of long term pre-pregnancy sick leave was significantly higher in the obese group compared to the normal weight group in model 2 (short-term versus long-term sick leave) (OR 2.8, CI 1.4 to 5.8, p=0.006). When analysing the pre-pregnancy sick leave per BMI group in model 1 (no sick leave versus any sick leave), no differences between the BMI groups were found.

The risk of any sick leave during pregnancy was significantly higher in the overweight group compared to the normal weight group in model 1.
Table 1. Characteristics of the study sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total population (n=490)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean (SD)</td>
<td>31.9 (4.1)</td>
</tr>
<tr>
<td>Parity, N (%)</td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>237 (48.4%)</td>
</tr>
<tr>
<td>Multiparous</td>
<td>253 (51.6%)</td>
</tr>
<tr>
<td>Hours worked per week, N (%)</td>
<td></td>
</tr>
<tr>
<td>12-23</td>
<td>113 (23.0%)</td>
</tr>
<tr>
<td>24-35</td>
<td>241 (49.25%)</td>
</tr>
<tr>
<td>&gt;36</td>
<td>136 (27.7%)</td>
</tr>
<tr>
<td>Predominant type of work, N (%)*</td>
<td></td>
</tr>
<tr>
<td>Seated</td>
<td>157 (32.0%)</td>
</tr>
<tr>
<td>Standing</td>
<td>92 (18.8%)</td>
</tr>
<tr>
<td>Combination seated-standing</td>
<td>26 (5.3%)</td>
</tr>
<tr>
<td>Hand</td>
<td>199 (40.6%)</td>
</tr>
<tr>
<td>Heavy</td>
<td>16 (3.3%)</td>
</tr>
<tr>
<td>BMI pre-pregnancy [kg/m²], mean (SD)</td>
<td>23.8 (3.8)</td>
</tr>
<tr>
<td>BMI category pre-pregnancy, N (%)</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>18 (3.7%)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>318 (64.9%)</td>
</tr>
<tr>
<td>Overweight</td>
<td>120 (24.5%)</td>
</tr>
<tr>
<td>Obese</td>
<td>34 (6.9%)</td>
</tr>
<tr>
<td>BMI at end of pregnancy [kg/m²], mean (SD)</td>
<td>28.7 (4.0)</td>
</tr>
<tr>
<td>BMI one year postpartum [kg/m²], mean (SD)</td>
<td>24.8 (3.9)</td>
</tr>
<tr>
<td>Sick leave days, median (10-90 percentiles)</td>
<td></td>
</tr>
<tr>
<td>1 year before pregnancy</td>
<td>5.0 (0 – 41.8)</td>
</tr>
<tr>
<td>Pregnancy until start of maternity leave</td>
<td>7.5 (0 – 80.0)</td>
</tr>
<tr>
<td>1 year after pregnancy</td>
<td>4.0 (0 – 41.0)</td>
</tr>
</tbody>
</table>

* Definitions used are stated in ‘FNV bondgenoten’, a Dutch large union.

(OR 2.0, CI 1.2 to 3.3, p=0.01). When analysing sick leave per BMI group in model 2, the risk of long term sick leave was significantly higher in the overweight group compared to the normal weight group (OR 1.6, CI 1.0 to 2.5, p=0.04). For sick leave postpartum no statistically significant differences were found between BMI groups in either model.

Discussion

In this study, we found that pre-pregnancy long term sick leave (a year before pregnancy) was significantly increased in obese women compared to normal weight women. Furthermore, sick leave during pregnancy was significantly increased in overweight women compared to normal weight women. In the year postpartum, no statistically significant differences were found.
Table 2. Results of logistic regression analyses for the risk of having sick leave (no vs. any sick leave and <11 days vs. ≥11 days) in different BMI groups

<table>
<thead>
<tr>
<th></th>
<th>Sick Leave (no vs. any)</th>
<th>Sick Leave (&lt;11 days vs. ≥11 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Pre-pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underweight</td>
<td>1.72</td>
<td>0.54 to 5.47</td>
</tr>
<tr>
<td>Overweight</td>
<td>1.36</td>
<td>0.85 to 2.17</td>
</tr>
<tr>
<td>Obese</td>
<td>1.81</td>
<td>0.76 to 4.35</td>
</tr>
<tr>
<td>During pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underweight</td>
<td>0.63</td>
<td>0.23 to 1.74</td>
</tr>
<tr>
<td>Overweight</td>
<td>1.97</td>
<td>1.17 to 3.32</td>
</tr>
<tr>
<td>Obese</td>
<td>2.31</td>
<td>0.85 to 6.23</td>
</tr>
<tr>
<td>1 year postpartum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underweight</td>
<td>0.62</td>
<td>0.23 to 1.68</td>
</tr>
<tr>
<td>Overweight</td>
<td>1.17</td>
<td>0.73 to 1.87</td>
</tr>
<tr>
<td>Obese</td>
<td>0.87</td>
<td>0.40 to 1.87</td>
</tr>
</tbody>
</table>

Obesity is a known risk factor for sick leave, especially long-term sick leave. Previous findings related to short-term sick leave are conflicting. In most studies, only (or mainly) men were included. Our result that obese women had a higher risk of long-term sick leave before pregnancy is in line with these previous findings.

One study reporting about BMI and sick leave in pregnancy found that BMI of women with sick leave in the third trimester was significantly higher compared to women without sick leave. Sydsjö et al. reported that only in manual types of work, obese women took more days of leave provided by a parental benefit programme than women with a BMI of <25 kg/m². Our results are in line with these data; lower BMI in pregnant women is related to less sick leave during pregnancy, and thus less productivity losses to society. In the study of Dørheim (underweight, normal weight and obese women), in which no differences were made for BMI, factors associated with sick leave in pregnancy were hyperemesis, exercising less than weekly, chronic pain before or during pregnancy, and infertility treatment, lower maternal age, multiparity, conflicts at the workplace, previous depression, insomnia and lower education. Many of these factors might also be related to being overweight or obese, explaining the higher sick leave observed in overweight women during pregnancy.

Furthermore, being overweight or obese increases the chance of pregnancy complications, and hence increases illness. Although part of these complications occur during maternity leave, this could influence the amount of sick leave in this group of women.
In the year postpartum no statistically significant increase in sick leave in overweight or obese women was observed compared to normal weight women. This could be explained by many factors contributing to taking sick leave that might not be related to weight status. One recent trial reinforces this observation: Sydsjø et al. estimated the effect of a weight reduction programme for obese pregnant women on sick leave and pregnancy benefits. No statistical significant differences in sick leave or pregnancy benefits were found between the groups. The authors argue that the relationship between sick leave and physical and mental health is complex. It is very well possible that social factors and attitude towards sick leave may influence the relationship between BMI and sick leave.

In the scarce cost-effectiveness studies of interventions aimed at weight reduction or maintenance among overweight and obese women before and in pregnancy, only the costs for the intervention, and the direct medical costs of complications, screening, treatment and delivery are taken into account. Those studies showed that the interventions were not cost-effective. However, we found that, from a societal perspective, also taking sick leave into account is important to estimate all costs potentially saved by interventions aimed at weight reduction or maintenance before or during pregnancy. For this, it would therefore be useful if future intervention studies assessed all direct and indirect cost, including sick leave, as an outcome measure.

**Strengths and Limitations**

The main strength of this study is that it is the first study to investigate the relationship between BMI and sick leave before, during and after pregnancy in a large diverse sample of working women. Women of childbearing age play a vital role in the population and increasing their health during pregnancy and postpartum will be of great value.

The data on weight and length were self-reported by the participants, this might have resulted to some inaccuracy in our data. Previous described self-reported data underestimate overweight and obesity prevalence, and more pronounced by bias for female sex and weight status.

The data on sick leave was objectively registered by the occupational health service providers or companies, which in general is fairly accurate, increasing the value of the data used for this analysis. No data are available on the course of pregnancy and pregnancy complications, as this was not asked in the questionnaire of the Mom@Work trial. Literature has shown that having a higher level of education appears to favour returning to work.

**Conclusion**

This study showed a significant relationship between BMI and pre-pregnancy sick leave, and also sick leave during pregnancy. This indicates that extra attention for the weight of pregnant employees could not only
increase their health but also their productivity, resulting in an increase in their contribution to society. Hence, these findings need to be taken into account when assessing weight loss or maintenance interventions in relation to pregnancy complications and outcomes, in order to assess their cost-effectiveness from a societal perspective.
References

35. Voss M, Stark S, Alfredsson L, Vingard E, Josephson M. Comparisons of self-reported and register data on sickness absence among public employees in