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## Mothers' Negative Affectivity During Pregnancy and Food Choices for Their Infants

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### Abstract

**Objective**—To investigate whether maternal negative affectivity assessed in pregnancy is related to subsequent infant food choices.

**Design**—Cohort study.

**Subjects**—Mothers (N = 37, 919) and their infants participating in the Norwegian Mother and Child Cohort Study conducted by the Norwegian Institute of Public Health.

**Measurements**—Maternal negative affectivity assessed pre-partum (SCL-5 at week 17 and 30 of pregnancy), introduction of solid foods by month 3, and feeding of sweet drinks by month 6 (by mothers' reports).

**Results**—Mothers with higher negative affectivity were 64% more likely (95% CI 1.5–1.8) to feed sweet drinks by month 6, and 79% more likely (95% CI 1.6–2.0) to introduce solid foods by month 3. These odds decreased to 41% and 30%, respectively, after adjusting for mother's age, body mass index, and education.

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**Conflict of interest**

The authors declare no conflict of interest.

**Conclusion**—The maternal trait of negative affectivity is an independent predictor of infant feeding practices that may be related to childhood weight gain, overweight, and obesity.

### Keywords

maternal feeding practices; negative affectivity; solid foods; sweet drinks

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It is well-established that rates of childhood overweight and obesity are increasing in developed countries. 1,2. One of the many determinants of this increase may be mothers' food choices for their infants. Personality traits influence individuals' lifestyle behaviors, including diet, that contribute to their own obesity<sup>3,4</sup> but little is known about the influence of personality traits on dietary choices made for others.

The personality trait of neuroticism is strongly correlated with anxiety and depression<sup>5</sup>, which are two of the main constituents of negative affect<sup>6</sup>. Although neuroticism is normally distributed in the population and is not an indicator of psychopathology, individuals with higher levels of neuroticism experience life as more threatening, problematic and distressing than more stable individuals<sup>7</sup>. They also tend to experience more pain and report more physical symptoms than those who are less neurotic<sup>8,9</sup>, and they are vulnerable to stress and prone to give up on goals<sup>10,11</sup>.

Previous studies of maternal personality and infant feeding have been limited by small samples and lack of prospective designs<sup>12,13,14</sup>. However, recent reports from the Norwegian Mothers and Child Cohort Study<sup>15</sup> indicated that mothers with higher levels of negative affectivity were more likely to have stopped exclusively breastfeeding at 6 months<sup>16</sup>, and were more likely to be feeding their child an unhealthy diet at 18 months<sup>17</sup>.

Dietary choices made on behalf of infants have been identified as risk factors for childhood obesity including feeding sweet beverages and the early introduction of solid food<sup>18</sup>. Except for breastfeeding, recent evidence-based guidelines for infant feeding are lacking<sup>19</sup>. However, exclusive breastfeeding for the first 6 months is widely recommended<sup>20,21</sup>. The early introduction of solid foods has been related to infant weight gain in several recent studies<sup>22,23,24</sup>. Consumption of sweet beverages, independent of solid food consumed, is related to weight gain in rats<sup>25</sup>, but evidence for a causal relation between sweet drinks and weight gain in humans is more controversial<sup>26,27</sup>.

We hypothesized that, due to their lower threshold for stress, mothers with higher levels of negative affectivity would be more likely to use solid food and sweet drinks earlier than recommended to soothe their infants. This hypothesis was tested in a large, prospective population study of mothers and their infants. The present study extends past research by examining for the first time the association between maternal negative affectivity and feeding practices for young infants during the first 6 months that may contribute to obesity.

## Method

### Study design and participants

The Norwegian Mother and Child Cohort Study is an ongoing longitudinal investigation of health determinants in a cohort comprising more than 100,000 pregnancies conducted by the Norwegian Institute of Public Health ([www.fhi.no/morogbarn](http://www.fhi.no/morogbarn)). The cohort was recruited from all except two of the maternity units in Norway with more than 100 births annually (n=50). The women received a postal invitation to join the Norwegian Mother and Child Cohort together with their appointment cards for routine ultrasound scans in week 17 to 18 of gestation. The participation rate was 42.7%<sup>15</sup>. The Norwegian Mother and Child Cohort Study releases updated versions of the data files once a year. The analyses reported here are based on the quality-controlled data files released in Spring 2007 (version 3). We included data from questionnaires at gestation weeks 17 and 30, and 6 months postpartum. Participation rates among those who gave informed consent initially were 95% at 17 weeks, 92% at 30 weeks, and 87% at 6 months postpartum. We also retrieved data from the Medical Birth Registry of Norway, which registers data on all births in Norway, including parental marital status, maternal health before and during pregnancy as well as birth and infant-related variables<sup>28</sup>.

For the present study, we selected mothers ( $N = 43,288$ ) of singletons who completed questionnaires at gestation weeks 17 and 30, and at 6 months postpartum. We excluded all mothers where information was missing for maternal age, the child's sex and birth weight, the age at which solid foods were introduced, and the frequency of feeding the child sweet drinks ( $N = 5,369$ ). This resulted in a sample size of  $N = 37,919$ , representing 87.6 % of the entire dataset. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.

### Independent variables

Maternal negative affectivity, conceptualized as the combination of anxiety and depression, was measured in pregnancy using a 5-item version of the Hopkins Symptom Checklist (SCL-5) administered at weeks 17 and 30 of gestation. It was also measured at 6 months post-partum. The SCL-5 is a short form of the SCL-25, which measures only the anxiety and depression dimensions of the full checklist<sup>29</sup>. Anxiety and depression are major components of negative affect, which is part of the neuroticism construct<sup>5,6</sup>. The SCL-5 was developed on a large Norwegian community sample by factor analyzing the SCL-25 and selecting two high-loading items for anxiety and three for depression. The correlation between the SCL-5 and the SCL-25 was .92<sup>30</sup>. The items were "Feeling fearful," "Nervousness or shakiness inside," "Feeling hopeless about the future," "Feeling blue," and "Worrying too much about things," and were rated on a 4-point scale from not bothered (1) to very bothered (4). Scores were averaged across the two assessments in pregnancy (Cronbach's alpha = 0.86) and correlated .56 with the assessment at 6 months post-partum, indicating that mothers' negative affectivity was relatively stable across time.

## Dependent Variables

At 6 months postpartum, mothers reported liquids and solid foods that they had fed to their child since birth. Four questions queried the frequency with which they fed their child sweetened drinks (“saft” i.e., berry or fruit-juice concentrate, with added sugar, that is mixed with water), other types of sweetened cordial, and fruit juice. The frequency of consumption was categorized as (1) never/seldom, (2) 1–3 times a week, (3) 4–6 times a week, and (4) at least once a day. From these four questions we constructed a dichotomous variable indicating whether the child was fed any of these sweet drinks at least 1–3 times a week.

From a list including 17 solid food items, including porridges and purees, mothers reported how often they fed each item to their child, and at what age it was fed to the child for the first time. We constructed a dichotomous variable indicating whether the child had been fed any of these foods at age 3 months or earlier.

## Potential Confounders

Data on maternal age at delivery were retrieved from the Medical Birth Registry of Norway. The mothers’ body mass index (BMI) in  $\text{kg}/\text{cm}^2$  before pregnancy was calculated from self-reported data at the assessment at gestation week 17.

Mothers indicated their highest level of completed education at gestation week 17 using one of six categories covering educational levels from 9 years (secondary school) to 18+ years (university). Each unit of this variable, which was treated as a continuous variable coded from 1 to 6, corresponds to an increase of 2–3 years of education. This variable was reverse coded so that higher scores indicated *less* education.

## Statistical Analysis

There were incorrect or missing values in 1–2% the cases for each confounding variable. Obviously incorrect values (such as a body weight of 570 kg) were replaced by missing values. Because listwise deletion of missing values would have reduced the sample size to around 28 000 cases, missing values were substituted by means of maximum likelihood imputation procedures<sup>31</sup> using information from correlated variables in the expectation-maximization algorithm. Missing educational level was estimated by means of the mothers’ self-reported income and their reports on the fathers’ educational level. Missing values regarding maternal weight before pregnancy were estimated from mothers’ self-reported height and weight 6 months after pregnancy. Logistic regression modeling<sup>32</sup> was used to calculate the effects of mothers’ negative affectivity and potential confounders on feeding their children sweet drinks at age 6 months and introducing solid foods at age 3 months.

## Results

Mothers’ mean age was 30 years and their mean pre-pregnancy BMIs were in the normal range (20–25). Their mean educational level corresponded to 14 years of education (see Table 1). At the categorical level, more than 50% of the mothers had a college or bachelor education (data not shown). Around one fifth of the mothers fed their child a sweet drink at

least 1–3 times weekly at 6 months, and 7% had introduced solid foods to the child at 3 months. Compared to mothers excluded from the analyses because of missing data on key variables including the outcomes ( $N = 5,369$ ), the 37,919 included mothers were slightly younger and heavier, but did not differ with respect to negative affectivity or educational level (see Table 1).

The unadjusted and adjusted odds ratios for the association of negative affectivity with infant feeding practices are displayed in Table 2. The unadjusted odds ratios showed that mothers scoring higher in negative affectivity had 64% (sweet drinks) and 79% (solid foods) increased odds of using these feeding practices. These odds decreased to 41% and 30%, respectively, after adjusting for age, higher BMI before pregnancy, and lower levels of education, all of which increased the odds for these feeding practices. Lower educational level ( $r = 0.14$ ) and younger maternal age ( $r = 0.08$ ) were associated with negative affectivity ( $p < 0.05$ ).

## Discussion

Previous studies of the Norwegian Mother and Child Cohort showed that mothers with higher levels of negative affectivity were more likely to use potentially obesogenic feeding practices when their children were 6 months or older<sup>16,17</sup>. The present study demonstrated similar findings for children under age 6 months. One explanation for consistent effects of higher negative affectivity on infant feeding practices is that these mothers are more susceptible to stress and less able to tolerate signs of distress in their infants and hence may use solid foods and sweet drinks to soothe their infants. Fussy (difficult temperament) children are less likely to be predominantly breastfed for 6 months<sup>33</sup>. Mothers with higher negative affectivity may introduce solid foods earlier and give sweet drinks because they interpret apparent infant distress as signs of hunger.

Negative affectivity remained a significant predictor after controlling for other variables. Younger mothers, mothers with higher BMI, and those with lower educational achievement were more likely to make potentially obesogenic food choices for their infants. Younger mothers' relative lack of child-rearing experience may have contributed to their early use of sweet drinks and solid foods. In this study as in others, negative affectivity was related to lower educational achievement<sup>34,35,36</sup>. Lower educational achievement may result in less attention to health information and less ability to respond to it. Breastfeeding is another variable that may influence food choices. When mothers stop exclusive breastfeeding during the first 6 months, they will not necessarily choose to feed sweet drinks or introduce solid foods. As additional analyses showed (not reported here), controlling for breastfeeding cessation at 3 months for solid foods and at 6 months for sweet drinks, resulted in only marginal reductions in the odds ratios for negative affect. Together, these findings indicate that negative affectivity, which is associated with obesogenic choices and effects for oneself, may also influence food choices for others.

## Limitations

The measure of negative affectivity used here only assessed anxiety and depression and so was not a complete measure of neuroticism, nor were other maternal personality traits

assessed. The feeding practices we studied may not be related to subsequent obesity. However, the use of solid foods and the use of sweet drinks prior to 6 months contradicts the recommendation to breastfeed exclusively for the first six months<sup>20,21</sup>. Sweet drinks may contribute to weight gain because they are less satiating so dietary compensation is weaker than for solid food forms of comparable nutrient content. In a descriptive study conducted in the US, beverages made up 84% of the daily food energy for infants aged 4 – 6 months, demonstrating the potential for excess calories if mothers give sweet drinks to their infants<sup>37</sup>. Studies of the effects of giving sweet beverages to infants under six months are lacking, although some studies have shown an association between consumption of fruit juice or sweetened beverages and obesity among older infants and children<sup>38,39</sup>. As yet, we do not know whether these feeding practices are associated with subsequent overweight in this sample, but we will be able to examine this in future studies. It should be noted that none of the children in our study attended external day care, which is associated with less breastfeeding and early introduction of solid food<sup>24</sup>, because in Norway parents can have a full year of paid maternity/paternity leave when a child is born.

## Conclusions

These findings indicated that maternal negative affectivity is a risk factor for potentially obesogenic infant feeding practices. Maternal distress should be recognizable by health personnel and maternal depression and anxiety could be assessed by a brief self report measure such as the SCL-5 used here. Distressed mothers will be anxious, nervous and helpless, and express undue concern about their child's health, growth and weight gain, and sleeping pattern. Health personnel should actively seek information from these mothers on their potential barriers to adherence to infant feeding recommendations, and invest more time in counseling and educating them. The benefits in terms of reduced childhood obesity could be considerable.

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**Table 1**

Characteristics (Means and SDs or Percentages) of the mothers included in the analyses (N=37, 919) compared to mothers excluded because of missing values on key variables (N=5,369)

<b>Maternal characteristics</b>	<b>Included N=37919</b>	<b>Excluded N=5369<sup>†</sup></b>	<b>F/<math>\chi^2</math></b>
Negative affectivity (range 1–4)	1.26±0.34	1.26±0.35	0.94
Age (years)	29.86±4.51	30.48±4.60	85.81*
Body Mass Index (kg/m <sup>2</sup> )	24.18±4.30	23.66±3.99	69.04*
Completed education in years (9–18years) <sup>‡</sup>	2.55±1.23	2.56±1.29	0.47
Feeding child sweet drinks at 6 months (%)	20.2	--	--
Introducing solid foods by 3 months (%)	7.2	--	--

\* P 0.005;

<sup>†</sup> Adjusted residual > 1.96, indicating significant differences between daily smokers<sup>40</sup>.

<sup>‡</sup> Reverse coded (6-1), a score of 2.55 corresponds to ca. 14 years of education.

**Table 2**

Associations of negative affectivity and confounding variables with feeding practices in mothers of 6 month-old infants

Maternal characteristics	Sweet drinks at 6 months		Solid foods at 3 months	
	OR	95% CI	OR	95% CI
Negative Affectivity (NA)				
unadjusted OR	1.64*	1.52–1.75	1.79*	1.63–1.97
adjusted OR <sup>§</sup>	1.41*	1.31–1.51	1.30*	1.18–1.44
Confounding variables <sup>§</sup>				
Age	0.97*	0.96–0.97	0.94*	0.93–0.94
Body Mass Index	1.03*	1.02–1.04	1.05*	1.04–1.06
Completed education in years (9–18years) <sup>‡</sup>	1.20*	1.21–1.27	1.49*	1.45–1.54

*N*=37 919; OR, odds ratio; 95% *CI*, 95% confidence interval for odds ratio;

\* P value of odds ratio = 0.001;

<sup>§</sup> Effects are adjusted for all confounding variables.

<sup>§</sup> Effects of all confounding variables are adjusted for each other and NA.

<sup>‡</sup> Reverse coded, higher numbers denote lower education.