Breast-Feeding and Alcoholism: The Trotter Hypothesis

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Objective: The authors' goal was to determine whether early termination of breast-feeding contributes to later alcohol dependence, as proposed more than 200 years ago by the British physician Thomas Trotter. **Method:** In 1959–1961, a multiple-specialty group of physicians studied 9,182 consecutive deliveries in a Danish hospital, obtaining data about prepartum and postpartum variables. The present study concentrates on perinatal variables obtained from 200 of the original babies who participated in a 30-year high-risk follow-up study of the antecedents of alcoholism. **Results:** Of the 27 men who were diagnosed as alcohol dependent at age 30, 13 (48%) came from the group weaned from the breast before the age of 3 weeks; only 33 (19%) of the 173 non-alcohol-dependent subjects came from the early weaning group. When challenged by other perinatal variables in a multiple regression analysis, early weaning significantly contributed to the prediction of the severity of alcoholism at age 30. **Conclusions:** The data support the hypothesis that early weaning may be associated with a greater risk of alcohol dependence later in life.

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During the American Revolutionary War, a British naval surgeon named Thomas Trotter submitted a thesis for a degree in medicine at the University of Edinburgh. The topic was alcoholism; it won much acclaim. In 1804 and 1813, he published revised versions of the thesis under the title *An Essay, Medical, Philosophical, and Chemical, on Drunkenness and Its Effects on the Human Body* (1). It was the first time the subject had been presented from a medical point of view. Trotter thought he knew the cause of alcoholism: part was inherited and part environmental. To Trotter, a crucial environmental factor was early weaning.

This idea disappeared from sight for 200 years. Our group has a database that includes information about nursing at the time the nursing took place, together with 1,500 other perinatal variables, on sons of alcoholics and sons of nonalcoholics. Further, we have information about what happened to these male infants 30 years later, especially with regard to their drinking.

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METHOD

In the late 1950s and early 1960s, a group of Danish physicians joined forces to search for causes of birth anomalies. They collected data about hundreds of perinatal characteristics, including the health of the parents, the circumstances of pregnancy and delivery, and the condition of the children at birth and 1 year later. The cohort consisted of 9,182 consecutive deliveries from 9,006 pregnancies. The findings were published in a two-volume monograph (2, 3). Of the 1,500 variables studied, only maternal venereal disease was associated with birth anomalies.

In 1978, a study was created to investigate the antecedents of alcoholism in this cohort. Details of the study have been presented elsewhere (4–6). Briefly, we used local and national registries to identify 223 sons of alcoholics and 107 comparison subjects whose parents were not alcoholic from the original birth cohort; the sons of alcoholics were considered at high risk because alcoholism, to some extent, is a familial disorder. The two groups were matched for age, birth order, and socioeconomic status at time of birth. Recently, a 30-year follow-up of 241 (71%) of the original 330 subjects was completed. As part of this follow-up effort, several comprehensive structured diagnostic interviews were administered by a psychiatrist after written informed consent was obtained. The interviews yielded diagnoses according to DSM-III-R criteria.

Of the 241 subjects in the 30-year follow-up, 200 had data available regarding when they were weaned. The mean age of these 200 men was 30. Most had completed 10 years or more of education, and 77% (N=154) had been employed at least part-time in the previous month; 67% (N=134) of the subjects were married or living with someone.

Sixteen measures were selected from the perinatal database to examine Trotter's hypothesis and challenge the singularity of any relationship found between time of weaning and alcoholic drinking 30 years later. As used in this article, "weaning" refers to the termination of breast-feeding. The five response options to the perinatal

weaning item "When was breast-feeding totally stopped?" were 1–2 weeks, 3–4 weeks, 2–3 months, 4–6 months, and more than 6 months. Neonates who were not breast-fed, a rarity in Denmark at the time, were excluded. A series of analyses with this weaning variable made it clear that the earliest weaning group contributed most to any effects that emerged. Therefore, the weaning item was dichotomized into an early weaning group (within 2 weeks of birth) (N=46 [23%]) and a later weaning group (after 3 weeks) (N=154 [77%]).

Other perinatal variables examined were 1) age of the mother at the time of the subject's birth (mean=24 years), 2) mother's social class rated on a 10-point scale on which 10 represented the highest social class (mean=2.83); 3) previous illness of the mother reflecting serious chronic medical conditions such as diabetes mellitus, coded as present (N=58 [29%]) or not present (N=142 [71%]), 4) illness during pregnancy, a summary of any illness occurring during the six stages of the pregnancy, coded as present (N=64 [32%]) or not present (N=136 [68%]), 5) birth order, the number of pregnancies preceding the birth of the subject, 6) birth weight coded as grams in 10 ascending categories, 7) weight change during the first 5 days of life coded as grams in three categories reflecting both weight loss and weight gain, 8) child's condition at birth coded as living and healthy (N=188 [94%]), living and mildly affected (N=6 [3%]), and living but heavily affected (N=6 [3%]), 9) sucking reflex during first examination at birth coded as normal (N=194 [97%]) or abnormal (N=6 [3%]), 10) sucking reflex during second examination 5 days later, also coded as normal (N=198 [99%]) or abnormal (N=2 [1%]), and 11) six perinatal global scales created to summarize different aspects of the pregnancy, birth, and early condition of the baby (3).

Two measures obtained at age 30 were employed as drinking outcome variables: 1) DSM-III-R diagnosis of alcohol dependence and 2) the number of alcoholism symptoms (out of 17) endorsed under the alcoholism module of the revised Psychiatric Diagnostic Interview (7). These two measures of alcoholism severity were significantly associated. The mean number of Psychiatric Diagnostic Interview lifetime alcoholism symptoms endorsed by the non-alcohol-dependent subjects at age 30 was 1.8, but the mean number of alcoholism symptoms endorsed by the alcohol-dependent men was 14.0, and there was virtually no overlap between the two groups ($F=438.4$, $df=1, 198$, $p<0.0001$).

RESULTS

As reported previously, by age 30 the sons of alcoholic fathers were more likely to have experienced a problem with alcohol than the sons of nonalcoholics (5). This finding is consistent with the first part of Trotter's hypothesis—that is, the possible influence of heredity on alcoholism.

As seen in table 1, almost half of the alcohol-dependent subjects came from the early weaning group, but only 19% of the non-alcohol-dependent subjects were weaned early, a highly significant difference (table 1). This result is consistent with Trotter's weaning hypothesis.

Could other perinatal factors better explain the relationship between time of weaning and adult alcoholism? We examined the data, asking two questions: 1) What perinatal variables were associated with mothers who stopped breast-feeding before their babies were 3 weeks of age? and 2) What perinatal variables were associated with alcohol dependence at age 30? Of the 16 perinatal variables identified previously, two were significantly associated with the dichotomized time of weaning variable—birth weight and weight change—and two were significantly correlated with later alcohol dependence—birth weight and mother's socioeconomic status at the time of birth. The early weaning group weighed less at birth than the later-weaned infants and lost significantly more weight in the first 5 days of life. Low birth weight and lower social class of the mother were also significantly associated with alcohol dependence 30 years later.

TABLE 1. Prevalence of DSM-III-R Alcohol Dependence in Men at Age 30 as a Function of Very Early and Later Weaning (N=200)[a]

	No Alcohol Dependence at Age 30 (N=173)		Alcohol Dependence at Age 30 (N=27)	
Time of Weaning	N	%	N	%
≤2 weeks after birth (N=46)	33	19.1	13	48.1
≥3 weeks after birth (N=154)	140	80.9	14	51.9

[a] Significantly more of the men weaned very early were alcohol dependent at age 30 ($\chi^2=9.56$, $df=1$, $p<0.002$).

To determine the unique contribution of early weaning to the development of alcohol dependence, a standard multiple regression analysis (SAS REG) was performed. Three of the four perinatal variables significantly associated with either time of weaning or alcohol dependence were entered into the regression as predictors. The perinatal weight change variable was dropped from the regression analysis because it was so highly correlated with time of weaning and therefore regarded as an epiphenomenon. In addition, a history of alcoholism in either the mother or father was included in the regression analysis to reflect the probable influence of inheritance.

The final regression analysis contained five predictor variables: 1) time of weaning, 2) mother alcoholic, 3) father alcoholic, 4) birth weight, and 5) mother's socioeconomic status. The dependent measure for the regression analysis was the lifetime alcoholism severity score on the Psychiatric Diagnostic Interview. The multiple R was significantly different from zero ($F=3.85$, $df=5, 170$, $p<0.003$), indicating that the regression equation provided a better-than-chance prediction of alcoholism severity. Almost 10% of the variance in alcoholism severity was accounted for by this five-variable equation. Only one regression coefficient differed significantly from zero. Time of weaning contributed significantly to the prediction of later alcohol symptoms (beta=–2.16, $p<0.05$).

The semipartial r^2 represents the unique contribution of each variable to the prediction equation. Presence of a father or mother treated for alcohol-related illness each explained 1% of the variance. The mother's socioeconomic status at the subject's birth and birth weight also accounted for 1% of the variance, and time of weaning accounted for 3% of the variance. The five predictors in combination contributed another 3% in shared variability. Although parental alcoholism, socioeconomic status of the mother, and birth weight each contributed to the prediction of alcoholism, only time of weaning contributed significantly to the prediction of alcoholism severity at age 30.

DISCUSSION

Early weaning significantly predicted alcohol dependence 30 years later. The correlation between early weaning and the 30-year drinking status of the subjects could not be explained by parental alcoholism or a variety of perinatal measures obtained before, during, and soon after birth. Our findings lend support to the more than 200-year-old hypothesis proposed by Thomas Trotter. Trotter thought that heredity plus early weaning were major contributing factors to alcoholism. Numerous studies, including our own (8–11), have supported the connection between heredity and alcoholism. To our knowledge, this study is the first to report a possible causal relationship between early weaning and alcoholism.

There are many unanswered questions. Even though perinatal variables for the original cohort amounted to about 1,500 items, some potentially useful information was lacking. Given the later importance of the fetal alcohol syndrome, the Danish investigators unfortunately did not ask whether the mother drank during pregnancy or nursing. Other illnesses also have been associated with early weaning. For example, in one study, children who later became diabetic were breast-fed for shorter periods than healthy siblings (12–14). In another study, deprivation of human milk appeared to affect the infant's immune system and make the child more susceptible to childhood malignancies, such as lymphoma (15). Lack of breast-feeding has been cited as a risk factor associated with Crohn's disease (16). Recently, longer duration of breast-feeding was found to predict higher cognitive functioning and educational achievement in childhood (17).

Especially provocative is the large animal literature on the effects of early weaning on neurodevelopmental systems, learning, resistance to stress, and appetitive behaviors in a variety of species. These studies seem to indicate a direct influence between early weaning and the development of dopaminergic mechanisms that play an important role in neurobiological theories of addiction (18, 19). One study (20) reported that early-weaned adult rats drank significantly more alcohol than later-weaned adult rats. However, a second study did not find an association between early weaning and alcohol consumption in prepubescent rats (21).

After all these years, Trotter's weaning hypothesis has been tested and supported. Replication by other investigators is clearly needed before time of weaning can be added to the list of antecedent influences that correlate with alcoholism in adulthood.

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