Korean J Nutrition 30(4) : 434~441, 1997

The Effect of Nutrition Knowledge and Attitudes on Fat Consumption Using 1989/1991 Continuing Survey of Food Intakes by Individuals/Diet and Health Knowledge Survey(CSFII/DHKS)

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ABSTRACT

Fat consumption has decreased since the 1950's in the United States, and coronary heart disease mortality rates have gradually declined as well. These changes might be associated with changes of attitudes due to increased information about the relationship between fat consumption and heart disease. The purpose of this study was to determine whether knowledge and attitudes concerning fat and foods high or low in fat had an impact on peoples' actual fat consumption. For this study, the data of fat consumption and knowledge/attitudes of people came from the 1989 – 1991 Continuing Survey of Food Intakes by Individuals/Diet and Health Knowledge Survey (CSFII/DHKS), conducted by USDA. It was found that women 65 years and older tried to avoid more fat and consume more vegetables than those aged 25 – 64 years ; in fact, the actual fat consumption of those over 65 years was lowest among all age categories. However, the elderly did not have as much nutrition knowledge as people aged 25 – 64 years. Attitudes concerning vegetables and health were a better predictor of fat consumption than those concerning fat itself. However, low-fat milk consumption was influenced by nutrition knowledge as well as attitudes about fat intake : people with better knowledge and attitudes concerning fat intake consumed more low-fat milk. This could be resulted from the reason that low-fat milk is a good substitute for whole milk. The conclusion of this study is that there are two essential elements in healthy eating patterns : a) good attitudes towards fat and vegetable consumption, and b) correct nutritional knowledge concerning the fat-content of foods and the availability of alternatives. (*Korean J Nutrition* 30(4) : 434~441, 1997)

KEY WORDS : attitude · knowledge · behavior · fat consumption.

Introduction

People have learned of dietary guideline for fat consumption from many sources, such as the popular media and education workshops[1-3]. Fat consumption, especially from animal fat, has been decreasing in the United States since the 1950's. The coronary heart disease mortality rate began to level off in the early 1950's and has decreased since the mid 1960's[4,5]. The decrease in fat consumption could be due to the acquisition of information about the relationship between dietary fat and diseases such as heart disease and cancer. However, it has been reported that fat consumption is usually affected by attitudes towards fat,

Accepted : March 20, 1997

but not by knowledge.

The definition of attitudes is diverse. Attitudes depend on a person's beliefs that the behavior leads to a positive outcome(favorable attitudes towards the behavior) or a negative outcome(unfavorable attitudes), and another person' beliefs, normative beliefs[6,7]. These beliefs influence a person's intention with relative importance of attitudinal and normative consideration, which ultimately affects behavior. The beliefs can come from the acquisition of knowledge. However, it has been reported that attitudes influenced behavior, independent of the individual's knowledge of nutritional concepts and practice[6-8]. People might change their personal attitudes and normative beliefs since people in the United States have concerns about health and the media have covered a lot of issues on health and food consumption. The confidence of one's own ability to understand the information and source credibility(believability) are also important factors in the relationship between knowledge and attitudes[8-10]. Attitudes are typically assessed in relation to objects, events, or people, but attitudes should be assessed as intention in relation to eating behavior as well. In our study, attitudes towards objects and events were assessed as attitudes of agreement(i.e. agr-ee or disagree with information about objects or events), and intentions were assessed as attitudes towards behavior(i.e. the behavior is seen as avoidable or unavoidable).

It has been reported that fat consumption is independently related to the individual's knowledge of nutritional concepts and practice[6-10]. However, these studies had limitations in sample size and population of samples. Also, low-fat substitutes were less available at the time of these studies than that at the time of Continuing Survey of Food Intakes by Individuals(CSFII) 1989. The purpose of this study was to determine, using better data, analysis whether nutrition knowledge and attitudes towards fat influence actual fat consumption. The data for this study came from the 1989 - 1991 Continuing Survey of Food Intakes by Individuals(CSFII)/Diet and Health Knowledge Survey(DHKS), in which 1906 individuals identified as meal planner/preparer participated. This survey was conducted by the United States Department of Agriculture(USDA).

Methods

1. Sample selection

Data for this study came from the 1989 - 1991 CSFII/DHKS conducted by USDA. The 1989 CSFII included information on food and nutrient intake by 5204 individuals of all ages surveyed in the United States. The 1989 - 1991 DHKS includes information on, diet, health, and food safety issues from 1906 individuals identified as main meal planner/preparers in 1989 - 1991 CSFII. The survey was designed to provide a multistage probability sample representative of all households in the 48 conterminous States(240 Census-defined areas). The stratification plan took into account geographic location, degree of urbanization, and socioeconomic considerations. The 1989 - 1991 CSFII/DHKS included basic income sample and low-income sample. Eligible low income households were those with an income at or below 130 percent of the poverty threshold during the mon-th previous to the survey[11]. Participation by households in the CSFII was about 68 percent for both income groups. The DHKS was completed by 86 percent of CSFII households. The possibility of residual non-response bias remains. For this study, the data from the 1,906 individuals who participated in DHKS were used for further analysis.

Dietary information for this study was obtained from the average of three days of dietary consumption (interviewed 1-day dietary recall and self-administered 2-day dietary records). Daily nutrient intake was calculated using the USDA nutrient data base for Individual Food Intake Survey for the 1989 CSFII[12].

Food frequency data was also collected from the questionnaires of the 1989/1991CSFII. The amount of consumption of individual food categories was measured as the unit of a month in food frequency data. Food frequency data usually give a better estimation of typical nutrient consumption. However, 3-day dietary collection may represent the usual intake better than food frequency data in 1989/1991 CSFII, since the portion sizes of several food categories were not specified, and the food categories of the questionnaires were not specific enough to use them for estimating fat consumption. For example, the milk group

was not separated into low-fat and regular milk groups. To verify that the 3-day dietary collection can represent the general dietary intake, the correlation between 3-day dietary collection and food frequency data was fested.

2. Scales of knowledge, attitudes, and behavior report

The inclusion of the DHKS in the 1989 CSFII marks the first time that national information has been collected that links an individual's knowledge with his/her attitudes towards his/her own dietary behavior. DHKS respondents were contacted by telephone within about six weeks after the collection of dietary data and asked to answer a series of questions about knowledge and attitudes concerning diet, health, and food safety. The DHKS questionnaires were scaled by indirect assessment of multiple scalogram[13-17]. The questionnaires were broken down into several categories, such as knowledge, attitudes of agreement, and attitude towards behavior[14)17)].

Knowledge categories were separated into knowledge about fat, knowledge about food with a high fat content, and knowledge of heart disease(aggregation of related categories). An example of a question is "Have you heard about any health problems that might be related to···_____: ··· with the "blank" asking for specific information, for example, how much fat a person eats : circulation problem." Each question about knowledge was scored with 1 for a right answer and 0 for a wrong answer.

Attitude questionnaires were divided into categories such as attitudes of agreement and attitudes towards behavior. Questions about "How much do you agree or disagree with the following statements about fat, vegetables, and general health?" were categorized as attitudes of agreement. Answers about attitudes of agreement were rated on a scale from 1(strongly disagree) to 6(strongly agree) if question was a favorable to lower fat consumption ; otherwise the scale was the opposite. Attitudes of agreement were separated into small categories concerning fat and vegetables.

Attitudes towards behavior were represented by questions like "Do you avoid too much of the following nutrients?", and the answers were rated from 1(not important at all) to 6(very important) in a similar way to the attitudes of agreement rating system. Questions about people's values were determined by their prior concerns about money, nutrition, safety and convenience when they purchased foods. Nutrition value was assessed by the proportion of their priority of nutrition to their priority of money, nutrition, safety and convenience of foods. Doctors credibility was measured by the total number of doctors order of a special diet and doctors diagnosis of heart disease, stroke or high blood cholesterol.

Every question in one category was rated by numbers and the numbers were summed in the same category. Higher scores of knowledge indicated better information or knowledge acquisition. For questions about attitudes, these were rated from the highest point(the most positive attitudes) to the lowest point (the most negative). These scaled and summed values generally showed normal distribution in the present study, and the numbers were used for further parametric statistical analysis.

3. Statistical Analysis

Means and frequencies of demographic variables along with scores of knowledge and attitudes were calculated with sampling weight adjusted by the probabilities of selection. This weight was adjusted for differences between sample characteristics and the inferred US population, provided by USDA. Means in different gender groups were compared by multiple comparison of different age groups by the Tukey Test using the SAS statistical package[18)]. To determine which variables were good predictors for fat consumption, a backward multiple regression was started with twenty-five independent variables including demographic variables, and scores from the questionnaires about nutritional knowledge, attitudes as agreement, and attitudes to behavior. The actual consumption of nutrients or food on the basis of a 1000kcal energy intake from the three days of dietary information was considered as the dependent variable. Pearson correlation coefficients were also calculated among all dependent and independent variables in the regression. The results were similar with and without using sample weights in regression and correlation analysis. Since most of the factors used in determining the weights in multiple regression analysis were included

as independent variables, the results of regression and correlation analyses were reported without the weights. The significance level was set at alpha=0.05.

Results and Discussion

1. Measurement of food consumption

Food frequency data may give better information about usual intake than data from dietary records or 24-hour recall, but frequency data provides limited information about nutrient intake for groups with different eating patterns[12]. The prediction of fat intake using food records from 3-day averages was checked against food frequency questionnaires to determine whether the 3-day food records were consistent with food questionnaires, which could be viewed as a better indicator of a usual dietary intake. Individual food intake(e.g. : red meat, poultry, fish, vegetables and fruit) from three consecutive days was found to be reasonably correlated to food frequency scores(r=0.3-0.4). However, fat intake from 3-day food records and particular food categories from food frequency results were not correlated(r=0.08). In the CSFII/DHKS 1989, food questionnaires contained broad categories for foods : milk, fruit, red meat, poultry, fish and shellfish, vegetables, and eggs. These categories would not explain how much fat people actually consumed because the method of cooking and the addition of ingredients such as butter were not included. Krebs-Smith[19] reported that each food group's contribution to fat intake was dramatically different depending on the method used to classify food mixtures, and one or two groups of food cannot be well representative of fat intake. So, even though 3-day food records have some limitations in measuring the usual intake, the record is a better estimation of nutrient intake than food frequency questionnaires for the purpose of our study.

2. Demographic characteristics

The demographic and economic characteristics of the respondents from the DHKS categorized by age and gender are given in Table 1. There were only a few differences in race, urbanization, income and education among the eight age/gender categories. The samples were mainly composed of female Caucasians with about 32.4% belonging to the low income group. This indicates that in the United States, the meal planner in a house is usually and primarily a woman. Since the main meal planner has a dominant role in food consumption decisions, he or she can affect consumption for the whole family.

3. Results of knowledge, attitudes, and behavior

1) Scores of knowledge, attitudes, and attitudes towards behavior

Scores(mean±standard deviation) of knowledge, at-

Table 1. The demographic and economic characteristics of the respondents from the DHKS of 1989 CSFII by age and gender[1)]

Age category	15-24 years		25-44 years		45-64 years		65+years	
Gender	Men	Women	Men	Women	Men	Women	Men	Women
Sample size(n)	38	135	155	603	104	384	102	385
Mean age(years)	22.5±2.1[2)]	22.2± 2.0	34.8± 5.2	34.4± 5.6	54.3±5.5	54.4± 6.1	72.4± 5.3	73.3± 6.5
Race(%)								
White	83.9	78.7	84.7	81.1	81.6	82.8	78.2	87.6
Black	9.7	16.5	10.5	14.4	17.1	13.8	19.2	9.6
Other	6.5	4.8	4.8	4.6	1.3	3.5	2.6	2.8
Urbanization(%)								
City	19.4	39.0	21.8	30.0	26.3	26.8	37.2	28.1
Suburb	54.8	35.4	48.4	42.6	47.4	43.5	28.2	38.2
Nonmetropolitan	25.8	25.6	29.8	27.4	26.3	29.7	34.6	33.7
Mean Income (thousand dollars)	18.9±9.1	16.6±11.5	31.4±10.0	29.4±23.1	32.9±3.3	29.3±27.0	18.4±15.2	15.4±15.1
Mean education(years)	13.0±2.3	12.3± 2.3	13.4± 2.3	12.6± 2.8	12.1±3.5	11.9± 2.9	10.1± 3.9	10.6± 3.3
Percentage of low income group	34.2	40.0	22.8	30.4	24.0	29.2	35.2	43.6

1) All calculations use the sample weights for the probabilities of the selection.
2) Mean±Standard Deviation.

titudes, and attitudes towards behavior are given in Table 2. The scores showed a similar trend between men and women in different age groups, although mens scores were not significantly different among age categories except for attitudes to behavior concerning vegetables. For women, the scores showed small but significant differences among age categories. Those aged 15 – 24 years and those over 65 years had less knowledge about fat and heart disease than those in other age categories. However, elderly people had similar scores to people aged 24 – 64 years on attitudes towards behavior concerning fat, vegetables, and health. The young women had higher scores of attitudes of agreement for fat than the elderly people, but not in attitudes towards behavior. As we expected, people over 65 years had more doctor's diagnoses of heart disease, stroke and high blood cholesterol.

2) From correlation study

Important correlation coefficients(r) among knowledge, attitudes, and nutrient intake on the basis of 1000 kcal energy intake are given in Table 3. There were somewhat weak but significant correlations among the consumption of nutrients, attitudes towards behavior, and doctor's diagnoses. Attitudes towards behavior about fat and vegetables were negatively correlated to intake of calories, total fat, monounsaturated fat, and saturated fat(each r=around −0.11). Fat consumption was not affected by attitudes of agreement in this study. Consumption of low-fat milk and whole milk showed only a significant correlation to knowledge among foods. Low-fat milk consumption adjusted for 1000 kcal was positively correlated to knowledge about fat and foods high in fat(r=0.16). Whole milk consumption was opposite to low-fat milk consumption.

Other studies[6,7] showed that the correlation coefficients between fat consumption and attitudes were around −0.26 to −0.65, and those between knowledge and fat intake were a round 0.07. But in our study, the correlation coefficients between knowledge and food with a low fat content(e.g. low-fat milk) was significantly positive. The low-fat foods or substitutes were less available at the time of other studies than at

Table 2. Mean scores(±Standard deviation) of knowledge, attitudes of agreement, and attitudes towards behavior in eight age/gender categories[1]

Gender	Men				Women			
Age category	15 – 24 years	25 – 44 years	45 – 64 years	65+ years	15 – 24 years	25 – 44 years	45 – 64 years	65+ years
Knowledge about fat and fatty food (0 – 24)[2]	14.5±2.8	15.0 ±2.8	14.9 ±4.2	14.7 ±3.1	14.7 ±3.1^{b}	15.6 ±2.5^{a}	15.3 ±3.0^{a}	15.2 ±3.0^{a}
Knowledge about heart disease(0 – 40)	20.4±4.2	22.1 ±4.9	21.3 ±6.6	20.4 ±5.7	20.9 ±5.6^{b}	22.4 ±4.7^{a}	22.2 ±5.1^{a}	21.1 ±5.2^{b}
Attitudes towards behavior for fat and fatty foods(0 – 30)	19.7±6.3	22.7 ±4.9	23.8 ±5.5	23.6 ±5.1	23.2 ±4.8^{b}	23.5 ±5.1^{a,b}	24.3 ±5.3^{a}	24.7 ±5.2^{a}
Attitudes towards behavior for vegetables(0 – 48)	18.8±6.6^{b}	20.3 ±5.6^{a,b}	23.1 ±5.2^{a}	21.6 ±5.8^{a,b}	21.8 ±5.3^{b}	22.4 ±4.8^{a,b}	22.9 ±4.9^{a}	23.3 ±5.4^{a}
Attitudes towards behavior for general health(0 – 42)	13.6±3.5	14.8 ±3.8	15.4 ±4.0	15.1 ±3.8	15.3 ±4.3^{b}	15.0 ±3.5^{b}	15.9 ±5.5^{a,b}	16.2 ±3.8^{a}
Attitudes of agreement for fat and fatty foods(0 – 54)	34.2±5.9	33.7 ±6.6	34.9 ±8.1	32.2 ±9.2	35.2 ±6.6^{a}	35.2 ±6.0^{a}	34.8 ±7.2^{a,b}	33.6 ±7.2^{b}
Nutrition value(0 – 32)	19.7±5.2^{b}	23.6 ±5.2^{a}	24.3 ±5.1^{a}	23.4 ±4.6^{a}	23.3 ±4.3^{b}	25.5 ±4.2^{a}	25.7 ±4.3^{a}	25.0 ±4.9^{a}
Doctor's warning (0 – 3)	0±0^{a}	0.08±0.3^{a,b}	0.23±0.5^{b,c}	0.46±0.7^{c}	0.01±0.1^{c}	0.07±0.3^{a}	0.26±0.5^{a}	0.51±0.7^{b}

1) All calculations use the sample weights for the probabilities of the selection.
2) Possible range of scores of a variable.
a,b,c : Alphabets with different superscripts are significantly different among four age categories by Tukey tests in each gender at $p < 0.05$.

Table 3. Important correlation coefficients among knowledge, attitudes towards behavior, and nutrient intake adjusted by 1000 kcal energy intake

	Total fat(g)	P : S ratio[1)]	Chol.[2)](mg)	Fiber(g)
Attitudes towardsbehavior for fat	-0.05*	0.1***	-0.06*	0.11***
Attitudes towardsbehavior forvegetable	-0.1***	0.07**	-0.06**	0.14***
Attitudes towardsbehavior for health	-0.1***	0.05	-0.06**	0.16***
Doctor's warning	0.13***	0.11***	-0.09**	0.15***

1) Ratio of polyunsaturated and saturated fat
2) Cholesterol.
*Significantly correlated between nutrient or food and knowledge, attitudes of agreement, or attitudes towards behavior($p < 0.05$). **$p < 0.01$ ***$p < 0.001$

the time of 1989 CSFII.

Education level was relatively highly correlated to knowledge of fat($r=0.25$), knowledge of heart disease ($r=0.32$), attitudes as agreement towards fat($r=0.29$), and nutrition value($r=0.17$). But education level did not alter peoples attitudes to behavior about fat. Physician's diagnosis of heart disease, stroke and high blood cholesterol level showed a negative correlation to fat consumption($r=-0.16$) and a positive correlation to attitudes towards behavior concerning fat($r=0.10$). People had better attitudes of agreement when they had better knowledge about fat and heart disease, but that did not change their actual fat consumption. However, people with better attitudes towards behavior decreased their actual fat consumption, regardless of knowledge. This agreed to the report of Shepherd et al[6].

3) From regression analysis

In regression analysis, significant independent variables were selected from twenty-five independent variables including demographic variables, and scores from the questionnaires about nutritional knowledge, attitudes as agreement, and attitudes to behavior. Actual fat intakes were dependent variables in the regression equation. Not many independent variables in our data can explain the variation of dependent variables. This probably resulted from the reason that actual food intake was influenced not by demographic variables, knowledge, attitudes as agreement, and attitudes to behavior, but by peoples preference the most. All of the regression equations had low values(0.1 to 0.2) of the coefficients of multiple determination (R^2), meaning that 10 to 20 percent of the variation in observed dependent variable values was explained by the fitted model. It indicates that the actual consumption of foods and nutrients had a large variation and only a small portion of variation could be explained by the model. Thus, the variation in actual foods and nutrients could be influenced by variables other than those we considered.

Although R^2 values were low, these equations gave useful information, since the coefficients of independent variables in regression equations were significantly different from zero. The coefficients in regression equations gave more information in the relationship between food intake and knowledge and attitudes than the correlation coefficients(Table 4). Doctor's diagnoses of heart disease and high cholesterol levels were negatively correlated with the intake of total fat, saturated fat, monounsaturated fat, and cholesterol on the basis of 1000 kcal energy intake. Kno-wledge, attitudes of agreement, and attitudes towards behavior concerning on fat and heart disease did not affect significantly the total fat consumption.

Consumption of poultry and red meat adjusted for 1000 kcal energy intake did not show any relationship to knowledge of fat and heart disease, attitudes of agreement toward fat and health, and attitudes towards behavior concerning fat. Doctor's diagnoses showed a positive relationship to poultry intake, but it was negatively correlated to red meat consumption. Low-fat milk consumption was positively related to attitudes towards behavior fat and health, attitudes towards fat, and knowledge about fat ; the opposite was observed for whole milk consumption. The consumption of low-fat milk, fruits, and vegetables was positively correlated to age, gender, and doctor's diagnoses. Females, the elderly, the well-educated, and people with a high risk of heart disease had less consumption of whole milk and egg products on the basis of 1000 kcal energy intake.

Table 4. Some regression coefficients between knowledge, attitudes of agreement, attitudes towards behavior, and food intake on the basis of 1000 kcal energy intake

Dependent Variables / Independent Variables	Red meat(g)	Poultry (g)	Fish (g)	Cheese (g)	Whole milk(g)	Low fat milk(g)	Fruit (g)	Vegetable (g)
Age	−0.01	0.02	0.06	0.05	−0.26*	0.61*	1.1*	1.21*
Gender[1)]	−6.03*	−0.84	2.09	2.52*	−4.44*	13.0*	13.2*	11.4*
Knowledge about heart disease	0.16	−0.54	0.23	−0.04	−1.56*	1.90*	0.86	0.17
Attitudes of agreement toward fat	−0.02	−0.06	−0.38*	0.05	−0.90*	1.75*	0.38	0.51*
Attitudes towards behavior for health	−1.48*	−0.22	0.45	0.73	8.99*	1.24*	2.8*	1.25*
Doctor's warning	−2.69*	2.31*	0.71	−0.33	−1.81	1.3	8.37*	6.23*
Nutrition value	−0.22	0.63*	0.42*	−0.1	−0.45	0.26	2.49*	0.45
Education	−0.68*	−0.1	0.53*	0.34*	−2.73*	1.81	5.54*	−0.75

1) Indicative variable : 1 male ; 2 female.
*Significant coefficients of dependent variables in the final regression equation from backward selection($p < 0.05$)

Conclusion

Knowledge of fat and heart disease did not lower people's fat consumption in this study. However, the consumption of some foods with a high fat content such as whole milk was low in people with much knowledge of fat. Since low-fat milk can be a good substitute for whole milk, it is easy to eat less fat without jeopardizing eating patterns. The availability of good substitutes for high-fat foods is important in order to change peoples fat consumption by information and/or knowledge. Also, people who had motivation to change their fat consumption on the basis of doctor's diagnoses could decrease their fat consumption. People consumed less fat when they had positive attitudes towards behavior for vegetables and fruits as well as positive attitudes towards behavior for fat. In order to have people consume less fat, it is better to recommend consuming more foods low in fat, such as fruits and vegetables, instead of consuming fewer foods high in fat, such as meat with a high fat content and fatty snacks. If people understand that good dietary habits are very important factors for decreasing diseases and staying healthy, and they know how to apply their knowledge to their lives, they will have better attitudes towards fat consumption, and they will alter their eating habits. Nutrition education is important in order to deliver knowledge about the relationship between fat consumption and heart diseases along with information on low-fat substitute guidelines and low-fat recipes.

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