

Health Media Information: How important is it to dairy product use by females?

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Abstract

Health professionals believe American consumers pay more attention to dietary choices as a result of exposure to media health information. It is important for dairy industries to understand how this information influences consumer choice of milk and dairy products. We investigate the effect of health information on the probability of fluid milk and dairy products by females in alternative life-cycle and find as a female consumer believes she reduces her consumption on fluid milk, cheese and butter due to the media health information she receives, her likelihood to be a more frequent user of fluid milk, cheese and butter declines.

Problem Statement

According to recent U.S. health statistics, the percentages of the male and female population classed as overweight have increased by 9.7 and 9.4, respectively. The number of overweight continues to grow even though now consumers indicate that they are paying closer attention to health claims and dietary choices [1]. Milk and dairy products have traditionally played essential roles in Americans' dietary choices. However, the conventional view is that regular fluid milk, cheese and butter are high in fat. In this study, we investigate the links between exposure to health and diet related print media and American females consumption of fluid milk, high fat to no fat, cheese and butter.

During the past several decades, fluid milk and dairy product consumption trends in the United States have been widely examined. For instance, industry statistics indicate that the per capita consumption of regular whole fluid milk has decreased significantly while the per capita consumption of reduced-fat, low fat, and skim fluid milk have all increased [2]. However, even though per capita consumption of lowfat/2%/1% fluid milk and skim fluid milk went up, the increase has not been sufficient enough to keep the total plain fluid milk from declining. In 1999, each American drank an average of 26 percent less plain fluid milk than in 1970. The "low fat concerned" attitude also appears on American's butter consumption. Per capita consumption of butter decreased by 1.2 pounds in 1970-1981 then increased to 4.9 pounds in 1985, and eventually, it dropped to 4.3 pounds in 1999. On the contrary, despite trends toward lower fat diets, per capita consumption of natural cheese has increased dramatically since 1970. Americans ate over two and half times any kind of cheese except cottage cheese in 1999 as in 1970 (see Figure 1) [2, 3, 4].

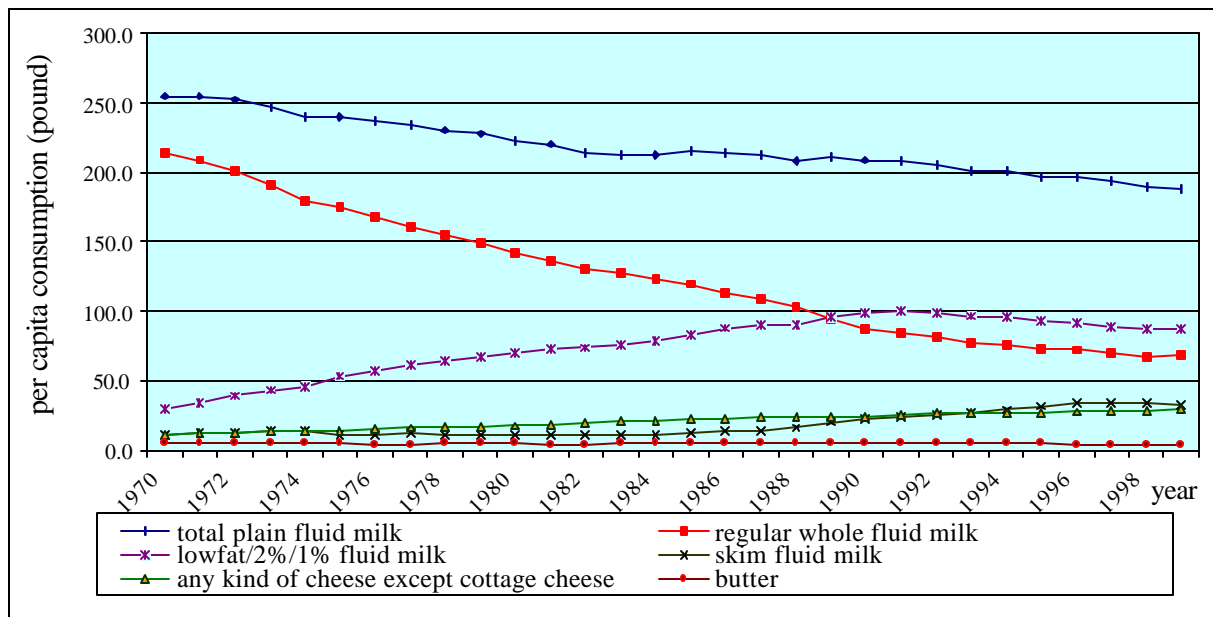


Figure 1: Fluid milk and dairy products – per capita consumption, 1970-1999

Why have American consumers shifted from higher-fat fluid milk consumption to lowfat/2%/1% fluid milk and skim fluid milk while simultaneously significant increasing their consumption high-fat cheese? If indeed American consumers preferred lower fat diets, why did consumption of cheese increase? What factors contributed to the change in consumption patterns? How did attitudes impact fluid milk and dairy products consumption, including cheese and butter? And finally, what kind of role did media reported health information play in changing these attitudes? Answers for these questions can assist industry leaders as they seek to develop effective marketing strategies to improve product image while preserving the health and nutritional attributes of their products.

Study Objective

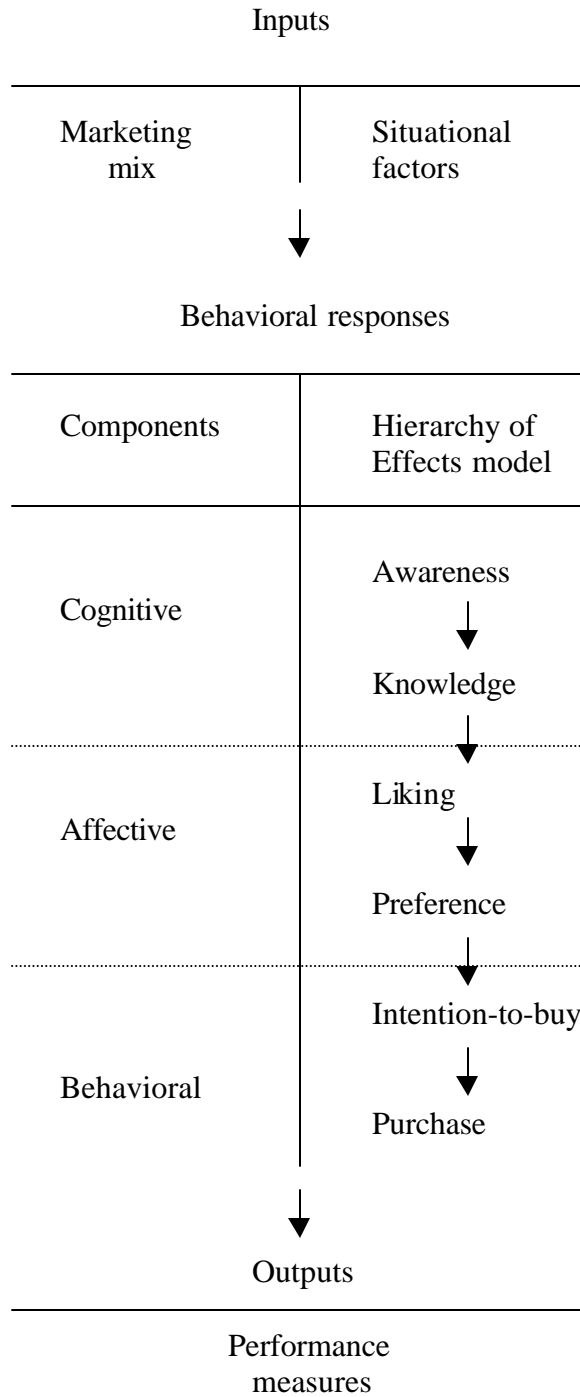
The objective of this study is to explore the factors that may influence American female's frequency consumption of fluid milk, cheese and butter, which are any type of fluid milk, regular whole fluid milk, lowfat/2%/1% fluid milk, skim fluid milk, any kind of cheese except cottage cheese and butter. Industry studies show that the female in the household has the primary responsibility for determining the food use and consumption habits of those in the household, especially younger children [5]. Also, as we compare the means and standard deviation for male and female respondents' attitudes toward health/diet information as Table 1, female respondents seem to pay more attention to health/diet information than males. Therefore, in this study, only 1,990 female respondents aged 13 years old or older were selected from the 1998 AUTS (Attitude and Usage Trend Study) survey database and used as a representative sample of the female population of the United States (see Appendix 1). Using these data we estimate an ordered logit model to assess the influence of female's health, diet attitude toward fluid milk, cheese and butter on reported frequency of product use. To examine the interaction of the hierarchy-of-effects and the life-cycle effects our analysis was applied to alternative female cohort age groups.

The Hierarchy-of-effects Model

The marketing literature defining the relationship between beliefs, attitudes and overt behavior identifies three main components, (1) a cognitive component; (2) an affective component; and (3) a behavioral component, are considered as the structure of attitude [6, 7]. These components can be depicted by the hierarchy-of-effects model shown in Figure 2. According to this model of behavior there are six basic levels of response by which an individual is hypothesized to progress through: (i) awareness, (ii) knowledge, (iii) liking, (iv) preference, (v) intention-to-buy, and (vi) actual purchase [7].

Statistical Model

In the model depicted in Figure 2 the behavioral variable is measured as a reported frequency of product use for each dairy product. This user-response variable is categorized as (1) non use, (2) very light frequent use, (3) light frequent use, (4) moderate frequent use, (5) heavy frequent use. This frequency of use is hypothesized to be explained by a set of variables which define the (1) cognitive component; (2) affective component; and (3) behavioral component, along with traditional socioeconomic set of variables.



Source: Kinnear and Taylor, "Marketing Research", 3rd Edition.

Figure 2: Model of behavioral response

The dependent variable is the ordered frequency of use for any kind of fluid milk, regular whole fluid milk, lowfat/2%/1% fluid milk, skim fluid milk, cheese, and butter. For the fluid milks the use categories are 1=never use, 2=drink occasionally, 3=often but less than one glass per day, 4=one to two glasses per day, and 5=more than three glasses per day. Frequency of cheese and butter use is reported on a similar order scale (see Appendix 2). Since the user-response categories have natural orderings and no absolute spaces between categories, the statistical model is that of a cumulative response probability. Briefly, let j denotes each observation, then the user-response variable has $k+1$ response categories where k is an integer greater than 1. The cumulative probabilities are given by

$$F_i(\mathbf{a}_i + \mathbf{b}'X_j) = P(Y_j \leq i | X_j) \quad i = 1, 2, \dots, k+1. \quad (1)$$

For the j^{th} observation, the probability of response i is as follows:

$$P(Y_j = i | X_j) = \begin{cases} F(\mathbf{a}_1 + \mathbf{b}'X_j) & i = 1 \\ F(\mathbf{a}_i + \mathbf{b}'X_j) - F(\mathbf{a}_{i-1} + \mathbf{b}'X_j) & 1 < i \leq k \\ 1 - F(\mathbf{a}_k + \mathbf{b}'X_j) & i = k+1 \end{cases} \quad (2)$$

where Y_j is the use-response variable corresponding to the known vector X_j' of explanatory variables; $\alpha_1, \dots, \alpha_k$ are intercept parameters; and β is the slope parameter vector [8]. When the value of explanatory variable is equal to zero, the probability of the j^{th} observation has response i is α_i , which implies the response variable is simultaneously independent of all explanatory variables. Furthermore, when $\beta > 0$ in equation (2), the probability of response level i , i.e. $P(Y_j = i | X_j)$, goes up as X_j increases; that is, each cumulative probability, $F(\mathbf{a}_i + \mathbf{b}'X_j)$, increases. That means that relatively more probability mass falls into the lowest level of the response categories by following Agresti's explanation [9]. The Maximum likelihood estimator is employed to calculate the β parameters in the ordered-logistic regression model. The detailed explanatory variables are illustrated as Appendix 3.

Data

Implementation of the ordered-logit model has stringent data requirements generally not available for consumer economic or market research. To conduct an ordered-logit analysis the researcher requires a consumer survey conducted representing a large sample of consumers. In the case of fluid milk and dairy products one such set of data are available as the Dairy Management Inc. AUTS database, which is sponsored by the United Dairy Industry Association. The survey instrument is a stratified quota sample frame of over 3,000 consumers from across the continental United States reporting on the frequency of use for a variety of products, along with belief and attitude questions, and individual and household demographics. For this research, which focuses on the female respondents, the survey conducted in 1998 was used for the analysis. According to the percentage quotas for Consumer Mail Panel (CMP) data gage "nationally balanced" samples, the survey data is selected by computer program. Every panel member household can only receive one questionnaire. Responses to attitude questions are measured by an ordinal six-unit Likert Scale with endpoints of Definitely Disagree (1) to Definitely Agree (6).

Empirical Results

What we learned about life cycle:

The unit of observation in the AUTS cross-section database is the individual respondent. Each respondent typically progresses through several stages in their life and at each stage; they have different beliefs, attitudes and actions [6, 7, 10]. Using the hierarchy-of-affects and the life-cycle model as a framework for analysis, the female respondents to the AUTS survey are segmented by age and life-cycle into five groups: (1) female teenager (13-17), (2) female with children (0-12), (3) female head of household (40⁺), (4) female head of household (40⁻ and no kids), and (5) young female panel member (18-24).

From our statistical analysis, we find that female teenagers (13-17) have the highest likelihood of being categorized as a heavy user of (1) any type of fluid milk, (2) lowfat/2%/1% fluid milk, (3) skim fluid milk, and (4) butter across all of the female categories. The most probable user of natural cheese turns out to be young female panel members (18-24). The likelihood for a female teenager to be a non-user of any kind of fluid milk is as 0.643 times high as a female with children (0-12). In a contrast, a female head of household (40⁺) and a female head of household (40⁻ and no kids) both have around as 1.5 times high likelihood to be a non-user of any kind of fluid milk as a female with children (0-12). Also, a female teenager has as 0.643 times and 0.754 times likelihood to be a non-user of lowfat/2%/1% fluid milk and skim fluid milk, respectively, as a female with children (0-12). On the other hand, for natural cheese product, the likelihood for a young female panel member (18-24) to be a non-user is as 0.447 times high as a female with children (0-12), but the likelihood for a female head of household (40⁺) to be a less frequent user is as 1.426 times high as a female with children (0-12). From these analyses, a marketing executive can notice that young female under 24 years old and without children have higher likelihood to be a heavy user of fluid milk, cheese and butter than those either having children or older than 25 years old. Therefore, a female with children or over 25 should not be the target group in fluid milk, cheese and butter markets while a marketer tries to improve the sales.

What we learned from personal present diet situation:

Even though “fat concerned” is an issue that is widely discussed in all types of media in America today, the female’s personal diet situation does not show a strong relationship with their consumption choices on fluid milk and dairy products. The only exception is lowfat/2%/1% fluid milk and skim fluid milk. That is, the likelihood for a female drinking more fat free milk and less low fat milk while she is on a diet and trying to lose weight is as 0.673 times and 1.230 times high as while she is not a diet or trying to lose weight.

What we learned from the household demographics:

Socioeconomic variables provide significant information on the household structure that in turn may assist us in learning more about female respondent behavior. From the statistical analysis, we find the following statistical regularities: (1) female respondents with a higher education level of female head of household have higher likelihood of being more frequent drinkers of low fat and fat free fluid milk and cheese; (2) female respondents having a non-white

female head of household have higher likelihood of being more frequent drinkers of high fat fluid milk and of being less frequent drinkers of low fat fluid milk and cheese; (3) female respondents living in households with higher household income exhibit higher likelihood of being more frequent drinkers of low fat or fat free fluid milk and cheese; (4) female respondents living in households with more household members have significantly higher likelihood of being more frequent users of lowfat/2%/1% fluid milk and cheese.

What we learned from attitudes on product fat characteristics:

In determining female consumer's consumption behavior on fluid milk, cheese and butter, the "fat concerned" issue is the second significant in all of attitude Likert variables. The Likert-scale belief variables related to "fat concerned" issue include (i) milk is fattening, (ii) regular whole milk has too much fat for me, (iii) 2 percent milk is high in fat, (iv) skim milk is great for people on a diet to lose weight, (v) cheese is fattening, and (vi) butter is fattening. As a female respondent agrees the belief milk is fattening more strongly, her likelihood of being a non-drinker of any type of fluid milk and skim fluid milk is as 1.078 times and 1.157 times high as the one who disagrees the belief, respectively. Besides, the likelihood for a female believing regular whole milk has too much fat for me to be a less frequent drinker of high fat milk and low fat milk is as 1.778 times and 0.840 times as the one who does not believe that statement. On the contrary, when a female tends to believe 2 percent milk is high in fat, her likelihood of being a non-drinker of low fat milk and fat free milk is as 1.131 times and 0.884 times as the one who does not believe that statement. The stronger the agreement with the belief that fat is connected with fluid milk, cheese and butter, the lower the frequency use for these products. For these reasons, it is good to know that low fat or fat free milk and dairy products is more attractive for those female consumers who think fluid milk, cheese and butter are fat while a marketing executive is developing the marketing campaigns. On the other hand, how to emphasize low fat or fat free by changing the wording of labeling is another pertinent subject to approach "fat concerned" female consumers.

What we learned from product "health" characteristics:

Beliefs about nutrition characteristics for fluid milk, cheese and butter and beliefs about health claims, are represented in the statements (i) milk is a healthful drink, (ii) cheese is a healthful food, (iii) butter is a healthful food, (iv) milk is a good source of calcium, (v) cheese is a good source of calcium, (vi) butter is a good source of calcium, (vii) cheese raises blood cholesterol, and (viii) butter raises blood cholesterol. The statistical results in most nutrition belief Likert variables do not display significant influences on female consumers' frequent use responses even though most of them do express strong beliefs toward those health statements. According these findings, we can demonstrate a consumer's knowledge (believe) does not directly connect her actual consumption behavior, which is consistent with the hierarchy-of-effects model.

What we learned from respondents "taste" attitudes:

In general, female respondent's attitude toward "liking and preference", such as taste, is the most important and significant factor in affecting her consumption of fluid milk and dairy

products. For example, the probability values of I have never liked milk and I like the taste of cheese are very significant both statistically and empirically. Not surprisingly if a female respondent expresses a more definite agreement to the attitude statement: I have never liked milk, her likelihood to be a non-user is very high, greater than as 1.4 times high as the one who shows a less definite agreement to the statement. On the other hand, as a female respondent agrees with I like the taste of cheese more definitely, she has as 0.638 times high likelihood of being a less frequent user of any kind of cheese except cottage cheese as the one who disagrees with that.

What we learned from respondents “health/diet media information”:

The media health/diet information variable also impacts female consumer’s fluid milk and dairy product consumption behaviors. If a female respondent tends to have more agreement with the statement: I drink less milk today because of health/diet articles I have read, I am actively cutting back on cheese use because of health/diet articles I have read, or I have reduced my use of dairy products because of health/diet articles I have read, the probability for her to be a more frequent user of any type of fluid milk, any kind of cheese and butter goes down significantly. That is, as a female has stronger agreement with her decreasing fluid milk and dairy products due to health media information, her likelihood of being a non-user of any type of fluid milk, cheese and butter is as 1.067 times, 1.167 times, and 1.134 high as the one who has less stronger agreement. As a consequence, exposure to health/diet media information indeed influences American female consumers’ fluid milk, cheese and butter use.

Summary

According to United States Department of Agriculture data, American consumers’ consumption trends for plain fluid milk have shifted from high fat to lower or fat free milk during last several decades. In contrast, Americans consume nearly two and half times cheese in 1998 as in 1970. In the last decades, “fat-concerned” and “health claim” have been widely discussed issues within the United States. If indeed American consumers preferred lower fat diets, why they only shifted from the consumption of higher-fat fluid milk to lower fat or even fat free fluid milk, but increased cheese consumption? This study explores the possible factors, including different females groups by age and life cycle, personal diet situation, household demographic information, and attitudes toward fat, diet, and health claims, which may affect female consumer’s frequent usage of fluid milk, cheese and butter. Cross-sectional data were obtained from the 1998 AUTS database developed by United Dairy Industry Association. An order-logit model was used to explore the hierarchy-of-affects and life-cycle models for this data.

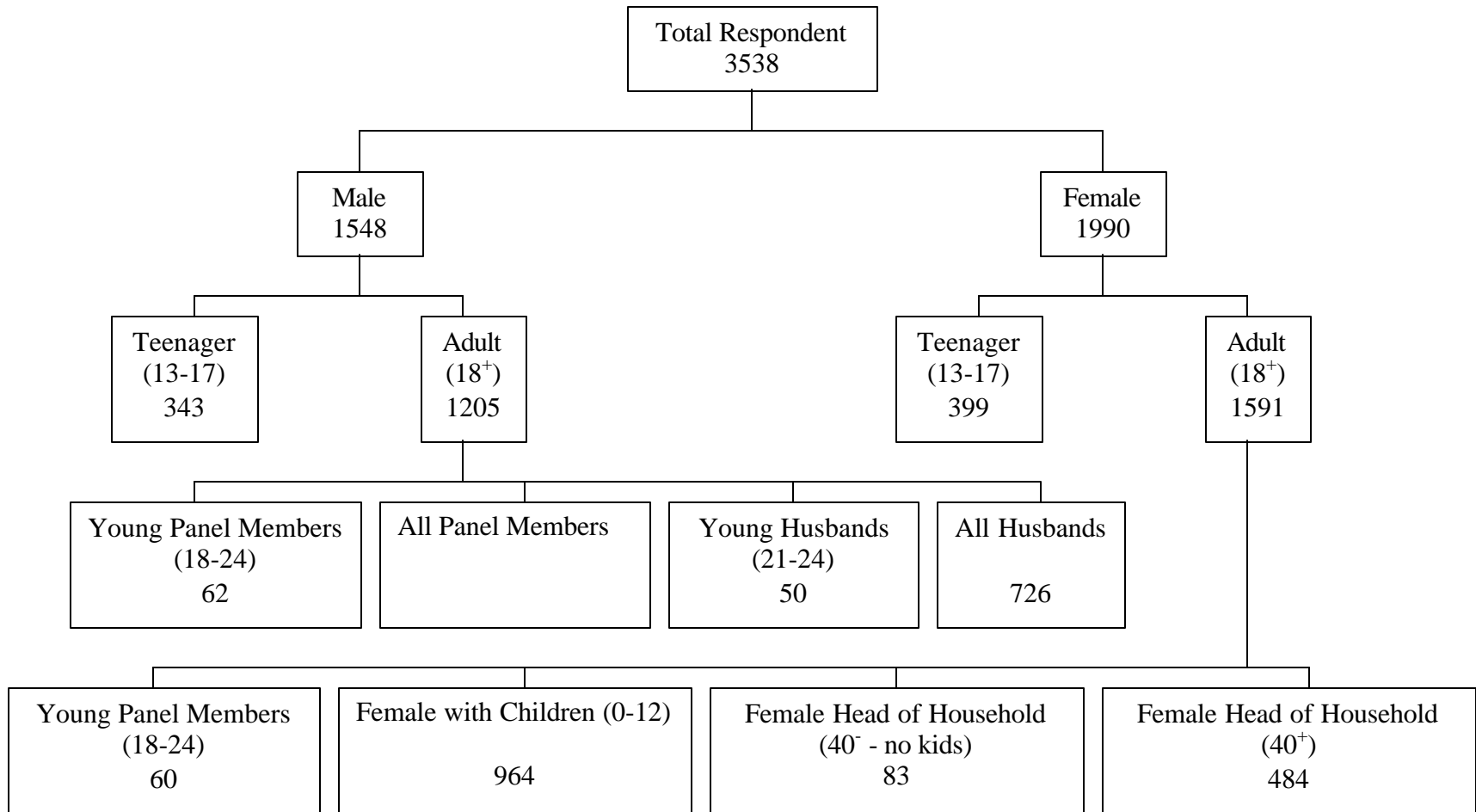
In the research, health media information is the factor that stimulates consumer’s perception and furthermore, may affect her preference. Moreover, it can change her consumption behavior. From our analyses, while female consumers do cut down their frequent usage of fluid milk, cheese and butter because of the health media information they have, they have less likelihood to be a heavy user of fluid milk, cheese and butter. As a result, a dairy industry leader should provide more positive media information, such as good taste and low fat image, in order to convince female consumers the benefits of using fluid milk, cheese and butter and furthermore, to improve the sales.

| Statement | Male | | | Female | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| | Frequency | MEAN | Std Dev | Frequency | MEAN | Std Dev |
| I drink less milk today because of health/diet articles I have read. | 1,071 | 2.2847806 | 1.5648421 | 1,891 | 2.1025912 | 1.4548036 |
| I am actively cutting back on cheese use because of health/diet articles I have read. | 1,071 | 2.5331466 | 1.5980635 | 1,891 | 2.4680063 | 1.5884528 |
| I pay close attention to what government agencies and medical groups say about foods or nutrients that should be cut down on in the diet. | 1,070 | 3.0710280 | 1.5657112 | 1,889 | 3.2922181 | 1.5162774 |
| I actively read newspaper and magazines for health and diet information. | 1,070 | 3.0149533 | 1.7116124 | 1,897 | 3.5872430 | 1.6847872 |
| I have reduced my use of dairy products because of health/diet articles I have read. | 1,069 | 2.4087933 | 1.4288223 | 1,888 | 2.4380297 | 1.4307453 |
| I would be interested in receiving diet and nutrition information from my doctor. | 1,063 | 3.4571966 | 1.6660458 | 1,888 | 3.8458686 | 1.6025529 |

Table 1: The comparison of MEANS procedure for male and female respondents' attitudes toward health/diet information

References:

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Appendix 1: AUTS samples distribution by sex and life-cycle

| Variable | Description | Ordinal Ranking | | | | |
|----------|---|-----------------|---------------------|----------------|-------------------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| ANYMILK | Any Type of Milk | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |
| RWMILK | Regular Whole Milk | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |
| LWMILK | Lowfat/2%/1% Milk | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |
| SKMILK | Skim Milk | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |
| CHEESE | Any Kind of Cheese Except Cottage Cheese | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |
| BUTTER | Butter | Non Use | Very Light Freq Use | Light Freq Use | Moderate Freq Use | Heavy Freq Use |

Appendix 2: Definition of endogenous variables – ANYMILK / RWMILK / LWMILK / SKMILK / CHEESE / BUTTER

| Variable | = 1 | = 0 |
|--|---|-----------|
| Female Respondent Categories by Age and Life-Cycle: | | |
| FT | if the respondent is female teenager (13-17) | otherwise |
| FCHIDS | if the respondent is female with children (0-12) | otherwise |
| FHOH40 | if the respondent is FHOH over 40 years old | otherwise |
| FHOHNKID | if the respondent is FHOH under 40 years old without kids | otherwise |
| YFPM | if the respondent is young female panel member (18-24) | otherwise |
| (Reference group is FCHIDS -- female with children from 0 to 12 years old) | | |
| Respondent's Present Diet Situation: | | |
| LOSEWEIGHT | if the respondent's present weight situation is on a diet; trying to lose weight | otherwise |
| Household Demographic Information: | | |
| FHOHEDUC | if education level of female head of household is greater than 12 years education level | otherwise |
| FHOHRACE | if female head of household is not white | otherwise |
| HHINCOME1 | if household income is less than \$19,999 | otherwise |
| HHINCOME2 | if household income is from \$20,000 to \$34,999 | otherwise |
| HHINCOME3 | if household income is from \$35,000 to \$59,999 | otherwise |
| HHINCOME4 | if household income is above \$60,000 | otherwise |
| (Reference group is HHINCOME1 whose level of household income is less than \$19,999) | | |
| HHSIZE | if household size is 1 | otherwise |
| Respondent's Personal Attitudes: | | |
| MSAFETY | I'm concerned about drinking milk from cows that have been injected with a product that stimulates milk production. | |
| SKTASTE | Skim milk tastes flat and watery. | |
| MHEALTH | Milk is a healthful drink. | |
| MCALCIUM | Milk is a good source of calcium. | |
| MPACKAGE | Milk in plastic containers is more nutritious than milk in cardboard containers. | |
| MDIET | Milk is an important part of your diet even when you're trying to watch your weight. | |

**Appendix 3: Definition of exogenous variables --
ANYMILK / RWMILK / LWMILK / SKMILK / CHEESE / BUTTER**

(Continued),

Appendix 3 (continued),

| | |
|---------------|---|
| MFAT | Milk is fattening. |
| RWTOFAT | Regular whole milk has too much fat for me. |
| LWHIFAT | 2 percent milk is high in fat. |
| SKGDIET | Skim milk is great for people on a diet to lose weight. |
| LWLABEL | Changing the label of 2% low fat milk to 2% reduced fat milk makes me feel more positive towards 2% milk. |
| SKLABEL | Changing the label of skim milk to fat free milk makes me feel more positive towards skim milk. |
| MPRICE | The price of milk is too high. |
| SKECON | Skim milk is an economical buy. |
| MNOLIKE | I have never liked milk. |
| MINFORMATION | I drink less milk today because of health/diet articles I have read. |
| CGREAT | Cheese is great when eaten by itself or with a cracker. |
| CCONVENIENT | Cheese is a convenient product to use. |
| CHEALTH | Cheese is a healthful food. |
| CCALCIUM | Cheese is a good source of calcium. |
| CCHOLESTEROL | Cheese raises blood cholesterol. |
| CFAT | Cheese is fattening. |
| CPRICE | The price of cheese is too high. |
| CTASTE | I like the taste of cheese. |
| CINFORMATION | I am actively cutting back on cheese use because of health/diet articles I have read. |
| BSUBSTITUTION | Nothing duplicates the taste of butter in baking. |
| BHEALTH | Butter is a healthful food. |
| BCALCIUM | Butter is a good source of calcium. |
| BCHOLESTEROL | Butter raises blood cholesterol. |
| BDIET | People should cut out butter if they're dieting to lose weight. |
| BFAT | Butter is fattening. |
| BPRICE | The price of butter is too high. |
| BINFORMATION | I have reduced my use of dairy products because of health/diet articles I have read. |
