SWEENEY, CATHERINE GREENWOOD. The 24-Hr. Recall and Its Application with an Elderly Population. (1977) Directed by: Dr. Aden Magee. Pp 81.

A study was conducted to test the validity of a common nutrition survey technique, the 24-hr. recall, with an elderly population. Three hypotheses were developed: 1) For a group of elderly subjects, the 24-hr. dietary recall reflects actual caloric consumption; 2) Recall ability concerning dietary intake is affected by the preference of the respondent for the foods to be recalled; and 3) Recall ability is affected by certain non-dietary factors - age, sex, education, health status, and meal site.

The actual food intake for one meal was observed for 50 individuals 60 years of age and older who participated in federally sponsored congregate meals programs at two sites. A representative serving of each food item on the menu was weighed and measured. The plate waste for each individual was collected and measured and this amount was subtracted from the representative serving to give the total amount consumed. Spilling, sharing, or saving of food during the meal was noted.

The following day each subject was interviewed. Included in this interview were a 24-hr. recall and a food preference survey for foods found in the observed meal. Social, demographic, and health information was also collected. The 24-hr. recall asks each respondent to describe all food and beverages consumed in the preceding 24 hour period along with the approximate portion size. Food models were used to assist the respondent in estimating portion size.

The observed and reported meal for each subject was converted into caloric values for the total meal and for five food groups within the meal. The results were analysed statistically to determine the nature of the relationship between observed and reported caloric intake and the effect of certain relevant variables on recall ability. The statistical tests used included the paired-t test and simple and multiple regression analysis.

Results showed that 84% of the respondents underestimated their caloric intake by an average of 21% for the observed meal. Regression analysis, however, suggested that a significant relationship does exist between observed (X) and reported (Y) caloric intake values. Further testing of this relationship showed that for the total caloric intake for one meal and for one food group, Dessert items, this may be considered a one-to-one relationship. Of the variables tested by multiple regression, only food preference was found to significantly affect recall ability.

On the basis of these results it was concluded that the hypothesis that the 24-hr. dietary recall validly reflects observed caloric intake in a selected group of elderly subjects could not be rejected. In addition, the preference of an individual for food items within a meal will affect the ability to recall total caloric intake for that meal.

THE 24-HR. RECALL AND ITS APPLICATION WITH AN ELDERLY POPULATION

by

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CHAPTER I

INTRODUCTION

The issue of accurately determining nutritional status carries with it far-reaching implications for national and international nutrition efforts. The crisis of world hunger amidst the concomitant pandemic in this country of diseases resulting from overnutrition requires effective determination and treatment of nutrition related problems.

Nutritional status surveys may include three distinct components: clinical diagnosis, biochemical tests, and dietary studies. Limitations exist in the determination and interpretation of all three methodologies. Clinical diagnosis of specific symptoms of nutritional deficiencies presumes a fairly advanced state of malnutrition and will not be useful in identifying and preventing potential nutritional inadequacies. Accurate biochemical measures of nutritional status for all nutrients are not available. Moreover, due to biological mechanisms for adaptation to low levels of intake, the biochemical evaluation may not reflect a deficiency condition until tissue reserves are depleted. In addition, both clinical and biochemical studies require trained professional personnel and must usually be limited to smaller samples because of the time and money involved in carrying them out.

It is widely acknowledged that dietary surveys must be an integral part of most nutritional status assessment studies (1,2). Determination of nutritional status based solely upon dietary intake, however, is fraught with difficulties. Among the major limitations of dietary surveys is establishing the internal validity of the data collected.

Although several methods of assessing dietary consumption have been used extensively for many years, relatively few studies have attempted to determine how accurately, in fact, these methods measure what they purport to measure, that is, actual dietary intake. As Young and Trulson (3) have noted:

> A major defect in the collection and processing of dietary data for any purpose lies in the inability to make precise or even approximate statements concerning the validity and reliability of the various procedures in current usage.

Without such validity studies, definitive progress cannot be made in improving procedures for conducting nutrition surveys.

It is estimated that by 1985, 25 million persons will be 65 years of age or older. The 1971 White House Conference on Aging stressed the nutritional vulnerability of the elderly and encouraged the implementation of programs designed to alleviate the malnutrition often found in this age group (4,5).

Nutritional status surveys play an integral role in

(a) establishing the vulnerability of the aged to dietary deficiencies, (b) determining the distribution of nutritional inadequacy among the elderly, and (c) identifying specific areas of nutritional deficiency. Once programs are established to meet the needs as outlined by dietary studies, additional dietary surveys must be conducted to assess the effectiveness of the program in meeting the nutritional needs of this age group. The reliance on dietary surveys to provide accurate nutritional assessment information requires an initial understanding and confirmation of the internal validity of our methodological tools, particularly with regards to this age group.

Surveys of dietary consumption often are designed as retrospective sudies in which the subject is required to report on foods eaten within a specific time period prior to the interview. The accuracy of such retrospective studies inevitably depends upon memory, and there are many studies indicating that memory declines with age (6,7).

The purpose of this study was to test the validity of a common nutrition survey technique, the 24-hour recall, with an elderly population. Three hypotheses were developed: 1) For a group of elderly subjects, the 24-hr. dietary recall accurately reflects actual caloric consumption; 2) Recall ability concerning dietary intake is affected by the preference of the respondent for the foods to be recalled; and 3) Recall ability is also affected by certain non-dietary

factors - age, sex, education, health status, and meal site of the respondent.

CHAPTER II

REVIEW OF LITERATURE

The validity of dietary survey information has been tested, primarily, by two methods. First, a comparative analysis is made of the results of dietary consumption surveys of the same population group using different survey techniques. A second study method has been to compare actual dietary intake when it is known with dietary consumption as determined by various nutrition survey techniques. The literature concerning the validity of the 24-hr. recall method as a nutrition survey technique is reviewed in terms of these two study methods. Particular attention is given to those studies involving an elderly population sample. In addition, the literature concerning the possible effect of certain factors on recall ability in an elderly population is considered.

A Comparison of the Validity of Various Dietary Survey Methods

The development of suitable methodologies for food consumption surveys opened the way towards an understanding of human nutritional requirements. Early investigators of the middle and late 19th century, such as Voit and Atwater, proposed dietary standards for protein and calories

based upon studies of actual dietary intake of apparently healthy people.

Standardization of the levels of nutritional adequacy along with the first organized efforts to evaluate the nutritional status of population groups came as a result of the work of the League of Nations Technical Commission on Nutrition (8). In 1939, Bigwood (9) described the details of procedure and methodology which have formed the basis for nutrition surveys ever since. Equally comprehensive reviews of complete procedural requirements for nutrition surveys include the 1949 publication of the National Research Council (10) and the more recent reviews by Christakis (2) and Marr (11).

Dietary surveys may be designed to determine the food consumption patterns of individuals or families. This study is concerned with methods to determine individual food consumption. The four methods most commonly used for the evaluation of individual diets are: estimation by recall, food record, dietary history, and weighed intake. Although the actual procedures for each method have been revised very little in the last 30 years, studies on dietary methodology have helped to define the significance of the results obtained by each method.

Briefly, the recall of food intake is normally taken for a 24 hour period only and, thus, is designated the 24-hr. recall. The subject is asked to recall all food consumed during the previous day and to estimate the quantities in

ordinary household measures. Although the information obtained may not be representative of the usual or overall dietary habits of one individual, it may provide a good qualitative description of group dietary patterns.

While the recall method has been most successful in identifying group patterns, the food record is used more frequently in individual nutritional status studies. The subject is taught to keep an accurate record of all food eaten during a period ranging from one to seven days or more. Quantities of food may be estimated or actually measured, either in common household measures or weighed on a scale. This method requires a cooperative and diligent subject but may provide fairly accurate measurements of food consumption patterns over a specific period of time.

A variation of the food record is the weighed intake in which the subject or a trained person weighs all food consumed within a given period of time. In addition, laboratory analysis may be performed on a duplicate of the foods eaten. The weighed food intake is the standard methodology preferred in a laboratory-controlled metabolic study. Because of the labor and cost of such studies, their use in surveys is limited.

The purpose of the dietary history is to discover the usual food pattern over a relativley long period of time and is most often obtained by a trained interviewer. The diet history can provide a broader, long-term description of

overall eating habits but may not reveal actual changes in the diet over time.

Several investigators (2,3,11) have pointed out the necessity for designing dietary studies carefully. The four methods enumerated above cannot be applied interchangeably. The actual objective of the study should determine which method may be employed. Limitations and practical considerations such as the size of the sample, the willingness and ability of the subject to cooperate, the time required per subject, cost, and the need for trained interviewers should further delineate the optimal methodology.

A variety of studies have been reported which compare the results obtained by several dietary methods on the same subjects. Young et al. (13) interviewed grade school, high school, and college students, pregnant women, and male industrial workers using three dietary study methods. The order of procedure was as follows: first, the 24-hr. recall was obtained; then, a detailed retrospective dietary history was solicited by a trained nutritionist; and finally, after proper instruction, the same subjects kept a seven- day dietary record. The investigators were interested in learning how the results of the three methods compared, first, when estimating the nutrient intake of an individual, and secondly, when estimating the mean nutrient intake of a group.

The dietary history and the seven-day record were each compared separately with the 24-hr. recall to test the hypothesis that the 24-hr. recall was an unbiased estimate

for either method. The authors found that it was virtually impossible to predict the same food intake of an individual from either the 24-hr. recall, dietary history, or seven-day record. Although the three methods appear to be measuring different facets of an individual's food consumption pattern, the study did not address the issue of internal validity. How well did any of the methods tested describe the actual food intake of the individual?

The results of the group mean estimates for nutrient intake from the three methods showed the estimate from the 24-hr. recall to be in close agreement with the estimate obtained from the seven-day record. Values obtained by the dietary history were decidedly higher than those obtained by any of the other estimates used. These researchers (13) concluded that a 24-hr. recall was appropriate if an estimate of fifty or more persons was desirable and if some errors of ten percent could be tolerated.

Chalmers et al. (14) concluded, also after a comparison of dietary study methods, that in characterizing a group by its mean intake, a one-day dietary record was found to be most efficient when the relative importance of the number of days was compared to the number of subjects. Thus, it would appear that a large number of accurately taken one-day records may be as useful to estimate the mean intake of a group as a smaller number of seven-day records.

Huenemann and Turner (15) in an earlier study of a comparison of a detailed dietary history with a series of carefully kept 10 to 14 day weighed records found the diet histories to have little quantitative value. No history was found to agree with the diet record within 20 percent for all constituents. For 16 of 21 subjects, estimated caloric intake was higher than the average for the diet records. According to the authors, "the chief reason for discrepancies between histories and records seemed to be that patients actually did not know what or how much they ate." Although Chalmers et al. (14) considered the seven-day diet record to be a reliable indicator of food intake, Huenemann and Turner (15) found that 10 to 14 day diet records obtained three to four times during a year showed significant variations from one period to another. Differences of from 0.05 gm. to 0.85 gm. for calcium, 54 to 500 micrograms for thiamin, 6 to 2065 micrograms for riboflavin, and 95 to 755 calories were noted.

Another comparison of dietary study methods with children was carried out by Bransby et al. (16) in England. The diet of fifty children ages 10 to 15 was followed for three days using four study methods: precise weighing at meal time, "questioning", or a 24-hr. recall, "homely measures" or records of amounts of food eaten in ordinary household measurements, and chemical analysis of duplicate portions of foods eaten. This was not felt to be a satisfactory test of the recall method since the children took an active interest in the proceedings and familiarized themselves with their food

more than usual.

A comparison of the results did reveal that for food groups and for average energy and nutrient values, there was good agreement between the weighing, questioning, and homely measures methods. However, the questioning and recording in homely measures gave overestimates compared with weighing. Eppright et al. (17) in this country also found that food intake calculated for children by their mothers in common household measurements exceeded values derived by weighing the children's diets.

Durnin and Blake (18) compared the results of a 24-hr. recall and a seven-day record for 26 men with a mean age of 56 years and 10 women, seven of whom had a mean age of 59 years and three with a mean age of 25 years. The mean intakes of protein, calcium, iron, and energy obtained by the two methods showed very good agreement. However, as in other studies, the two values for the individual subjects frequently showed much discrepancy.

Berry and Dower (19) found that, similar to earlier studies mentioned previously with children (15,17), detailed food records obtained at intervals in an elderly population provided distinctly different results. These investigators found a wide difference in caloric intake for 39 elderly subjects when a comparison of two seven-day records completed 10 to 12 months apart was made. In 60% of the cases there was a difference of 10% or more in the intake from one record

to the next. Generally, they found a tendency towards a lower intake being recorded on the second occasion. The authors questioned whether the difference reflected true fluctuations due to health or aging or to the unreliability of certain old people in record keeping.

A recent attempt by Macleod (20) was made to determine the most efficient method of collecting dietary information in an elderly population for the purpose of identifying individuals with suboptimal intakes. The seven day retrospective history of foods eaten during the previous week may require a substantial amount of time and recall ability on the part of the elderly. A seven-day weighed food record, although more exact, can be a difficult task for the elderly subject and lack of cooperation may limit the size of the study population. The third method examined was the 24-hr. recall which the investigator believed was limited in its ability to account for day-to-day variations in the diet. At the same time, the investigator questioned whether this difficulty is less important in the elderly since their diet may tend to remain monotonous and contain very little variation.

A comparison of these three methods with 200 randomly selected subjects 65 years of age or older living at home was made. The seven-day record was taken to be the most accurate description of the individual's diet. Macleod found that for calories, protein, fat, iron, potassium, and perhaps calcium, the percentage disagreement between the

seven-day record and either the seven-day history or the 24-hr. recall was within "reasonable limits", defined as 25%. The 24-hr. recall was found to give varying degrees of underestimate while the seven-day history fluctuated between definite overestimate and underestimate. For these nutrients the author felt either alternative simple method would be adequate for screening for these nutrients, but because of its greater simplicity, the 24-hr. recall would be preferred. Probably due to the tendency of the 24-hr. recall to underestimate intake, this method identified more subjects with suboptimal diets than did the seven-day history when compared with the results of the seven-day record.

Tests of the Internal Validity of the 24-Hr. Recall

As has been noted, the literature on dietary methodology provides few tests of the actual validity of various study methods. The 24-hr. recall, because of its simplicity and widespread use, has probably received the greatest attention. Meredith et al. (21) obtained recall information from 94 children, ages 9 through 18, for a school lunch for which actual consumption records for each child were also available. The investigators were able to observe which food items were chosen by each child and to record the standard portion for that food item, but not the exact amount, given to each child. Plate

waste was collected and recorded and was then subtracted from the standard amount served to give the amount eaten. The possibility that some children may have eaten additional food not purchased in the lunchroom or that they may have given food away on their trays was taken into consideration between the recall and the computed records. The authors do not say, however, how this was done nor how frequently they discovered these practices while interviewing the children. The 24-hr. recall was performed 30 minutes to 2 hours after the meal was observed.

In 33 records or 35 % of the recalls the children reported the same number of items and kinds of foods as had been observed but were incorrect in quantities reported for one to three items. Only 6 of the 94 records agreed completely in number and kind of food item as well as quantity. In general, they found a tendency for underreporting of both number of items and quantity of food.

The school lunch program was again used to test the validity of the 24-hr. recall with young children in 1973 by Emmons and Hayes (22). A total of 151 children from grades 1 through 4 were given a 24-hr. recall which included a school lunch from the previous day. Similar to the methodology described for the study by Meredith et al. (21), actual food consumption was computed by subtracting individual plate waste measurements from standard portion sizes. To minimize the possibility of sharing of food, children known to have large

appetites were offered second helpings. Those children with bag lunches were seated at a different time than those eating the regular school lunch.

The authors found that the ability to recall correctly the foods eaten improved with age. Children in Grade 4 remembered an average of 80.6% of the foods in their school lunch while children in Grade 1 remembered an average of 60.5% of the food items. When the nutritive level for calories and eight nutrients were calculated and correlated for both the recalled and observed school lunch, the authors found that the number of significant correlation coefficients among the nine nutrients increased with age. Only three of the nine correlation coefficients were significant in Grade 1, but all nine correlations were significant at this level in Grade 4.

Campbell and Dodds (23) tested the hypothesis that failing memory due to age might limit the use of a retrospective study tool such as the 24-hr. recall. In this study, the menu served to 200 persons, 100 of whom were between twenty and forty years of age and 100 who were 65 years old and over, was known but not the actual amount consumed. The subjects were primarily patients in a State Hospital for persons with lung disorders. Fifty older women were contacted in two neighboring retirement homes as well. A 24-hr. recall was solicited from each subject. Then, the subject was shown the printed menu of food offered during the past 24 hours and asked if he had eaten any of the foods on the menu which

he had not mentioned. Any foods added in this way were recorded as "items probed" and were used as an indicator of forgetfulness. A comparison of "probed" calories was used to evaluate memory loss. It was found that there was a significant difference between the mean level of probed calories for younger subjects compared with older subjects. Young institutionalized men forgot 21% of their total calories while older institutionalized men forgot 35%. The figures for women were 12.5% additional probed calories for young institutionalized women and 28% for older women.

Campbell and Dodds (23) did not indicate whether or not extra foods were ever recalled initially and, if so, how these calories were related to the "probed" items. Both Meredith et al. (21) and Emmons and Hayes (22) found that children would occasionally mention foods as eaten which had not been served. This study cannot be viewed as an actual test of validity since the actual foods eaten, including quantity, were not known. It is the accuracy of the initial recall in comparison with the actual food intake which ultimately tests the use of the 24-hr. recall in dietary surveys.

Such a study was conducted by Goodman (34) and reported by Madden et al. (24) with an elderly population. Actual intake was observed for one meal for 76 elderly subjects, 60 years and older, in an elderly feeding program. Each person was assumed to have been given a standard portion weighed separately by the investigator. Plate waste was

observed by trained individuals but not weighed. These estimated amounts were subtracted from the average amounts served to determine "actual intake". No special precautions were taken to observe any sharing or spilling of food. Subjects were interviewed within 24 hours and a 24-hr. recall was obtained. The interview included questions on health and disability to mask the real purpose of the interview.

In order to determine the relationship between observed and reported nutrient intakes certain statistical tests were performed. The means of the recalled and actual intakes were not significantly different for all nutrients examined except kilocalories. Subsequent regression analysis found that for three of the eight nutrients examined, kilocalories, protein, and vitamin A, subjects tended to over-report their intake when they were observed to have eaten small quantities but to under-report large quantities resulting in the so-called "flat slope syndrome", or "talking a good diet". The authors were interested in the use of the 24-hr. recall for group comparisons and concluded that the recall method would distinguish significant differences in dietary intake between groups. However, due to the perverse results found for three nutrient indicators, calories, protein, and vitamin A, further replications of their validity study were recommended.

The Effect of Other Factors on Dietary Recall in the Elderly

The accurate recall of dietary intake consumed during a specified period of time may be influenced by various dietary and non-dietary factors. Variables which might affect the validity of the 24-hr. recall have not been systematically examined. Obviously, estimation of intake is subject to individual errors of observation and memory and to conscious or unconscious exaggeration or minimizing of intake. In addition, however, certain factors such as sex, education, health, and food preference may be considered to affect overall recall ability.

In a study mentioned previously, Campbell and Dodds (23) determined that memory for dietary intake became less accurate with age. These investigators questioned as well, however, whether sex or level of education might affect an individual's ability to recall his food intake. A significant difference was found between the recall ability of men and women with women having a lower probed caloric level, suggesting that their initial recall ability was better. Although young and older women did not differ significantly in level of education, the percentage of calories picked up by the probing technique was different for the two groups. These investigators concluded that the factor of age rather than education produced the difference in these two comparable groups. Years of education has been shown in psychological tests of memory loss, however, to be directly

related to recall ability (31, 37).

Goldfarb (37) has suggested that a decline of mental functioning capacity may be precipitated by the advent of poor health affecting normal cerebral function. The ability of elderly persons to adequately rate their health status was examined by Tissue (30). Data from 256 elderly persons indicated that a self-rating of health as "Good, Fair, or Poor" was directly related to health.

Pilgrim (27) reported that food preference is an important predictor of food consumption. Brogdon (28) was able to show an association between food preference and dietary intake for fruits and sweets in an elderly population. The possibility that a preference for foods within a meal might affect the ability to recall having eaten these foods has not been studied.

A review of the literature suggests that the 24-hr. recall compares favorably with other dietary survey methods for most population groups. The ability of the 24-hr. recall to accurately measure actual food consumption is related to the age of the population sampled. The use of the 24-hr. recall with an elderly population requires further study. Important variables which may be related to recall ability in an aging population include sex, age, health status, and food preference of the respondent.

CHAPTER III

METHODOLOGY

Statement of the Hypotheses

The hypotheses developed for this study were:

1) For a group of elderly subjects the 24-hr. dietary recall reflects actual caloric consumption.
2) Recall ability concerning dietary intake is affected by the preference of the respondent for the foods to be recalled.
3) Recall ability concerning dietary intake is also affected by certain non-dietary factors. The five factors analyzed in this study were: age, sex, self-perceived health status and total years of education of the respondent, and the meal site where the individual was observed to eat the test meal.

Description of Population

Data were collected from 50 individuals who were 60 years of age and older and were participants in a federally-sponsored congregate meals program. The Nutrition Program for

the Elderly was established to provide low cost, nutritionally sound meals once a day, five days a week to groups of older citizens in strategically located centers where they can obtain other social and rehabilitative services as well (25). In Wake County, North Carolina there are six such centers. Subjects for this study were chosen from two sites which differed significantly in size and in the characteristic makeup of the participant group.

Glenwood Towers is a high rise apartment building publically financed and supported for senior citizens located in downtown Raleigh, N.C. Residents of the Towers come from varied backgrounds and income levels, although the majority live on only a small fixed income. The meal center is located in a small building adjacent to the high rise itself. Facilities are modern and well-maintained. The meal service is carried out in a large room with 14 oblong banquet tables seating 4 to 6 persons. The central kitchen for the preparation of all Title VII meals served in Wake County is located in this center.

Participation in the meal program is open to all persons 60 years of age and older regardless of whether or not they are residents of Glenwood Towers. At the present time, of the average 160 meals served per day at this center, approximately 52% are served to individuals who reside in Glenwood Towers. The racial makeup of this site is primarily white, approximately 87%.

The second meal site is located in the small rural community of Holly Springs, N.C., population 3,578, located approximately 20 miles south of Raleigh, N.C. The participants gather in an old frame house converted into a neighborhood center by the local Community Action Agency. Transportation to the center is provided for those living in other communities around Holly Springs. An average of 30 meals per day are served at this center. The meals are brought in insulated containers from the central kitchen at Glenwood Towers. There is no one room large enough to serve everyone, so participants are divided into two rooms. The quality of the facilities is adequate but substantially below those available to the participants at Glenwood Towers. During the month of November, for example, when the author was conducting interviews in Holly Springs, participants often had to wear overcoats while eating because of poor heating and insulation.

All of the participants of the Holly Springs site were black. Most have worked as farmers and have lived in this area all of their lives. Income level was uniformly at or below the poverty level. Educational background was limited. The most popular activity provided by the meal site for its elderly participants were Adult Basic Education classes held twice a week before the meal for approximately two hours.

The two sites contrast sharply in general atmosphere as well. Although the participants at both sites enjoy the socialization at mealtimes, the smaller numbers at Holly

Springs seem to allow for greater group spirit and camaraderie. Meals are served from the small Holly Springs kitchen as for an extended family gathering. At Glenwood Towers, participants appear to view the setting as a special type of cafeteria but feel no overall sense of allegiance to the group as a whole.

Through a sampling procedure described later, 34 individuals from the Glenwood Towers site and 16 individuals from Holly Springs were selected and interviewed for this study. Table 1 provides a descriptive comparison of the two sites.

TABLE 1

Sex and Racial Breakdown of Participants in the Two Sites

Site	Number of Subjects	Sex		Race	
		Male	Female	White	Black
Glenwood Towers	34	8	26	33	1
Holly Springs	16	3	13	0	16
Total	50	11	39	33	17

The average age of this sample was 73 years. For the 11 male subjects the average age was 76 years, slightly higher than that of the 39 women, 72.5 years. As can be seen in Table 2, the sample group from Glenwood Towers was slightly older than the group from Holly Springs. A total of 73% of the sample from Glenwood Towers were 70 years of age and older versus 62% of the sample from Holly Springs.

TABLE 2

Age of Subjects by Meal Site

Age in Years	Glenwood Towers No.	%	Holly Springs No.	%
60-64	0	0	2	13.0
65-69	9	26.5	4	25.0
70-74	9	26.5	5	31.0
75+	16	47.0	5	31.0

The average educational level attained at both sites was the 8th grade. The average number of years of education for the sample population at Glenwood Towers was 8.2 years and 6.8 years for the respondents at Holly Springs.

The work background of our sample varied considerably for those at the Glenwood Towers site. The occupations included blue collar factory jobs, waitress and secretarial positions. Two men had worked in small businesses and another man was a college-educated electrical engineer. At Holly Springs, all but three persons said their major work experience was farming. Many of the women had also performed some paid domestic work.

The respondents were asked several questions concerning their health although only one, the overall self-assessment of health status, was used in the subsequent analysis. Information from the other questions was not felt to contribute to the

overall analysis but will help to further describe the sample population.

A total of 28 persons felt their health was Excellent or Good. The remaining 22 individuals felt their health was only Fair or Poor. Of the participants from the Glenwood Towers site, 62% felt they were in Excellent or Good health while only 44% of those sampled from the Holly Springs site reported Good or Excellent health. The most common medical problems reported by respondents from both sites were: heart disease, hypertension, and arthritis. A total of 34 individuals reported taking prescription medicine for their medical problems.

The Title VII meal programs for the elderly do not cater to special dietary needs. Those persons who must follow a strict diet usually will not attend the meal sites. Nevertheless, 33 persons in the present sample reported some type of dietary restriction. There was one individual with diabetes and three persons were following a "bland diet". Other common restrictions reported were no salt or pork, no greasy or fried foods, and weight reduction restrictions.

Forty persons said they wore dentures or partial plates. Only two individuals of those sampled were observed to have no teeth at all.

Sample Selection Procedure

The selection of the sample was carried out in the following manner. On the day in which a meal was to be observed,

the author visited the meal site at least one hour before the meal was served. At both sites, participants would generally begin arriving one half hour to 45 minutes before the scheduled meal time. This was generally a period of socialization and, at Glenwood Towers, due to the very large participation, the early arrival time guaranteed a good position in the waiting line. By the time the meal was to be served, approximately 50 people might be waiting in line at Glenwood Towers.

As the line began to form, the author would ask each person as they arrived if he or she would be willing to participate in a small "survey". The author introduced herself as a dietitian from Duke Hospital who was interested in learning more about the food habits of elderly persons. They were also told that they would be asked some questions concerning their food likes and dislikes which would help the staff of the meal site to design menus which appealed to their tastes. It was necessary that the individual agree to return to the meal site the next day for the actual interview if he was not a resident of Glenwood Towers. Otherwise, a time was agreed upon in the morning when the author would visit the subject at his apartment. Generally, interviews with five people were set up per day.

As a group, the participants at Glenwood Towers arrived in a random fashion. Of the final sample population selected at Glenwood Towers, 23 were residents of the Towers. Approximately one-third of those persons contacted refused to participate in the survey.

At Holly Springs the author was assisted by the volunteer site manager, who was also an elderly participant, in finding a sample group. Because the interview was to be conducted at the meal site the next day, participants chosen for the study had to be those who said they would return the next day. Although an average of 25 to 30 participants were at the site each day, less than 20 would be considered regular participants. The total group from which the sample was drawn was, therefore, very small. With the help of the site manager very few participants refused to be interviewed. Two mentally retarded women were excluded.

Procedure for Observing Food Intake

The cycle of menus was available to the author for both sites so that it was known in advance what was to be served. Very few substitutions were made. The author arrived early enough at the site to observe the actual menu before it was served. This menu was written on The Worksheet (Appendix A) for each subject.

The menus served conform to an established meal pattern approved by State and Federal officials. The meal pattern is:

3 ounce portion of meat or protein substitute

2, 1/2 cup servings of vegetable or fruit

1 serving bread or alternate

1 teaspoon butter or fortified margarine

1/2 cup dessert

1/2 pint milk, either skim, whole, buttermilk, or chocolate

Coffee or tea, optional

Using a standard 8 ounce measuring cup, set of measuring spoons, a 6 inch ruler, and a small scale, the standard portions for a sample meal as served were recorded. Standardization of portion size is a federal requirement of this program so such a system was deemed adequate for determining observed portion size for the sample group.

The author remained in the lunch room throughout the time the meal was served. It was possible to unobtrusively observe for each subject exactly which foods had been chosen, for example, whether or not they chose dessert or which beverage was picked. As the meal progressed, the author was able to observe whether or not food was shared, spilled, or put in a napkin and kept until later in the day. The participants were accustomed to observers, whether Federal, State, or local officials, so the presence of a guest with a clip board did not appear unusual to the group.

At Glenwood Towers participants take their finished trays to a central point next to the kitchen where the dishes are scraped and handed to the dishwashers. The author was able to stay near this spot to receive the trays of the observed subjects. Since there was often a buildup of trays, the offer to "take a couple of trays into the kitchen" to help clear up the pile seemed natural. At a spot in the kitchen away from the general view of the participants, the plate waste was weighed and measured for each subject.

The situation at Holly Springs required a slightly different procedure. There was no possible way to take specific trays to weigh plate waste without creating an unusual scene. Standard portion sizes were measured ahead of time but actual plate waste had to be visually estimated. Plate waste for each subject was noted on the individual Worksheet, and the total amount consumed was calculated from the measured standard portion size.

Interview Procedure

As described in the preceding section, a specific appointment time for the interview was set up the day before with each subject. Interviews were conducted in quiet settings without major distractions or disturbances. Many of the interviews were held in the subject's own home, others were held in small rooms adjacent to the dining area. Each interview required approximately 25 minutes.

The interview consisted of three major parts. The first section contained social, demographic and health questions which helped to characterize the complexion of the sample group as well as to identify potential non-dietary factors involved in obtaining an accurate 24-hr. recall.

The second section consisted of the actual 24-hr. recall. Although the only meal of interest was the noon meal, the

subject was asked to recall all foods eaten within the preceding 24 hour period. This procedure was not only more in accord with the expressed purpose of the interview, that is, "to learn more about the food habits of older persons", but also helped to control against unforeseen variables in administering an actual 24-hr. recall. Since the purpose of the study was to test the validity of the 24-hr. recall, it was felt necessary to perform the entire test as it is normally given. The procedure used is described later.

The third section contained questions designed to elicit the measure of preference each subject had for the meal which was being recalled.

A copy of the interview schedule is included in Appendix A.

Social, Demographic, and Health Information

All questions contained in this section were asked of the respondent directly, except for information on income level. Through Title VII records, income was determined to be above or below Bureau of the Census poverty figures for each participant sampled. Under "Additional Comments", the author noted whether or not the subject was alert and cooperative along with comments made by the respondent concerning the interview.

The Twenty-Four Hour Recall

The procedure for the 24-hr. recall followed an accepted format as described by Christakis (2) and United States Department of Agriculture publications (26). Subjects were asked to relate their entire food and beverage intake for the 24 hours preceding the interview, beginning with the most recent meal. Since the interview in this study took place in the morning before another noon meal, the meals recalled included breakfast that morning and dinner and lunch from the day before.

The subject was also asked to approximate the portion size of the foods and beverages consumed. To assist the respondent, certain food models and measuring devices were available and their use was carefully explained to the individual. These models included:

8 ounce glass
kitchen serving spoon
set of measuring spoons
6 inch ruler
1/2 cup serving cooked rice
1/2 cup serving of mixed vegetables

Information was solicited by general questions about food intake. A food was not suggested unless first mentioned by the respondent.

The form used to record the 24-hr. recall is shown in Appendix A. The column labeled "Subsequent Recall Information"

was included for foods which the subject remembered having eaten after the recall had been given. For example, it was felt that when the respondent was asked to state his preference for certain food items, including those he had eaten the day before, he might be made to recall his food intake in greater detail than might normally occur. When food items were recalled in this way they were not considered as part of the original 24-hr. recall.

Food Preference

In this section all food items offered throughout the week during which the recall was being given were listed. Since interviews were conducted during several different weeks, the food items listed varied for the individual respondents. Each subject was asked to state a preference for each food item as it was named. He or she was asked to state whether they "liked the food item very much, did not care one way or the other about it, disliked it very much, or whether they liked the food item but for one reason or another did not consume it." This last choice was available for those who restricted their diet for medical or personal reasons.

Definition of Variables

This study is intended to investigate the relationship between observed dietary intake and reported intake using a common nutrition survey instrument, the 24-hr. recall, as

well as the influence of various relevant factors. The dependent variable was considered to be the reported caloric intake for the observed meal, and the independent variables include the observed caloric intake and other relevant factors.

Dependent Variable

Under normal nutrition survey conditions the actual intake of food is not known and the 24-hr. recall may be used as an estimate or predictor of actual dietary intake. In this study, however, the recall of calories from one meal is being predicted from the observed intake of calories for that same meal. The dependent variable is, therefore, reported caloric intake since the reported data was felt to contain substantial random variations, whereas the observed caloric values were believed to have been more accurately and consistently determined.

In this analysis the dependent variable is the reported caloric intake which is expressed as total kilocalories for one meal and the reported caloric value of five food groups within this meal:

1) Main Dish
2) Vegetables
3) Dessert
4) Bread
5) Beverage

Independent Variables

The independent variables include the observed caloric intake for one meal plus several variables considered to influence dietary intake and recall. These variables include the following: food preference, health, education, sex, age, and meal site.

Observed Caloric Intake

The caloric content of all foods and beverages consumed in the observed meal for each subject was calculated. Total kilocalories for the observed meal was then divided according to the five food groups described for the dependent variable.

Food Preference

Food preference has been shown to be an important predictor of food consumption, although not always with an elderly population (27,28). The possibility that food preference may affect the validity of the 24-hr. recall has not been tested by the major studies of this research technique.

It was hypothesized that there would be a relationship between the ability of an individual to recall the calories consumed in a meal and his preference for foods within that meal.

Subjects were asked to rate their preference for individual food items included in the test meal and through-

out that week on a 3 point scale:

L = Like

I = Indifferent

D = Dislike

In addition, a fourth choice (R) was available to describe those foods which were restricted for health or personal reasons.

In the statistical analysis food preference was coded as a dummy variable with the categories of Indifferent, Dislike, and Restricted combined under a Negative preference = 1. (Like = 0)

Health

Since health is often cited as a factor influencing dietary intake, a health variable was included. In addition, an individual's health may affect his recall ability. It has been shown that actual physician-diagnosed state of health correlates well with self-assessed health status (29,30).

Respondents were asked to rate their health as:

Excellent

Good

Fair

Poor

The results were coded as a dummy variable with Fair and Poor combined into Unsatisfactory health = 1 and Excellent and Good health = 0 .

Education

Level of education has often been tested as a correlate of recall ability, not only in psychological tests of memory, but also in dietary recall studies (31,23). Total years of education was tested as an independent variable affecting recall ability in this study.

Sex and Age

These variables were coded as follows:

Sex as a dummy variable, Male = 1.

Age: Years since birth.

Meal Site

The differences in the composition of the sample groups at each site was considered a potentially important variable between observed and reported intake values.

Data Analysis

For each of the 50 respondents, intakes of energy were computed for both observed and reported dietary intake using standard food composition tables (32,33). Caloric values were used in all the subsequent statistical analysis.

The paired-t test was used to test for equality of the means, and ordinary least-squares regression was used to test the hypotheses that: 1) there is a relationship between observed and reported caloric intake; and that 2) this is a one-to-one relationship.

Six simple regressions were computed for total calories and for each separate food group studied. Subsequently, a series of multiple regression analyses were utilized on the dependent variable. The independent variables were observed caloric intake plus a number of control variables: food preference, health, education, age, sex, and meal site. Food preference, sex, health, and meal site were represented by dummy variables. Age, years of education, and observed caloric intake were treated as ordinary numerical variables. In addition, simple descriptive statistics were used to delineate the characteristics of the sample group.

CHAPTER IV

RESULTS

The 24-hr. recall procedure requires two tasks of the respondent. First, the actual kinds of foods consumed must be remembered, and second, as accurate an estimate as possible of the portion size on the reported food intake must be given. This information provides a quantity which may be translated through food composition tables into numerical values for various nutrients.

Only two of the 50 respondents reported the exact meal and the correct portion sizes that had been observed. A total of 15 subjects or 30%, however, were able to recall the actual foods consumed but failed to estimate correctly their portion sizes.

When the incorrect reports of the kinds of foods eaten were classified by food group, it was obvious that certain food groups were more easily recalled than others. Table 3 includes the number of incorrect reports for each food group. This represents 1) false reports, for example, cole slaw reported instead of collards, or peach cobbler instead of jello and 2) incomplete reports, such as failing to report any dessert eaten when the individual was observed to have eaten dessert.

TABLE 3

Number of Incorrect Reports by
Respondents for each Food Group

Food Group	Number of Respondents
Main Dish	5
Vegetables	21
Bread	17
Dessert	17
Beverage	6

For most of the observed meals there were two vegetables served. Of the 21 respondents who failed to identify the vegetables in their meal correctly, eight individuals reported both vegetables incorrectly.

The preference of each subject for the foods served in the observed meal was determined. A total of 29 respondents reported a negative preference for one or more food items in the observed meal. The remaining 21 respondents did not dislike any food served or consumed in the meal. In Table 4 the respondents' food dislikes are classified by food group. Vegetables were the least preferred food item in the meal; desserts and beverages were viewed less disfavorably.

TABLE 4

Negative Preference for Food Items
in Observed Meal According
to Food Group

Food Group	Number of Reports of Food Item as Disliked *
Main Dish	11
Vegetables	16
Bread	10
Dessert	6
Beverage	3

* Some respondents expressed a negative preference for more than one food item in the observed meal.

Paired-t Test

When portion size was considered, calorie levels were calculated for the observed and reported intakes, and certain statistical tests were performed. The total level of calories consumed and the breakdown of these calories by food group for the observed intake (X) and the reported intake (Y) were compared by the paired-t test.

The null hypothesis guiding this analysis was:

$$H_o: \mu_y - \mu_x = 0$$

There is no difference between the means of the observed (X) and reported (Y) intake values. The alternative hypothesis was that there is a significant difference between the observed and reported intake values.

The results presented in Table 5 show that the mean values for observed and reported caloric intake differ significantly at the .01 level for total kilocalories and for two of the five food groups, Vegetables and Bread. In addition, the mean values for Main Dish items differed significantly at the .05 level. Therefore, the null hypothesis was rejected and the alternative hypothesis that there is a significant difference in the mean values for observed and reported intake for total kilocalories and for three of the five food groups was supported.

When the differences between the observed and reported caloric intakes for the total meal were scrutinized case by case, it was found that the median difference was 129 calories. The differences ranged from an overestimation of 117 calories to an underestimation of 548 calories. When the two meal sites were analyzed individually, the median difference was a negative 137.5 calories at Glenwood Towers and a negative 129 calories at Holly Springs. For both sites a fourth of the differences were less than 50 calories. At the other extreme, 32% of the differences were over 200 calories. A total of 42

TABLE 5

Paired-t Test for Observed and Reported Caloric Intake

Food Group	$\bar{Y}$ Reported	$\bar{X}$ Observed	t-Value	df[a]
Total Meal	561.46	712.18	7.042**	49
Main Dish	170.54	198.44	2.210*	49
Vegetables	105.26	140.26	3.179**	49
Dessert	145.12	158.30	1.245	49
Beverage	75.14	78.44	0.509	49
Bread	58.26	107.62	4.901**	49

* Significant ($p \leq .05$)

**Highly Significant ($p \leq .01$)

[a] df indicates degrees of freedom

respondents or 84% underestimated their caloric intake for the observed meal. On the average, each respondent reported 79% of their total observed intake.

In summary, the results of the paired-t test suggest that for kilocalories the 24-hr. recall probably does not provide a valid indicator of observed intake. Of the food groups making up the total kilocalorie figure, the mean differences between observed and reported intake were significant underestimates for the Main Dish, Vegetables, and Bread items.

Simple Regression Analysis

As a further test of the validity of the reported dietary intake, the data were subjected to regression analysis. The purpose of this analysis was to establish whether or not a predictive relationship exists between the observed (X) intake and the reported (Y) intake. In the simple regression analysis the null hypothesis was:

$$H_0: B = 0$$

The alternative hypothesis was:

$$H_1: B \neq 0$$

Specifically, the simple regression model is:

$$Y = a + bx + e$$

where e is a random variable which accounts for the fact that

there is not an exact straight line relationship between Y and X. It is assumed that for each value of X, e has a mean equal to zero and some constant variance, σ^2.

The primary statistical test for this hypothesis is the F test for analysis of variance of regression, which tests the significance of the R^2 or proportion of the variance in Y explained by X. In the event that X explains a significant proportion of the variance in Y, then additional statistical tests of hypothses regarding the nature of the relationship between Y and X may be conducted.

Six simple regressions were computed, one for total kilocalories and one for each of the five food groups included in the analysis. No control variables were included in this simple regression analysis. The six regression equations are presented in Table 6.

In each of the simple regressions, the F test indicated that a highly significant ($p \leq .01$) relationship exists between the observed and reported values for five of the six variables. A significant ($p \leq .05$) relationship was established between the observed and reported caloric intake of Bread.

Secondary tests were then performed using the Student's t test to test the hypothesis that $B = 1$. This hypothesis was not rejected for total kilocalories and for the Dessert food group. It was rejected for Main Dish items, Vegetables, Beverages, and Bread.

TABLE 6

Simple Regression Analysis for Observed and Reported Caloric Intake

Food Group	Regression Equation[a] (Kilocalories)	Statistics[b] R^2	F	$t_{B=0}$	$t_{B=1}$
Total Meal	Y =-67.34 +.88X (.10)	.63	80.47**	9.02**	1.20
Main Dish	Y = 42.27 +.65X (.16)	.24	15.35**	3.92**	2.14*
Vegetables	Y = 15.01 +.64X (.11)	.42	34.85**	5.90**	3.27**
Dessert	Y = 0.69 +.91X (.12)	.56	60.90**	7.80**	0.75
Beverage	Y = 9.77 +.83X (.08)	.68	102.77**	10.14**	2.03*
Bread	Y = 14.21 +.41X (.16)	.13	6.92*	2.63*	3.80**

* **Significant ($p \leq .05$)**

** **Highly Significant ($p \leq .01$)**

[a] Numbers in parentheses indicate the standard error of the regression coefficient (b).

[b] F test with 1 and 48 degrees of freedom, to test the significance of the R^2. t-test with 48 degrees of freedom to test the hypothesis that B= 0 and B= 1.

Figure 1 is a graphic representation of the relationship between observed (X) and reported (Y) total caloric intake in this study. The regression line for total kilocalories has been drawn in.

In summary, these results showed that for all six variables a systematic predictive relationship does exist between observed and reported intake values. However, for four of the six variables, the relationship is not always a one unit increase in Y for each one unit increase in X. For the other two variables the hypothesis that there was a one-to-one relationship between X and Y values for both total kilocalories and Dessert items was not rejected.

Multiple Regression Analysis

In order to study the effect of certain independent variables and their relationship to the dependent variable, total reported caloric intake, multiple regression analysis was performed. The independent variables include observed caloric intake and six control variables: age, food preference, level of education, health status, sex, and meal site.

The regression equations are shown in Table 7. Each regression equation tested the relationship between the dependent variable, reported caloric intake (Y), and the independent variable, observed caloric intake (X_1) along with one of the control variables (X_2). This is shown in Model I.

FIGURE 1
Regression Line of Observed (X) and
Reported (Y) Kilocalories

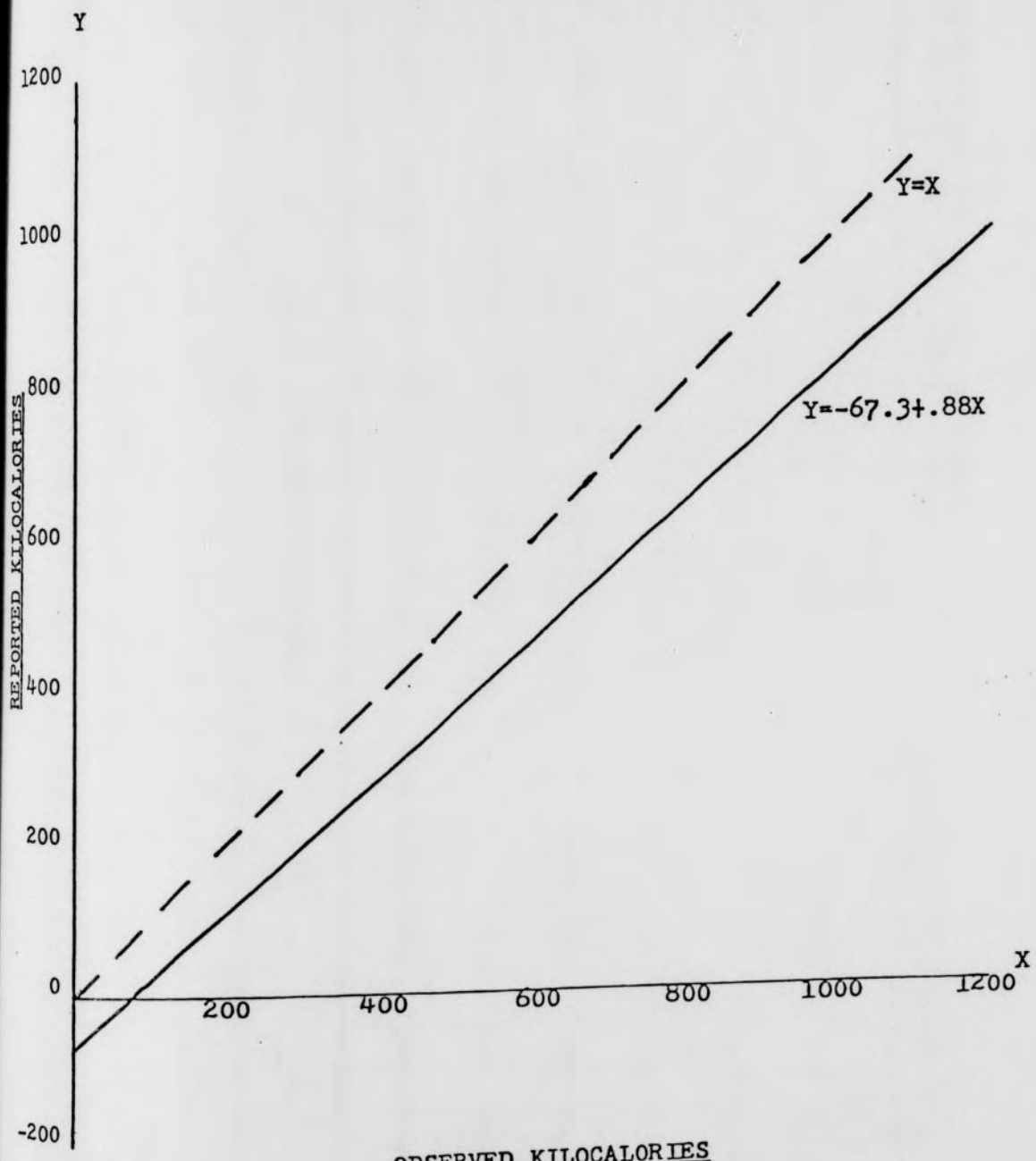

TABLE 7

Multiple Regression Analysis

Model I

X_1[a]	X_2	Regression Equation[b]	R^2	F	$t_{B_1=0}$	$t_{B_2=0}$
Obs. Kcal.	Food Preference	$Y = -46.5 + .95X_1 - 114.8X_2$ $(.09)^1 \quad (41.8)^2$	.68	49.51**	9.95**	-2.75**
Obs. Kcal.	Age	$Y = 47.5 + .88X_1 - 1.5X_2$ $(.10)^1 \quad (3.4)^2$	.63	39.56**	8.75**	-0.44
Obs. Kcal.	Education	$Y = -27.6 + .88X_1 - 4.7X_2$ $(.09)^1 \quad (6.8)^2$	.63	40.04**	8.89**	-0.70
Obs. Kcal.	Heal[illegible]	$Y = -75.6 + .86X_1 + 41.7X_2$ $(.09)^1 \quad (42.8)^2$	.64	40.91**	8.94**	0.98
Obs. Kcal.	Sex	$Y = -60.0 + .88X_1 - 25.3X_2$ $(.09)^1 \quad (51.9)^2$	.63	39.72**	8.86**	-0.49
Obs. Kcal.	Meal Site	$Y = -69.9 + .87X_1 + 31.9X_2$ $(.09)^1 \quad (47.3)^2$	.61	40.00**	9.10**	0.68

[a] X_1 is Observed Kilocalories.

[b] Numbers in parentheses indicate the standard error of the regression coefficient.

The null hypothesis for the regression equation in Model I was:

$$H_o: B_1 = B_2 = 0$$

The alternative hypothesis was:

$$H_1: \text{not } B_1 = B_2 = 0$$

The F test for each of the regression equations in Model I indicated a significant R^2 or coefficient of determination. To test the relative significance of X_1 (observed dietary intake) versus the other independent variable in each equation, further testing using the Student's t-test was performed. The independent variable of total observed caloric intake was significant ($p < .01$) in each of the multiple regression equations. Of the other six control variables, only food preference was found to be significant.

Model II represents the complete regression model for six independent variables and the dependent variable of reported caloric intake. Results of the analysis of Model II were essentially the same as those for Model I. With the exception of food preference, none of the control variables were significant. Although the value of the R^2 in Model II is greater than that for any of the equations in Model I, the increase may be considered only marginal.

In summary, of the variables tested by multiple regression analysis, only the independent variable of observed caloric intake and the control variable of food preference were significant.

TABLE 8

Multiple Regression Analysis

Model II

Regression Model II with Dependent Variable (Y) Equal to Reported Kilocalories Interacting with Control Variables (X)

Independent Variable (X)	Regression Coefficient (b)	Standard Error for (b)	$t_{B=0}$
Observed Kcal.	0.94	0.09	9.48**
Food Preference	-117.90	44.80	-2.63**
Age	-1.60	3.40	-0.48
Education	1.30	7.00	0.19
Health	37.10	43.80	0.85
Sex	-41.90	52.10	-0.80
Constant	62.90		
R^2 = .69			
F = 15.98**			

**p ≤ .01

Summary

A comparison of observed and reported dietary intake records for 50 elderly subjects shows that a majority of respondents tended to underestimate their actual caloric intake. This was apparent in inaccuracies in naming the kinds of foods eaten and in errors in citing the correct portion size.

When the mean values for observed caloric intake (X) and reported caloric intake (Y) were compared statistically using the paired-t test, a significant difference was found between the mean values for total kilocalories. This result suggests that for kilocalories, reported intake probably does underestimate actual mean intake for one group of elderly persons. Results of the paired-t test for mean reported and observed caloric intakes for five food groups within the observed meal, showed a signficant underestimation in three food groups: Vegetables, Bread, and Main Dish.

Using regression analysis, it was shown that a significant relationship exists between observed (X) and reported (Y) intake values for total kilocalories and for caloric levels in all five food groups making up the observed meal. In addition, the hypothesis that a one-to-one relationship exists between observed and reported intake for total kilocalories and for caloric intake in the Dessert food group was not rejected.

The independent variable of observed caloric intake and six control variables were subjected to multiple regression analysis. Observed caloric intake was a highly significant variable. Of the control variables tested, only food preference was found to be significant in explaining variation in the recall of dietary intake.

CHAPTER V

DISCUSSION

On the basis of the results of this study the primary hypothesis that the 24-hr. recall validly reflects actual caloric consumption for a group of elderly subjects was not rejected.

The results showed that there was an overall tendency among the sample population to underestimate their caloric intake. The difference between the means for observed and reported intake was shown to be significant when tested by the paired-t tests. Further statistical testing, however, by the more powerful tool of regression analysis showed 1) that a significant relationship does exist between observed and reported caloric intakes and 2) that the hypothesis that this is a one-to-one relationship for total caloric intake cannot be rejected.

A review of recent dietary surveys of selected elderly populations points out inadequate energy intake as one of the most common nutritional deficiencies (34). In light of the findings presented here, low caloric intake may be a result of the survey instrument used, often a 24-hr. recall. Studies of the validity of the 24-hr. recall with children (21,22) and with the elderly (23) suggest that the 24-hr. recall does tend to underestimate actual consumption.

A recent study by Goodman (34) and reported by Madden (24) tested the validity of the recall method under conditions similar to those used in this investigation. Their findings can be compared with those reported here.

In the Goodman study the results of the paired-t test suggested that, for kilocalories, reported intake probably does underestimate actual mean intake for a group of elderly persons. The mean values for observed and reported intake of seven other nutrients were tested and were not found to differ significantly.

Regression analysis for kilocalories and seven other nutrients indicated that a significant relationship did exist between observed and reported values. Secondary tests on the hypothesis that B = 1 were then performed. This hypothesis was not rejected for five of the eight nutrients. The exceptions were: kilocalories, protein, and vitamin A.

The results of the regression analysis differed from those in the present study. Goodman interpreted her results to mean that at low intakes subjects tend to over-report consumption, but they tend to under-report their intake when they are observed to have eaten a large quantity. The results of the study reported here do not support the same conclusion. Regardless of the amount of kilocalories consumed, subjects tended to underestimate their observed intake in the present study. The findings of this study

also suggested that a predictive one-to-one relationship does exist between observed and reported total caloric intake, in contrast with the results of Goodman's study. In view of the apparent inconsistency in the results of the two studies, further testing of the validity of the recall method is needed. Suggestions are offered for future research at the end of this study.

The second hypothesis of this study, that is, that recall ability for dietary intake is affected by the preference of the respondent for the particular foods to be recalled was also supported. In the regression analysis, food preference was found to be a significant variable affecting the recall of dietary intake. On the basis of this analysis, one would predict that the presence of a food item within the observed menu that was "disliked" by the respondent would result in greater underestimation of calories consumed than if all foods were "liked". The question of whether a relationship exists between preference for an individual food item and the ability to recall that particular food item was not addressed in this study.

The influence of several non-dietary factors on recall ability were not significant. Sex, age, education, health status, and meal site were all found not to affect the ability to recall caloric intake.

The possibility that certain food groups making up the observed meal might be more easily remembered than others

was examined. Empirical investigation of the results showed that subjects incorrectly reported Vegetable, Bread, and Dessert items most often. The Main dish selection and the Beverage were most often reported correctly. Statistical testing of these results were inconclusive. Results of the regression analysis suggested, however, that there is a one-to-one relationship for observed and reported intake values for Dessert items alone.

When caloric content is calculated, distinctions between individual food items are obscured. Although Dessert items were among those most often reported incorrectly, statistical testing of the caloric values for observed and reported intake showed no significant difference. For example, several respondents reported eating chocolate cake, but, in fact, they had eaten gingerbread. Although the food items are completely different, the difference in caloric content for the two items is not large. Further investigation is needed in this area.

The aging process itself would seem to put increasing restraints on the use of the 24-hr. recall. Decrease in memory for recent events and a decline in sensory perceptions, including the sense of taste, affect the ability of an elderly individual to interact with and interpret his environment (35,36,37). The 24-hr. recall also requires that the respondent have some special awareness of his food intake, knowledge of the composition of mixed dishes, and

an ability to estimate portion size. These latter prerequisites apply to all age groups participating in a 24-hr. recall. On the basis of this study, a comparison of the dietary recall ability of the elderly with that of other age groups cannot be made. Nevertheless, it can be concluded that in this select group of elderly persons a significant relationship does exist between the observed caloric intake and the reported caloric intake as elicited through the 24-hr. recall technique.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the relationship between observed and reported caloric intake for a group of elderly persons using the 24-hr. recall technique. The influence of other relevant dietary and non-dietary variables on the dietary recall was also assessed.

A total of 50 individuals 60 years of age and older who attend a federally sponsored meal program participated in the study. Subjects attend either of two meal sites located in Wake County, North Carolina for one noon meal five days a week.

Each subject was observed eating a meal. Since federal law requires standardized servings, a representative serving of each food item on the menu was weighed and measured. The plate waste for each individual was collected and measured and this amount was subtracted from the representative serving to give the total amount consumed. Spilling, sharing, or saving of food during the meal was carefully noted by the investigator.

The following day each subject was interviewed. Included in this interview was a 24-hr. recall and a food preference survey for all foods found in the observed meal. The 24-hr.

recall asks each respondent to describe all food and beverage consumed in the preceding 24 hour period as well as the approximate portion size. Food models were used to assist the respondent in estimating portion size.

The observed and reported meal for each individual was converted into its caloric content. The data were analysed to compare the equality of the means for observed and reported intake values for total caloric intake for one meal and for five food groups using a paired-t test. Subsequent regression analysis was performed to examine the relationship between observed and reported caloric intake for total kilocalories and the five food groups. Multiple regression analysis was done to determine the influence of several variables on the ability to recall total caloric intake. These variables included: food preference, sex, age, education, health status, and meal site.

The results showed:

1) The mean values for observed and reported caloric intake were significantly different for total kilocalories consumed and for caloric intake for three of the five food groups, Vegetables, Bread, and Main Dish items.
2) In the simple regression analysis, a significant relationship was found to exist between the observed (X) and reported (Y) intake values for

total kilocalories consumed and for observed and reported caloric intake for all five of the food groups examined. This relationship was further tested and the hypothesis that this was a one-to-one relationship (B = 1) was not rejected for total kilocalories consumed and for calories consumed in the Dessert food group.

3) Of the variables tested through multiple regression analysis, only the independent variable of observed caloric intake and the control variable of food preference were found to significantly affect the dependent variable, reported caloric intake.

It was concluded on the basis of this study that the 24-hr. recall does validly reflect the total caloric intake of a group of elderly persons. A predictive one-to-one relationship was found to exist only between total calories consumed and calories for Dessert food items. In addition, the preference of an individual for food items within a meal will affect the ability to recall total caloric intake for that meal.

Recommendations

Further replications of this study under various conditions and various populations is needed. In the interest of such future research, the following suggestions are made.

1) In a meal program with an established cycle menu and meal pattern, the respondent's recall ability may be affected by his own expectations

of what should be served. For example, many of the respondents in this study knew that the typical menu pattern contained two vegetables and that potatoes were usually served with fish. The ability to recall by association would probably also occur in a home or other less structured setting. Nevertheless, the importance of this effect needs to be investigated before the results from validity studies in similar meal settings may be extrapolated to other survey conditions.

2) **Certain menus served may be easier to accurately** recall and easier to quantify. At the Glenwood Towers site, most participants anticipated the menu to be served, either by calling the kitchen or by checking the posted menu. Fried fish was a particularly popular meal and many people would come just for the meal. It is very conceivable that this special reason for eating at the meal site would give the respondent greater reason to remember his food intake.

3) The question of naming foods accurately is important to both the interviewer and the respondent. Knowledge and familiarity with the contents of mixed dishes will affect the ability of the respondent to report his intake accurately. In the present study, several respondents had to misname gingerbread,

peanut butter cake, and even stew because these were either unfamiliar foods or the individual could not describe the contents of the food correctly. It is also important that the interviewer be familiar with local food customs and vocabulary to interpret certain food names, such "salad greens" meaning cooked collard, turnip, or mustard greens.

4) The effect of certain potentially important variables on recall ability needs to be investigated. These variables might include: the predisposition of certain individuals to maintain a greater awareness of food intake because of prior work experience or special dietary restrictions; and the effect of preference for an individual food item on the ability to recall that item.

5) Several limitations in methodology of previous studies were taken into consideration in this study, such as careful observation of subjects during the meal and actual plate waste calculation. Ideally, however, each individual plate should be measured ahead of time.

6) To avoid the appearance of "response set" in the interviewer, it is recommended that the interviewer not attend the observed meal. The interviewer may tend to be influenced by his own observation and may

interpret vague answers to fit the observed meal. Also, the respondent, having seen the interviewer at the meal, may seek to rely on him for assistance in the recall.

7) Underestimation by the respondent of his dietary intake may be the result of insufficient probing on the part of the interviewer. Probing needs to be accomplished, however, without leading the subject to a particular response.

8) Few people have any reason to remember what they eat. This has always been a strong criticism of the 24-hr. recall procedure. Several respondents in this study remarked that either they were too busy talking to notice what they ate or that they simply ate whatever was placed in front of them without regard for what it was. In order to get a reliable indication of an individual's diet, people are usually not told that they will be asked about their diet ahead of time. It is often feared that the subject would then change his diet to reflect what he felt he <u>should</u> eat. However, a validity study done in a setting such as the one used here would be able to successfully test the actual effect of food awareness. Subjects could be told ahead of time that they would be asked about their food intake. The hypothesis that greater awareness of food intake

would improve recall ability could then be tested and the results compared with the study presented here.

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APPENDIX A

INTERVIEW FORMS

FOOD AND NUTRITION INFORMATION SURVEY

Name_____ Date_____

Time of interview:_____

Age_____ Sex_____ End:_____

Race_____

Marital status_____

Place of birth_____

Where have you lived most of your life? _____

How many years did you attend school? _____

What did you do before you retired? _____

Who prepares your meals at home? _____

On the advice of a doctor, or on your own, are you following a special diet?__

If Yes, what kind? _____

Income level (approximate) _____

Additional comments: _____

_____

_____

How would you rate your health at the present time?

Excellent Good Fair Poor

If "Fair" or "Poor", what is wrong with your health?

_____

_____

Are you presently taking a medicine prescribed by a physician? _____

Do you wear dentures? _____

Name _____ Date of interview _____

24-Hour Recall Time _____

MEAL	FOOD	AMOUNT		SUBSEQUENT RECALL INFORMATION
Breakfast				
A.M. Snack				
		Amount Recalled	Amount Observed	
Lunch				
P.M. Snack				
Supper				
Bedtime				

Week 1

Now, I would like to ask you about your particular preferences for certain foods. I will name several different food items. Please tell me for each item whether you like this particular food (L), dislike it (D), or have no feeling about it one way or another (I). Indicate, also, if it is a food that you like but are not able or allowed to eat (U). For example, you may like cabbage, but it doesn't agree with you,or your doctor may have told you not to eat any pork products.

Circle response:

1. Chicken and dumplings	L	D	I	U
2. Pork barbeque	L	D	I	U
3. Beef stew	L	D	I	U
4. Fish filet	L	D	I	U
5. Salisbury steak	L	D	I	U
6. Broccoli	L	D	I	U
7. Collard greens	L	D	I	U
8. Mashed potatoes	L	D	I	U
9. Beets	L	D	I	U
10. Cole slaw	L	D	I	U
11. Scalloped potatoes	L	D	I	U
12. Carrot-raisin salad	L	D	I	U
13. Tossed salad	L	D	I	U
14. Three bean salad	L	D	I	U
15. Cabbage	L	D	I	U
16. Gingerbread	L	D	I	U
17. Applesauce and cookie	L	D	I	U
18. Banana pudding	L	D	I	U
19. Peach cobbler	L	D	I	U
20. Jello with fruit				

21. Macaroni and cheese	L	D	I	U
22. Biscuit	L	D	I	U
23. Soft roll	L	D	I	U
24. Cornbread	L	D	I	U
25. Whole milk	L	D	I	U
26. Buttermilk	L	D	I	U
27. Chocolate milk	L	D	I	U

WEEK 2

Now, I would like to ask you about your particular preferences for certain foods. I will name several different food items. Please tell me for each item whether you like this particular food (L), dislike it (D), or have no feeling about it one way or another (I). Indicate also, if it is a food that you like but are not able or allowed to eat (U). For example, you may like cabbage, but it doesn't agree with you; or you doctor may have told you not to eat any pork products.

Circle response:

1. Beef Pot Pie	L	D	I	U
2. Barbeque chicken	L	D	I	U
3. Spaghetti with meat sauce	L	D	I	U
4. Fish	L	D	I	U
5. Smoked sausage	L	D	I	U
6. Steamed cabbage	L	D	I	U
7. Apple-celery salad	L	D	I	U
8. Buttered new potatoes	L	D	I	U
9. Green beans	L	D	I	U
10. Broccoli	L	D	I	U
11. Tossed salad	L	D	I	U
12. Au Gratin potatoes	L	D	I	U
13. Cole Slaw	L	D	I	U
14. Baked beans	L	D	I	U
15. Turnip greens	L	D	I	U
16. Chocolate cake	L	D	I	U
17. Ice cream	L	D	I	U
18. Canned peaches	L	D	I	U
19. Canned apricots	L	D	I	U
20. Cherry cobbler	L	D	I	U
21. Applesauce and cookie	L	D	I	U

22. Soft roll	L	D	I	U
23. Biscuit	L	D	I	U
24. Cornbread	L	D	I	U
25. Whole milk	L	D	I	U
26. Buttermilk	L	D	I	U
27. Chocolate milk	L	D	I	U

Now, I would like to ask you about your particular preferences for certain foods. I will name several different food items. Please tell me for each item whether you like this particular food (L), dislike it (D), or have no feeling about it one way or another (I). Indicate, also, if it is a food that you like but are not able or allowed to eat (U). For example, you may like cabbage, but it doesn't agree with you; or your doctro may have told you not to eat any pork products.

Circle response:

1. Liver and onions	L.	D	I	U
2. Sloppy Joe	L	D	I	U
3. Beef, cheese, macaroni casserole	L	D	I	U
4. Chicken Pot Pie	L	D	I	U
5. Fish filet	L	D	I	U
6. Garden peas	L	D	I	U
7. Squash and onions	L	D	I	U
8. Pinto beans	L	D	I	U
9. Tossed salad	L	D	I	U
10. Green beans	L	D	I	U
11. Carrot and raisin salad	L	D	I	U
12. Potato puffs	L	D	I	U
13. Collard greens	L	D	I	U
14. Sliced tomatoes	L	D	I	U
15. Cole slaw	L	D	I	U
16. Macaroni and cheese	L	D	I	U
17. Chocolate pudding	L	D	I	U
18. Spiced pears	L	D	I	U
19. Baked apples	L	D	I	U
20. Fruited jello	L	D	I	U
21. Apricots, canned	L	D	I	U
22. Peaches, canned	L	D	I	U

23. Peanut butter cake	L	D	I	U
24. Soft roll	L	D	I	U
25. Biscuit	L	D	I	U
26. Cornbread	L	D	I	U
27. Whole milk	L	D	I	U
28. Buttermilk	L	D	I	U
29. Chocolate milk	L	D	I	U

Now, I would like to ask you about your particular preferences for certain foods. I will name several different food items. Please tell me for each food item whether you like this particular food (L), dislike it (D), or have nor feeling about it one way or another (I). Indicate also, if it a food that you like but are not able or allowed to eat (U). For example, you may like cabbage, but it doesn't agree with you; or your doctor may have told you not to eat any pork products.

Circle response:

1. Meat loaf	L	D	I	U
2. Baked ham with raisin sauce	L	D	I	U
3. Beef and gravy	L	D	I	U
4. Fish	L	D	I	U
5. Fried chicken	L	D	I	U
6. Buttered corn	L	D	I	U
7. Steamed cabbage	L	D	I	U
8. Sweet potatoes	L	D	I	U
9. Turnip greens	L	D	I	U
10. Mashed potatoes	L	D	I	U
11. Green beans	L	D	I	U
12. Cole slaw	L	D	I	U
13. Canned pears	L	D	I	U
14. Canned peaches	L	D	I	U
15. Gingered carrots	L	D	I	U
16. Tossed salad	L	D	I	U
17. Lemon tarts	L	D	I	U
18. Apple pie & cheese	L	D	I	U
19. Fruited jello	L	D	I	U
20. Yellow cake /choc. icing	L	D	I	U
21. Ice cream	L	D	I	U

22. Macaroni and cheese	L	D	I	U
23. Soft roll	L	D	I	U
24. Biscuit	L	D	I	U
25. Cornbread	L	D	I	U
26. Rice	L	D	I	U
27. Whole milk	L	D	I	U
28. Buttermilk	L	D	I	U
29. Chocolate milk	L	D	I	U

WORKSHEET

NAME_____ DATE_____

SITE_____

MENU	AMOUNT SERVED	AMOUNT REMAINING	TOTAL AMOUNT CONSUMED