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FOOD BEHAVIOR FACTORS INFLUENCING THE DIETARY FIBER INTAKE OF OLDER WOMEN IN SOUTHEASTERN MICHIGAN

By

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ABSTRACT

FOOD BEHAVIOR FACTORS INFLUENCING THE
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Fifty-nine noninstitutionalized elderly women were interviewed about their food behavior including usual meal pattern, health, and understanding about fiber. Calculation of the dietary fiber (DF) content of the diets, based on Southgate's data, showed mean DF intake was 14 g/day (range 3-34 g/day). DF intakes were significantly lower for those with a tendency to constipation who took laxatives than for those who did not take laxatives or had no tendency to constipation. Those in poor health also had significantly lower DF intakes. Factors not related to DF intake included age, participation in a meal program, living arrangement, understanding of fiber, and functional health. Fruits and vegetables were eaten regularly by 93 and 98 percent of respondents respectively. Half of bread eaten was reported to be dark, whole wheat or rye. Bran cereals accounted for 30 percent of cereal consumption.

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INTRODUCTION

Indigestible plant fibers in food, commonly called dietary fiber, contribute to the production of a large, soft, well-formed stool that is easy to pass (Cowgill and Anderson, 1932), and have been associated with the maintenance of a normal healthy colon throughout life (Hodgson, 1975; and Painter, 1969). Due to technological advances in the last century refined foods, from which dietary fiber (DF) has been removed, have become widely available in many nations, leading to changes in the food behavior of many populations (Robertson, 1972). The long-range effects of these changes in food behavior are uncertain.

Painter and Burkitt (1971) suggested that inadequate DF in western diets was responsible for the high incidence of diverticular disease found among older people in western countries. Other evidence has suggested that DF may influence serum lipid levels (Jenkins et al., 1975b) and reduce mineral absorption (Stiles, 1976). Research on the role of DF in human well-being has been hindered by the lack of satisfactory data on the DF composition of foods (Van Soest and McQueen, 1973), as well as lack of knowledge of the interrelated effects of the various constituents of DF on colon function and other body processes (Spiller and Amen, 1975).

Some studies have shown that vegetables and fruits, which are important DF sources, are not consumed in adequate quantities by many older individuals (Pao, 1971; and Lyons and Trulson, 1956), and that

sweets, which are often poor sources of DF, are popular (Swanson, 1964). A U.S. Department of Health, Education and Welfare survey of 3,500 elderly individuals prior to participation in the Demonstration Nutrition Program for the Elderly (Pelcovits, 1972) revealed that 34 percent had eaten no fruit and 18 percent no vegetables in the previous 24 hours. The DF content of cereal grain foods rarely has been considered in food consumption studies, so evidence is lacking for the contribution of whole grains to the DF content.

If DF is necessary for good health, it is imperative that physicians and dietitians be aware of the DF content of foods and understand the factors which influence the DF intake of individuals.

The usefulness of the usual calculations of the DF content of diets (Brodribb and Humphreys, 1976a; and Bergan and Brown, 1976) is limited because results are stated in terms of crude fiber (CF), the century-old AOAC (1970) method of fiber determination in which substantial portions of DF are lost (Van Soest and McQueen, 1973). Newer methods of analysis, using detergents (NDF) (Van Soest and Wine, 1967) or enzymes (EZF) (Southgate, 1969; and Hellendoorn et al., 1975) to separate DF from the other constituents of food, yield values which are considered to be closer approximations of DF. While NDF and EZF values are available for a limited number of foods, the published values (Spiller and Amen, 1975; Hellendoorn et al., 1975; and Southgate, 1976 and 1977) are sufficient in number to allow for the calculation of the approximate DF content of diets. These approximations of DF intake can then be used in examining the factors which influence the DF content of diets.

An ecological approach is necessary if one hopes to delineate the factors which affect DF intake (Sims et al., 1972). The nutrient content of a person's diet depends on the choices he makes in getting, selecting, preparing, consuming, and disposing of his food, that is, a person's nutrient intake depends on his food behavior. Many factors influence a person's food behavior--his health, his life situation, his knowledge about and attitude toward food. These all must be considered in examining food behavior.

The objectives of this research were to: (a) describe the food behavior, health and life situation of a selected population of older women, (b) to estimate the DF content of their diets, and (c) to identify and describe the factors in their food behavior, health, and life situation which appeared to influence their DF intake. Older women were chosen as subjects because their laxative use suggests that they frequently suffer from constipation (Connell et al., 1965), which may be related to diets low in DF. Older women also suffer a high incidence of diverticular disease (Manousos et al., 1967) which suggests that they may be likely to exhibit many food behaviors which limit DF intake.

OPERATIONAL DEFINITIONS

Dietary Fiber.--All the plant polysaccharides and lignin in the diet that are undigested by human digestive enzymes.

Food Behavior.--The way in which an individual or group selects, prepares, consumes, and disposes of food.

Independent living adult.--An adult who is not living in an institution.

Nutrition Program for the Elderly (Nutrition Program).--A government program funded under Title VII of the Older Americans Act, which is designed to provide one meal a day for up to five days a week in a congregate setting to people sixty years old or older who are not eating properly for economic or social reasons.

Nutrition Site.--A location at which the meals of the Nutrition Program for the Elderly are served.

Nutrition Meal.--A meal served at a Nutrition Site, which has been planned to provide one-third of the Recommended Dietary Allowances for all nutrients.

Laxation.--The process of evacuating the bowels.

Site Host.--The supervisor of a Nutrition Site.

REVIEW OF LITERATURE

Definition of Dietary Fiber (DF)

Any discussion of food behavior in relation to dietary fiber (DF) intake must be preceded by a definition of DF, yet the effort to define what is meant by "dietary fiber" has been fraught with much confusion and disagreement.

The term was first used by Hipsley (1953) to refer to "lignin, cellulose, and hemicelluloses," It was not used again until Trowell (1972) proposed a new definition based on physiological considerations. Influenced by the early work of McCance and Widdowson (1929; and 1960) and the recent work of Southgate (1969) at Cambridge with "unavailable carbohydrates," Trowell (1972) defined DF as "the remnants of plant cells resistant to hydrolysis by the alimentary enzymes of man."

Because of Van Soest and McQueen's (1973) investigation of the constituents of plant cell walls, Trowell (1974) equated DF with the indigestible polysaccharides and lignin in the walls of plant cells. Recently Trowell and coworkers (1976) have extended the definition of DF to include undigested storage polysaccharides present within the cell as well as cell wall polysaccharides and lignin. Southgate (1977) has accepted this definition, calling it a "philosophical" definition, since it refers to the theoretical 'true fiber' in the diet and does not denote any method or analytical procedure.

The fiber studies of Van Soest and McQueen (1973) have utilized plant cell walls, not including the soluble polysaccharides. In a recent review, Van Soest and Robertson (1977) did not accept the more inclusive definition of DF and suggested that the soluble polysaccharides should be recognized as a separate class of substances, since they require a different analysis and possess some properties not shared with the insoluble polysaccharides.

In contrast, Southgate (1977) supported the inclusion of these indigestible soluble polysaccharides in the definition of DF, on three main grounds. First, the soluble polysaccharides are related structurally, in a chemical sense, to the insoluble polysaccharides present in plant cell walls. Second, these soluble polysaccharides behave physiologically in a similar way in increasing stool bulk and water retention. Finally, it is virtually impossible to distinguish, analytically, some components in the diet derived from the plant cell walls from those derived from other sources.

Spiller and associates (1976a) concurred with the DF definition of Trowell and coworkers (1976), but proposed a new term 'plantix' to replace the variously defined 'dietary fiber.' Although lignin is unrelated chemically to the indigestible polysaccharides, it is generally accepted as part of DF because of its intimate association with the polysaccharides of plant cell walls while not belonging to any other major food compartment (such as plant cell wall proteins).

Several unresolved questions concerning the definition of fiber have been pointed out (Trowell, 1977), including how to classify other indigestible non-plant or non-polysaccharide substances, such

as the products of the Maillard reaction, cell wall proteins and lipids, animal polysaccharides and synthetic polysaccharides used in food. It has been suggested that the indigestible proteins and lipids (waxes and cutins) associated with cell walls be included, along with DF, in a more comprehensive category called DF complex (Trowell et al., 1976) or complantix (Spiller and Shipley, 1976b).

For the purpose of this research, the widely accepted definition of DF was used, that is, DF includes all the plant polysaccharides and lignin in the diet that are undigested by the endogenous secretions of the human digestive tract (Southgate, 1977).

Components of Dietary Fiber

The components of dietary fiber have been described in several reviews (Cummings, 1973; Spiller and Amen, 1975; and Southgate, 1977), and include lignin, cellulose, and the non-cellulosic polysaccharides, hemicelluloses, pectic substances and gums.

The physicochemical structure of the non-cellulosic polysaccharides, about which Van Soest and Robertson (1977) and Southgate (1977) have disagreed, has not been elucidated completely, nor is the relationship between the subcategories clear. There is evidence from cultured sycamore cells that the pectins, hemicelluloses and cellulose are linked with covalent and hydrogen bonds into a cell wall macromolecule (Theander, 1977). Albersheim (1965) suggested that there is a continuum of polysaccharides from those containing a high percentage of uronic acid, the pectic substances, to those with a low degree of uronides, the hemicelluloses, and that the separation of pectins or

hemicelluloses is the result of the ease with which certain bonds are hydrolyzed under acid or alkaline conditions.

Analysis of Dietary Fiber

The standard crude fiber procedure (AOAC, 1970) for measuring fiber in the diet is being abandoned by researchers in favor of newer methods of analysis that give a more complete analysis of dietary fiber. Practical methods for analyzing dietary fiber can be grouped into three categories: simple empirical procedures such as those of Van Soest and Wine (1967) for measuring neutral detergent fiber (NDF); procedures which measure indigestible residue by the in vitro digestion of food, such as the enzymatic method (EZF) of Hellendoorn and coworkers (1975); and more involved procedures such as that of Southgate (1969) which measure unavailable carbohydrate.

Fiber Values Found in the Literature

Values for the crude fiber content of foods are found in Food Values of Portions Commonly Used (Church and Church, 1975). These values are considered unsatisfactory by most researchers (Spiller and Amen, 1975; Van Soest and Robertson, 1977; Trowell, 1977; and Southgate, 1977) but are still the basis of some recent studies (Bergan and Brown, 1976).

Values for the neutral detergent fiber of a limited number of representative foods have been reported by Spiller and Amen (1975) based on analysis by Robertson and Steh at Cornell University. A few NDF values also are found in a report by Van Soest and McQueen (1973). Values for the enzymatic fiber in a few representative foods have been reported (Hellendoorn et al., 1975; and Hellendoorn, 1976).

Southgate (1976) has published a guide to calculating intakes of DF in which values for the DF content of many, though by no means all, foods are presented. Many of the same values are given again in a later paper (Southgate, 1977).

DF values for many foods have not been published, particularly for some vegetables and many fruits. NDF or EZF values are available for some of these foods, but only crude fiber values can be found for others.

Comparison of Analytical Methods

Results of the analysis of some representative foods by three procedures are shown for comparison in Table 1. Values for the grain products display considerable agreement. For fruits and vegetables, values for neutral detergent fiber and indigestible residue (enzymatic method) are generally lower than those for unavailable carbohydrates as the pectic substances are lost during these procedures.

Physiological Effects of Dietary Fiber

Many studies have shown that adding bran to the diet increased the daily stool weight significantly (Eastwood et al., 1973; Cummings et al., 1976; Fuchs et al., 1976; and Findlay et al., 1974). Williams and Olmsted (1936) demonstrated that the fiber in carrots, corn germ meal, cabbage, and agar agar also increased subjects' stool weights substantially, while canned peas, 'cellu flour,' and cottonseed hull resulted in smaller increased in stool weight. Cummings and coworkers (1976) found that the increase in percent water content of the stool after the addition of wheat fiber to the diet was significant when

Table 1.--Comparison of Dietary Fiber Measured by Three Methods.

Food	Dietary Fiber, g/100 g, dry weight		
	Unavailable Carbohydrate[a]	Indigestible Residue[b]	Neutral Detergent Fiber[c]
White bread	4.6	4.0	3.3
Whole wheat bread	14.1	15.5	14.9
Wheat bran	48	56.0	
All Bran	26.7		34.0
Dried white beans	~24[d] (canned, baked)	15.7	
Onion	29.2	~8	7.1
		10.5 (dehydr.)	
Cabbage	32.6	18	14.2
		21.5 (dehydr.)	
Carrots	28.6	~13	9.2
		9.9 (dehydr.)	
Green peas	31.9 (canned)	13.2	
	47.6 (frozen)		
Potatoes	14.1 (raw)	8 (flesh only, baked)	4.7 (peeled)
Pears	14.7 (flesh only)	~7	
Apples	9.2	~8	7.6

[a]Values reported by Southgate (1977).

[b]Values reported by Hellendoorn and coworkers (1975).

[c]Values reported by Spiller and Amen (1975), analyzed by Robertson and Steh, Animal Science Department, Cornell University.

[d]Value reported by Southgate (1976), converted to dry weight basis.

large amounts of wheat fiber were added, but Wyman and coworkers (1976) found the increase in percent water content to be minimal when less fiber was added. Fantus and Frankl (1941) investigated increases in fecal volume but results were inconclusive because of difficulties in accurate measurement.

Two studies have shown that the addition of 20 g/day of bran to the usual diet increased the rate of passage of food through the digestive tract in persons with initially slow transit times, and also decreased the rate in those with rapid transits (Harvey et al., 1973; and Payler et al., 1975). Bran also was found to be effective in normalizing the frequency of defecation in those with infrequent, irregular bowel movements (Painter et al., 1972).

Studies have shown that several factors are involved in producing the effects of DF on laxation. McConnell and associates (1974) showed that the water binding capacity of polysaccharides is large but variable. The large water binding capacity of the mucilagenous polysaccharide in psyllium seeds accounts for its use as a stool softener, bulk-forming agent in treating constipation (Baker, 1975). Kirwan and coworkers (1974) also found that particle size influenced water binding capacity of cereal fibers, with coarse bran producing a greater decrease in intestinal transit times than finely ground bran. Wyman and coworkers (1976) compared Kellogg's All Bran and unprocessed miller's bran and found that the processed bran was less effective than the unprocessed bran in increasing stool weights.

Polysaccharides in the colon are attacked by bacterial action in the bowel and partially degraded to form volatile fatty acids and other nutrients consumed by bacterial cells, methane and carbon

dioxide (Van Soest and Robertson, 1977). The volatile fatty acids are thought to have a direct cathartic action on the bowel as well as drawing water by osmosis.

In an early study, Williams and Olmsted (1936) found that the increase in stool weight associated with ingestion of various kinds of fiber was related more closely to the bacterial degradation of fiber in the colon and the associated increase in fecal volatile fatty acids than to the amount of fiber consumed.

Recently Cummings and coworkers (1976) observed a significant decrease in transit time and increase in fecal weight associated with a highly significant ($p<.005$) increase in total volatile fatty acids per day following the addition of 28 g/day DF to the diet of six subjects. These researchers also noted that the concentration of fecal volatile fatty acids remained the same, suggesting that they were partially controlling fecal water content.

Dietary Fiber and Diverticular Disease

The hypothesis linking DF and diverticular disease was first proposed by Painter and Burkitt (1971). Burkitt (1970) found from epidemiological evidence that populations consuming a traditional African diet which was high in fiber had a low incidence of diverticular disease, while in England the incidence of diverticular disease had risen to high levels following a rise in the consumption of highly refined foods and meats in the late 19th century.

At the same time, Painter and associates (1965) found that intra-colonic pressures in diverticular patients were unusually high, due to hypersegmentation. Painter (1969) proposed that the high

intra-colonic pressures observed caused the formation of diverticula in the sigmoid colon. Painter and Burkitt (1971) then proposed that the lack of sufficient residue in the typical English diet was the cause of diverticular disease.

Other researchers have observed localized high pressure areas in the colon, or hypersegmentation, in the colons of subjects who were constipated (Connell, 1962), patients with spastic-type irritable colon (Chaudhary and Truelove, 1961) and rabbits fed a low residue diet (Hodgson, 1975). Morson (1975) observed that muscle thickening but not inflammation was characteristic of the colons of diverticular patients.

While the issue of the etiology of diverticular disease has not been resolved, increased levels of DF in the diet have been used with apparent success in treating patients with diverticular disease. In a study of 70 patients by Painter and associates (1972), treatment included a high fiber diet of fruits, vegetables and whole grains, plus as much unprocessed bran as was required to produce a soft bowel movement that did not require straining. Symptoms were relieved or abolished in 89 percent of the patients by the high fiber diet with bran (3-45 g/day), while three of the patients were improved by the high fiber diet alone.

In another study (Brodribb and Humphreys, 1976b), 40 patients with diverticular disease were treated with wheat bran (24 g/day). Thirty-three patients showed a very satisfactory clinical response, with 60 percent of symptoms abolished and a further 28 percent relieved. Examination also showed that stool weights increased

significantly, transit times tended to normalize, and intracolonic high pressure waves decreased, especially during and after eating.

Efforts which have been made to conduct double blind studies of the effect of increased DF on colonic disorders have shown disappointing results. In two studies of patients with irritable bowel syndrome, treatment with muffins or biscuits which did or did not contain bran produced no significant improvement (Lyford et al., 1975; and Søltoft et al., 1976). The obvious effects of DF on laxation as well as the variable response of individuals to level of dietary fiber observed by Painter and coworkers (1972) and Findlay and coworkers (1974) may have spoiled the double blind aspect of the studies.

Other Physiological Effects of Fiber

In vitro and in vivo evidence showing that bile acids and neutral sterols are strongly absorbed by certain fractions or types of fiber has been reviewed by Spiller and Amen (1975), suggesting that DF may influence blood cholesterol levels. Early studies with human subjects (Keys et al., 1960) showed that an 'Italian style diet,' characterized by an abundance of fruits and vegetables produced consistently lower serum cholesterol levels than an American type diet with more simple carbohydrates. Further studies in the controlled conditions of a metabolic unit (Keys et al., 1961) demonstrated that pectin but not cellulose (15 g/day) produced a significant reduction in serum cholesterol of about five percent.

In more recent tests in London (Jenkins et al., 1975b), guar gum or pectin but not wheat fiber (36 g/day) added to the normal diet of healthy volunteers resulted in a significant drop in serum

cholesterol levels. Other studies have noted also that wheat bran has little effect on serum cholesterol levels (Brodribb and Humphreys, 1976c; Connell et al., 1975; and Heaton and Pomare, 1974). In contrast, legumes have been shown to have a significant hypocholesteremic effect (Hellendoorn, 1976).

Other physiological changes some of which may be detrimental have been noted in association with increased ingestion of dietary fiber. These observations include reduced serum folate (Brodribb and Humphreys, 1976c), reduced serum iron and ionized calcium (Persson, 1976), and decreased efficiency of absorption of energy nutrients (Southgate and Durnin, 1970). Hill (1974) has proposed that DF alters the balance of intestinal microflora, reduces the concentration of fecal bile acids, and lowers fecal pH, leading to less degradation of fecal sterols to potentially carcinogenic or cocarcinogenic compounds which might lead to cancer of the colon. Eastwood and coworkers (1976) have suggested that volvulus of the colon is related to the consumption of large amounts if dietary fiber in rural Africa, while Heaton (1973) hypothesized that food fiber is an obstacle to energy intake.

Levels of Dietary Fiber Intake

There has been little evidence upon which to base a recommended daily allowance for fiber, since, until recently, there was little evidence that indigestible residues in the large intestine might be essential for good health (FNB, 1974). Nearly 50 years ago Cowgill and Anderson (1932) studied the laxative effects of changing the crude fiber (CF) content of diets and concluded that a CF intake of

90-100 mg/kg of body weight might be a 'physiological roughage minimum,' as this amount of CF in the diet was required before all subjects had easy bowel movements. No other research concerning a recommended level of DF intake was found, yet a recent medical article (Benson, 1975) has recommended the same level of intake, 100 mg/kg of 'bulk residue' daily, or about 6 g/day for a 60 kg person. No recommendations for levels of dietary fiber intake were found.

Current Levels of Dietary Fiber Intake

Levels of CF intake less than 90-100 mg/kg have been reported among persons consuming U.S. or European diets. In a large study based on 10-day diet records, Bergan and Brown (1976) found CF intakes of 4.0 and 2.8 g/day for males and females, respectively, aged 14-96 years.

In England, Brodribb and Humphreys (1976a) reported CF intakes of 2.6 g/day for subjects with diverticular disease, and 5.2 g/day for age- and sex-matched controls. These subjects were 75 percent female, so that the fiber intake of the control subjects, (5.2 g/day) represented a substantially higher fiber intake than a group of the U.S. subjects (Bergan and Brown, 1976) with the same proportion of females would have had (3.1 g/day).

In Holland, Groen (1973) reported the approximate fiber content of a typical 'western' diet containing generous amounts of meat and fats at 5 g/day, a value comparable to that of the control subjects in the study by Brodribb and Humphreys (1976a). Higher fiber values of 7, 8, and 13 g/day also were reported by Groen (1973) for Arab Bedouins, Yemenite Jews, and Trappist monks, respectively.

The dietary fiber content of a 'standard Western type diet' produced in a metabolic kitchen for research purposes was reported by Cummings and coworkers (1976) to be 17 g/day, using DF values from Southgate (1976). The crude fiber content of the same diet was 3.8 g/day (Jenkins et al., 1975a), a value only one-fifth the DF content of the diet.

Examining CF contents of British diets from a different point of view, based on national statistics relating total food supplies, Robertson (1972) found that daily fiber intakes rose from 2.1 g in 1880 to 4.2 g in 1970, with a peak of 5.3 g in 1942, during World War II.

Little effort has been made to document nutritional status with respect to fiber in relation to health except for general statements that people consuming 'western' diets are bothered more by constipation because they don't consume enough fiber, and as a result probably are subject to a number of diseases common in western countries (Burkitt et al., 1974).

Nutrient Intakes Related to Dietary Fiber Intake

While little has been done to investigate the DF content of diets or document DF status in relation to health, nutrient intakes of energy provide some evidence that DF intakes may be low since many foods which provide calories also contain DF. Many studies have shown that energy intakes of older women tend to be low (Ohlson et al., 1948 and 1950; Exton-Smith et al., 1965; Joering, 1971; Schlenker, 1976; and Brown et al., 1977). Steinkamp and coworkers (1965) noted that

subjects in a longitudinal study had significantly reduced food intakes after age 75, but no significant differences in distribution of calories from fat, carbohydrate, protein, and alcohol, and concluded that the reduction in caloric intake with age appeared to be related to a general decrease in the amount of food consumed, rather than a reduction in consumption of specific foods. In contrast, a cross-sectional study by Bergan and Brown (1976) showed that calorie intakes showed a tendency to decrease with age while fiber intakes did not.

Garcia and coworkers (1975) studying women in different age cohorts observed that when the intakes of individuals born in a particular year were evaluated over time, no significant changes occurred in mean intakes of food energy. The researchers concluded that it was important to account for generation or cohort effects before making inferences about the effects of aging on dietary intakes.

Food Behavior Related to Dietary Fiber Intake

A person's usual intake of any nutrient is determined by the choices that person makes in getting, selecting, preparing, consuming and disposing of his food (NRC, 1945). These choices are usually habitual and constitute a complex of individual food habits which are referred to as food behavior.

Few researchers have examined the food behavior which determines the dietary fiber content of diets. Groen (1973) observed that the western diet which is relatively low in fiber contains generous amounts of meat and fats. In contrast, he noted that Yemenite Jews, with medium levels of fiber intake, consumed more bread and less fat

than was found in the western diet, and Arab Bedouins, with medium levels of fiber intake, consumed large amounts of bread and little meat, fats, fruits, or vegetables. On the other hand Groen found that Trappist Monks who ate large quantities of bread, potatoes and legumes, no meat, and little fat, had very high fiber intakes.

The 'standard' western-type diet used by Jenkins and associates (1975a) and Cummings and associates (1976) contained meat, milk, eggs, vegetables, sugar, butter, and refined breads and cereals.

Painter and Burkitt (1971 and 1975) examined the change in food behavior which influenced fiber intake in Britain during the previous 100 years. They noted that large amounts of stone ground wheat mixed with rye, together with oatmeal porridge, were commonly consumed until 1880, when the advent of roller milling made available flour from which two-thirds of the fiber had been removed. Then increased prosperity, better transportation, and better refrigeration made other foods cheap and available. Meat imports doubled and sugar, jam and white bread became part of the diet of the poorest classes. Sugar consumption doubled between 1865 and 1890, while bread consumption declined.

Robertson (1972) challenged the findings of Painter and Burkitt (1971), noting the general increase in the crude fiber content of British diets in the last 90 years, which was due to an 87 percent increase in available fruits, vegetables and nuts, even though use of potatoes and cereal products had declined. A peak in fiber intakes during World War II was due to the use of large quantities of high extraction flour during the war years.

Food Behavior of Older Persons Related to Dietary Fiber (DF) Intakes

Some researchers have documented food behavior of older individuals which would relate to DF intakes. A U.S. Department of Health, Education and Welfare survey of 3,500 elderly individuals prior to participation in the Demonstration Nutrition Program for the Elderly (Pelcovits, 1972), indicated that 34 percent had eaten no fruit and 18 percent no vegetables in the previous 24 hours.

Swanson (1964) observed that the overall consumption of fruits and vegetables by older women was lower than that of younger women, while consumption of cereal products tended to remain constant, though providing a greater share of total calories, and sweets were often consumed in excessive quantities. Other researchers have reported that fruits and vegetables rich in vitamins A and C often are omitted from the diets of older persons (Steinkamp et al., 1965; LeBovit, 1965; and Clancey, 1975) but the implications of these findings for DF intakes is uncertain.

The DF content of cereal grain foods rarely has been considered in food consumption studies. Rountree and Tinklin (1975) reported that whole grain bread and rolls were used daily by nine percent of elderly subjects in Kansas. No other evidence was found for the contribution of whole grains to the DF content of diets.

Health Factors Related to Dietary Fiber (DF) Intake

Levels of DF intake have been implicated in problems with laxation (Williams and Olmsted, 1936; Eastwood et al., 1973; and Cummings et al., 1976). No U.S. studies were found which investigated

the incidence of constipation among older persons. A British study (Millard, 1971) found that 17 percent of women over 70 years were constipated although 56 percent were taking laxatives. Another British reseracher (Wigzell, 1969) found that 78 percent of persons aged 90-99 years had normal bowel habits. Again a large percentage of the subjects (66%) were taking laxatives. Methods of assessing constipation were not reported in either of these studies.

Yet another British study (Connell et al., 1965) measured laxation by the number of bowel movements per week and found that the percent of subjects with a bowel frequency of 5-7/wk tended to decrease through the sixth decade. Numbers in the age group 60-69 years were too small to draw conclusions about that trend in later life. A trend to increased use of laxatives with age was seen, with 14 and 30 percent of 60-69 year old subjects in the two populations studied reporting laxative use more than once a week. Results were not reported by sex.

Health and Environmental Factors Associated with Low Energy Intakes or Poor Nutrient Status

Many health, social, and environmental factors have been associated either with low energy intakes or poor nutrient status. Ohlson and coworkers (1948) found that elderly women in poor health tended to consume fewer vegetables and whole grains, and consistently ate less food than those in good health. LeBovit (1965) observed that the food limitations imposed by weight control and poor appetite were closely related to poor diets of older persons, while the presence of physical disability in the elderly was significantly related to poor diets in a study by Caird and associates (1975).

Guthrie and coworkers (1972) found that 46 percent of elderly subjects in rural Pennsylvania had inadeqaute caloric intakes, with consistently more subjects in the low than in the high income groups, consuming inadequate intakes of all nutrients evaluated. Significantly more of the high than the low income groups rated their health good to very good, while fewer of the high income groups were receiving medical treatment under a physician's care, and only half as many had chewing problems.

A 1962 study of elderly English women (70 years and over) by Exton-Smith and coworkers (1965) revealed a sharp fall (19%) in calorie intake during the years between 70 and 80. A follow-up study seven years later of those subjects who were available and willing to participate (Stanton and Exton-Smith, 1970) showed that about one-sixth of the original sample showed little decrease in their intake of calories or protein since the previous study, and also little deterioration in health. The remaining follow-up subjects who showed decreases in calorie and protein intake also consistently showed a deterioration in health. Stanton and Exton-Smith (1970) concluded that the decrease in caloric intake seen with age is the result, not of age, but of the deteriorating health which afflicts a large portion of persons in the eighth decade.

Several researchers have noted that older people who are living alone with little social interaction are less interested in eating (LeBovit, 1965), have lower nutrient intakes (Clancey, 1975; Davidson, 1962), and poorer eating patterns (Anderson, 1971).

Other social and environmental factors which have been associated with poor nutrition in older women have been low incomes and

poor lifetime eating patterns (Wruble, 1976), amount spent on food (Caird et al., 1975), and for low-income women studied by Exton-Smith and coworkers (1965), lack of adequate food storage space, difficulty in shopping and lack of incentive to prepare meals.

The Nutrition Program for the Elderly

Needs in the area of elderly nutrition were shown to be great from experiences and findings of the research and demonstration program to improve nutritional services for the elderly enacted in 1968 under Title IV of the Older Americans Act of 1965. Title IV projects proved to the Congress and President of the United States that the proper provision of congregate meals for groups of elderly fostered social interaction, facilitated the delivery of supportive services and met emotional needs, while at the same time it improved nutrition (AOA, 1973c). For example, a study by Joering (1971) evaluating the nutritional impact of a Cincinnati pilot congregate meal program showed that the average daily nutrient intake was greater for all nutrients when a center prepared meal was included in the subject's meals for the day.

Congress responded to these demonstrated needs of the elderly by enacting, in 1972, Title VII of the Older Americans Act, for the purpose of providing older Americans, particularly those with low incomes, with low cost, nutritionally sound meals served in strategically located centers where they could obtain other social and rehabilitative services. Besides promoting better health among the older segment of the population through improving nutrition, the program was aimed at reducing the isolation of old age, offering older Americans an opportunity to live their later years in dignity.

The Nutrition Program for the Elderly is currently serving 27,000 meals daily in Michigan at 617 Nutrition Sites (Perri, 1978). Most projects provide five meals a week.

Kohrs (1976) evaluated the influence of the Congregate Meal Program in central Missouri on dietary practices and nutritional status of participants and found that between 40 and 60 percent of the total daily intake of each nutrient was obtained from the program meal on days that subjects ate at the site. Subjects who ate at the meal site consumed significantly more calories, protein, and calcium than those who did not. Kohrs also found that the inclusion of a program meal in the day's meals eliminated the differences in calorie and protein intakes that were found to relate to socioeconomic factors in those who did not eat a program meal.

Measurement of Nutritional Status

Nutrient intake depends on food behavior, including all the choices a person makes in getting, selecting, preparing and consuming his food. A person's choice of what foods to eat is a complex behavior dependent on past experience, personal taste preferences, resources, and food availability (Gifft et al., 1972). No statement about food behavior is complete which does not include:

> identification of the food eaten so that it is possible to state that food in terms of nutrients; identification of the human being eating the food so that it is possible to define him further in terms of the entire body of cultural practices which he now embodies in his behavior; identification of the place from which the food comes or, put another way, the position of the human being in a food production and distribution system; the exact time at which the act under analysis is taking place. (NRC, 1945)

In a study of young children, Sims (1971) pioneered in using an ecosystem approach to the study of nutritional status which might be applied to the study of older persons as well. Sims and coworkers (1972) recognized that the influences upon a person's well-being act as a complex of interacting factors. Identification and analysis of the interrelationships among such variables were recognized as essential for a complete understanding of nutritional status. They proposed that current family setting, resource availability and use, and social-psychological attributes be studied as they provide input into dietary intake which results in measurable signs of well-being. Demographic data, physical description of the near environment, psychological characteristics, dietary assessment, and biochemical and anthropological measures were analyzed within this framework.

Dietary Assessment

Twenty-four hour recall methods of dietary assessment are easy but do not adequately characterize the diets of individuals unless several randomly repeated 24-hour recalls are taken (Marr, 1971; Balogh et al., 1971).

Weighed diet records give an accurate picture of food intake but often require more subject cooperation than the elderly are able or willing to give (Marr, 1971). Ohlson and coworkers (1950) found that food intakes apparently were altered by the restrictions of keeping a weighed diet record.

Burke (1947) suggested that, for research, it is important to know average dietary intake for a given period, rather than specific

dietary intake for a particular period of time, and developed a diet history method to fill that need.

The reliability of the Burke-type diet history was assessed in Israel by Reshef and Epstein (1972) by comparing interviews taken several months apart. Analysis showed no significant differences between estimated intakes of individuals from the two interviews for several food categories.

Schlenker (1976) found that the dietary recall records obtained from elderly women were essentially the same as the written diet records, suggesting that memory lapses were not a problem in assessing food intakes. On the other hand, Madden and associates (1976) found that elderly subjects using food models tended to underestimate large servings and overestimate small servings when recalling food intake from a meal that had been unobtrusively observed and measured by the researchers.

Moore and coworkers (1967) observed that the use of the food models in taking diet histories saved time and reduced the frustration of respondents who had formerly searched for words to describe size, volume and weight. Data handling also was reduced because answers were definite and comparable.

Measurement of Laxation

Connell and coworkers (1965) noted that simple methods of measuring laxation may be misleading as no single variable, such as frequency of bowel movements, stool consistency, or use of laxatives, provides a reliable measure of degree of problem with constipation. Williams and Olmsted (1936) observed that the subjects' subjective

estimation of relative laxation effect was related to increment in stool weight. Cowgill and Anderson (1932) noted that subjects felt subjectively that evacuation was easier and more satisfactory and complete when one ounce of bran was added to a basal diet although laxation rate changed very little. They concluded that subjective impressions as well as fecal weights were the most sensitive indicators of a significant laxative effect, although laxation rate and transit times were more objective.

Measurement of Functional Health

Functional health of older people has been defined by Rosow and Breslau (1966) as the degree to which they report they can manage adequately or are restricted in their activities because of their physical condition or capacity. They observed that a person's functional capacity is sociologically more significant than his technical medical condition. As a simple way of measuring the subject's self-assessment of functional health, Rosow and Breslau (1966) developed a Guttman Scale of responses to questions about the subjects ability to function in ordinary activities. Steps in the Guttman scale included: (1) subject still healthy enough to do without help when going out to movie, church, meeting, or visit; (2) subject walks up and down to second floor without assistance; (3) subject can walk half a mile; (4) subject chose statement 'I am not limited in any activities'; (5) subject has no physical condition or illness now; (6) subject still able to do heavy work around without help.

A perfect Guttman scale is cumulative, each step of the scale indicating that that step plus each of the previous steps is true of

the respondent (Guttman, 1951). That is, ideally, all those who, for example, have given three positive responses, will have responded positively only to the questions in steps 1, 2 and 3.

Results of the study of 1200 older persons in Cleveland by Rosow and Breslau (1966) showed that 69 percent of the subjects gave 3 or more positive responses, 53 percent 4 or more, 46 percent 5 or more and 21 percent 6 positive responses. They concluded that for surveys and sociological studies of the aged which must effectively depend on self-assessments of health in interviews, this scale provides a simple, economical means of differentiating functional health within a sample.

The General Public and Dietary Fiber (DF)

A search of dictionaries and books for the general public about nutrition or health showed that the word 'fiber,' as a constituent of food, did not appear commonly until the 1970s. Neither the Oxford English Dictionary (OED, 1971) nor the Random House Dictionary (Stein and Urdang, 1966) listed the nutritional meaning of the word 'fiber,' but 'crude fiber' is given as a meaning of 'fiber' in the latest edition of Webster's Unabridged Dictionary (Gove, 1976), with crude fiber being defined as "the chiefly cellulose material obtained as a residue in the chemical analysis of vegetable substances, as foods or animal feed.

A popularly written, reliable book on nutrition (Deutsch, 1971) used the word 'fiber' twice without defining it, in the first case in describing cellulose as a part of carbohydrate which "makes up much of the bulk and fiber necessary to keep our intestines working

well," and in the second case when explaining chronic constipation, "other foods such as low-fiber foods tend to slow intestinal motility." A more recent book for the general public by the same author (NNC, 1975) referred to fiber more extensively than the earlier book, explaining why a diet of nothing but refined foods is not recommended. Cellulose was equated with fiber in this book, and was exemplified by:

> fibrous material in celery or the strings in beans. These materials are sometimes called fiber . . . Smaller bits are found in all foods from plants . . . We know that fiber supplies much of the bulkiness of our food and that it is helpful in stimulating the movement of food in the intestines. (NNC, 1975)

A recent paperback medical encyclopedia (Wingate, 1972) referred to the dietary fiber concept in these words: "Undigested ballast (roughage) such as vegetable fibre improves the mechanical efficiency of the intestine." Another medical encyclopedia (Kuhne, 1960) described sources of "roughage" as whole wheat bread, the coarse varieties of vegetables and vegetables like lettuce and radishes. A large-print cookbook called Cooking for Two (USDA, 1974) which contained some nutrition information commented that "whole grain breads and cereals provide bulk."

'Roughage' and 'bulk' do appear in the Random House dictionary (Stein and Urdang, 1966). Roughage was defined as "food, as green vegetables, bran, and certain fruits containing a high proportion of indigestible cellulose which stimulates peristalsis in the intestines." Bulk is defined as "food which forms a fibrous residue in digestion, allaying hunger and promoting normal elimination."

Research findings in the late 1960s and early 1970s (Cleave et al., 1969; and Painter and Burkitt, 1971) prompted a sudden surge of

interest in fiber in the popular press. The Natural High Fiber Life Saving Diet (Subak-Sharpe, 1976) and The Save Your Life Diet (Reuben, 1975) appeared on bookstands. A guide to fiber in foods (Kraus, 1975) was published. High-fiber breads containing added cellulose (McCormick, 1976) appeared on grocery shelves and were advertised widely in newspapers. The high fiber diets and high fiber breads were discussed on television programs. The influence of the general interest in fiber on elderly persons has not been documented.

Measurement of Attitudes Toward the Practice of Nutrition

Attitude is frequently defined as a predisposition to react in a particular way toward a given object (Zimbardo and Ebbesen, 1970). If this supposition is correct then knowledge of attitudes toward the practice of nutrition as an object might enable the researcher to observe relationships between attitude and behavior in the practice of nutrition. Attitudes cannot be measured directly but must be inferred from an observable response. In a study of nutrition education assistants by Carruth (1974) attitudes toward the practice of nutrition were inferred from a Likert-type attitude instrument. A 40-item attitude instrument was developed consisting of statements about food and nutrition that reflected a willingness or disposition to be persuaded (that is, adaptability) or reflected rigidity (that is, inflexibility). Factor analysis of the responses to the items in the instrument showed that 17 items contributed significantly to a component designated 'Factor I: Change Dimension' which indicated "change is good" or "change is not good." Scores on Factor I: Change Dimension

were related to other variables, namely, scores on the observed behavior of the subjects classified as applications of nutrition knowledge and scores on verbal behaviors related to the practice of nutrition. Carruth concluded that the statements in Factor I: Change Dimension represent a beginning point for the development of further attitude instruments to be used in research.

Summary

A review of the literature has shown that little is known about food behavior related to dietary fiber. Problems in the definition and analysis of fiber were noted. One aspect of health, namely laxation, is clearly related to the consumption of foods containing fiber, but the exact nature of this relationship has not been elucidated. Research in the field of dietary fiber is hindered by the lack of values for dietary fiber content in tables of food composition, but DF values for some foods have been published and provide the basis for estimating DF intakes.

Low calorie intakes seen frequently in older women suggest that fiber intakes may also be low. Environmental factors which influence caloric intake may also affect DF intakes. The incidence of constipation and use of laxatives seen in older women may be related to DF intakes.

Dietary assessment of older persons is difficult, as no method of assessment is entirely satisfactory and any method used must be a compromise between precision and practicality. Also, better methods for measuring laxation are needed.

Information about fiber, some of it unreliable, has become available to the general public in recent years. The impact of this information on food behavior or DF intakes has not been assessed.

The present study was designed to estimate the DF intakes of a sample of older women and document the food behaviors, as well as health and environmental factors, that influenced DF intake.

METHODS AND PROCEDURES

The subjects selected for study were older women (60 years and over) enrolled in a meal program for the elderly in Oakland County, Michigan. The data collection method was an hour long interview with each participant. Specific factors studied were the respondent's usual meal pattern and other food behavior information, living situation, self-assessment of health, laxation, activity level, knowledge of fiber, and attitudes toward eating in general and dietary fiber in particular.

Development of the Instruments

The ecosystem approach was used by the researcher in developing the Interview Schedule, with questions included about current family setting, food behavior, nutrition knowledge and attitudes, and health, factors which a review of the literature had shown to influence food intake. This approach required a lengthy interview with the respondent, which was likely to lead to fatigue in older subjects. The researcher wished to avoid a second interview and at the same time make the interview move swiftly for the respondent. To meet these requirements, colorful visual aids were designed to focus the attention of the respondent and at the same time facilitate the collection of data. The interview was planned to take about one hour to administer. Most questions in the Interview Schedule were open-ended, with

responses recorded as completely as possible. The complete Interview Schedule, alone with explanation and description of the materials is found in Appendix A.

Data Collected

Information obtained during the interview included living situation and family background, food behavior, health of the respondent, diet history, knowledge of dietary fiber and attitude toward fiber. Demographic questions about income and education were excluded from the Interview Schedule because they frequently are construed as an unnecessary invasion of privacy and were not considered essential to the study.

Included under food behavior were questions about food expenditures, grocery shopping, meal planning, kitchen facilities, meals eaten away from home, and therapeutic changes made in the diet. Questions about weight category, bothersome health problems, outside activities, and laxation were asked to assess the respondent's general health. In addition, the respondent's ability to function in ordinary household tasks was assessed by a series of questions adapted from a Guttman health scale for the aged developed by Rosow and Breslau (1966). Data also were collected on frequency and ease of evacuation, consistency of the stool, use of laxatives, and occurrence of constipation or diarrhea.

A modification of the Burke diet history method (Burke, 1947) was used to assess food intake and included the Usual Meal Pattern and food frequency information. Collected through the Usual Meal Pattern were data about the types of foods usually eaten during the

course of the week, with emphasis on qualitative and quantitative data about foods containing fiber. The protocol for the Usual Meal Pattern is found in Appendix A as Schedule Cards A and B. Food frequency information on plant foods was collected through the use of Food Cards (p. 36).

The respondent's knowledge of and attitude toward dietary fiber were assessed by means of a series of carefully ordered open-ended questions about any foods they ate to avoid constipation, where and what they had heard about 'fiber,' what came to mind when they heard the word 'fiber,' if they paid any attention to the amount of 'roughage' in their diet, and their use of bran and the reason for its use. Probing questions were asked if respondents gave a response which did not reveal their understanding of fiber.

Finally, the respondent's attitude toward the practice of nutrition was assessed by a series of ten Likert-type "Viewpoints on Eating" statements adapted from those of Carruth (1974), which were purported to measure "willingness to change."

Construction of Visual Aids

As an aid in the collection of quantitative data for the Usual Meal Pattern, Food Models (Christensen, 1973) were constructed to assist respondents in estimating portion sizes. The models were constructed by the researcher and consisted of plain rounded foam shapes painted in appropriate colors to represent a wide variety of foods. A description of the Food Models is found in Appendix A, Equipment For Conducting The Interview.

To facilitate the collection of food frequency data, Food Cards illustrating common fruits, vegetables, and other miscellaneous fiber-containing foods were constructed, along with Colored Boxes for sorting the Food Cards. The Food Cards were made from 4" x 6" white card stock. Pictures of the foods for the Food Cards were cut from seed catalogs and magazines, and heat-sealed onto the card stock and then heat-laminated with plastic. Foods for which no pictures could be found were photographed, and the pictures cut from the prints, heat-sealed to the card stock, and laminated with pressure adhesive plastic. Each card was labeled in large print with the name of the food. The foods pictured on the Food Cards are listed on the Food Card Response Forms (Appendix A). The Food Cards were sorted by the respondent into the Colored Boxes which were color-coded and labeled with the following categories: Very often, more than once a week (green); Often, about once a week (yellow); Occasionally, less than once a week (orange); Less than 5-6 times a year (white); Cannot eat (pink); Dislike (red); and Other (blue). Foods eaten very often in season were also noted. The Colored Boxes are listed in Equipment for Conducting the Interview (Appendix A). Protocol for the use of the Food Cards and Colored Boxes is found in Schedule Card C (Appendix A).

To assist in answering questions about body weight category, stool consistency and limitations on activity and in responding to the ten Likert-type "Viewpoints on Eating" statements, probe cards were designed. These consisted of large-print copies of the response choices mounted on colored posterboard and laminated with pressure adhesive plastic. Because the word 'probe' was considered

potentially offensive by agency personnel, these cards were called Response Aids and are listed in Equipment For Conducting The Interview (Appendix A).

Gift to Participant

As a means of conveying the gratitude of the researcher for the respondent's participation in the study, and to maintain good will among the research population, a gift was offered to participants at the close of the interview. Two books were offered of which the participant could choose one. The books were Cooking for Two (USDA, 1974) and Nutrition Labeling, How It Can Work For You (NNC, 1975).

Fieldnotes

In addition to the data recorded on the Interview Schedule, fieldnotes were recorded, which included length of interview, general impressions from each interview, and further details related by the respondent.

Informed Consent--The Introductory Letter and Consent Form

An introductory letter explaining the study to potential participants and encouraging their participation was developed. The Consent Form also was developed to be signed by those participating in the study indicating that they understood the project, participated willingly, knew they could stop at any time, and knew that the information provided would be treated confidentially. The introductory letter and Consent Form are also found in Appendix A.

Pretesting

The research tool was pretested for clarity, length, and ease of administration with 16 volunteers from the community, 12 of whom were women over 50 years of age. Minor revisions were made to increase clarity, shorten the interview and facilitate the recording of data.

Approval of Research Involving Human Subjects

The complete Interview Schedule was approved by the Michigan State University Committee on Research Involving Human Subjects. Approval of the study, including Interview Schedule, also was obtained from the appropriate professionals of the Oakland Livingston Human Service Agency (OLHSA), sponsor for the Nutrition Program for the Elderly in Oakland County, source of participants for the study.

Sample Selection

Older women were selected for study for several reasons. In the interest of obtaining an homogeneous sample, sex was eliminated as a variable since caloric intakes, and therefore probably DF intakes, vary with sex. The caloric requirements of women are generally lower than those of men, and also appear to decrease with age. In so far as dietary fiber content of diets is related to caloric intake, older women are more likely to consume small amounts of dietary fiber, which might lead to greater incidence of constipation. The greater incidence of infrequent stools in older subjects seen in the study of Connell and Coworkers (1965), as well as the greater use of laxatives with age, does suggest that older women suffer more constipation. Women also display a high incidence of diverticular disease (Manousos et al., 1967).

Participants for this study were selected from a population of older (60+ years of age) urban women who were living independently. Because of the difficulties involved in obtaining the names and cooperation of participants from the general population, and to control expense, participants were selected from among women who had enrolled in the Nutrition Program for the Elderly in urban Oakland County, Michigan. OLHSA professionals cooperated in selecting representative Nutrition Sites and enlisting the assistance of the Site Hosts in obtaining the names of potential participants.

Four Nutrition Sites were selected, representing a variety of types of audiences: (1) Lake Orion Multipurpose Center, a large suburban site with many participants living in their own homes; (2) First Christian Church, a small urban site not connected with housing for the elderly; (3) Woodland Heights, an urban site associated with an apartment complex for the elderly in a low income area; and (4) Cliff-view, a suburban site associated with an apartment complex for the elderly in a high income area.

Names of potential participants were obtained from the files of the Site Hosts. Because of the large number of inactive names on file, people who had moved or died, each Site Host assisted in the drawing of a population of names. Names of women known to be too ill to participate were eliminated. A population of 186 names was developed, from which the prospective participants were selected randomly within each site, using a table of random numbers.

In preparation for the actual interviewing the researcher visited each site to become acquainted with the participants through

a brief food demonstration about flavored milk drinks (Appendix B). Potential participants were contacted by means of an individually typed, personally addressed introductory letter followed by a telephone call to make an appointment for the interview. At least three attempts were made to contact each potential participant by phone unless information was received that she was away for an extended period or was too ill to participate.

Analysis of Data

Information collected on the Interview Schedule was coded by the researcher and analyzed on a CDC6500 computer using programs in Statistical Package for the Social Sciences (Nie et al., 1975). Scales for health problems, functional health, and laxation were constructed in preparation for analysis of the data. The dietary fiber content of the diets was also computed using an original procedure developed for the study by the researcher.

Scale of Health Problems

In order to provide a measure of the degree of ill health of respondents a Scale of Health Problems was constructed by scoring two points for each serious or life-threatening health problem mentioned by the respondent and one point for each other health problem mentioned. Conditions counted as serious health problems included severe arthritis, gastric ulcers, history of heart attack or stroke, evidence of heart disease, cancer, recent or impending major surgery, kidney trouble and obesity.

Guttman Functional Health Scale

Functional health, defined as the degree to which persons claim they can function in ordinary household tasks or are restricted in their activities by their physical condition, was measured using the method of Rosow and Breslau (1966) for developing a Guttman functional health scale.

Responses to questions pertaining to the respondent's ability to function in ordinary household activities were tested for their ability to form an acceptable Guttman Scale. The resulting five-point scale, with an acceptable coefficient of scalability of .77, was used for measuring the functional health of respondents. The steps of the Guttman Functional Health Scale are shown in Figure 1.

Laxation Scale

Factors which the literature has shown to be involved in laxation (Connell et al., 1965; Williams and Olmsted, 1936; and Cowgill and Anderson, 1932) were included in questions about laxation asked of respondents. The responses to these questions were coded on

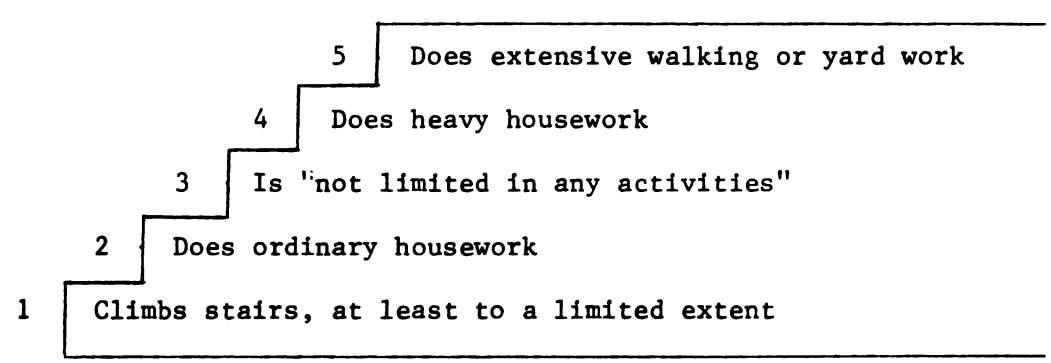

Figure 1. Guttman Functional Health Scale

a four-point scale indicating perceived degree of problem with constipation (1 being greatest and 4 least problem) and the questions then tested for their ability to form a reliable scale of laxation. Five factors which formed a scale with an acceptable reliability coefficient (alpha = 0.91) were bowel consistency, ease of bowel movement, frequency of bowel movement, occurrence of constipation or diarrhea, and frequency of laxative use. The sum of the values for each factor then constituted the score on the Laxation Scale, which was used as a measure of laxation.

Coding of the Diet History Data

Using a conversion chart developed by the researcher, food intakes recorded on the Usual Meal Pattern as Food Model sizes and common measures together with food intakes from the bran consumption question were coded into the following major food groups in units of one-eighth cups per week, unless otherwise noted: bread (slices or equivalent/wk), cereal, potatoes, cooked vegetables, vegetable salads or raw vegetables, fruit, bran (oz/wk), legumes, nuts, peanut butter, pie and cake or cookies. Each food on the miscellaneous Food Cards (Appendix A, p. 154) was coded in the same way. Intakes from the Usual Meal Pattern, the Food Card data, and the bran question were compared and differences reconciled. Intakes of refined cereals and white bread were calculated by subtracting from total cereal and bread intakes, values for whole grain cereal and bread consumption obtained from the miscellaneous Food Card data.

Assignment of Dietary Fiber Values

For the purpose of this research, the dietary fiber definition of Southgate (1977) was accepted, i.e., dietary fiber includes all the

plant polysaccharides and lignin in the diet that are undigested by the endogenous secretions of the human digestive tract. By Southgate's (1977) definition dietary fiber included cellulose, hemicellulose, pectin, and lignin. Southgate's definition of dietary fiber differed from that of Van Soest and Robertson (1977) in that Southgate included pectin within dietary fiber. This researcher agreed with the logic of Southgate that there was not sufficient justification for excluding pectin from dietary fiber as Van Soest had done (Southgate, 1977; and Van Soest and Robertson, 1977).

Having accepted Southgate's definition of dietary fiber, this researcher selected the analytical method of Southgate (1969) as best representing the dietary fiber content of foods, since this procedure measures all components of dietary fiber, including pectin. Published values for the dietary fiber content of foods analyzed by the Southgate method (Southgate, 1976 and 1977) were used in calculating the dietary fiber content of the diets in this study. Since Southgate dietary fiber values have not been published for many foods, other fiber values that have been published, based on Van Soest's neutral detergent method (NDF) (Van Soest and McQueen, 1973; and Spiller and Amen, 1975), an enzymatic method (EZF) (Hellendoorn et al., 1975) and the crude fiber method (CF) (Adams, 1975) provided a basis for estimating the dietary fiber content of other foods for which dietary fiber values were not available. This researcher observed that, when compared on a dry weight basis, the ratios of DF to NDF, EZF or CF values were similar for related foods. Degree of tenderness, type of vegetation, calorie content, and ability to form gels were factors which appeared to relate

to these ratios. These ratios then provided the basis for estimating the dietary fiber content of foods for which no Southgate values had been published, using the formula:

$$\text{DF of Food}_x = R \times \text{NDF, EZF, or CF of Food}_x$$

where R is the ratio of DF to NDF, EZF, or CF for a related food or group of foods for which both values are known, with all values stated in percent or grams per 100 grams. Details of these calculations are given in Appendix C, Table A-1.

Calculation of Estimated Dietary Fiber Intakes

After DF values had been designated for all foods on the Food Cards as well as other fiber-containing foods which were commonly mentioned in the Usual Meal Pattern, these DF values were then used to calculate Conversion Factors for translating the volumetric data from the Usual Meal Pattern into estimates of DF intake, using the formulas:

$$\text{Conversion Factor (g/unit vol.}^b\text{)} = \frac{\%\text{DF(fresh wt)}}{100} \times \text{Fresh wt/unit vol.}^c$$

$$\%\text{DF(fresh wt)} = \%\text{DF(dry wt)} \times \frac{\%\text{ dry matter}^a}{100}$$

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[a]Values from U.S. Agriculture Handbook No. 456 (Adams, 1975).

[b]The unit of volume used for coding most foods was one-eighth cup, which yielded values between 01 and 99. Bread was coded in terms of slices, or slice equivalents, while bran, bran cereal, and popcorn were coded directly in ounces.

[c]Values calculated from information in Food Values of Portions Commonly Used (Church and Church, 1975), or in a few cases measured by the researcher.

Details of the calculation of Conversion Factors used in programming the computer are found in Appendix C, Table A-1.

For the actual computation of the estimated dietary fiber contents of the diets, foods containing fiber were divided into 10 major food groups: cooked vegetables, bread, fruit, legumes, potatoes, cereal not including bran, salads and raw vegetables, nuts, bran, and desserts. The estimated dietary fiber intake from each food group was computed separately. DF intakes for each group except fruit and cooked vegetables were computed directly with the Conversion Factors for bread, bran cereals, cereals, legumes, and miscellaneous foods found in Table A-1 (Appendix C), using the formula:

$$DF(g/day) = (Z_1C_1 + Z_2C_2 + Z_3C_3 + \ldots . Z_iC_i)/7$$

where Z_i = amount of 'i'th food in the group

C_i = Conversion Factor for the 'i'th food

Nutrient intakes calculated from detailed food frequencies are subject to large error because of the accumulation of errors likely in estimating the many frequencies required, especially with a large class of food like fruits or vegetables. In order to avoid this large accumulation of error, the researcher used the fruit and vegetable frequency data to calculate the approximate pattern of fiber consumption for use in estimating the fiber contribution of the usual amount of fruits and vegetables eaten. The fruits and vegetables were grouped according to DF/8th-cup in three levels of DF content for fruits and three levels for cooked vegetables. Common Conversion Factors were assigned to each of these groups and used in step 2 in the next paragraph.

The following three steps were used in calculating the dietary fiber contribution of fruits and vegetables consumed (not including potatoes). The example is given in terms of fruits:

1. Count F_{if}, where F_{if} = The number of fruits of i fiber content consumed with f frequency

   i = the level of fiber content of fruit,[a]
   H - 0.5 grams per eighth-cup
   M - 0.3 " " "
   L - 0.1 " " "

   f = the relative frequency of consumption,
   3 - more than once a week (0.6)
   2 - once a week (0.3)
   1 - less than once a week (0.1)

2. Calculate the Conversion Factor for fruits consumed with f frequency (DF_f grams/eighth-cup), using the Conversion Factors for the fruit groups given in Table A-1 (Appendix C)

$$Df_f = \frac{(F_{Hf} \times 0.5) + (F_{Mf} \times 0.3) + (F_{Lf} \times 0.1)}{F_{Hf} + F_{Mf} + F_{Lf}}$$

3. Calculate DF intake from fruit (grams/day) using the Conversion Factors from Step 2.

$$\text{DF intake (fruit)} = \frac{Z \text{ eighth-cups/wk}}{7 \text{ days/wk}} \times (0.6 \times DF_3) + (0.3 \times DF_2) + (0.1 \times DF_1)$$

   where Z = total eighth-cups of fruit consumed per week.

The method of computation of DF intakes used in this study produces values which are only estimations, since many of the values for the DF content of foods are estimates. For the sake of simplicity, these values for the estimated dietary fiber content of the respondents' diets will hereafter be referred to as dietary fiber (DF) intakes.

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[a]Conversion Factors for low-, medium-, and high-fiber fruits and vegetables from Table A-1, Appendix C.

Respondents' Understanding of the Concept 'Food Fiber'

Responses to the open-ended questions about fiber were clustered into the following categories: (1) Respondent had not heard of fiber in food; (2) Respondent had heard of fiber, but did not mention improved bowel function or correct sources of fiber; (3) Respondent gave evidence of limited understanding of fiber by making vague or uncertain comments about the function of fiber and correct sources of fiber; (4) Respondent gave evidence of understanding fiber by mentioning improved bowel function and correct sources of fiber.

Respondents who stated that bran helped elimination, made the bowels move, or a similar comment were considered to have adequate understanding of the relation of bran to bowel function.

Willingness to Change Scale

The 10 Likert type opinion statements about nutrition devised to measure "willingness to change" were tested for their ability to form a reliable scale. A Willingness to Change Scale was constructed from four statements which demonstrated an acceptable reliability coefficient (alpha = .73). The statements are as follows:

1. It is fun to try out new foods and old foods fixed in a new way.
2. I like to stick with my old favorite meals rather than experiment with new kinds of foods.
3. I try new recipes frequently.
4. Food selection is a personal matter, people shouldn't try to persuade me to change.

Scoring the responses to each of the four statements from 1 (most willing to change) to 5 (least willing to change), the sum of the scores on the four statements divided by four constituted the score on the Willingness to Change Scale.

Statistical Analysis

Frequencies were computed for all variables. Means and ranges were computed for total dietary fiber intake as well as the DF intake from each of the major food groups. Respondents were grouped into three equal groups according to level of DF intake for use in chi-square analysis of the factors relating to DF intake. Factors which were tested for their relationship to DF intake were age, living situation, history of having lived on a farm, food expenditure, frequency of produce shopping, number of meals consumed at Nutrition Site, Scale of Health Problems, score on Guttman Functional Health Scale, frequency of outside activities, Laxation Scale, understanding of concept dietary fiber, and Willingness to Change Scale. Chi-square analysis also was used for comparing knowledge of fiber in food with awareness of roughage in the diet. Student's t test was performed on the means of food expenditures for those who did and did not eat at a Nutrition Site or elsewhere away from home, and also for means of DF intake for those who did and did not watch the amount of roughage in their diet and for the Laxation Groups. Pearson correlation coefficients were computed for the Scale of Health Problems, the Guttman Functional Health Scale, and age. Fisher's exact test was used to test the significance of variations in the proportion of respondents at different levels of DF intake who had different Laxation Scores.

RESULTS AND DISCUSSION

The Sample

Interviews with 59 older women were completed between May 5 and July 30, 1977, from 102 initial letter contacts, a completion rate of 58 percent. One interview could not be completed because of poor health of respondent, and was not included in the analysis. An average of 3.2 phone calls were required for each appointment made and completed. Reasons for failure to complete an interview included the researcher's inability to contact subject (28 percent), ill health of subject (23 percent), subject too busy (21 percent), subject unwilling to cooperate (21 percent), and other reasons (7 percent).

Participation rates varied considerably between sites, from 80 percent at Cliffview to 43 percent at First Christian Church. Twenty-five respondents were from the population of names obtained from Lake Orion Multipurpose Center, 11 from First Christian Church, 11 from Woodland Heights Apartments, and 12 from Cliffview Apartments.

Interviews were conducted in the homes of all but five respondents who preferred to meet the researcher at the Nutrition Site. The rights of the subject were explained to each respondent at the beginning of the interview and her signature obtained on the Consent Form. Two respondents gave their verbal consent and were interviewed, but refused to sign the Consent Form because they "never sign anything."

The average length of an interview was about 80 minutes, although the interview could be completed in 50 minutes with no distractions or extra conversation. It had been anticipated by some professionals who approved the research project that elderly subjects would show signs of fatigue after 30 minutes of interviewing. This was not the case, as most respondents completed the entire interview without showing marked signs of fatigue or boredom such as restlessness or yawning. Several respondents remarked how quickly time had passed. Four interviews lasted two hours because the participants enjoyed talking and volunteered much additional information. The researcher got the impression that the use of visual materials helped to provide a change of pace during the interview which prevented boredom.

Communication difficulties due to hearing impairment presented the greatest deterrent to completion of an interview. One interview could not be completed because the participant was in poor health and could not take the strain of trying to communicate. Another interview required a second visit for completion, with the daughter-in-law present to help interpret and answer questions.

Sample Characteristics

The 59 women ranged in age from 58 to 89 years (Table 2), with a mean age of 73.2 years. Age verification was not requested before the interview, since Nutrition Program participants must be 60 years or over, except for spouses of eligible participants. Hence it was found during the course of interviewing that two respondents were less than age 60. The health of these two respondents was

Table 2.--Selected Household and Family Characteristics of the Sample.

Characteristics	Number	Percent[a] N = 59
Age (years)		
58-64	11	19
65-69	6	10
70-74	17	29
75-79	10	17
80-84	12	20
85-89	3	5
Living Arrangement		
Live alone	40	68
Live with husband	16	27
Live with daughter and family	2	3
Roomers in household	1	2
Type of Dwelling		
Private House	30	51
Apartment for elderly	23	39
Other apartment	5	9
Mobile Home	1	2
Ethnic Origin		
Black	5	8
White	54	92
England, Ireland, Scotland	20	34
Germany, Switzerland	15	25
Other European countries	8	14
Mixed European ancestry	8	14
Didn't know	3	5
Birthplace		
Country of Ethnic Origin	8	14
United States, Canada	51	86

[a]Totals greater than 100% due to rounding error.

relatively good, but not better than that of many older respondents, so these individuals were included in the sample.

All but two of the respondents lived in the city of Pontiac or its surrounding suburbs in Oakland County, Michigan, although several were currently living on semi-rural lake front property. The other two respondents lived in a rural area of northern Oakland County.

Living Situation

About two thirds (68%) of the respondents were living alone, while 27 percent lived with their husbands. Two respondents lived with a daughter and family and one had roomers living in her house.

Nationally, 33 percent of women 65 years and older are living with their husbands (AOA, 1971), a somewhat higher proportion than the 27 percent seen in the present study, which included younger women aged 58-64 years. This may reflect a tendency for women who are living alone to be more interested in the Nutrition Program because of the opportunity it presents for socializing, an important benefit of a congregate meal program, which helps to improve interest in good food (Rankine and Taylor, 1975; and Sherwood, 1973).

National statistics also show that 26 percent of women aged 65 years and older live with relatives other than husbands (AOA, 1971). The very low proportion of respondents in the present study who were living with other relatives (3%) is more difficult to explain. Even after excluding the 23 respondents from the two Nutrition Sites that were associated with special housing for the elderly, where one would not expect to find resident living with a relative other than husband, only six percent of respondents were living with other relatives. It

may be that older women who live with other relatives may have more difficulty with transportation to the site, or may be reluctant to leave the other relative if he/she is too young to be eligible to participate in the Nutrition Program.

About 50 percent of the respondents lived in private houses, while nearly 40 percent lived in apartments constructed for the elderly. Five of the respondents lived in other apartments and one in a mobile home. A higher than usual proportion of respondents lived in apartments, as only 28 percent of Detroit Area residents live in dwellings housing two or more families.

Ethnic Background

Fifty-four of the 59 respondents were of European ancestry. Of these, 20 were of English-speaking ancestry, 15 of German-speaking ancestry, and 16 were from other areas of Europe or had a mixed European background. Three of the white respondents could not identify their ethnic origins. The remaining 5 respondents (8%) were black, and, generally, knowledge of their immediate ancestors had been lost. The proportion of black respondents reflected the general population of elderly in Michigan, who are also 8 percent black (10% in urban areas) (AOA, 1973b). Eight of the respondents were born in the country of their ethnic origin.

Farm Background

Nearly half of the respondents (44%) had lived on a farm at some time during their childhood. Six of these also had done some farming as adults. An additional seven respondents had not lived on a farm

as a child but had done some farming or extensive gardening at some time during their adult years. Forty-four percent had never lived on a farm.

Food Purchasing Behavior

The respondents estimated weekly food expenditures, including cost of food eaten out, and the estimates ranged from $3-32, with a mean of $13 per week (Table 3). The face value of food stamps was to be used in calculating the weekly food expenditures, in effect raising the estimate above the amount of actual money spent. To avoid embarrassment the researcher did not inquire about the respondents' use of food stamps, and few volunteered the information.

Estimating weekly food expenditures was difficult for many respondents. Ten respondents could give no estimate and five said their food expenditures varied so greatly because of stockpiling that they could not give an average expenditure. When present, husbands frequently helped answer the question. The low food expenditure of three dollars was cited by a woman who lived with a daughter and her family who raised and preserved a large portion of their food.

Comparing the food expenditures of these elderly women with "Cost of food at home for week" for a woman 55 years and over (USDA, 1977), it appears that one quarter of the respondents were spending about at the level of the USDA thrifty plan ($8.60), while one third spent in the range of the low or moderate cost plans ($11.30 and $13.90, respectively). Nine individuals reported food expenditures in the range of the liberal plan ($16.50), but the

Table 3.--Food Purchasing Behavior of Respondents.

	Number	Percent
Average Cost of Food, per week		N = 59
Less than $5	1	2
$6-10	14	24
$11-15	20	34
$16-20	5	9
More than $20	4	7
Could not estimate, highly variable	5	9
Didn't know	10	17
Principle Means of Transportation to Grocery Store		
Drives own car	26	44
Walks	1	2
Rides with husband, relative, friend	15	25
Rides bus	9	15
Shopping done by husband, relative, or friend	8	14
Fresh Produce Shopping		N = 57
Frequency		
Less than once a week	14	25
Once a week	26	46
More than once a week	17	30
Sources		
Supermarket only	28	49
Supermarket plus store specializing in fresh produce	26	46
Both of above plus home storage	3	5
Supplementary Produce Sources in Summer		
Have garden	19	33[a]
Gift from garden of friend, relative	16	28
Bought from local producer	12	21
None	19	33

[a]Total more than 100 percent because of responses in more than one category.

uncertainty of the other 15 respondents suggests that they were not on a tight food budget and may also have been spending liberally for food.

Comparison of Food Expenditures

Twenty-two percent of elderly persons (65 years and over) living in urban areas of Michigan fell below the poverty line in the 1970 Census (AOA, 1973a), although there has been a decrease in the percent of elderly considered poor since 1970. A somewhat higher proportion of respondents in the present study (26%) appeared to be spending at the level of the USDA Thrifty plan. Since older individuals who live alone are more than three times as likely to be poor as those who live in families (AOA, 1973a), one would expect to find more poor individuals among respondents, since the proportion of respondents living alone was twice the national average.

Since the relatively high cost of eating at restaurants contributed to the food expenditures of many respondents (Table 4), while the use of low cost meals available at the Nutrition Sites may help to extend the food budget of others, the food expenditures of those who ate often at a Nutrition Site and those who did not were compared, using Student's t test (Table 4). Those who ate three or more times a week at a Nutrition Site, and could give an estimate of food expenditures, spent significantly less money for food than those who ate at a Nutrition Site less often.

On the other hand, there was little difference between the food expenditures of those who did or did not eat elsewhere frequently, although more of those who frequently ate elsewhere could not give an

Table 4.--Frequency of Eating Away From Home and Mean Food Expenditure[a]

Eating away from home	Respondents (N = 59) Total N	No $ Estimate N	No $ Estimate row%	Gave $ Estimate N	$/wk Mean
At Nutrition Site					
≥ 3 times/week	23	5	22	18	11.4[r]
< 3 times/week	36	10	28	26	14.3[s]
Elsewhere					
≥ 2 times/month	44	13	30	31	13.5[t]
< 2 times/month	15	2	13	13	12.5[t]

[a]Common superscripts indicate no significant differences ($p < .05$) within columns ($^{r}, ^{s}, ^{t}$) using Student's t test.

estimate of their food expenditures, which would tend to skew the results (Table 4). One would expect those who eat out often to spend more money on food, but it is possible that some respondents failed to include money spent at restaurants in their food expenditure estimates although they were instructed to include them.

Grocery Shopping

Most respondents (86%) did their own grocery shopping. The most common means of transportation was the respondent's own car (Table 3, p. 55), with 44 percent driving themselves. Twenty-five percent went shopping with their husband, a relative, or a friend, and 15 percent took the bus. One respondent always walked to the store,

although an additional five individuals walked to the store part of the time. A friend, relative, or husband did the food shopping for the remaining eight respondents.

Sherman and Brittan (1973) found that 79 percent of elderly shoppers in a low to moderate income core city area walked to the store, while 10 percent drove. Several used bus transportation. In contrast they found that only 15 percent of elderly shoppers in an upper middle class neighborhood away from the central city walked to the store, while 73 percent drove. In the present study most respondents (69%) drove to the store as did the upper middle class shoppers in Sherman and Brittan's (1973) study. On the other hand, respondents who lived in Woodland Heights, the apartment complex in a low income urban area, resembled the low income group in Sherman and Brittan's (1973) study in that few used automobiles regularly for shopping. Forty-five percent of Woodland Heights respondents had to use the bus at least part of the time to go grocery shopping, compared to 8 percent of the rest of the respondents. Woodland Heights respondents did not walk to the store because of distance and fear of violence. Problems with transportation were mentioned by several women in this group, as few drove and friends and relatives were often not available for transportation. Rountree and Tinklin (1975) also found that fewer elderly high-rise apartment residents used a personal car for shopping than did non-high-rise subjects. Exton-Smith and coworkers (1965) also noted that difficulty in shopping was a problem related to nutrition among low income women. In contrast, Guthrie and coworkers (1972), in studying two groups of elderly persons in a rural area of

Pennsylvania, found that the poorer group relied much more on either friends or relatives for transportation to the store and help in food purchasing than did the higher income group.

Fresh Produce Shopping

Because access to fresh fruits and vegetables might influence the dietary fiber intake of individuals, questions were asked concerning produce shopping. The majority of respondents (75%) shopped for fruits and vegetables at least weekly (Table 3, p. 55). Among the 14 respondents (25%) who shopped for fresh produce less often few indicated problems in getting enough fresh produce.

Nearly 50 percent shopped in the supermarket for fruits and vegetables. Three of the four Nutrition Sites were near a store which specialized in fresh produce. One of these specialty stores was mentioned as the main source of produce by 51 percent of respondents. In addition three respondents reported home storage of fresh produce bought or grown in season, including storage in freezer or root cellar.

Summer brought additional sources of fruits and vegetables, as 33 percent reported growing food in their own gardens, 28 percent received gifts of food from the gardens of friends and relatives, and 21 percent said that they bought produce directly from growers (Table 3).

Food Preparation Behavior

All but two respondents did all their own meal preparation when they ate at home. Only the two who lived with their daughters

did not usually prepare their meals. Although these two women both helped in the kitchen, each considered her daughter to be a capable cook and in charge of the household kitchen. Thirty-six percent of respondents usually ate their main meal away from home, so meal preparation at home was simplified. A few women mentioned that noon was a better time than evening to eat at a restaurant because a luncheon meal was adequate but less costly than a dinner meal.

Kitchen Facilities

All respondents indicated that they had satisfactory kitchen facilities, including stove with oven, refrigerator with freezer space, and adequate workspace, storage space and equipment for preparing and serving food. While many kitchens were small apartment kitchenettes, several individuals mentioned that the kitchenette was adequate since they did less cooking and entertaining than they used to. The one complaint expressed by several respondents was the limited freezer space in the single-door refrigerators which were standard equipment in the apartment complex for the elderly in which nine respondents lived. Recent statistics from the Detroit area (U.S. Dept. Com., 1972) showed that only two percent of year-round housing units and four percent of renter-occupied housing units do not have complete kitchen facilities, so respondents in the present study were typical of the area in that they all had kitchen facilities. In contrast, 15 years ago Davidson and coworkers (1962) reported that ten percent of elderly subjects in Boston did not have a refrigerator and 16 percent had to share a stove. Twenty-one percent of the subjects

lived in a furnished room. This difference probably reflects an improvement in housing conditions in recent years.

Food Consumption Behavior

Most of the respondents (93%) followed a traditional three-meals-a-day pattern (Table 5). Of these, 46 percent also included snacks in their meal pattern. Of the remaining respondents, three ate two meals a day plus snacks and one ate one meal a day plus snacks.

The main meal of the day was eaten with equal frequency at noon and in the evening (Table 5). Forty-two percent of respondents usually ate their main meal at noon and 36 percent ate in the evening. Another 14 percent usually ate their main meal in the evening except when they ate away from home at noon, in which case they would eat a small meal in the evening. The other five respondents usually ate a full-course meal both at noon and in the evening.

Early studies reported that older women generally ate three meals a day (Lyons and Trulson, 1956; and Davidson et al., 1962) and that snacks were consumed by 30 to 60 percent of the subjects. In contrast Swanson (1964) noted that snacks were not common among the elderly subjects studied. Pao (1971) reported that nearly one-half of more than 500 subjects from the North Central region of the United States ate four or five meals a day, while the remainder ate three meals a day, but a "meal" included any intake of food or beverage other than water, so the pattern was similar to that of the respondents in the present study.

Table 5.--Food Consumption Behavior.

	Number	Percent[a] (N = 59)
Meal Patterns		
3 meals a day, no snack(s)	28	48
3 meals a day plus snack(s)	27	46
2 meals a day plus snack(s)	3	5
1 meal a day plus snacks	1	2
Time of Main Meal		
Normally eaten at noon	25	42
Normally eaten in the evening	21	36
Normally eaten in the evening unless noon meal was eaten out	8	14
Full meal eaten both at noon and in the evening	5	9
Meals Eaten at Nutrition Site		
Less than one per week	22	37
1-2 per week	14	24
3 or more per week	21	36
Delivered to home	2	3
Meals Eaten Elsewhere		
One per month or less	15	25
2-3 per month	12	20
1-2 per week	23	39
3 or more per week	9	15
Total Meals Eaten Away from Home		
Two or less per week	21	36
3-4 per week	17	29
5 or more per week	21	36

[a]Totals more than 100 percent due to rounding error.

In contrast, a recent study in Tennessee (Todhunter et al., 1974) found that 84 percent of elderly white women ate three meals per day and only 53 percent of black women did so, while 16 percent of white women and 44 percent of black women ate two meals per day. Forty-eight percent consumed snacks daily or several times a week. Black women were more likely than white women to eat snacks throughout the day. In a small study of elderly persons in Detroit, Unnewehr (1977) reported that 68 percent of subjects ate an average of three meals a day, while 18 percent said they usually ate two meals a day, with the morning meal most frequently skipped. Most individuals studied by Unnewehr mentioned that they consumed snacks, especially before bedtime. Only seven percent of respondents in the present study ate less than three meals a day. Methods of evaluating meal patterns are not standardized, but are subject to the interpretation of the investigator, so results from different studies are not always directly comparable, as shown by the method of Pao (1971).

Few researchers have reported details of meal patterns, but an early study by Jordan and coworkers (1954) reported that 40 percent of the elderly subjects surveyed had their large meal at noon, a result similar to the present study.

Meal Eaten Away from Home

Although the respondents' names had been obtained through the Site Hosts, not all respondents ate meals regularly at the Nutrition Sites. Thirty-seven percent ate at a Nutrition Site (Table 5) less than once a week. Of these three quarters said they rarely ate

at a Nutrition Site. Twenty-four percent of respondents ate a nutrition meal 1-2 days a week, and 36 percent ate 3 or more meals a week at a Nutrition Site.

Two individuals were receiving a home delivered meal from a Nutrition Site. About 15 percent of the meals from the Nutrition Sites in Oakland County are delivered to the homes of recipients (MacQueen, 1978). Hence the sample was not representative of all regular participants in the Oakland County Nutrition Program for the Elderly. On the other hand many of the healthy individuals whose names were on the roles at the Nutrition Sites attended the meal program rarely but were well represented in the sample.

Many respondents also ate regularly elsewhere (Table 5), most frequently at a restaurant offering a full selection of foods or at the home of a friend or relative. Thirty-nine percent mentioned eating elsewhere once or twice a week and 20 percent two to three times a month. Fifteen percent ate elsewhere three or more times a week, while 25 percent went elsewhere to eat rarely or no more than once a month.

There was little relationship between the number of meals eaten at the Nutrition Site and the number of meals eaten elsewhere. That is, of those who ate often at a Nutrition Site some frequently went out to other places to eat, and some rarely ate elsewhere, while the same was true of those who rarely ate at a Nutrition Site. Overall more than half the respondents (64%) ate three or more meals a week away from home.

Other recent research also has noted the frequency of meals eaten away from home. Schlenker (1976) found that nearly three

quarters of the older Michigan women studied ate outside the home at least once a week. In studying 185 participants of a meal program in Cincinnati, Joering (1971) noted that the majority did little home food preparation. In contrast, Todhunter and coworkers (1974) reported that 28 percent of white women and 9 percent of black women ate lunch away from home one or more times a week, while 13 percent of white women and 6 percent of black women ate the evening meal away from home that often. Guthrie and coworkers (1972) found that 13 percent of elderly subjects in rural Pennsylvania had eaten out in the previous 24 hours, but no report is given of how many ate out during the course of a week. Researchers in the 1950s found that less than 20 percent of the elderly person studied ate some meals away from home (Jordan et al., 1954; and Lyons and Trulson, 1956). While most respondents in the present study ate elsewhere frequently, only a few (9%) mentioned that they did little cooking anymore.

Use of Therapeutic Diets

Forty-three percent of the respondents reported following some diet restriction or special diet suggested by their physician, while an additional 34 percent said they had made recent changes in their diets of a therapeutic nature (Table 6). Low salt diets and low fat or cholesterol diets were each being followed by 14 percent of respondents. Ten percent of respondents were on a high fiber diet or one including more fruits and vegetables. Weight loss and bland diets were each mentioned by nine percent of respondents.

Table 6.--Use of Therapeutic Diets By Respondents.

	Number	Percent[a] (N = 59)
Use of Therapeutic Diets		
Physician-prescribed diet	25	43
One	18	31
More than one	7	12
Self-prescribed diet change	20	34
None	14	24
Therapeutic Diets Prescribed by Physician		
Low salt	8	14
Low fat, low cholesterol	8	14
High fiber, more fruits & vegetables	6	10
Weight reduction	3	5
Bland, avoid bothersome foods	5	9
Diabetic, prediabetic	2	3
Self-Prescribed Diet Changes Related to Health		
Less salt and/or more potassium	3	5
Less fat or frying	6	10
More roughage, wholegrains, fruits, vegetables	4	7
Less food	9	15
Less starch, sugar, junk foods	6	10
Avoids bothersome foods	5	9
More food supplements	2	3

[a]Total greater than 100 percent due to rounding error.

Self-Prescribed Diet Changes

The most common self-prescribed diet change reported was eating less food, mentioned by 15 percent of respondents who were not on a weight reduction diet (Table 6). Ten percent said they were eating less fat, another 10 percent mentioned less sugar, starchy foods or junk foods, while 5 percent reported eating less salt and/or more potassium. Avoidance of bothersome foods was noted by nine percent

of respondents who were not on a bland diet. Two respondents stated they were taking more food supplements.

Fiber Related Diet Changes

In all, over 75 percent of the respondents reported making some health related change in their diet. In 10 cases this involved a change that would increase fiber intake and in 10 cases a change that would tend to decrease fiber intake. Of particular interest in this study were the diet modifications cited by 11 respondents who reported having diverticular disease, since fiber content of the diet has been a factor in the treatment of the disease. None of these women reported restrictions on their fiber intake while three reported eating more fruits and vegetables or more roughage because of the disease. In contrast, two years earlier Schlenker (1976) found that the four Michigan women studied who had diverticular disease were all required to avoid all raw fruits and vegetables as well as whole grains. This contrast reflects the changing methods of treatment of diverticular disease.

Few other food behavior researchers studying older persons have reported on diet modifications related to health. LeBovit (1965) found that eight in ten subjects had some diet limitation linked to health, a ratio similar to the 75 percent found in this study. In contrast Wruble (1976) found that 22 percent of the subjects interviewed reported the use of a special diet prescribed by a physician while four percent were following a self-prescribed weight reduction diet.

The present study found that nearly 20 percent of the respondents were restricting sodium intake or using less salt, while Wruble

(1976) found that only two percent of rural Michigan subjects were restricting salt. Todhunter and coworkers (1974) reported that six percent of white elderly women and nine percent of black women were following a low salt diet. In contrast, Jordan and associates (1954) reported 20 years ago that 31 percent of the subjects restricted use of salt.

Health of Respondents

The most frequently mentioned health problems that bothered respondents are shown in Table 7. High blood pressure, arthritis, and heart disease were the most common problems, each cited by 35-40 percent of respondents. Diverticular disease and eye problems also were common, reported by 19 and 17 percent of respondents, respectively.

Obesity

Obesity was not considered a health problem by any of the respondents, but upon further questioning many indicated that they did have a weight problem. Table 8 shows the weight categories into which respondents placed themselves.

In some cases the respondents' perception of their weight category did not agree with the subjective judgement of the researcher. Twenty-five respondents (42%) considered themselves 'just right,' but the researcher disagreed in six cases, judging five to be overweight and one underweight. The researcher also disagreed with the four women who regarded themselves as 'very overweight,' judging them to be 'moderately overweight' instead. One respondent judged by the researcher to be very overweight thought of herself as just right.

Table 7.--Health Problems Reported by Respondents.

Health Problem	Number	Percent[a] N = 59
Problems of the Gastrointestinal Tract		
Diverticular disease	11	19
Diverticulosis	7	12
Diverticulitis	2	3
Bowel resection due to diverticular disease	2	3
Colitis, ulcers, nervous disorders	6	10
Hiatus hernia	5	8
Hemorrhoids	3	5
Cancer of the colon	1	2
Other	2	3
None	30	51
Other Health Problems		
High blood pressure	23	39
Arthritis	20	34
Heart disease	21	36
Cataracts, glaucoma	10	17
Nervousness	6	10
Allergies	4	7
Other cancers	2	3
Elevated blood sugar	5	8
None	4	7
Scale of Health Problems		
0-2	14	24
3-4	23	39
5-10	22	37

[a]Total more than 100 percent because of responses in more than one category.

Table 8.--Respondents' Self-Assessment of Weight Category.

Weight Category	Number	Percent N = 59
Too thin	5	9
Just right	25	42
Slightly overweight	15	25
Moderately overweight	10	17
Very overweight	4	7

Respondents considered to be moderately or very overweight in the subjective judgement of the researcher were classified as obese by the researcher. Thirty-one percent of the respondents were judged to be obese. Subjective estimation of weight category is not a precise method for measuring obesity, but was considered adequate for the limited purposes of this study because of the complications involved in making a more precise weight assessment.

A wide variation in the incidence of obesity has been observed by other researchers. Hollifield and Parson (1959) measured the incidence of obesity in older persons in Virginia twenty years ago, and found that only 16 percent were more than 20 percent above the average weight for their height and age, while Davidson and coworkers (1962) found 25 percent of Boston subjects similarly overweight. LeBovit (1965) judged a third of the New York subjects surveyed to be overweight. Among the Michigan subjects studied by Schlenker (1976) more than one half were 20 to 40 percent over ideal weight.

Obesity is difficult to define or measure. The variability found in these studies may reflect variations in the methods of measurement or regional differences in the incidence of obesity.

While the reliability of the subjective assessment of obesity used in the present study is limited, it was considered adequate as an approximation of weight level. Many respondents had difficulty responding to this question even with the presence of the Response Aid (Appendix A, p. 132) listing the weight categories and asked the researcher's opinion. Use of the researcher's assessment of weight level rather than that of the respondent was justified on these grounds.

Scale of Health Problems

Resulting scores on the Scale of Health Problems (Table 7) showed that nearly one quarter of respondents (24%) had scores of two or less indicating few health problems, while 39 percent had scores of three or four indicating a moderate number of health problems. Several health problems were reported by more than one-third (37%) of respondents, with scores of five to ten.

Guttman Functional Health Scale

Scores on the Guttman Functional Health Scale (Table 9) indicated that 44 percent of respondents had excellent functional health, with scores of 4 or 5, showing that they did heavy housework, often walked more than half a block, or did extensive yard work. Sixty-one percent had a score of 3 or more meaning that they did not feel limited in any of their activities. Twenty-five percent of the respondents had a score of 2, indicating that they did ordinary housework, but were limited in their activities, including housework, and three felt that they could no longer climb stairs.

Table 9.--Guttman Functional Health Scale.[a]

Scale Step	Items on Interview Schedule	Number	Percent N = 59	Cumulative Percent
5	Does extensive walking and/or yardwork	15	25	25
4	Does heavy housework	11	19	44
3	Is not limited in any activities	10	17	61
2	Does ordinary housework	15	25	86
1	Is able to climb stairs, at least to limited extent	5	9	95
0		3	5	100

[a]Coefficient of Scalability - .77
Coefficient of Reproduceability - .93

Rosow and Breslau (1966), in developing a similar health scale during a study of 1200 older persons in Cleveland found that 53 percent of the subjects were not limited in any activities. Steinkamp and coworkers (1965) noted that 50 percent of elderly subjects in the follow-up San Mateo study reported that their activities were not affected significantly by disability conditions. A somewhat higher proportion of respondents in the present study (61%) fell into a similar category, 'is not limited in any activities,' suggesting that this group of older women had somewhat better than normal health for persons of their age.

Rosow and Breslau (1966) also found that 21 percent of elderly subjects studied could still do heavy work around the house. This

compares to 44 percent in the present study, further suggesting relative good health in these subjects.

Because one would expect the ability to function in ordinary household tasks to be related to the general health of the subject, the Scale of Health Problems and Guttman Functional Health Scale were compared and found to correlate significantly ($r = .28$, $p < .05$).

Although one would expect the older subjects to be in poorer health and less able to do housework than the younger subjects, there was no significant correlation between age and the Scale of Health Problems or the Guttman Functional Health Scale. This may be due to the exclusion from the study of those who were in such poor health that they could not be interviewed.

Activity Patterns

Most respondents engaged in activities away from home more than once a week. Four women went out of the house infrequently for activities other than shopping. Only one stayed home for health reasons. In contrast 29 percent of the women studied by Schlenker (1976) seldom left home. This comparison again suggests that this group of women may have been healthier than normal for people their age. Those individuals with many health problems still managed to get out regularly. One would expect the respondents in the present study to be healthier than normal, since the length of the interview required the elimination from the sample of those who were considered too ill to participate.

The most frequent activity of respondents (81%) was eating out, either at a Nutrition Site, a restaurant, or the home of a friend or relative (Table 10). Social visits, religious meetings, club meetings,

Table 10.--Activities of Respondents.

Activity	Number	Percent N = 59
Meals eaten out	48	81
Social visits	32	54
Religious meetings	27	46
Club meetings	21	36
Shopping trips (other than for food)	21	36
Yard and garden work	17	29
Classes and other special activities for the elderly	13	22
Part-time employment	6	10

shopping at a mall and classes or special activities for the elderly were mentioned frequently as popular activities by the respondents. Six respondents (10%) were employed part-time. This compares well with the 10 percent of women age 65 and older who are employed nationally (AOA, 1971).

Unnewehr (1977) reported similar activities by older urban residents of Michigan. Many participants in the study (63%) attended the Nutrition Program for the Elderly, but then many subjects had been recruited through the Nutrition Sites. Eating out at restaurants was not reported as an activity, but church was mentioned by 59 percent. Bridge clubs, gardening, women's groups and Girl Scouts also were reported as popular activities by these subjects.

Laxation Scale

Scores on the Laxation Scale clustered into four groups (Lax Groups): Lax Group 1, tendency to hard, infrequent bowel movements but laxatives used frequently; Lax Group 2, tendency to hard, infrequent

movements but did not use laxatives frequently; Lax Group 3, regular, well-formed movements without use of laxatives; and Lax Group 4, tendency to loose, runny movements. The laxation scores after clustering into Lax Groups are shown in Table 11.

Two-thirds of the respondents (67%) had normal laxation (Lax Group 3). Ten percent had a tendency to hard stools but rarely used laxatives (Lax Group 2). Nineteen percent had hard stools moved with considerable straining and frequently used laxatives (Lax Group 1). Two respondents had frequent loose movements and constituted Lax Group 4.

Because the use of laxatives has shown an inconsistent relationship to incidence of constipation in other studies (Connell et al., 1965; Wigzell, 1969; and Millard, 1971) the use of laxatives by respondents was examined separately. Sixty-three percent of respondents rarely or never took laxatives. All of these respondents indicated they were never bothered by constipation, or at the most only occasionally under special circumstances such as traveling. Thirteen respondents (22%) took laxatives frequently or more than once a week. Eleven of these individuals were the eleven respondents in Lax Group 1 who had a tendency to be bothered by constipation. One of the other two took a fiber-containing stool softener to control diarrhea. The slowing effect of fiber on abnormally fast transit times has been noted by several researchers (Payler et al., 1975; Harvey et al., 1973; and Painter et al., 1972). The other woman took a laxative after her bowels hadn't moved for two days, about once a week, and therefore displayed a tendency to constipation. The remaining nine respondents

Table 11.--Laxation Scores of Respondents.

Lax Group	Scale Meaning	Laxation Scores	Number N = 58[a]	Percent[b]
1	Hard stools moved with considerable straining, frequent use of laxatives	5-8	11	19
2	Tendency to hard stools, occasional laxative use	9-13	6	10
3	Soft, well-formed stool, moved easily, infrequent laxative use	14-17	39	67
4	Frequent, loose stools	18-19	2	3

[a]One respondent with colostomy excluded from calculation.

[b]Total less than 100 percent due to rounding error.

who reported taking laxatives 'sometimes' or 'once or twice a month' were constipated only occasionally. Thus laxative use was consistent with incidence of constipation in this sample of older women.

Heavy use of laxatives by older persons has been reported by other researchers. Jordan and coworkers (1954) reported that laxatives were taken routinely, three times a month to daily, by 55 percent of elderly subjects surveyed. In Scotland, Wigzell (1969) found that 66 percent of the 90-99 year-old independent living persons studied took laxatives regularly, although 78 percent of them had normal bowel habits. Millard (1971) found that 17 percent of the English women studied were constipated, but 56 percent were taking laxatives. This reported heavy use of laxatives by older persons may reflect excessive use of laxatives or may result from inconsistencies in the definition

of laxative use and constipation. Connell and coworkers (1965) found that laxatives were used more than once a week by 14 and 30 percent of subjects from two different populations respectively. Connell and coworkers (1965) also noted a decline in laxative use compared to the results of a 1940 study, although they found a strong trend toward increased use of laxatives with age. Davidson and others (1962) found that 22 percent of subjects took laxatives daily or almost daily, a figure very similar to the results of the present study.

Dietary Fiber Intakes

Results of the calculation of the dietary fiber content of the respondents' diets (procedure, p. 44) are shown in Table 12. The mean of total dietary fiber intake per day was 14 g, with the intakes of most individuals falling within the range of 8 to 23 g (Figure 2).

Unusually low fiber diets of 3, 5, and 6 g respectively were described by three respondents. The first individual reported that she had been consuming no fruits, vegetables, whole grains or nuts out of fear of aggravating an ulcer that had flared up two years previously. The second individual currently was consuming only one small meal a day in an effort to treat refractory obesity which was aggravating heart disease. The 6 g low fiber meal pattern was that of a very small 86-year-old lady with a tiny appetite who consumed no whole grain bread and did not like fruit.

One unusually high fiber meal pattern, 34 g/day, was described by an individual, also in her 80's, who ate few processed foods, did her own baking using whole grains and wheat germ, and placed heavy emphasis on fruits, vegetables, salads and nuts in her diet.

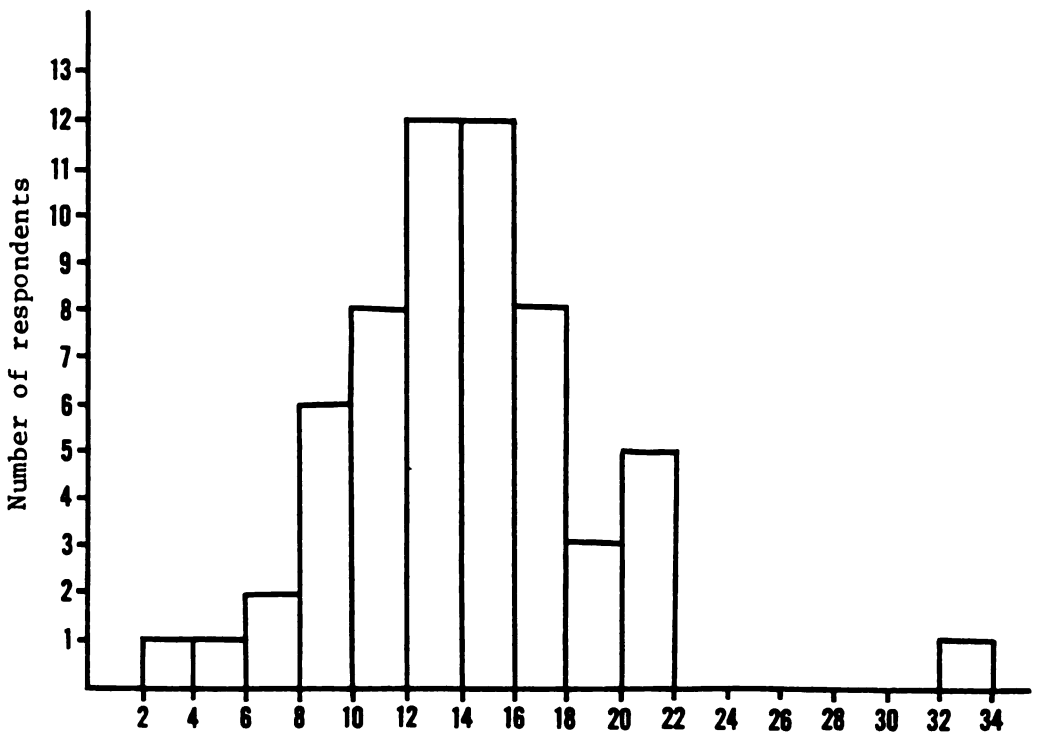

Figure 2. Dietary Fiber Consumption of Respondents.

Table 12.--Dietary Fiber Intake from the Major Food Groups.

Food Category	Dietary Fiber g/day		Percent[a] of Total
	Mean	Range	
Total intake	14.0	3.2-33.8	
Cooked vegetables	2.9	0-8.1	21
Bread	2.6	0.3-7.7	19
Fruit	1.9	0-8.6	14
Legumes	1.6	0-7.7	11
Potatoes	1.3	0-3.9	9
Cereal, not including bran	1.0	0-4.4	7
Salads, raw vegetables	1.0	0-2.8	7
Nuts	0.8	0-7.3	6
Bran	0.6	0-5.1	4
Desserts	0.5	0-1.9	4

[a]Total more than 100 percent due to rounding error.

Few researchers have measured the dietary fiber content of diets. Crude fiber intakes of 2.8 g/day for women and 4.0 for men (Bergan and Brown, 1976), 2.6 for diverticular patients and 5.2 for controls (Brodribb and Humphreys, 1976a), and 5 for men (Groen, 1973) have been reported. In tests with men on the relation of fiber to laxation, Cummings and coworkers (1976) and Jenkins and coworkers (1975a) used a standard western type diet which contained 17 g/day of dietary fiber as calculated from Southgate (1976) values and 3.8 g/day of crude diber (a DF:CF ratio of 4.5). The diet was produced in a metabolic kitchen and contained white bread, biscuits made from white flour, and corn flakes as cereal sources, hence was low in fiber because of the absence of whole grains, but high in calories (2800 Cal./day).

The dietary fiber content (17 g/day) of the diet used by Cummings and coworkers (1976) is somewhat higher than the mean dietary fiber intake of 14 g/day found in the present study, probably because calorie content of that diet was higher than the typical calorie intake of older women. Multiplying the ratio (4.5) of dietary to crude fiber found in the studies by Cummings and coworkers (1976) and Jenkins and coworkers (1975a) times the crude fiber intake (2.8 g/day) of women in the Rhode Island study (Bergan and Brown, 1976) produces a dietary fiber value of 13 g/day, which is comparable with the results of the present study. Higher crude fiber intakes for men reported by Bergan and Brown (1976) and Groen (1973) are no doubt due to the higher calorie intake of men, as compared to women.

Limitations of the Method of Diet Assessment

The methods of diet evaluation, the Usual Meal Pattern and food frequency estimates, and fiber calculations using estimated values for dietary fiber content of foods, used in this research are not precise. Madden and coworkers (1976) found, in studying the validity of the 24-hour dietary recall, that subjects tended to overestimate small amounts of food eaten and underestimate large amounts, even though food models were used to assist in making the estimates, a phenomenon they call "talking a good diet." This may have been a problem in the present study in the estimates of serving size. Marr (1971) commented that the aged introduce more error into diet histories because of forgetfulness, although women remember more about what they eat than men. Schlenker (1976) reported that written dietary

records collected for that study indicated essentially the same nutrient intakes as the recall records and cited that fact as evidence that memory lapses are not necessarily a limitation on the validity of recall dietary records for older individuals. It appears that no method of dietary assessment is entirely satisfactory. The researcher must select the method of dietary assessment which meets the needs of the particular study, in this case the diet history, while recognizing the limitations of the method.

The second step of diet evaluation, calculating nutrient intake, presents unusual problems in the case of fiber. The unacceptability of crude fiber methods has been reviewed. The limitations of the method of estimating dietary fiber used in the present study are recognized but were considered more acceptable than those associated with the use of crude fiber. There is an obvious need to meet the challenge of agreement on a new standard for measuring fiber, and develop the required tables of food composition. It is hoped that the present study will contribute to that effort.

Contribution of the Major Food Groups to Dietary Fiber Intakes

The contribution to dietary fiber intakes of the ten major food groups are shown in Table 12. Cooked vegetables provided the largest proportion of dietary fiber, followed closely by bread, 2.9 and 2.6 g/day, respectively, or about 20 percent of total each. Nearly 15 percent of the fiber was furnished by fruit. Other food groups which supplied about 10 percent of the DF included legumes, potatoes, cereal, and salads. Bran, nuts, and desserts made small contributions to the total daily fiber intake.

As indicated by the range values in Table 12, all categories of foods except desserts furnished large amounts of DF for some individuals even though the average DF contribution of that food group was small. Only bread consumption was reported by every respondent, although more than 95 percent of respondents reported that they ate cooked vegetables, potatoes, fruit and salads.

Combining cooked vegetables, potatoes, salads and legumes into one general vegetable category showed that vegetables provided nearly 50 percent of the DF intake of respondents, while the cereal grain category, bread, cereal and bran, furnished 30 percent of the fiber.

Trowell (1972) and Robertson (1972) have examined the relative contribution of the food groups to crude fiber intake in the U.S. and Britain, using information from published research studies and national statistics relating to total food supplies for the population as a whole. They reported that 6-13 percent of crude fiber intakes came from the cereal grain group, values substantially lower than the 30 percent seen in the present study.

The limitations of using crude fiber for assessment are made apparent by examination of the 1863 consumption of bread and potatoes, reported by Robertson (1972) to contain an apparently low 2.4-4.1 g/day of crude fiber. Comparing the crude fiber content of stone ground white flour used by Robertson (1972) (0.2-0.5%) with the DF content of white flour reported by Southgate (1976) as 3.15 percent, shows at least a six-fold difference, so that if recalculated using Southgate (1976) values, the 1863 fiber intake becomes 25 g/day of DF, a substantial amount of DF.

Apparently the crude fiber analytical procedure produces abnormally low fiber values for white flour (5-10% of DF), which tend to obscure the contribution of the cereal grains to fiber intake when used. The same is not true of crude fiber values for whole wheat which are the expected 20-25 percent of DF. Thus further comparison of dietary fiber contributions in the present study with crude fiber values found in other studies must be approached with caution.

Vegetable Consumption of Respondents

The food groups were further analyzed to characterize the nature of their contribution to dietary fiber intake. Cooked vegetables and fruit provided substantial amounts of fiber for most individuals, while only 50 percent of respondents consumed salads supplying 1 g/day of fiber.

Data collected through the use of the Food Cards (Appendix A, p. 152) showed that the most popular vegetables, eaten regularly by more than 75 percent of respondents, included green or wax beans, onions, green peas, potatoes, corn, carrots, lettuce, cabbage, celery, tomatoes, lima beans, and cucumbers or pickles. Also well-liked, but consumed somewhat less frequently and by fewer than 75 percent of respondents were asparagus, broccoli, green peppers, summer squash or zucchini, winter squash, sweet potatoes, cauliflower, muchrooms, radishes, spinach and beets.

Bean sprouts, brussels sprouts, all varieties of greens, potatoes with skins, and root vegetables like turnips, parsnips, and rutabaga were eaten at least occasionally by fewer than 60 percent of respondents. The least preferred vegetables were okra and eggplant,

eaten by 25 percent of respondents and also, along with greens, placed in the dislike category by another 25 percent of respondents.

Vegetables Avoided for Health Reasons

Avoiding some vegetables for health reasons can influence dietary fiber intake. Only three respondents omitted more than five vegetables from their diet for health reasons, citing a very bland ulcer diet, a very bland diet after colostomy, and a very low sodium diet as reasons for the omissions. Sixty-five percent of respondents excluded no more than one vegetable from their diet for health reasons. The remaining 30 percent avoided two to five vegetables for a variety of reasons, most commonly indigestion or flatulence. Peppers and radishes most commonly were cited in this respect, avoided by 15 and 20 percent of respondents respectively. Collards, corn, cucumbers, onions, lima beans, and brussels sprouts were avoided by about 10 percent of respondents because of reported indigestion or flatulence. Ten percent of respondents also excluded potatoes with skins and beets from their diet for a variety of health reasons, most notably high blood pressure in the case of beets. Other vegetables were excluded by fewer than seven percent of respondents.

Fruit Consumption of Respondents

The fruits eaten regularly by most respondents included applesauce or peeled apple, peaches, bananas, oranges, pears, pineapple, and grapefruit. Consumed somewhat less frequently and by less than 75 percent of respondents were plums, raisins, prunes, apricots, and tangerines or mandarin oranges. Certain fruits were consumed more

often when they were in season and could be eaten fresh. The most popular of these fruits, eaten by 75 percent of respondents, were strawberries, cantaloupe and grapes, followed by blueberries, raspberries and watermelon, consumed by 60 percent. About 50 percent of respondents reported eating cherries, cranberries, dates, and apples including the skins. The least favored fruits were avocado and figs, consumed by about 25 percent of respondents.

Fruits Avoided for Health Reasons

Over 65 percent of respondents avoided no more than one fruit from their diet for health reasons. Two respondents omitted nearly all fruits from their diet, one because of an ulcer diet and the other because of food allergies. One respondent excluded many fruits because of food allergies and diverticulitis, another omitted fruits with a high calorie content. The remaining 27 percent of respondents avoided from two to five fruits for a variety of health reasons.

Figs and the skins on apples were most commonly cited as sources of health problems when consumed, by 17 and 32 percent of respondents, respectively. The most common reasons mentioned were difficulty chewing and indigestion, and for figs, the calorie content. Dates also were rejected by three respondents for their high calorie content. Cantaloupe, watermelon and prunes each were noted by four respondents as causes of indigestion. Raisins and grapes were refused by several for a variety of medical reasons. Other fruits examined caused medical problems for fewer than six percent of respondents.

Legume Consumption of Respondents

Respondents' consumption of legumes was examined separately from other cooked vegetables because of the high fiber content of the mature vegetable seeds and because they are commonly believed to cause flatulence. The best liked legumes, consumed at least once a month by 65 percent of respondents, and less frequently by another 15 percent, were white beans, either baked or in soup. About 40 percent of respondents regularly ate red beans in stew or salad, and pea soup, and another 20 percent ate them a few times a year. Garbanzo beans were eaten in small amounts by nearly 50 percent of respondents. Lentils, soybeans, and blackeye or crowder peas were unfamiliar to many respondents and eaten by fewer than 25 percent.

The flatulence caused by beans is due to gas formed as a result of the fermentation by intestinal bacteria of that part of the carbohydrates of the beans which has not been digested and absorbed in the small intestine (Hellendoorn, 1976).

Red beans were the legumes most frequently (17%) avoided because of flatulence. Many of these same respondents also omitted other legumes from their diet.

Cereal Grain Consumption of Respondents

The average daily consumption of bread and related grain products such as crackers was two slices or the equivalent, mostly in the form of bread, providing 2.6 g/day DF, or about 20 percent of the total fiber intake. Of this bread, over half was reported to be something other than white bread. Dark, wheat, or whole wheat bread was eaten by 78 percent of respondents and accounted for 42 percent of the

total bread reported. Rye bread was consumed by 50 percent of respondents, but amounted to only 10 percent of total bread intake. The new types of bread with fiber added were eaten by only 10 percent of respondents and represented four percent of total bread intake. Two respondents reported consuming wheat germ.

Whole grain cereal consumption rarely has been reported, but Rountree and Tinklin (1975) observed that only 9 percent of elderly subjects used whole grain bread or rolls daily.

Eighty percent of respondents reported consuming cereal regularly, including whole grain, refined, and bran cereals, which provided a mean daily intake of dietary fiber of 1.6 g, or 11 percent of total DF. Among those respondents eating cereal regularly consumption averaged about one-half cup of cereal per day. Whole grain cereals such as oatmeal, puffed wheat and whole wheat flakes accounted for about 45 percent of the total cereal consumption and provided nearly 50 percent of the DF from cereal.

Almost 30 percent of cereal intake was in the form of bran cereals contributing nearly 40 percent to cereal fiber. Refined cereals such as farina and Rice Krispies represented less than 15 percent of cereal consumption or seven percent of cereal fiber. Popcorn and brown rice also were included with cereals and accounted for six and two percent of cereal fiber, respectively. Twenty-seven percent of respondents reported eating popcorn while 19 percent said they ate brown rice occasionally.

Ten percent of respondents rejected whole grain breads or cereals for a variety of medical reasons, including difficulty

digesting or chewing and use of a bland diet. Only one respondent could not eat dark wheat bread. On the other hand nearly 20 percent of respondents refused popcorn for several health reasons, most commonly difficulty in chewing.

Nut Consumption of Respondents

The mean DF intake from nuts was 0.8 g/day, constituting about six percent of the total DF consumed. Over 75 percent of respondents reported that they ate nuts or peanut butter, although fewer consumed nuts (53%) than peanut butter (61%). Nuts were used in greater quantities than peanut butter and consequently contributed over 75 percent of the total fiber from nuts.

Twenty percent of respondents rejected nuts for health reasons, including indigestion, calorie content, and difficulty in chewing. Fewer respondents (12%) could not eat peanut butter.

Other Foods Consumed by Respondents

Other foods which made small contributions to DF intake included cake, cookies, and pie, particularly fruit pie. Because these foods are highly variable in DF content, sometimes including large quantities of sugar containing no fiber and sometimes containing high fiber fruit or nuts, the estimate of DF intake from these foods can be stated with much less confidence, but appeared to account for about five percent of the total DF intake. Most respondents reported eating these dessert foods although 13 women did not.

Consumption of pasta type products and refined rice was reported infrequently. Since information concerning their DF content

was not available and was assumed to be low, no effort was made to probe for the extent of their consumption and include them in the DF calculation. If reported they were categorized as white bread in the fiber calculation.

Discussion

Other researchers have noted health problems associated with certain foods. LeBovit (1965) reported that three elderly persons out of 10 surveyed had difficulty chewing. After men had been fitted with dentures it was found that they ate less bread and more crisp, raw vegetables in a study by Anderson (1971). In contrast, Davidson and coworkers (1962) observed no correlation between oral condition and nutrient intake of older subjects, and in fact were surprised at how well they ate with no teeth or with ill-fitting dentures. Schlenker (1976) found that only one of the 28 older women studied had difficulty chewing. The present researcher also noted that, at least in relation to plant foods, few foods were rejected because of chewing difficulties. Only apples were mentioned as a frequent source of chewing problems (32%) and were often eaten peeled.

Another common health problem with foods mentioned by other researchers is flatulence or "gas." Davidson and coworkers (1962) noted that food was eliminated if it was thought to give gas. Schlenker (1976) found that 64 percent of subjects did not eat gas-forming vegetables such as cabbage or onions. In the present study only 17 percent of respondents avoided dried beans for health reasons, and fewer (9%) avoided onions, while just two refused cabbage for this

reason. The 20 percent who avoided radishes were the highest percentage who avoided any fiber-containing food for health reasons.

Respondents' Understanding of the Concept of Fiber in Food

Awareness of the concept of fiber in food may influence consumption of fiber in the diet. To examine the respondents' understanding of this concept they were asked if they remembered reading or hearing anything about fiber in the food they eat, and what came to mind when they heard the word 'fiber.' Results are based on 58 interviews.

Forty-one percent gave no indication that they understood the concept of fiber in food, although three quarters of these respondents reported that they had heard or read something about food fiber (Table 13).

A similar proportion of the 58 respondents (43%) (Table 13) demonstrated adequate understanding of food fiber by citing appropriate sources of fiber and noting its relation to proper bowel functioning. The remaining nine respondents displayed a limited understanding of food fiber.

Several respondents expressed their uncertainty about fiber, while one mentioned the idea that fiber improved bowel function but added she didn't believe it, and another noted the function of the fiber when added to bread as a filler to lower calories.

Many respondents (32%) mentioned a new kind of bread which contains added fiber, when asked what they had read or heard about fiber. This bread had apparently been the subject of much discussion

Table 13.--Respondents' Knowledge of Food Fiber.

	Number	Percent
Understanding of Concept Food Fiber		(N = 58)
No understanding of food fiber	24	41
Had not heard of fiber in food	6	10
Had heard of fiber, referred to bread with added fiber	13	22
Had heard of fiber but did not refer to bread with added fiber	5	9
Limited understanding of food fiber	9	16[a]
Referred to appropriate sources of fiber	6	10
Also referred to bread with added fiber	3	5
Acceptable understanding of relation of food fiber to bowel function	25	43
Referred to appropriate sources of fiber	22	38
Also referred to bread with added fiber	3	5
Understanding of Bran in Relation to Bowel Function		(N = 59)
Adequate understanding	51	86[a]
Displayed knowledge, but uncertain	2	3
No understanding	4	7
Recalled use of bran on farm	3	5
Sources of Information About Food Fiber		(N = 51)
Television programs	26	51[b]
Magazine and newspaper articles and advertisements	14	27
Newspaper advertisements for bread with added fiber	3	6
Friends, relatives	7	14
Nutrition professionals	2	4
Couldn't remember	7	14
Had known about fiber for a long time	3	6

[a]Total not exact due to rounding error.

[b]Total more than 100 percent due to overlapping categories.

on TV talk shows and at the Nutrition Sites, because several respondents expressed dismay at the report that there were "woodchips" in this bread. The researcher refrained from commenting on these concerns until the fiber section of the interview was completed, at which point the safety of using trees as a source of cellulose was explained. The frequent mention of the new bread with added fiber illustrates how rapidly information and misinformation about food can be disseminated if there is something that sparks interest.

Rountree and Tinklin (1975) tested elderly subjects on their nutrition knowledge and found that only 25 percent answered more than 35 percent of the questions correctly. This compares with 43 percent of respondents in the present study who understood the concept 'food fiber.'

Sources of Information About Fiber in Food

The most common source of information about food fiber, cited by over 50 percent (Table 13) of those respondents who had heard about fiber, was television programs. One quarter of these respondents also reported reading about fiber in newspapers or magazines. Discussions with friends or relatives provided information for 14 percent of these respondents. Three respondents mentioned magazine and newspaper advertisements for the bread with added fiber. Two respondents reported receiving information about fiber in food from health professionals and one indicated popular health food magazines as a source of information.

Knowledge of the Relationship between Bran and Bowel Function

Although only 43 percent of respondents demonstrated that they understood the concept of food fiber, most respondents (85%) (Table 13) mentioned the role of bran in regulating bowel function, when asked what they knew about bran. An additional two respondents mentioned this function of bran, but were uncertain whether they were correct.

Mention of bran brought back memories for three respondents of early days on the farm, where bran was a byproduct of wheat milling used for feeding livestock or making dark bread. Only two respondents said they didn't know anything about bran.

Ways of Avoiding or Relieving Constipation

As further illustration that food fiber was recognized unconsciously (before fiber was mentioned in the interview) as related to bowel function, many respondents cited foods containing fiber when asked about their special ways of avoiding or relieving constipation without the use of laxatives. Fruits and prunes most commonly were reported, by 39 and 30 percent of respondents respectively. Vegetables and bran each were cited by about 25 percent of respondents, while 10 percent mentioned roughage. Also mentioned by about 20 percent of respondents were water, hot water with lemon, or coffee, and by six individuals, some form of exercise. Four women indicated they didn't know of any special ways of avoiding constipation because they were never bothered by it. On the other hand six said nothing ever worked to relieve their constipation. Four of these six respondents had low DF intakes of 12 g/day or less, while the other two had higher intakes

of 15.1 and 17.0 g/day respectively, and both reported they had suffered attacks of diverticulitis.

Attitudes Toward the Practice of Nutrition

Several respondents demonstrated behaviors which revealed their attitudes toward the practice of nutrition. One respondent displayed unusual beliefs about food, expressing strong opinions about several matters of nutrition. She had many popular books on nutrition and read Prevention magazine. One respondent showed the researcher the food supplements she was taking that she had gotten from a relative who was a supplier. Two respondents lived with family members who were organic gardeners. One individual mentioned her fear of eating "poisons" in foods and indicated that she read Prevention magazine.

On the other hand, two women mentioned being active in cooperative extension. The diet histories of several women who had prescribed diets, as well as the comments of these women, indicated that they were trying to follow their diets carefully.

Willingness to Change Scale

Attitudes toward the practice of nutrition were measured by the Willingness to Change Scale (p. 47). Scores on this Scale were clustered into three groups. Nineteen percent of respondents had scores of 1.5-2.3, indicating willingness to change, while 22 percent had scores of 4.0-4.5, indicating lack of willingness to change. Many respondents (56%) had intermediate scores of 2.5-3.5 suggesting uncertainty or ambiguity of feelings.

Responses to the 10 Likert-type opinion statements (Appendix A, p. 151) were generally not very consistent. Statements which mentioned the word 'nutrition' were more difficult for persons to respond to and did not correlate well with other statements, and were eliminated during scale construction. Respondents rarely chose the responses indicating uncertainty or strong opinions. The researcher got the impression that it was difficult for the respondents to think in terms of a five-point scale of responses.

Attitudes Toward Food Selection as Revealed by Cereal Selection Attitudes

Indications of attitudes toward food selection were obtained by inquiring about the factors which were considered when choosing cereal. Of the 47 respondents who indicated that they did consume cereal, the largest group, more than 50 percent, stated that they bought what they liked. Twenty-six percent of respondents said they did not want added sugar in their cereal. Five respondents looked for natural cereals or cereals without preservatives. Only three reported that they wanted fortified cereals, while two respondents indicated they felt that hot cereals had greater food value.

Specific health factors were mentioned by one quarter of the respondents in selecting cereal. Eating bran for constipation was cited by six women, as a reason for cereal choice, while ease of chewing the cereal, blandness, low sodium content and ease of digestion were noted by one or two individuals. Only two respondents reported that price was a consideration in choosing cereal.

Other researchers have rarely examined the attitudes of older persons in selecting foods. As in the present study, Schlenker (1976) found that half of those studied considered taste preference when choosing foods, while fewer considered food value and very few financial considerations.

Attitudes Toward Fiber

Roughage and bulk are traditional terms for food fiber and were therefore used in the interview to explore attitudes toward food fiber. Asked if they found that they had to pay attention to the amount of roughage or bulk in their diet, 60 percent of respondents said no, saying they didn't think about it, or didn't need to watch because they normally ate enough roughage or were not bothered by constipation. Two respondents said they didn't think about it because eating more roughage didn't help their constipation.

The remaining 40 percent of respondents paid attention to the amount of roughage in their diet, but only 33 percent followed with a satisfactory explanation, including mention of foods containing fiber or mention of how roughage helped elimination. The other four women gave explanations which indicated that they were confused about the meaning of roughage. Comparison of the knowledge of food fiber between the 33 percent who did give a satisfactory explanation of how they watched the amount of roughage in their diet and the remaining respondents showed a significantly higher proportion of the first group (65%) than the second (33%) displayed acceptable understanding of fiber in food ($\chi^2 = 5.21$, d.f. 1, $p < .05$). On the other hand, using Student's t test for the comparison of the mean fiber intakes

of those who did and those who did not watch the amount of roughage in their diet showed no differences in fiber intake. Only one woman said that she watched not to get too much roughage.

The three participants who mentioned being bothered by hemorrhoids present an interesting illustration of the interplay between knowledge of and attitude toward fiber. Two of the three women had low laxation scores and moderate dietary fiber intakes (10-11 g/day), and took laxatives regularly, a stool softener and mineral oil, respectively. The other woman had a high dietary fiber intake (20 g/day) and was not bothered by constipation. None of the three indicated that they paid attention to the amount of roughage in their diet although two of the women displayed knowledge of the function of fiber. The woman with the high dietary fiber intake gave no indication that she knew anything about fiber, but was consuming four times more bran than the mean consumption. In other words, although the first two women associated fiber in the diet with improved bowel function, they apparently chose to treat their constipation with medication rather than increasing the roughage in their diet. In contrast, the third woman did not appear to understand the function of fiber, but nevertheless was consuming a high fiber diet. It appears that knowledge about matters of health or nutrition, attitudes toward these matters, and actual behavior are often not well coordinated.

Special Treat Choices

Responses to the closing question, asking the respondent's choice of a special treat to buy at the grocery store revealed an attitude of acceptance of nutritious foods as treats. Nearly half of

respondents (42%) named some fruit or, in some cases, a vegetable as a special treat. Eleven mentioned meat, fish or poultry, while less than one-third listed a high calorie dessert. Four chose other foods like salty snacks and six didn't know what they would choose or couldn't decide. There were some multiple choices.

Pao (1971) found a different pattern in examining the snack food preferences of older women. He reported that cake, cookies, and pies were listed above fruit in order of preference. While some of the foods mentioned as special treats by respondents in the present study are not often thought of as snacks, such as vegetables and meats, these foods are promoted as nutritious snacks by nutritionists (MDPH, Undated).

A question that might be asked is, did the subjects in the present study respond to the stimulus of the many colorful fruit and vegetable Food Cards (Appendix A) by selecting these nutritious foods as special treats? Further investigation of this question would provide valuable information for nutrition educators.

Presentation of Gifts

Gift books were presented to 56 respondents, 29 copies of the large print cookbook, Cooking for Two, (USDA, 1974), and 27 copies of the nutrition information book, Nutrition Labeling, (NNC, 1975). Three individuals did not receive books because of inability to read, poor eyesight, and disinterest. The choice of the nutrition information book by nearly half of the respondents was a surprise to the researcher. Many respondents commented spontaneously on their choice of book. Twelve cited poor eyesight as a reason for choosing

the large print cookbook, although three others already had the book and therefore chose Nutrition Labeling. Five chose Nutrition Labeling because they did little cooking anymore, while six said they had plenty of cookbooks. Nine commented that they really did want to know more about nutrition or they would have liked to have both books. On the other hand, six people commented that they were not interested in more nutrition information.

Factors Influencing Dietary Fiber Intake

In order to explore possible relationships between dietary fiber intake and other characteristics observed in respondents, comparisons were made between dietary fiber consumption and other factors which might influence dietary fiber intake, using chi-square analysis. For the analysis, respondents were divided into three equal groups according to level of DF intake. These levels of DF intake were labeled low, medium, and high. Results showed no relationship between dietary fiber intake and age, living situation, history of having lived on a farm, food expenditure, frequency of produce shopping, number of meals consumed at a Nutrition Site, score on the Guttman Functional Health Scale, frequency of outside activities, understanding of the concept dietary fiber, or scores on the Willingness to Change Scale. Only in comparing DF intake with Laxation (Lax) Group and the Scale of Health Problems were significant relationships found.

Comparison of the proportion of respondents in each Lax Group who had low, medium, and high fiber intakes showed that 82 percent of respondents in Lax Group 1 displayed low fiber intakes, while only 17 percent of those in Lax Group 2 and 22 percent in Lax Groups 3 and

4 consumed low fiber diets. The initial chi-square analysis showed that there were significant differences ($p < .01$), but did not explain which differences were significant. Fisher's exact test was used for this purpose. Because Lax Group 4 was so small and similar in laxation characteristics to Lax Group 3, these two groups were combined for the analysis. Also because there was little differences in the proportions of each Lax Group that had medium and high fiber intakes, while several of these cells were very small, the medium and high fiber groups were combined for the analysis, forming a 2 x 3 table. Results of this analysis are shown in Table 14.

Chi-square analysis of the relationship between Lax Group and DF from cereal grains (the bread, cereal and bran food groups combined) did not show significant differences.

Confirmation of the general belief that constipation is affected by lack of dietary fiber in the diet is found in these data, in that those respondents who used laxatives (Lax Group 1) generally had low fiber intakes, while those who did not use laxatives (Lax Groups 2, 3 and 4) had generally medium or high dietary fiber intakes. Many other investigators also have found evidence of the relationship of low fiber intakes to constipation (Cowgill and Sullivan, 1933; Williams and Olmsted, 1936; and Hoppert and Clark, 1942a and 1942b) although little recent research has been done.

Resistance to the Effects of Fiber

Several facts stand out upon examination of the data from those respondents who did not follow the general pattern of Lax Groups 1 and 2. The two women in Lax Group 1 who had higher dietary fiber intakes

Table 14.--Comparison of Levels of Dietary Fiber Intake and Laxation Group for 58 Respondents[a,b].

Laxation Group	Explanation	Total		Level of Dietary Fiber Intake			
				Low 12.2 g/day		Medium to High 12.2 g/day	
		N	%	N	row%	N	row%
1	Tendency to hard stools, frequent laxative use	11	19	9[r]	82	2[r]	18
2	Tendency to hard stools, infrequent laxative use	6	10	1[s]	17	5[s]	83
3,4	Normal, loose stools	41	70	9[s]	22	32[s]	76

[a]Respondent with colostomy not included.

[b]Common superscripts indicate no significant differences ($p < .05$) within columns (^{r},^{s}) using Fisher's exact test.

both had suffered an attack of diverticulitis and were presently taking stool softeners. One mentioned that her physician had recommended that she consume more roughage. In response to the question about special ways of avoiding constipation without taking laxatives, each remarked that nothing ever seemed to relieve their constipation.

Other researchers have noted an apparent resistance to the usual effects of high fiber intake on laxation. Southgate measured the disappearance of dietary fiber during transit through the gastrointestinal tract and found apparent digestibility ratios for cellulose ranging from 0.20 to 0.65 in elderly women and 0.24 to 0.84 in elderly men (Southgate and Durnin, 1970).

Flynn and coworkers (1977) weighed the fecal residue of 10 healthy men who were eating four weighed constant diets and found that the fecal fiber content as percent dry weight varied greatly, from 6.7 to 18.6 percent. Results for each individual for the four diets were more consistent and suggested variability in the way each subject's digestive tract handled the dietary fiber.

Even the early researchers Cowgill and Sullivan (1933) found that some patients required the addition of more bran to their diets for relief of constipation, apparently because they exhibited greater breakdown of fruit and vegetable fiber in the digestive tract.

This apparent resistance to the effect of dietary fiber has been observed also in patients with diverticular disease. In experiments with the use of bran in treating diverticular disease, Painter and associates (1972) found that subjects required the addition of highly variable amounts of bran (3-45 g/day) in addition to a high fiber diet, to achieve a soft stool that was easy to move. They noted that some but not all of this variation was due to variations in fiber content of the rest of the diet.

Findlay and associates (1974) also found that subjects with diverticular disease responded differently than normal subjects when fed 20 g/day of raw bran in addition to regular meals. The normal subjects showed a statistically significant increase in wet and dry stool weight while subjects with diverticular disease did not show a significant difference in wet or dry stool weights.

Brodribb and Humphreys (1976b) also used bran (24 g/day) for the treatment of diverticular disease and noted that the increase in

fecal weight in patients with diverticular disease after increasing their fiber intake was less than normal subjects after a similar increase in fiber intake.

One might speculate that the two respondents with diverticular disease in the present study who had high intakes but were bothered by constipation also displayed this apparent resistance to the effects of dietary fiber observed in these other studies.

Resistance to Bowel Irregularity

Turning again to other respondents in Lax Groups 1 and 2 who did not fit the expected pattern of relationship between dietary fiber intake and laxation, it was found that the one individual in Lax Group 2 who had a low fiber intake had indeed a very low intake (3.2 g/day). She reported that although her stools were hard and difficult to move, she had a daily movement without taking laxatives. None of the other respondents in Lax Groups 1 or 2 claimed to have daily bowel movements unless they were taking laxatives frequently. In contrast nearly all the respondents in Lax Group 3 did have daily movements, even those with low fiber intakes. Only 10 percent of the 39 respondents in Lax Group 3 had movements less than once a day. There also was a sharp distinction between Lax Groups in their reported incidence of constipation. Only 18 percent of those in Lax Groups 1 and 2 said they were infrequently bothered by constipation and rarely took laxatives, while 95 percent of those in Lax Groups 3 and 4 said the same.

Studies by several investigators have suggested that abnormal bowel motility is a cause of constipation and other bowel disorders.

Some have observed abnormally high intraluminal colonic pressures in subjects who were suffering from recurrent attacks of unexplained abdominal pain (Holdstock et al., 1969), pain and constipation (Connell, 1962), and diverticular disease accompanied by constipation (Painter et al., 1965). Connell (1962) also noted hypoactive bowel motility in older subjects who took laxatives frequently. Chaudhary and Truelove (1962) frequently observed hypermotility in patients with spastic colon which was stimulated by discussion of specific disturbing topics of importance in the patient's life. Goy and coworkers (1976) also found evidences of disordered bowel habit in subjects with diverticular disease and spastic type irritable bowel syndrome, and noted that these subjects also had significantly less fecal magnesium and calcium, which was related to hypermotility. Hodgson (1975) produced hypermotility in rabbits fed a low residue diet.

These studies suggest that disturbed bowel motility is a factor in constipation and other bowel disorders and may result from a variety of other causes besides insufficient dietary fiber. Again one might speculate that the one individual in the present study who had daily but hard bowel movements and a very low fiber intake, but never took laxatives, somehow avoided the abnormal bowel motility associated with constipation, and therefore had daily movements.

Physiological Fiber Minimum

Forty-five years ago, Cowgill and Anderson (1932) measured the effect on laxation of varying the crude fiber content of standard diets and noted a "physiological roughage minimum" required to produce

easy bowel movements, a daily crude fiber intake of 90-100 mg/kg of body weight (5-6 g for a 60 kg person). Almonds, apple-butter, potatoes and bananas were removed from the high fiber diet in the Cowgill and Anderson (1932) study to produce a diet which promoted marked bowel stasis unless bran was added to the diet. Cowgill and Anderson (1932) also noted that some individuals had satisfactory laxation at slightly lower fiber intakes.

No research has been done since the 1930s to test the hypothesis that there is a minimum intake of dietary fiber that protects most people from constipation. Yet a recent medical article about constipation (Benson, 1975) recommended 100 mg "bulk residue" /kg body weight daily to prevent constipation, the same figure suggested by Cowgill and Anderson (1932).

The methods of diet assessment and dietary fiber computation used in the present study were not adequate for testing a hypothesis about minimum fiber intake, but a marked difference in estimated DF intakes was observed in those bothered by constipation, between those who took laxatives frequently (Lax Group 1) and those who did not (Lax Group 2) (Table 11, p. 76). Mean DF intake for Lax Group 1 was 10.5 g/day ($s = 3.5$) and for Lax Group 2, 14.6 ($s = 6.3$). Student's t test showed this difference to be significant ($t = 1.75$, d.f. 15, $p < .05$). With the exception of the two women who reported having diverticulitis (p. 101) all the respondents in Lax Group 1 had DF intakes of 12 g/day or less. In contrast, with the exception of the woman consuming very low amounts of fiber discussed on page 103, all the respondents in Lax Group 2 had DF intakes of 12 g/day or more.

Among those who were not bothered by constipation, Lax Groups 3 and 4, DF intakes covered a wider range, 7-34 g/day.

Dietary Fiber Intakes and Scale of Health Problems

Scores on the Scale of Health Problems also showed a significant relationship to dietary fiber intake (Table 15). Only 22 percent of respondents with few health problems (scores of 0-4 on the Scale of Health Problems) had low dietary fiber intakes (less than 12.2 g/day) while 55 percent of those with more health problems (scores of 5-10) were in the low fiber group.

Examination of the diets of respondents with low fiber intakes who had high scores on the Scale of Health Problems showed that seven women had low fiber intakes resulting from health problems, namely, low calorie intake due to weight reduction diets or poor appetite, low fiber ulcer diet, fiber restriction due to colostomy, and frequent indigestion.

Many researchers have observed that low nutrient intake was related to the presence of medical problems. Jordan and coworkers (1954) found that medical reasons were often given for changes in eating habits. Wruble (1976) observed that changes in eating habits usually resulted in decreased food intake with increased risk of malnutrition and also noted that physical handicaps were associated with greater nutritional risk. Caird and coworkers (1975) also found that poor diets were related to physical disability, while Ohlson and coworkers (1948) associated chronic ill health with lower quality and quantity of food intake. In a longitudinal study of women 76 years

Table 15.--Comparison of Scale of Health Problems and Levels of Dietary Fiber Intake[a].

Scale of Health Problems	Score	Total N	Total %	Level of Dietary Fiber Intake: Low <12.2 g/day N	Low <12.2 g/day row%	Medium to High ≥12.2 g/day N	Medium to High ≥12.2 g/day row%
Few health problems	0-4	37	63	8[r]	22	29[r]	78
More health problems	5-10	22	37	12[s]	55	10[s]	45

[a]Common superscripts indicate no significant differences ($p < .01$) within columns ([r],[s]) using the chi-square test.

old, Stanton and Exton-Smith (1970) found that nine of the women had shown little change in their diet since the first study six years earlier, and also maintained their health, while 13 who showed decreases in calorie and protein intakes consistenly showed a deterioration in their health. Stanton and Exton-Smith (1970) concluded that the decrease in nutrient intake seen in the first study (Exton-Smith et al., 1965) between the 70 and 80 year old subjects was due to ill health rather than age. The present study provides support for these findings in the special case of dietary fiber.

Dietary Fiber and Diverticular Disease

Since diverticular disease is a health problem which has been associated with low fiber intakes (Painter and Burkitt, 1971), the fiber content of the diets of respondents who reported having diverticular disease was examined. Four respondents in this study reported having

diverticulitis, treated successfully by colon resection in two cases. The individuals with diverticulitis which had not been treated by surgery had high fiber intakes but were bothered by constipation, and reported resistance to the usual effects of dietary fiber on laxation, as was discussed on pages 101-102. Both of these individuals were consciously eating more roughage, one because her physician had recently changed the recommended mode of treatment from a low to a high fiber diet. The two colon resection patients described normal laxation patterns and high fiber intakes. Since these respondents did not show resistance to the usual effects of dietary fiber on laxation it appears that the removal of the defective section of the colon may have allowed the return to normal laxation. No inquiry was made into the history of laxation before colon resection, but severe pain and hard, pellety stools, as well as inflammation, are common symptoms of diverticulitis (Goy et al., 1976).

Seven respondents reported that they had been told they had diverticulosis. Four of these women had normal laxation, or in one case a tendency to have loose movements, and said they did not watch the amount of roughage in their diets, although the DF intake of only one was considered to be high. The other three individuals had DF intakes of about 12 g/day, which apparently was adequate to prevent constipation. Although none of these women reported paying attention to the amount of fiber in their diets, one mentioned that the doctor had said that it was important to eat plenty of fruits and vegetables.

Of the remaining three respondents reporting diverticulosis, two said they were watching the amount of roughage in their diet

because of the diverticulosis. One of these individuals also reported being bothered by diarrhea which was being treated with a high fiber-type stool softener as well as increased fiber in the diet. There is evidence that diarrhea is associated with painful hypermotility in spastic colon patients (Chaudhary and Truelove, 1962), even though it has been suggested that diarrhea is due to lack of segmental contractions of the distal colon which delay transit of the fecal material so that absorption of water may take place (Connell, 1962). Goy and coworkers (1976) present evidence that spastic colon and diverticular disease have a common etiology, therefore it may be that the diarrhea seen in the present case of diverticulosis is related to disturbed bowel motility in which excess activity alternates with the absence of activity, leading to high pressures sufficient to produce diverticula alternating with episodes of diarrhea.

The other respondent with diverticulosis who was watching the roughage in her diet had a low fiber intake of 10 g/day, which in her case was associated with normal laxation. Her low fiber intake was due to several diet restrictions, including a weight reduction diet of 1000 calories and severe sodium restriction, so that her food intake was low and ordinary whole grain breads which contain salt were not consumed. She also reported taking medication for bowel spasms that reportedly caused the diverticulosis to "act up."

Severe calorie restriction due to a needed weight reduction diet limited the fiber intake of the remaining woman with diverticulosis to a very low 5 g/day. She also was very bothered by constipation. The diverticulosis had shown up on recent X-rays, but had

not bothered her, so she did not seem concerned about treatment, probably because of other, more serious illnesses.

The case histories of these respondents with diverticular disease illustrate the complexity of factors that can influence dietary fiber intake.

Food Behavior and Dietary Fiber Intake

It has been observed that many factors influence dietary fiber intake, but since nutrient intake is determined by food behavior, the Usual Meal Patterns were examined to see what characterized the food habits of those with the highest and lowest intakes. As mentioned above (p. 101), several respondents had low fiber intakes which were explained by health problems, low calorie intake, fiber restriction, and indigestion. Personal preference appeared to account for the low fiber intake of many other individuals, that is, dislike of vegetables, whole wheat bread, dried beans and/or nuts led to the consumption of other foods which were lower in fiber.

Examination of the diets of the 10 individuals with the highest dietary fiber intakes showed that bran consumption was a factor in the high fiber intake of several, taken for bowel regularity by some and by personal preference by others. On the other hand several respondents with high DF intakes did not consume any bran other than that occurring naturally in whole grain breads and cereals. Personal preferences for whole wheat bread, nuts, dried peas and beans, fruit and vegetables also characterized this group. High calorie intake appeared to contribute to fiber intake for a few individuals, but caloric intake was not measured, so could not be compared. High fiber intakes were not

usually the result of eating excessive amounts of one fiber rich food, such as bran, but were generally the result of eating many different foods rich in fiber.

Evidence has shown that different plant foods influence laxation to varying degrees (Williams and Olmsted, 1936; and Hoppert and Clark, 1945) and also that physical characteristics of plant foods such as particle size of bran (Kirwan et al., 1974) and method of preparation of bran and beans (Wyman et al., 1976; and Hellendoorn, 1976) resulted in different responses to ingestion. The present study was not designed to determine if one source of dietary fiber is better than another in improving bowel function. This is an area which needs extensive investigation.

SUMMARY AND CONCLUSIONS

General Summary

The estimated dietary fiber intakes of 59 older women were determined. Most DF intakes fell within a range of 8-23 g/day, with a mean of 14 g/day. All major plant food groups made contributions to the DF intakes of most respondents. No single food group predominated as a source of fiber, although cooked vegetables and bread each contributed about one-fifth of the total DF intake. Bran contributed only four percent of total DF intake, but up to 5 g/day for some individuals. The contribution of vegetables of all kinds, including potatoes and legumes, to DF intake was nearly 50 percent. Vegetables were generally well liked and less than one-third of the respondents avoided more than one vegetable for health reasons. Dried cooked beans were avoided for health reasons by only 20 percent of respondents. Over 40 percent of bread consumption was reported to be dark, wheat, or whole wheat bread.

Two health factors found to relate significantly to DF intakes were scores on the Laxation Scale and Scale of Health Problems. Eleven of the respondents with low laxation scores reported having hard, infrequent stools for which they frequently took laxatives. Most of these women had low fiber intakes. On the other hand, six women reported having a tendency to hard infrequent stools but rarely took laxatives. Most of these women had medium or high fiber intakes. Most

of the women (70%) reported that they rarely or never were bothered by constipation. Some of these women had low fiber intakes. The evidence suggests that low fiber intakes may lead to constipation in some individuals who have a tendency to become constipated, but not in others who do not exhibit this tendency.

Generally the respondents were a healthy group of older women with few health problems that kept them confined at home, although most women mentioned some health problem associated with aging such as high blood pressure or arthritis. This was expected since the requirements of the lengthy interview precluded the interviewing of those who were in very poor health. Among those respondents who reported several health problems and therefore had higher scores on the Scale of Health Problems a higher proportion had low DF intakes than among the healthier women. Dietary information collected from these respondents suggested that poor health often resulted in low food intakes, and therefore low DF intakes, due to diet restrictions or poor appetite.

There was no evidence that the older women (over 80 years) had lower DF intakes nor were they less healthy than the younger women. Again, this may have been due to the exclusion from the sample of those in very poor health. On the other hand, the existence within the sample of this group of healthy older women who were consuming average amounts of fiber is evidence that health and vigor, and probably appetite, are maintained by many women as they pass their 80th birthday.

Personal food preferences for foods high in fiber appeared to be a major factor resulting in high fiber intakes for some respondents. Consumption of legumes, whole grains, and nuts, as well as generous

amounts of fruits and vegetables, characterized the diets of those with high fiber intakes. The well distributed contributions of the major food groups to DF intake suggest that all plant foods should be emphasized in a high fiber diet. Bran has often been used to increase the DF content of test diets, but in the present study DF intakes from cereal grains did not show the same relationship to laxation that was shown by total DF intakes. On the other hand, since there is evidence from other studies that the effect of DF intake on laxation is not directly proportional to the DF content of foods, more research is needed to determine which foods are more effective in promoting laxation and which constituents of dietary fiber are related to these effects.

While the sample was generally a healthy group of women, a large proportion of them (43%) said they were following some diet restriction or special diet suggested by their physician. Others reported making similar sorts of diet change on their own. Again, the sample may have been biased, since nutrition education is offered periodically at the Nutrition Sites. Many respondents may have been exposed to new ideas about nutrition, and therefore more receptive to suggestions from their physician for diet changes.

Fiber in food had become a topic of public discussion before the study was conducted. This was evident in that nearly one-half of the respondents understood the concept 'fiber' in food and could name some sources of dietary fiber. On the other hand, there was no evidence that knowledge about fiber had been translated into increased fiber intakes, as DF intake and knowledge of fiber were not related.

Although many respondents had reported making health-related changes in their diet, few of these changes were related to dietary fiber. On the other hand there was a group of respondents with low fiber intakes who were taking laxatives, who might have benefitted from increasing the fiber in their diet.

Another finding of the study was that many of the respondents went out to eat often, either at a Nutrition Site or at a restaurant that offered a full selection of food. It is not clear if this is characteristic of all healthy older women. Again, it may be that the sample was biased in favor of those who enjoyed going out, since the population was obtained from among those who had shown enough interest in outside activities to come to a Nutrition Site and enroll in the program there.

Conclusions and Implications

The findings of this study must be viewed with some caution because of the limitations in the method of assessing DF intakes. The method of estimating dietary fiber was subject to large error, emphasizing the need for standardizing the methods of determining dietary fiber and incorporating DF values into tables of food consumption. On the other hand, the relationships noted between DF intakes and laxation suggest that more research is needed to clarify the relationship between laxation and the various components of dietary fiber. Of more practical concern to physicians is the question of which, if any, of the major plant food groups, or possibly individual plant foods, is most effective in promoting soft, easy bowel movements in those who are bothered by constipation. If future research shows that

low DF intakes are related to other disease processes, the answer to this question will assume added importance.

DF is not considered an essential nutrient by the committee responsible for establishing the Recommended Dietary Allowances (FNB, 1974), yet for certain nutrients the amount that will just prevent failure of a specific body function is used by the committee in assessing the requirement for that nutrient. Several studies including the present one have concluded that laxation, a specific body function, is unsatisfactory when DF intake is low. Experiments demonstrating this relationship need to be undertaken, contingent on acceptable methods of measuring DF.

Most respondents in the present study had satisfactory bowel movements without the regular use of laxatives, suggesting that the normal food intake of these subjects would provide sufficient DF for satisfactory laxation for most people. This has important implications for the nutrition educator who must address the problem of constipation due to low DF intakes. Although increased fiber intake, especially of cereal grains, has been associated with decreased blood levels of certain minerals, such as calcium and iron, the nutrition educator can recommend with confidence normal eating patterns to those whose DF intakes are low. The fruits, vegetables, and whole grains which supply fiber in a normal diet also are rich sources of other nutrients. Foods which are good sources of calcium and iron should also be stressed, especially in light of the gradual loss of calcium from bone seen in the elderly. For those who appear to require high DF intakes for normal laxation caution should be exercised in making

recommendations for increasing DF intakes until interactions with other nutrients have been clarified.

Most respondents in the present study enjoyed eating vegetables and whole grain or dark bread. For those who do not eat dark breads, the food manufacturers can contribute to the DF content of diets by developing more palatable methods of preparing whole grain breads. It is not clear that formulated high fiber baked products are normally necessary or effective in preventing unsatisfactory laxation. Education of the food industry concerning the nutritional implications of food processing is needed.

Food expenditures were not related to DF intakes in the present study. Documentation of the cost of high fiber foods may be necessary to dispel myths about the high cost of whole grain breads or certain vegetables. The finding that most vegetables as well as whole grain breads were well liked by most respondents suggests that stereotypes about the food preferences of the elderly should be re-examined. While vegetables were generally well liked by respondents and given an important place in the meal pattern by most, methods of preparation which preserve the color and enhance the flavor of vegetables should be stressed by nutrition educators in guiding those who want to increase their DF intake. Suggestions for the selection of restaurant meals that provide needed fiber could also be given. The Nutrition Meals are a means of introducing older persons to less familiar fiber foods as well as the use of herbs in enhancing their flavor. Peer influence in this setting may encourage individuals to try new foods.

The conclusions about the DF intakes of these women cannot be extended to other groups of persons in the US. Documentation of the DF intakes of older men and younger persons is needed.

The fact that a large proportion of the respondents had made health related changes in their diet suggests that older women are often willing to make adjustments in what they eat when health is a motivation. For some groups of persons, consuming more vegetables and whole grain breads may require additional motivation. The selection of fruit and, in some cases, vegetables by nearly half of these women as a special treat suggests that nutritious foods can also be preferred foods. The question of whether the colorful food cards stimulated this response deserves attention. Food advertising as well as food use in magazine articles and television programming, information channels which were the major sources of fiber information in this study, could be used more effectively to influence the attitudes of all people toward the consumption of fruits, vegetables, and whole grains.

The present study did not show a relationship between DF intakes and an attitude of willingness to change food behavior. Better instruments are needed to document the relationships between external influences, nutrition attitudes and food behavior change. An understanding of these relationships must be the basis of all nutrition education regardless of the age of the target group.

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APPENDICES

APPENDIX A

INTERVIEW SCHEDULE

EXPLANATION OF INTERVIEW SCHEDULE

1. The interview schedule has been designed to facilitate the recording of the participants' responses to the questions, which are meant to be open-ended, that is, the printed responses which follow most questions will be checked if they represent the substance of the participant's response. But if the participant's response differs in substance from the printed responses the actual response will be recorded. The printed responses will not be shown or read to the participant unless use of a RESPONSE AID is specifically stated.

2. General format of the interview schedule:

   a. Instructions for the interviewer that are not to be read are printed in capital letters and enclosed in parentheses.

   b. All basic questions and their responses begin at the left margin and should be asked of all participants.

   c. Some questions have been marked with an asterisk (*). These are questions related to functional activity level and optional activity level, which are not a part of the main analysis.

   d. All contingency questions, which depend on the response to the previous questions, and their responses begin at the first indentation and are to be asked only if the response immediately above is checked.

3. Visual materials have been designed to be used with the interview schedule to facilitate the conducting of the interview and also to make it more interesting for the participant. While some of the materials will be useless for those who are not literate, where possible the materials have been designed with colors and pictures to have meaning for the non-literate. For those who are visually handicapped, large print visuals have been produced. For participants who are blind it may be necessary to complete a short interview and exclude the data from analysis, although the entire interview can be completed without the visual participation of the participant if she is very cooperative and willing to take the additional time required.

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EQUIPMENT FOR CONDUCTING THE INTERVIEW

1. Basket for carrying the supplies.

2. Complete Interview Schedule:

   a. Introductory letter.

   b. CONSENT FORM.

   c. PARTICIPANT IDENTIFICATION FORM, for recording the identifying information about the participant. It includes CHECKLIST FOR COMPLETION OF INTERVIEW, for recording the completion of each necessary step in the interview procedure.

   d. INTERVIEW SCHEDULE, the form providing the schedule of questions to be asked and space for recording of answers during the interview.

   e. SCHEDULE CARD A--USUAL MEAL PATTERN, the schedule of questions for obtaining information on foods usually eaten, for Item #19 of INTERVIEW SCHEDULE.

   f. SCHEDULE CARD B--USUAL MEAL PATTERN, the schedule of questions for obtaining specific data about foods mentioned in response to SCHEDULE CARD A. To be used with FOOD MODELS.

   g. SCHEDULE CARD C--FOOD PREFERENCES, the schedule of questions for obtaining food preference information in Item #20 of INTERVIEW SCHEDULE. To be used with COLORED BOXES and FOOD CARDS.

   h. FOOD CARD RESPONSE FORM, Used for recording information obtained from Items #20 and #21 of the INTERVIEW SCHEDULE.

   i. PROCEDURE FOR CONDUCTING THE INTERVIEW.

3. Visual Materials:

   a. FOOD MODELS, to be used by participant as required for estimation of the usual serving size (Total of 20 items). Included are:

      1. Three orange models (1/4 cup, 1/2 cup, and 3/4 cup) representing fruits and vegetables. (Marked A, B, and C)

      2. Three white models (1/2 cup, 1 cup, and 1 1/2 cup) representing a hot dish or casserole. (Marked B, D, and E)

      3. Three brown models (2 ounce, 4 ounce, and 6 ounce) representing meat. (Marked A, B, and C)

      4. Three yellow models (1 teaspoon, 1 tablespoon, and 2 tablespoons or 1 ounce) for estimating butter, cheese, and condiments. (Marked 1, 2, and 3)

EQUIPMENT, p. 2

5. Three saran-wrapped bowls containing 1/2 cup, 1 cup, and 1 1/2 cup puffed rice for estimating soup and cereal. (Marked B, D, E)
6. Three glasses (4ounce, 8 ounce, and 12 ounce) for estimating beverages. (Marked B, D, and E)
7. Two spoons (1 teaspoon and 1 tablespoon) for estimating sugar, unprocessed bran. (Marked 1 and 2)

b. FOOD CARDS, 4" x6" laminated picture cards (total of 77 items) of most fiber-containing foods, in the categories, Fruits, Vegetables, and Miscellaneous (legumes, whole grains, nuts and seeds, and certain starchy vegetables). Used for Item #20 of INTERVIEW SCHEDULE.

c. 7 COLORED BOXES into which FOOD CARDS will be sorted, with the following colors and labels:

1. Green--"Very often, more than once a week."
2. Yellow--"Often, about once a week."
3. Orange--"Occasionally, less than once a week."
4. Pink--"Cannot eat."
5. Red--"Dislike."
6. Blue--"Other."
7. White--"Less than 5-6 times a year."

Categories 1-3 are used for Fruits and Vegetables but not Miscellaneous foods, about which more specific food frequency information is obtained. Individual fruit and vegetable consumption varies so widely that more detailed cateforization of frequency would be of questionable validity.

d. Large print written materials for use by participant:

1. RESPONSE AID A--QUESTIONS FOR USUAL MEAL PATTERN, used with SCHEDULE CARD B to remind participant of information needed about each type of food eaten.
2. RESPONSE AID B--Weight categories, used for Item #16 of INTERVIEW SCHEDULE.
3. RESPONSE AID C--STOOL CONSISTENCY, used with Item #26 of INTERVIEW SCHEDULE.
4. RESPONSE AID D, containing the three statements for Item #45 of INTERVIEW SCHEDULE.
5. RESPONSE AID E--VIEWPOINTS ON EATING, containing statements from Item #48 of INTERVIEW SCHEDULE.
6. RESPONSE CARD F, presenting the color-coded, 5-point, Likert-type scale used in responding to statements on RESPONSE AID E. The scale consists of: Strongly agree (blue), Agree (green), Undecided (gray), Disagree (orange), and Strongly disagree (red).

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EQUIPMENT, p. 3

4. Miscellaneous Supplies:

   a. Clipboard.

   b. Three sharpened pencils.

   c. Three rubber bands to put around FOOD CARDS.

   d. Ten 5" x 6" cards, folded to fit into COLORED BOXES, for separating each category of FOOD CARD.

   e. Gift for participant.

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION · HUMAN ECOLOGY BUILDING

DEAR MRS.

SOME OF OUR MOST SERIOUS HEALTH PROBLEMS IN AMERICA ARE BEING LINKED BY DOCTORS TO THE KINDS OF FOOD AMERICANS EAT. THESE NEW IDEAS HAVE STIMULATED A GREAT DEAL OF RESEARCH, BUT MANY QUESTIONS REMAIN TO BE ANSWERED. I'D LIKE TO GIVE YOU AN OPPORTUNITY AS A CONCERNED CITIZEN TO BE A PART OF THE IMPORTANT SEARCH FOR ANSWERS TO THESE DIET RELATED MEDICAL PROBLEMS.

IN COOPERATION WITH DR. KATHRYN KOLASA I HAVE DEVELOPED A RESEARCH PROJECT TO STUDY WHAT FOODS PEOPLE ARE EATING NOW AND WHY THEY ARE EATING THESE FOODS. YOU HAVE BEEN CHOSEN FROM AMONG THE WOMEN PARTICIPATING IN THE OLHSA (OAKLAND LIVINGSTON HUMAN SERVICES AGENCY) NUTRITION PROGRAM TO TAKE PART IN THIS STUDY. YOU CAN MAKE A VALUABLE CONTRIBUTION TO THIS RESEARCH EFFORT BY SITTING DOWN WITH ME FOR ABOUT AN HOUR TO TELL ME ABOUT WHAT YOU EAT AND ANSWER SOME QUESTIONS ABOUT YOUR HEALTH AND OTHER THINGS THAT MAY INFLUENCE YOUR DIET.

NO SPECIAL KNOWLEDGE IS REQUIRED TO ANSWER ANY OF THE QUESTIONS BECAUSE THERE ARE NO CORRECT ANSWERS. THIS IS A CHANCE FOR YOU TO TELL ME ABOUT YOURSELF AND YOUR OPINIONS ABOUT EATING AND ALSO ASK ME ANY QUESTIONS YOU HAVE ABOUT EATING.

I WILL BE CALLING WITHIN THE NEXT WEEK TO ARRANGE A MEETING WITH YOU. BE SURE TO ASK ME ANY QUESTIONS YOU HAVE WHEN I CALL. IF YOU WOULD LIKE TO CHECK ON THE VALIDITY OF THIS STUDY, PLEASE FEEL FREE TO CALL DR. KATHRYN KOLASA, (517) 353-1669, OR MRS. JANE NOVAK, 858-5197.

I TRULY APPRECIATE YOUR COOPERATION AND AM CONFIDENT THAT YOU WILL BE WILLING TO PARTICIPATE IN THIS IMPORTANT STUDY.

VERY SINCERELY,

KRIS JOHNSON (MRS. CARL W.)
COMMUNITY NUTRITION RESEARCHER
(313) 338-1287

KJ/AP

Food Behavior of Older Women

PARTICIPANT IDENTIFICATION FORM

1. Participant code _____

2. Name of participant _____

3. Address _____

_____

4. Phone _____

5. Title VII meal site _____

6. Is participant female? _____

7. Is participant living independently? _____

8. Is participant 60 years old or older? _____

CHECKLIST FOR COMPLETION OF INTERVIEW

Date

_____ Letter sent.
_____ First telephone call made.
_____ Second
_____ Third
Appointment made:

	Date	Time	Location	Outcome
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

_____ Interview completed.
_____ FOOD CARD information recorded.
_____ Information recorded on INTERVIEW SCHEDULE checked for completeness and readability.
_____ Record notes in Field Notebook.

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CONSENT FORM

_____
Name of Participant

I hereby agree to participate in a study being conducted by Carolyn K. Johnson under the supervision of Dr. Kathryn Kolasa of Michigan State University's Department of Food Science and Human Nutrition. I understand that my participation involves an interview of about an hour's length and that I am free to discontinue at any time.

I know that the purpose of this interview is to gather information about food habits and diet-related health problems which will enable dietitians and nutritionists to improve the diet counseling given to patients.

I understand that my personal identity and information about myself will be held in the strictest confidence. I further understand that I have been asked not to discuss the interview with others until the study is completed. I alsoknow that I can receive additional explanation of the study after the interview and that a summary of the results will be made available to me at my request.

_____
Participant

_____
Address (if results are requested)

_____
Interviewer

_____
Date

1.

PC _____

Food Behavior of Older Women

INTERVIEW SCHEDULE

We know that there have been many changes in food habits in recent years. I'm very interested in finding out what older women are eating now and what factors influence their food habits. I'd like to begin by asking you some questions about the things that influence what you eat, such as where you live and how you fix your food.

1. Do you live alone?
_____ Yes
_____ No
Who else do you live with?
_____ Husband
_____ Family (SPECIFY RELATIONSHIPS) _____
_____ Adult female
_____ Adult male
_____ Other _____

2. When you are at home do you usually prepare your meals?
_____ No
a. Who does prepare your meals at home?
_____
b. Do you prepare any of your own meals? Which?
_____ No
_____ Yes _____
c. Do you help with meal preparation?
_____ Yes
_____ No
Is there any special reason why you don't help fix the meals?
_____

_____ Yes
d. Are there certain of your meals that someone else often prepares?
____ No
e. Does any one help you with meal preparation?
_____ No
_____ Yes
Who helps you?
_____

_____ Yes
f. Who prepares these meals?
_____
g. Which meals does he/she prepare?
_____
h. Does he/she help you when you prepare a meal?
_____ No
_____ Yes

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PC _____

*3. Do you usually decide what you want to eat at home?

_____ Yes
_____ No
a. Who does plan your meals?

_____

_____ Sometimes
b. Which meals do you plan yourself?

_____

_____ Other _____

_____ Question not asked, not appropriate

4. Do you feel that the food preferences of others influence what you eat now? (Such as your husband.) In what way?

_____

5. What kitchen facilities do you have? (IF ANY LISTED ITEM IS NOT MENTIONED, ASK:) do you have _____ (listed item)?

_____ a. Stove/hotplate
How many burners does your stove/hotplace have?

_____

_____ b. Oven of any kind

_____ c. Refrigerator
(IF NO:) Do you have access to any place where you can keep food cold?

_____

_____ d. Space to store frozen foods
What kind of freezer space do you have?

_____

_____ e. Adequate workspace for preparing food

_____ f. Adequate storage space for food and equipment

_____ g. Equipment needed to prepare and serve food (pans, can opener, electric appliances)

_____ h. Other _____

6. Do you do your own grocery shopping?

_____ Yes
a. How do you get to the store?

_____

_____ No
b. Who does do your grocery shopping (the relationship)?

_____

c. Do you give them a list of what you want?

_____ No

_____ Yes

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7. How often do you eat at the [nutrition site? / multipurpose center?]

_____ times per week/month
_____ Other _____

a. (IF PARTICIPANT VOLUNTEERS ANY OPINIONS ABOUT THE MEAL PROGRAM, RECORD HERE)

_____

_____

8. How often do you eat somewhere else other than at home or at the
__ [nutrition site? / multipurpose center?]

_____ times per week/month
_____ Never (GO TO QUESTION 10)
_____ Other _____

9. Where do you go to eat?
_____ To a friend's house
_____ To a relative's house _____
_____ To a restaurant
Does the restaurant offer a full selection of foods, including salads and cooked vegetables?
_____ Yes
_____ No
_____ Other _____

_____ Other _____

10. How much do you usually spend for food for yourself each week, including what you spend when you eat out? (HELP WITH ADDING UP TOTAL, IF NEEDED, INCLUDING FACE VALUE OF FOOD STAMPS.)

___ $ _____ per week

a. Does this include food for anyone else?
_____ No
_____ Yes
Who else?

_____

b. Does this include paper products, cleaning items, and toiletries at the grocery store?
_____ Yes
_____ No

_____ Didn't know
_____ Refused to answer
_____ (ESTIMATE) _____

11. Have you lived on a farm at any time in your life?
_____ No
_____ Yes

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 PC _____

12. Another factor that influences the food we eat is our national background. What country do you or your ancestors come from?

_____

a. Were you born there?
_____ Yes
_____ No

b. Has your _____ (country of ancestry) heritage influenced your cooking?
_____ Yes
_____ No

_____ No answer

13. Would you mind telling me your age?
_____ years old
_____ Refused to answer
(ESTIMATE OF INTERVIEWER):
_____

14. Is there any physical condition, chronic illness, or health problem that bothers you now?
_____ No
_____ Yes
Describe the problem.
_____

15. Do you feel that you have a weight problem?
_____ No
_____ Yes

16. Which of these weight descriptions fits you the best?
_____ A. Too thin
_____ B. Just right
_____ C. Slightly overweight
_____ D. Moderately overweight
_____ E. Very overweight
(INTERVIEWER AGREES ___ DISAGREES ____)

17. Are you on a special diet prescribed by a doctor of given to you by a dietitian?
_____ No
_____ Yes
What kind of diet?
_____

18. In recent years have you made any changes in your diet because of your health or because of other changes in your life (such as eating less because there is no one to cook for or staying away from eggs.)
_____ No
_____ Yes
a. What changes have you made?
_____
_____
b. Why have you made this change?
_____
_____

5. PC_____

c. (IF PARTICIPANT MENTIONS ANY CHANGES IN HEALTH RELATED TO DIET, RECORD HERE.)

____

____

19 USUAL MEAL PATTERN.
(ARRANGE FOOD MODELS AND RESPONSE AID A ON TABLE. INTERVIEWER USE SCHEDULE CARDS A AND B. DRAW A LINE AFTER EACH MEAL OR SNACK AND INDICATE WHERE MEAL IS USUALLY CONSUMED. RECORD CONSTITUENTS OF A COMBINATION FOOD INDENTED UNDER THE MAIN FOOD. RECORD FREQUENCY, SERVING SIZE AND DETAILS ONLY FOR MEAT AND FOODS CONTINING FIBER)

Meal Location	Food Item	Frequency per week	per month	Number of Servings	Serving Size Common Measure	Food Model	Details
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6. PC_____

USUAL MEAL PATTERN, cont.

Meal Location	Food Item	Frequency		Number of Servings	Serving Size		Detail:
		per week	per month		Common Measure	Food Model	

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7. PC_____

20. FOOD PREFERENCES
(USE PROCEDURE ON SCHEDULE CARD C. FOLLOWING INTERVIEW RECORD INFORMATION ON FOOD CARD RESPONSE FORM.)

21. (TAKE THE MISCELLANEOUS CARDS FROM THE WHITE BOX.) Now I'd like to have you tell me how often you eat the foods that you put into the orange box just now. Tell me how many times per week or month you eat_____ (food from first card)? What size serving do you usually have? Use the food models to make your estimate. (RECORD INFORMATION BELOW. REPEAT QUESTIONS FOR EACH CARD.)

Food Code	Frequency		Serving Size		COMMENTS
	per week	per month	Common Measure	Food Model	

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(RETURN CARDS TO WHITE BOX.)

8. PC_____

22. (TAKE ALL THE CARDS FROM THE PINK BOX.) These are the foods that you cannot eat for some reason. Would you explain to me why you can't eat them. Why can't you eat_____(food on card)? (RECORD INFORMATION BELOW AND REPEAT QUESTION FOR EACH FOOD CARD FROM PINK BOX.)

Food Code	Complaint Code	Comment

Complaint Code

1. flatulence, gas
2. heartburn,belching
3. allergy
4. diarrhea
5. constipation
6. abdominal pain
7. doctor's orders
8. other (RECORD COMMENT)

___No cards in pink box.

(RETURN FOOD CARDS TO PINK BOX. NEST ALL BOXES TOGETHER AND PLACE IN BASKET.)

23. (IF PARTICIPANT VOLUNTEERS UNUSUAL FRUITS AND VEGETABLE NOT ON FOOD CARDS RECORD HERE:)

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PC _____

24. Now I'd like to ask some questions about your food shopping.

How often do you buy or get <u>fresh</u> fruits and vegetables?

_____ Rarely/never (CROSS OUT ANSWER THAT DOES NOT APPLY.)
a. Is there any special reason why you rarely/never get fresh fruits and vegetables?

_____

_____ Other _____

_____ _____ times per week/month

b. Where do you get your <u>fresh</u> fruits and vegetables now during the winter?

_____

c. Where do you get them in the summertime?

_____

25. (ARE CEREALS PART OF MEAL PATTERN?)
_____ NO
_____ YES
There are many kinds of cereals in the store so we have to make a decision about which kind to buy. How do you decide which kind of cereal to buy? What factors do you consider?

_____

26. Now we're going to shift gears and talk about a health problem that bothers many of us, which may be related to the food we eat. I'd like to ask you some questions about your bowel movements. How would you describe the consistency of your normal bowel movements, that is, without having taken a laxative? (USE RESPONSE AID C.)
_____ a. Hard
_____ b. Soft, well formed
_____ c. Soft, fluid
_____ Other _____

27. Would you say that you usually move your bowels easily, or only with considerable straining?
_____ Easily
_____ Considerable straining
_____ Other _____

28. How often do you usually have a bowel movement?
_____ (1) More than 2 times per day
_____ (2) 1-2 times per day
_____ (3) Every 2-3 days
_____ Variable, usually _____
_____ Other _____

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10. PC_____

29. Would you say that you often are bothered by constipation or diarrhea? How often?

Constipation	Diarrhea
____	____ No
____	____ Yes, _____ times per week/month
____	____ Yes, all the time.
____	____ Sometimes, less than once a month
____	____ Other_____

30. Have you ever been told by a doctor that you have diverticulosis or any other bowel problem?

____No
____Yes, diverticulosis
____Yes, other
Describe the problem.
_____

31. Do you take laxatives or any other medicine for your bowels?

____No
____Yes
How often? (IF ANSWER IS INCONSISTENT WITH # 29 QUESTION FURTHER FOR REASON.)
_____times per week/month
____Answer inconsistent with # 29
a. When do you decide to take a laxative?
_____
____Other
_____
b. What laxative/medicine do you take?
_____

*32. Constipation seems to mean different things to different people. Would you explain what you mean by constipation? How would you describe being constipated?

_____

____Question not asked

33. Some people have their own special ways of avoiding or relieving constipation without the use of laxatives. Is there anything special that you would recommend for constipation? (Do you feel that certain foods help to avoid constipation? Which foods?)

_____
_____

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11. PC_____

34. Now I'd like to talk about a topic that I am interested in--fiber. Do you remember reading or hearing anything about fiber in the food we eat?
____No
____Yes
a. Where did you hear about fiber?
_____

b. Can you tell me briefly what you read/heard about fiber? Why did you mention that? In what way? What difference does_____make?)
____No
____Yes_____
_____

c. Have you ever bought a book about fiber?
____No
____Yes
What book?

_____

35. What comes to your mind when I mention fiber? (Why did you mention that? In what way? What difference does_____ make?)
_____

_____

36. Tell me what you know about bran. (Why did you mention that? In what way? What difference does_____make?)

_____

_____

37. Do you find that you have to pay attention to the amount of roughage or bulk in your diet?
____No
____Yes
In what way?_____

_____

38. Do you ever eat bran in any form?
____No
____Yes

39. Is there any special reason why you eat bran? / don't eat bran?
____No
____Yes
Would you explain your reason.
_____

_____

_____

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12. PC_____

40. What kind of bran do you eat? How often? What size serving? How do you use it?

Type of Bran	Frequency			Serving Size		Uses
	per day	per week	per month	Common Measure	Food Model	

*41. Another thing that affects what people eat is how active they are and what they are able to do physically. Are you physically able to do heavy work around your house/apartment, like scrubbing the floors?
____No
____Yes

*42. Do you do the ordinary work around your home yourself, like vacuuming and changing the bed?
____No
Are you able to do light housework?
____No
____Yes
____Yes

*43. Can you walk up and down stairs without assistance?
____No
____Yes

*44. Do you ever go for a walk when the weather is nice or engage in other outdoor activity?
____No
a. Do you have difficulty walking?
____No
____Yes
____Yes
b. How often do you get out for a walk or other outdoor activity?
_____times per week/month
____Other_____

*45. Which of these statements fits you best? (HAND PARTICIPANT RESPONSE AID D.)
____A. I cannot keep house at all now because of my health.
____B. I have to limit some of the work or other things that I do.
____C. I am not limited in any of my activities.

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13. PC_____

*46. How often do you get out of the house for other activities besides eating out, and shopping for food?

_____times per week/month

____I don't go out if the weather is bad
How often do you get out when the weather is better?

_____

____Other_____

*47. What are these other activities?

____Other kinds of shopping
____Visiting friends or relatives
____Regigious services
____Club meetings
____Volunteer work
____Part time job
____Full time job
____Other_____

48. (SEE NEXT PAGE)

49. Now I'd like to close with one more question.
If you decided to buy a special treat at the grocery store what food would you buy?

_____

50. I really thank you for your cooperation, Mrs._____.
It's hard work to answer so many questions. To show my appreciation I'd like to give you a little gift.
(PRESENT CHOICE OF GIFT BOOK)
____Cooking For Two
____Nutrition Labeling

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14. PC_____

49. VIEWPOINTS ON EATING

(LAY OUT RESPONSE AIDS E AND F.) To close I'd like to get some of your viewpoints about eating. (POINT TO RESPONSE AID E.) These statements have been made by other people about eating and learning about food. After I read each statement will you tell me what your viewpoint is, using this scale of responses (POINT TO RESPONSE AIDF): strongly agree(SA), agree (A), undecided (UN), disagree (D), and strongly disagree (SD).

	Statement	SA	A	UN	D	SD
1.	Learning something new about nutrition will probably not lead me to change what I eat.					
2.	I have found it worthwhile to watch my calorie intake.					
3.	It is fun to try out new foods and old foods fixed in a new way.					
4.	I like to stick with my old favorite meals rather than experiment with new kinds of foods.					
5.	I like to eat fruit for dessert.					
6.	In actual practice, my nutrition knowledge has little influence on what I choose to eat.					
7.	When I decide what food to buy, nutritive value is a major consideration.					
8.	I try new recipes frequently.					
9.	Food selection is a personal matter, people shouldn't try to persuade me to change.					
10.	I am willing to eat foods I don't like very much if I know they are good for me.					

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(GO BACK TO PREVIOUS PAGE.)

FOOD CARD RESPONSE FORM--VEGETABLES PC_____ 1.

Box Color and Designation							Vegetable
Gre. >1/wk	Yel. ~1/wk	Ora <1/wk	White 5/yr	Blue Other	Red Dislike	Pink Cannot eat	
							V1. Asparagus
							V2. Broccoli
							V3. Beans, green or wax
							V4. Cabbage, sauerkraut
							V5. Carrots
							V6. Celery
							V7. Collards, chard
							V8. Corn
							V9. Cucumber, pickles
							V10. Lettuce
							V11. Okra
							V12. Onions, leeks
							V13. Peas, green
							V14. Peppers, green or hot
							V15. Squash, summer, zucchini
							V16. Squash, winter, pumpkin
							V17. Sweet potatoes, yams
							V18. Tomatoes
							V19. Beans, lima
							V20. Bean sprouts
							V21. Beets
							V22. Cauliflower
							V23. Chinese cabbage
							V24. Brussel sprouts
							V25. Eggplant
							V26. Greens, mustard, beet, kale
							V27. Mushrooms
							V28. Radishes
							V29. Rutabaga, turnips, parsnips
							V30. Spinach
							V31. Mixed vegetables
							V32. Vegetable soup

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FOOD CARD RESPONSE FORM--FRUIT PC_____ 2.

Box Color and Designation							
Gre. >1/wk	Yel. ~1/wk	Ora. <1/wk	White 5/yr	Blue Other	Red Dislike	Pink Cannot eat	Fruit
							F1. Apple with skin
							F2. Pears
							F3. Banana
							F4. Blueberries
							F5. Cantaloupe or melon
							F6. Fruit Cocktail
							F7. Grapefruit
							F8. Grapes
							F9. Orange
							F10. Peaches
							F11. Plums
							F12. Prunes
							F13. Raisins, currants
							F14. Apricots
							F15. Avocado
							F16. Raspberry, boysenberry
							F17. Strawberries
							F18. Cherries
							F19. Cranberries
							F20. Dates
							F21. Figs
							F22. Pineapple
							F23. Papaya, Mango
							F24. Tangerine, mandarin orange
							F25. Watermelon
							F26. Applesauce or peeled apple

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PC_____ 3.

FOOD CARD RESPONSE FORM--MISCELLANEOUS FOODS

Data from Ques. 21				Box Color & Designation				
Frequency		Serving Size						
per week	per mon.	Common Meas.	Food Model	White <5/yr	Blue Other	Red Dislike	Pink Cannot eat	
								M1. Beans, dried white
								M2. Bean, dried red
								M3. Peas, dried
								M4. Garbanzos, chick peas
								M5. Lentils
								M6. Soybeans
								M7. Peanut butter
								M8. Salted peanuts or other nuts
								M9. Potatoes with the skins
								M10. Potatoes without skins
								M11. Whole wheat baked products
								M12. Rye bread
								M13. Bread containing added fiber
								M14. Brown rice
								M15. Fruit pie
								M16. Whole grain cereals, as Wheaties, Shredded Wheat, Oatmeal
								M17. Blackeye peas, crowder peas
								M18. Popcorn

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SCHEDULE CARD A--USUAL MEAL PATTERN (#19)

(TAKE OUT FOOD MODELS AND EXPLAIN PROCEDURE WHILE SETTING UP FOOD MODELS.) Now I'd like to find out about what you usually eat and drink every day. I'd like to have you tell me the kinds of food you eat at each meal. To help you estimate how much of a particular food you usually eat I have some food models here for you to look at, and then tell me which model is about the same size as your usual serving. (EXPLAIN MEANING OF MODELS.)
(IF PARTICIPANT INDICATES THAT SHE HAS TEMPORARILY CHANGED HER DIET FOR ANY REASON, SUCH AS SICKNESS, ADD:) I want to know what you usually eat under normal circumstances. (RECORD ALL RESPONSES ON PAGES 5 &6 OF INTERVIEW SCHEDULE.)

(KEY QUESTIONS. USE DETAIL QUESTIONS TO GET COMPLETE INFORMATION ABOUT EACH MEAL OR SNACK.)

1. What do you usually have to eat or drink when you get up in the morning?
2. Do you have anything to eat later in the morning? What do you have?
3. What do you usually have to eat or drink in the middle of the day?
4. What do you usually eat at noon when you eat at the nutrition site?
5. Do you usually have anything to eat or drink later in the afternoon? What do you have?
6. What do you usually have to eat in the evening?
7. Is your usual evening meal different on days when you [do / do not] eat [out / at the] nutrition site. Describe your usual evening meal on these days.
8. Do you usually have anything to eat or drink later in the evening? What do you have?

(DETAIL QUESTIONS.)

1. (IF ANSWER IS SOMETHING LIKE, "ALL KINDS OF THINGS", ASK:) Tell me what you eat on a typical day, for example yesterday.
2. What else do you have to eat at this time?
3. What do you have to drink?
4. Do you have anything else with this meal?
5. (FOR EACH FOOD THAT INCLUDES FRUITS, VEGETABLES, OR CEREAL GRAINS, ASK QUESTIONS ON SCHEDULE CARD B.)
6. (IF A FOOD ON CHECKLIST HAS NOT BEEN MENTIONED, ASK:)
   You didn't mention eating _____ (food on checklist).
   Do you ever eat _____?
   How often do you eat _____?
   What size serving do you have?
   What kind of _____ do you have?

CHECKLIST
Salads
Vegetables
Fruit
Cereal
Bread
Soup

Thank you. You've given me a good picture of the foods you usually eat.
(GO TO SCHEDULE CARD C.)

SCHEDULE CARD B--USUAL MEAL PATTERN

1. (RECORD LOCATION OF MEAL. IF LOCATION IS NOT CLEAR, ASK:) Where do you usually eat this meal?

2. How often do you have _____(class of food mentioned)?

3. What size serving do you usually have?
   OR
   How many _____(class of food mentioned) do you usually have?

4. (IF SERVING SIZE IS NOT CLEAR FROM RESPONSE TO #3, ASK:) Which model represents your usual serving the best?

5. (IF FOOD OF THIS CLASS IS NOT EATEN EVERY DAY, ASK:) What do you eat on other days?

(FOR THESE SPECIFIC FOOD CLASSES, ASK:)

6. (SOUP, CEREAL, SANDWICH, BREAD, SALAD, SNACK FOOD) What kind of _____ do you have?

7. (SANDWICH, CASSEROLE) How do you make your _____? What do you include in it?

#20. SCHEDULE CARD C--FOOD PREFERENCES

1. (WHILE EXPLAINING PROCEDURE, GIVE VEGETABLE CARDS TO PARTICIPANT AND ARRANGE GREEN, YELLOW, ORANGE, AND WHITE BOXES WHERE SHE CAN SORT INTO THEM.)
   Now I'd like to find out in more detail the kinds of vegetables that you like to eat. I have here some cards with pictures of each vegetables on them. I'd like to have you sort them into these boxes according to how often you eat them. If there is any vegetable you don't recognize feel free to ask me. Into the green box put those vegetables that you eat very often, that is more than once a week. Into the yellow box put those vegetables that you eat often, that is about once a week. Into the orange box put those vegetables that you eat occasionally, that is less than once a week on the average. If you eat the vegetable less than five or six times a year put it in the white box. (IF PARTICIPANT HESITATES WITH SEASONAL VEGETABLES, LAY OUT THE "VERY OFTEN IN SEASON" CARD AND EXPLAIN.)

2. (HAND FRUIT CARDS TO PARTICIPANT.) Now I'd like to have you do the same thing with these fruit cards. Sort the cards into these boxes according to how often you eat them.

3. (NEST AND PUT ASIDE ORANGE, YELLOW, AND GREEN BOXES.)

4. (SET OUT PINK, RED, AND BLUE BOXES. GIVE PARTICIPANT THE CARDS FROM THE WHITE BOX.) Now would you sort these cards according to why you don't eat them. If the fruit upsets you or you cannot eat it for some medical reason, put it in the pink box. If you dislike it, put it in the red box. Those you don't eat for any other reason, such as expense or not being familiar with them, put in the blue box. Things you do eat once in a while put back in the white box.

5. (ADD "I EAT THESE" CARD TO THE WHITE BOX. GIVE PARTICIPANT MISCELLANEOUS CARDS.) Now I'd like to have you sort these cards into these boxes to show me which of these foods you eat and why you don't eat the others. Remember the pink box is for foods you cannot eat, the red box for food you dislike, the blue box for foods you don't eat for other reasons, and the white box for food that you do eat.

   (GO TO #21 of INTERVIEW SCHEDULE.)

APPENDIX B

FOOD DEMONSTRATION

Outline of the Food Demonstration

I. Problem of thinning bones in older people

A. Presentation

1. Osteoporosis and peridontal disease
2. Calcium in bones
3. Calcium balance - calcium cube demonstration
4. Sources of calcium - poster

B. Demonstration

1. Make Peach Milk Shake
2. Distribute samples

II. Other Factors in calcium balance

A. Presentation

1. Bones as storehouse of calcium
2. Vitamin D, the sunshine vitamin
3. Intolerance of milk

B. Demonstration

1. Make Banana Yogurt Shake
2. Distribute samples

III. Exercise and strong bones

A. Presentation - astronaut experience

B. Demonstration

1. Make 'Brown Bear', molasses peanut butter milk drink
2. Distribute samples

APPENDIX C

CONVERSION FACTORS

Table A-1. Conversion Factors for Estimating Dietary Fiber Content of Foods

Food	Conversion factor[a]	Fresh wt per unit volume[b,c]	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method,[e] fresh[d]	Dietary fiber, g/100g: Southgate method,[e] dry	Dietary fiber, g/100g: Other methods, dry	Crude fiber, dry, g/100g[b]	Comments[k]
Bread	g/slice	25g/slice						
White	0.7	"		2.7	4.6[f]	3.3[g] 4.0[h]		
Brown	1.3 } 1.7	"		5.1				Conversion factor used was mean of that for brown and whole wheat breads, since these were not distinguished by respondents.
Whole wheat	2.1 }	"		8.5	14.1[f]	14.9[g] 15.5[h]	2.6	
Rye	1.3	"				21.0[h]		DF reported probably for whole grain rye, so Conv. Factor reduced to that of brown bread because of white flour in most rye breads.
Fiber added	2.3	"		8.5-9.5[i]				Such as Fresh Horizons.
Bran Cereals	g/oz							
Wheat bran	12.3				44[e] 48[f]	56[h]	9.1	
All Bran	7.5				26.7		8.2	
40% Bran Flakes	3.3				(12)[j]		3.6	DF:CF ratio for All Bran
Cereals	g/8th-cup							
Refined	0.2	1oz/cup			4.5	7.4[g]		Rice Krispies, Special K
					5.5	7.9[g]		Special K, Corn Flakes

Table A-1 (cont'd.).

Food	Conversion factor, g/8th-cup[a]	Fresh wt per unit volume, g/8th-cup[bc]	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method, fresh[e]	Dietary fiber, g/100g: Southgate method, dry	Dietary fiber, g/100g: Other methods, dry	Crude fiber, dry g/100g[b]	Comments[k]
Cereals (cont'd.)								
Whole grain	0.5	1oz/cup			12.3[e]	10.4[g]		Shredded Wheat, oatmeal.
					15.4[e]	17.6[g]		Puffed wheat, Wheat Chex.
Brown rice	0.3	24	30	(1.2)	(4.0)[j]		0.8	DF:CF ratio of whole wheat.
Legumes								
Beans, white	2.3	31	30	7.3	(26.0)	15.7[h]	5.0	
Beans, red	2.3	31	30			15.0[h]		Conv. Factor same as white beans.
Garbanzos	1.2	15	30	(7.9)			5.0	DF:CF ratio of peas.
Lentils	2.3	31	30				3.9	Conv. Factor same as beans.
Peas, whole	2.3	31	30	7.9	(26.3)		4.9	
Pea soup	0.3	31	15	(1.0)	(6.5)		1.2	DF:CF ratio of peas.
Crowder peas	2.3	31	30				5.7	Conv. Factor same as peas.
Soybeans	1.6	20(roasted)	97		(8.1)	5.1(defatted)[g]		DF calculated from defatted value(80% non-fat solids, 17.7% fat).
Miscellaneous								
Fruit pie	0.8	34		(2.4)			0.6 (fresh)	DF:CF ratio of 4, intermediate between flour and fruits.
Nuts	1.7	20		7.7				Brazilnuts.
				9.3				Peanuts.
Peanut butter	2.4	32		7.6				

Table A-1 (cont'd.).

Food	Conversion factor,[a] g/8th-cup	Fresh wt per unit volume,[b,c] g/8th-cup	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method, fresh[e]	Dietary fiber, g/100g: Southgate method, dry	Dietary fiber, g/100g: Other methods, dry	Crude fiber, dry g/100g[b]	Comments[k]
Miscellaneous (cont'd.)								
Popcorn	3.0g/oz	-		(3.0)[j]			0.6g/oz	DF:CF for wheat.
Potatoes, peeled	0.6	25	17	2.5	14.1[f]	4.7[g]		
Potatoes, whole	0.9	25	20	3.5	(17)	9.9[h]		
Salad vegetables								
Group factor	0.2							
Celery	0.2	13	5		(24)	14.4[g]	12	DF:NDF ratio of 1.7.
Chinese cabbage	0.2	13	5		(28)		12	DF:CF ratio of 2.4.
Cucumber	0.1	13	5		(22)	12.7[g]	12	DF:NDF ratio of 1.7.
Green pepper	0.1	13	10	0.9	(18)	17.2[g]	14	
Lettuce	0.2	13	5	1.5	(26)		11	
Radishes	0.2	13	6		(24)	14.3[g]	11	DF:NDF ratio of 1.7.
Tomato	0.3	20	7	1.4	21.9[f]		8	
Low fiber vegetables								
Group factor	0.3							
Asparagus	0.3	19	7		(24)		10	DF:CF ratio of 2.4.
Bean sprouts	0.2	13	9		(19)		8	DF:CF ratio of 2.4.
Cabbage	0.4	13	8	2.8	32.6[f]	14.2[g]		
Cauliflower	0.3	19	7	1.8	(26)	15.1[g]		
Mushrooms	0.3	13	10		(22)		9	DF:CF ratio of 2.4.

Table A-1 (cont'd.).

Food	Conversion factor,[a] g/8th-cup	Fresh wt per unit volume,[b,c] g/8th-cup	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method, fresh	Dietary fiber, g/100g: Southgate method, dry	Dietary fiber, g/100g: Other methods, dry	Crude fiber, dry, g/100g[b]	Comments[k]
Low fiber vegetables (cont'd.)								
Onion	0.3	13	10	2.1	19.3[f]	7.1[g] 8[h]	6	
Spinach	0.4	25	8		(19)[j]		8	DF:CF ratio of 2.4.
Summer squash	0.4	25	5		(28)		12	DF:CF ratio of 2.4.
Vegetable soup	0.4	30	16		(8)		2	DF:CF ratio of 4 for vegetables requiring cooking.
Medium fiber vegetables								
Group factor	0.6							
Beets	0.8	20	13		(30)	11.8[g]	6	DF:NDF ratio of 2.5.
Broccoli	0.8	19	9	4.1	(46)	11.3[g]		
Brussels sprouts	0.6	19	12	2.9	33.8[f]	14[h]	14	
Carrots	0.7	19	9	3.7	28.6	9.2[g] 12[h]	11	
Eggplant	0.7	25	7		(37)	21.8[g]	13	DF:NDF ratio of 1.7.
Green beans	0.5	16	8	3.4	(45)		13	
Okra	0.6	25	9		(26)		11	DF:CF ratio of 2.4.
Parsnips	1.0	21	18	4.9	(27)		10	
Rutabaga	0.5	21	10	2.4	(24)	10.2[g]	9	
Turnips	0.5	21	7	2.2	(31)	20[h]	14	

Table A-1 (cont'd.).

Food	Conversion factor,[a] g/8th-cup	Fresh wt per unit volume,[b,c] g/8th-cup	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method, fresh[e]	Dietary fiber, g/100g: Southgate method, dry	Dietary fiber, g/100g: Other methods, dry	Crude fiber, dry, g/100g[b]	Comments[k]
High fiber vegetables								
Group factor	1.2							
Collards	1.2	25	10		(45)[j]		8	DF:CF ratio like kale.
Corn	1.0	21	25	4.7	(20)		3	
Green peas	1.6	21	20	7.8	47.6[f]		10	
Kale	1.4	25	12		(45)	30.2[h]	8	DF:EZF ratio like cabbage.
Lima beans	1.7	21	30		(27)		6	DF:CF ratio for starchy veg.
Sweet potatoes	1.0	25	30		(14)		3	DF:CF ratio for starchy veg.
Winter squash	1.1	25	12		(37)	14.7[g]	12	DF:NDF ratio for root veg.
Low fiber fruits		25[l]						
Group factor	0.1							
Cranberry sauce	0.2		4(not inc. sugar)		(15)		5	DF:CF ratio of 3.
Grapefruit	0.1		11		(2.7)		2	DF:CF ratio of mandarin orange.
Mandarin orange	0.1		10	0.3	(6.0)			
Melon	0.1		9		(5)		3.5	DF:CF ratio of mand. orange.
Orange	0.2		14		(5.4)	3.7[g]	3.5	DF:CF ratio of mand. orange.
Watermelon	0.1		7		(6)		4	DF:CF ratio of mand, orange.

Table A-1 (cont'd.).

Food	Conversion factor,[a] g/8th-cup	Fresh wt per unit volume, g/8th-cup	Percent dry matter	Dietary fiber, g/100g Southgate method fresh[e]	Southgate method dry	Other methods, dry	Crude fiber, dry, g/100g[b]	Comments[k]
Medium fiber fruits		25[l]						
Group factor	0.3							
Apple flesh	0.3		15	1.4	6.0[f]		3.5	
Apple peel				3.7				
Banana	0.4		24	1.8	(6.0)[j]		2	
Cherries	0.3		20	1.2			2	
Figs	0.3		23		(4.5)		3	DF:CF ratio of 1.5.
Fruit cocktail	0.3		20		(6)		2	Like peaches, grapes.
Grapes	0.4		19		(7-8)		1.5	DF:CF ratio of raisins.
Mango	0.3		18	1.0	(6)		5	
Papaya	0.3		11		(12)		8	Like mango.
Peach, flesh	0.3		11		(12)			
" with skin				2.3				
Pineapple	0.3		20		(4.5)		1.5	DF:CF ratio of 3.
Plum	0.3		19	1.5 (with skin)	9.6[f]		2.5	
High fiber fruits								
Group factor	0.5							
Apple, whole	0.5		16		(12.0)		6-7	Computed from values for flesh and peel, peel 15% of whole.
Apricots	0.5		15		(12)		4	DF:CF ratio of 3.
Avocado	0.6		16		(15)		10	DF:CF ratio of 1.5.

Table A-1 (cont'd.).

Food	Conversion factor,[a] g/8th-cup	Fresh wt per unit volume, g/8th-cup	Percent dry matter[c]	Dietary fiber, g/100g: Southgate method fresh[e]	Southgate method dry	Other methods, dry	Crude fiber, dry g/100g[b]	Comments[k]
High fiber fruits (cont'd.)		25[l]						
Blueberries	0.6		17		(14)[j]		9	DF:CF ratio of 1.5.
Pears (flesh)	0.5		14	2.4	4.7[f]		8	
Strawberries	0.5		10	2.1	19.1[f]		13	
Dates	0.5	13	78		(4.5)		3	DF:CF ratio of 1.5.
Prunes	0.9	13	72(softenized)		(9.6)		2	Same as plums.
Raisins	0.6	13	82	4.4	(5)		1	
Raspberries	1.2		16		(30)		20	DF:CF ratio of 1.5.

[a]Conversion factors were used with the computer program to calculate dietary fiber(DF) content of food items recorded. For convenience most foods were coded in one-eighth cup units (8th-cup), a volume measure which yielded values between 1 and 99. Bread consumption was coded in terms of slices of equivalent, and bran and popcorn consumption was more conveniently coded in ounces of weight. Conversion factors were calculated using either of these formulas:

$$\text{Conversion factor (g/unit volume)} = \frac{\%\text{DF, dry wt}}{100} \times \frac{\%\text{dry matter}}{100} \times \text{Fresh wt/unit vol.}$$

$$\text{Conversion factor (g/unit volume)} = \frac{\%\text{DF, fresh wt}}{100} \times \text{Fresh wt/unit volume}$$

[b]Calculated from values in Church and Church (1975).
[c]Calculated from values in U.S. Agr. Handbook No. 456 (Adams, 1975).

Table A-1 (cont'd.).

[d]Denotes values reported on fresh (or dry) weight basis.
[e]Values from Southgate (1976), unless otherwise noted.
[f]Values from Southgate (1977).
[g]Values in Spiller and Amen (1975), from analysis of Robertson and Steh.
[h]Values from Hellendoorn and coworkers (1975).
[i]Calculated from values in McCormick (1976), using DF of 1.8-2.0 g/100g white flour used in making bread.
[j]Values in parentheses denote values calculated from fresh weight DF values, or estimated as explained in footnote [k] and the comments.
[k]The ratios of DF values measured by the Southgate (1969) method to crude fiber (CF) values for the same foods were used to estimate DF for similar foods for which only CF values were available. The mean of DF:CF ratios for several starchy vegetables was 4.5 (2.4-5.9), and for several other vegetables 2.4 (1.3-3.4). Similarly, ratios of DF to neutral detergent fiber (NDF) (Van Soest and McQueen, 1973; and Spiller and Amen, 1975) or enzymatic fiber (EZF) (Hellendoorn et al., 1975) values were used to estimate DF for similar foods for which only NDF or EZF values were available. The mean of DF:NDF ratios for roots and tubers was 2.5 (1.4-3.9) and for other vegetables 1.7 (1.0-2.4). The DF:CF ratio for many fruits was around 3, but for seedy, non-gelling fruits around 1.5.
[l]Since the volume of a typical serving of fruit varies depending on the state of preparation (fresh, stewed, dried), the eighth-cup was assumed to be 1/4 of a typical serving, or 25g, unless otherwise noted.

APPENDIX D

SUPPLEMENTARY FOOD CARD DATA

Table A-2. Consumption of Fiber Foods Reported by Respondents.

Food	Frequency of consumption[a]					Reasons for non-consumption[b]									
							Health reasons							Dis-	
	>1/wk	1/wk	<1/wk	Seas	<5/yr	Total[c]	Gas	Indig	Aller	Cal	Teeth	Ulcer	Other	like	Other
Vegetables	← % of respondents →														
Asparagus	12	15	22	17	9	3			2			2		10	12
Beans, green or wax	53	34	5			5		2				2	2	2	2
Beans, lima	15	29	34		5	12	3	3		2		2	2		5
Bean sprouts		10	34		7	5	2					2	2	7	37
Beets	10	27	34	3	9	10		2				2	7	3	2
Broccoli	14	17	34	7	3	3	2					2		10	12
Brussels sprouts	5	3	31	3	10	9	3	2				2	2	12	27
Cabbage, sauerkraut	32	24	32		2	5	3					2		2	3
Carrots	61	25	9			3						2	2	2	
Cauliflower	5	20	37	5	7	5	2	2				2		9	12
Celery	56	17	20		3	3						2	2		
Chinese cabbage		7	12	2	7	5	2					2	2	7	61
Collards, chard	2		12	5	9	14	5	2				2	5	19	37
Corn	22	31	25	7	5	10	3	2		2		2	2		
Cucumbers, pickles	29	27	19	3	3	14	2	9				2	2	2	2
Eggplant	2	5	19	5	10	5		3				2		27	27
Greens, beet, mustard, kale	5	9	19	2	12	3	2					2		19	32
Lettuce	80	14	3			3						2	2		
Mushrooms	12	17	39	2	7	2						2		9	14

Table A-2 (cont'd.).

Food	Frequency of consumption[a]					Reasons for non-consumption[b]									
						Health reasons								Dis-	
	>1/wk	1/wk	<1/wk	Seas	<5/yr	Total[c]	Gas	Indig	Aller	Cal	Teeth	Ulcer	Other	like	Other
Vegetables (cont'd.)	←					% of respondents								→	
Okra	3	7	15		5	2						2		25	42
Onions, leeks	54	27	5			9	3	3				2		2	3
Peas, green	41	31	20			3				2		2		5	
Peppers, green or hot	19	24	22	5	5	15		14				2		5	5
Radishes	10	14	25	10	9	22	3	15			2	2		7	3
Rutabaga, turnips, parsnips	5	15	17	5	15	7	2	2		2		2		14	22
Spinach	15	27	31	2	3	5	2					2	2	10	7
Squash, summer, zucchini	10	14	25	24	10	2						2		9	7
Squash, winter, pumpkin	12	12	32	17	12	3				2		2		5	7
Sweet potatoes	5	19	49		17	7	2	2		2		2		3	
Tomatoes	59	17	9	10		5			3			2			
Vegetables, mix	25	31	29		5	3	2					2		3	2
Vegetable soup	36	24	25		5	2						2		2	5
Fruits															
Applesauce, peeled apple	42	22	27		3	3		2				2			2
Apple with skin	22	12	12	5	5	32	3	9			14	2	5	3	7
Apricots	12	29	25	7	7	5	2		2			2		6	10

Table A-2 (cont'd.).

Food	Frequency of consumption[a]					Reasons for non-consumption[b]									
							Health reasons							Dis-	
	>1/wk	1/wk	<1/wk	Seas	<5/yr	Total[c]	Gas	Indig	Aller	Cal	Teeth	Ulcer	Other	like	Other
Fruits (cont'd.)	← % of respondents →														
Avocado	3	7	12		12	5				3		2		22	36
Banana	56	14	20	2	2	3		2		2				5	
Blueberries	9	12	19	25	10	7		2			2	2	2	5	14
Cantaloupe, melon	9	9	20	41	7	10		7	2			2		2	3
Cherries	10	2	20	22	12	5		2				2	2	14	15
Cranberries	10	3	34	3	29	3		2				2		9	9
Dates	7	7	34		20	10	2	2		5		2		2	17
Figs	3	2	17	5	9	17	2	2		5	5	3		12	36
Fruit cocktail	20	31	32		5	5		2		2		2		3	3
Grapefruit	41	10	20	5	3	9		3	2			2	2	5	7
Grapes	17	14	29	14	9	10		3	3			2	2		9
Orange	51	20	12	2	5	7		3	2			2			3
Papaya, mango				3	3	2						2		17	73
Peaches	27	41	15	10	2	5		3				2			
Pears	22	24	32	10	7	2		2						2	2
Pineapple	15	34	34	2	3	7		2	3			2			5
Plums	17	17	25	14	7	3		2				2		9	9
Prunes	22	9	34		14	14	2	9		2		2			9
Raisins, currant	20	17	34		9	14	2	3	2	2		2	3	2	5
Raspberries	7	10	19	31	12	5		2	2				2	5	12
Strawberries	15	14	14	41	7	5			3				2	2	3
Tangerine, mandarin orange	19	9	37	5	14	3			2			2		2	12
Watermelon	7	7	15	34	14	12		7	2	2		2		3	9

Table A-2 (cont'd.).

Food	Frequency of consumption[a]			Reasons for non-consumption[b]									
				Health reasons								Dis-	
	Eaten	>5/yr[d]	Seas	<5/yr	Total[c]	Gas	Indig	Aller	Cal	Teeth	Ulcer	Other	like	Other
Bread	← % of respondents →													
Brown, whole wheat	78			2	2							2	9	10
Rye	49		2	10	5		3				2		14	20
With added fiber	10			5									3	82
Cereal														
Whole grain	71		2	10	7		2	2	2			2	3	7
Brown rice	19			7									3	71
Legumes														
Beans, red	39		5	14	19	10	5		2		2		10	14
Beans, white	64		3	12	14	7	5		2				3	3
Garbanzos	19			17	7	2	2		2				12	46
Lentils	12		2	12	3	3							12	59
Peas, dried	44		3	19	12	5	3		3				9	14
Blackeye or crowder peas	10		3	5	7	3	2		2				9	66
Soybeans	5			9	5	2		2				2	14	68
Miscellaneous														
Fruit pie	70			9	10		2		7				2	10
Nuts	52		2	14	20		5		3	5	2	5	3	9
Peanut butter	61			12	10		3		5	2			3	14
Popcorn	27			19	19	2	2	2	2	7	2	3	7	29
Potatoes, peeled	92		2	5	2				2					
Potatoes, with skin	54		5	7	10		2		3	2	2	2	2	22

Table A-2 (cont'd.).

[a]Meaning of frequency column headings: >1/wk, more than once a week; 1/wk, about once a week; <1/wk, less than once a week; Seas, often in season; <5/yr, less than 5 times a year.

[b]Meaning of non-consumption column headings: Gas, flatulence or gas; Indig, indigestion or heartburn; Aller, allergies or soreness in mouth; Cal, too many calories or sugar content; Teeth, hard to chew or swallow; Ulcer, aggravates ulcer or diverticulosis; Other, other health reasons; Dislike, food is disliked; Other, other non-health reasons, such as too expensive, never think of it, not familiar.

[c]Total may not equal breakdown because of rounding error.

[d]Exact frequencies for bread, cereal, legumes, and miscellaneous foods were reported but are not recorded in this table.