The Association of Dietary Fat with Ability to Obtain Breast Fluid by Nipple Aspiration

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Abstract
The ability to obtain breast fluid by nipple aspiration was examined in relation to self-reported dietary fat intake in 1347 white and 153 black women. Study participants were between 20 and 59 years of age, were not pregnant or breastfeeding, and had no history of breast cancer. The proportion of women from whom nipple aspirate fluid was obtained increased with increasing dietary fat consumption; the odds ratio for obtaining breast fluid was 1.4 (95% confidence interval, 1.0–1.8) in white women who consumed over 90 g of fat/day compared with those who consumed less than 50 g of fat/day, adjusting for age, smoking, and parity. Among black women, the association was much stronger; the odds ratio for obtaining nipple aspirate fluid in those who consumed over 90 g of fat/day was 3.6 (95% confidence interval, 1.3–10.1) compared with those who consumed less than 50 g of fat/day. In both blacks and whites, the associations were most pronounced in women aged 30–44 years. These findings suggest a relationship between dietary fat consumption and breast secretion.

Introduction
The breast glands of the adult female secrete and reabsorb breast fluid that can be obtained with a modified breast pump in approximately 50% of nonlactating women (1–3). We and others have investigated the natural history of benign and malignant breast disease through studies of the biochemical and cytologic constituents of NAF (4–7). In prior studies, we identified four factors that were consistently associated with our ability to obtain NAF; these included an age of 35–50 years, early age at menarche, history of parity and lactation, and non-Asian compared with Asian ethnicity (8). Asian ethnicity was found, in our earlier studies, to be related to a genetic dimorphism of dry versus wet earwax (2). This dimorphism affects the breast and other apocrine glands (2).

A number of investigators have found that increasing consumption of dietary fat increases the risk of breast cancer (10–13), and this possibility has received additional support from a recent metaanalysis of case-control studies (14). However, the association of fat and breast cancer is still very much debated. In the present study, we examined the possible effects of dietary fat intake on the ability to obtain NAF in a population of healthy women with no history of breast cancer. Our results indicate a significant effect of dietary fat on the ability to obtain NAF which is independent of the effects of factors previously identified.

Materials and Methods
The 1496 participants (1347 white and 153 black women) were nonpregnant, nonlactating women aged 20–59 years who had no history of breast cancer and were part of a large study of breast disease at the University of California, San Francisco, and Children’s Hospital and Adult Medical Center, San Francisco, between January 1981 and February 1986. Detailed descriptions of subject eligibility criteria, recruitment and interview methods, and NAF sampling methods have been reported (2, 9). In brief, nipple aspiration of breast fluid with a breast pump was attempted in all consenting women by the technique of Sartorius et al. (5). This involves the use of a modified breast pump consisting of a 15-cm³ syringe attached by a short plastic tube to a small cup. With the cup placed over the nipple, the plunger is withdrawn to 10 ml and held for 5 to 15 s until fluid appears; this degree of negative pressure is necessary to overcome the closed nipple ducts in most women. A woman was designated as a secretor of breast fluid if a drop or more of fluid was obtained from one or both breasts. NAF was obtained from approximately 40% of the women. We strictly followed human research confidentiality guidelines and informed consent procedures.

A food frequency questionnaire was administered to each participant to estimate dietary fat intake; subjects were asked to indicate frequency of consumption of 42 food items. The dietary questions were not meant to be comprehensive; the list, published by the American Heart Association, which includes meat, luncheon meats, dairy products, fat, and oils and desserts, was selected because of each item’s contribution to dietary fat and cholesterol. Frequency of consumption was categorized as never, less than 1 time/month, 1–3 times/month, 1–4 times/week, and 5–7 times/week. In addition to dietary data, each woman’s age, menopausal status, age at menarche, ethnicity, oral contraceptive use, breastfeeding, parity, history of tobacco and alcohol use, weight, height, and family history of breast cancer were ascertained.
To compute the average daily consumption of total fat and saturated fat, a nutrient database for the 42 food items was compiled from U.S. Department of Agriculture food composition tables found in the U.S. Agriculture Handbook (15). For each food, the nutrient content for a given standard serving portion was multiplied by the intake frequency the participant records. Nutrients were totaled for the 42 food items and expressed as average intake per day.

Several factors previously reported to be associated with the ability to obtain NAF, such as age, parity, and menopausal status, were selected for the analyses. Other factors possibly associated with dietary fat intake, such as Quetelet’s body mass index (weight/height²), tobacco and alcohol use, and physical activity, were also analyzed. Using univariate analysis, we first identified factors which differed among women from whom breast fluid was and was not obtained. For those factors indicating a significant association with the ability to obtain NAF, we computed the bivariate relationship with dietary fat. Then, multivariate logistic regression analyses using the computer program BMDPLR (16) were performed to compute estimated odds ratios. Ninety-five% confidence intervals for dietary fat intake and age were calculated. There was a statistically significant linear trend to smoking in white women and NAF status. The adjustment was carried out by Schlesselman (17). Age was categorized into five intervals were computed using the methods described in Table 2.

Table 2 shows unadjusted and adjusted odds ratios and their 95% confidence intervals for dietary fat intake and NAF status. The adjustment was carried out by multiple logistic regression, and age, parity (nulliparous), and smoking status (never, past, current) were held constant. For both races, as daily dietary fat intake increased, the ability to obtain NAF increased accordingly. There was a statistically significant linear trend for categories of fat intake for both unadjusted (P = 0.01 for whites; P = 0.02 for blacks) and adjusted (P = 0.04 for whites; P = 0.03 for blacks) odds ratios. The ability to obtain NAF was 1.4 times greater in whites who consumed over 90 g fat/day compared with those who consumed less than 50 g/day.

Among both whites and blacks, the proportion of women from whom NAF was obtained was associated with both age and dietary fat intake (Table 2). Among whites aged 30–44, we obtained NAF from a higher proportion of women with high dietary fat intake than from those with low dietary fat intake. In black women, the association of dietary fat with age and the proportion of women yielding NAF appeared to be stronger than in whites, but the number of women sampled was small, and no attempt was made to test for an interaction between age and race. We obtained NAF from approximately 75% of black women aged 30–44 whose fat intake was over 90 g. For women under 30 years of age or more than 45 years of age, in both whites and blacks, the effect of dietary fat was minimal.

Table 3 shows unadjusted and adjusted odds ratios and their 95% confidence intervals for dietary fat intake and NAF status. The adjustment was carried out by multiple logistic regression, and age, parity (nulliparous), and smoking status (never, past, current) were held constant. For both races, as daily dietary fat intake increased, the ability to obtain NAF increased accordingly. There was a statistically significant linear trend for categories of fat intake for both unadjusted (P = 0.01 for whites; P = 0.02 for blacks) and adjusted (P = 0.04 for whites; P = 0.03 for blacks) odds ratios. The ability to obtain NAF was 1.4 times greater in whites who consumed over 90 g fat/day compared with those who consumed less than 50 g/day. The effect was even stronger in blacks. We were 3.7 times more likely to obtain NAF from black women who consumed over 70 g/day than from those who consumed less than 50 g of fat/day. The relationship to smoking in white women

Results
Table 1 shows characteristics of white and black women from whom NAF was and was not obtained. For both races, mean dietary fat intake was greater in women from whom NAF was obtained than it was in women from whom NAF was not obtained. Mean dietary saturated fat intake showed a similar trend, especially among blacks. Among whites, there was a significantly higher proportion of parous women and of women who had ever smoked among those from whom we obtained NAF. Other characteristics, such as years of education, Quetelet index, percentage ever drinking alcohol, and percentage engaging in active physical exercise, showed no difference between yielders and nonyielders of NAF in either race.
(Table 1) disappeared in the multiple logistic regression analysis.

Discussion

We obtained NAF from a significantly lower proportion of women who consumed less than 50 g of fat than we did from women who consumed higher quantities of fat per day. A progressively greater proportion of NAF yielders was found with increasing consumption of fat, which was particularly evident among white and black women 30–44 years of age. We cannot address the effects of total calories here because complete dietary data were not obtained. But due to the high positive intercorrelations between fat, protein, and total calorie intake, our results could also be consistent with a possible positive association with dietary energy.

The other limitation on the dietary instrument is that it is very possible for misclassification of fat intake; thus, the observed odds ratios could have been attenuated toward null.

A physiological explanation for the effect of fat intake on the ability to obtain NAF is not clear. One possible explanation may be the demonstrated effect of fat on prolactin secretion. Schultz et al. (18) found that prolactin levels are positively associated with caloric intake and protein, total fat, and saturated fatty acid intake. As shown in our data, the proportion of yielders of NAF increased progressively with fat intake over 50 g/day. The distinctly lower NAF yields in women consuming less than 50 g of fat/day might be the result of decreased prolactin secretion and its effect on breast secretion. In prior studies, we found that the ability to obtain NAF was related to income, with a higher proportion of NAF yielders in women from higher-income groups. As reported in the Second National Health and Nutrition Examination Survey (19), women from higher-income groups are likely to have higher caloric, fat, and protein intake than women from very low-income groups.

In prior studies, we reported that chemical substances of exogenous and endogenous origin, including mutagenic and toxic substances and estrogenic and other steroidal hormones, are secreted and accumulated by the adult female breast (1, 20–22). We proposed that a dynamic balance between secretion, reabsorption, and turnover of these substances may be an important determinant of exposure of the breast epithelia to putative initiating and carcinogenic agents. Our current findings may have significance for studies of dietary fat intake and breast cancer risk, since they suggest that very low fat intake is associated with decreased breast secretory function. A decreased secretion of NAF might reduce the risk of breast cancer by decreasing exposure of the breast epithelium to carcinogens and promoting substances.

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References

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