

Nutrition and Dietary Habits of Aging Women^{*†}

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ATTEMPTS to measure the nutritional status of an adult population with the objective of adapting dietary recommendations to the nutritive needs of the individual have been baffling and, for the most part, unsatisfactory. Yet the selection of a diet for the individual which will prove nutritionally sound without strain or waste is the ultimate goal of all nutritional research.

THE EXPERIMENTAL PATTERN

The studies conducted at Michigan State College on women from 40 through 90 years of age have been designed to observe women in their usual environments. Food intake and other habits of living have been interrupted only to the degree necessary to obtain valid observations, conduct a complete balance experiment in the woman's own home and

to arrange occasional visits to the laboratory for physical examination, chemical and physiological tests. There has been no attempt to avoid periods of strain or worry on the assumption that these are a part of modern living. The friendship of the woman has been cultivated by means of daily visits so that detailed and accurate records of unusual situations were obtained. Physical examinations have been made by a competent physician,** food consumption records and chemical and physiological tests have been done by the staff of the Foods and Nutrition Department.

Two types of studies have been made. The first used typical survey techniques such as those employed by the Mobile Units of the U. S. Public Health Service, differing only in that repeated contacts with each subject have been made. Two samples of 100 women each have been drawn from Lansing, using area sampling techniques. Food intake records repre-

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sent a recall of the previous 24 hours' diet, several recall samples having been obtained from each woman. The details of this experiment will be given in a later report.

The second type of experiment, which has been done with the cooperation of 18 women ranging in age from 48 through 77 years, will be considered in this report. All were living in their own homes and were active in the care of those homes and each in the management of a family. All women had borne one or more children and were free from disease which seriously limited activity. Several individuals had elevated blood pressures, and a case of pernicious anemia controlled with injections of liver extract, and a case of limited heart damage which was fully compensated with a minimum dose of digitalis, were included.

The women chosen represented a cross-section of economic and social levels in Lansing and East Lansing. Since one of the objectives of the experiment was to study food selection, no case was included in this series where the family income precluded the purchase of a minimum adequate diet and no women from families of great wealth were studied, although at least two of the cases came from homes of moderate luxury. The sample included such widely divergent social groups as the wives or mothers of factory workers engaged in manual labor, of small independent business men, business executives, and college professors.

The original contact with the subjects was made by the same techniques used in the survey study; i.e., each woman was interviewed and information obtained concerning economic and social status, history of illness, operations and child bearing, dietary habits and a 24 hour recall diet. Following three or four such interviews, a complete physical examination was obtained and the woman was inducted into the techniques of

weighing her diet and the collection of samples of food and excretions for the laboratory. She continued on a weighed diet for 3 to 4 months. Complete collections of food samples and excreta were made for the last 10 days of each month. During the first month an attempt was made to secure a pattern of the woman's usual diet when it was completely self selected. During each balance period, at least one morning was spent in the laboratories, at which time basal metabolism and various chemical and physiological tests were made. Methods used for chemical analysis and physiological tests have been described elsewhere.^{2, 3} This is a continuing study and the data to be presented should be considered as a progress report.

RESULTS OF DIETARY STUDIES

Much has been written concerning the validity of various methods of collecting and analyzing records of food intake. The first two tables are presented to illustrate the different kinds of information obtained when more than one technique is applied in a given situation. Table 1 presents the estimated calories, protein, and calcium intakes of 13 subjects computed from menus by the method of Donelson and Leichsenring.¹ The first column for each nutrient represents the mean values computed from three 24 hour recall diets recorded by the interviewer. The size of servings was estimated by careful questioning of the woman at the time of interview. The second column represents the mean of 10 days of weighed diet (usually consecutive) for each subject. No attempt was made to control or dictate food selection but the 10 days of weighed diet coincided with the first period during which complete collections of food and excreta were made for laboratory analysis.

The apparent mean intake of all nutrients was greater when measured by the recall diets. A study of individual

TABLE 1

Estimated calorie, protein, and calcium intakes computed¹ from recall and weighed diets (13 subjects)

Age of Subject	Intake					
	Calories		Protein		Calcium	
	Recall ²	Weighed ³	Recall gm.	Weighed gm.	Recall gm.	Weighed gm.
51	2,264	2,320	87	75	0.64	0.51
52	2,959	2,158	104	91	0.78	0.99
53	645	925	27	45	0.17	0.29
56	2,564	2,180	92	75	1.43	0.50
56	2,417	1,869	80	70	0.78	0.60
60	1,790	1,114	55	31	0.34	0.23
61	1,053	1,963	69	70	0.68	0.66
67	1,930	1,687	82	60	1.28	0.69
68	2,164	1,599	64	49	0.69	0.56
69	1,498	1,449	50	53	0.52	0.45
74	1,833	1,912	42	62	0.52	0.60
77	1,575	1,488	44	43	0.22	0.28
77	2,083	1,552	68	52	0.47	0.51
Mean	1,906	1,708	67	59	0.66	0.61

1. The short method of Donelson and Leichsenring, 1945, was used.

2. Recall diets are the mean of 3 1 day samples taken at widely spaced intervals.

3. Weighed diets are the mean of 2 5 day samples, usually consecutive.

records would suggest four reasons for the differences. First, two separate samples of food intake are represented for each woman. While this would be expected to yield slightly different results for each woman, it would not be expected to bias the mean. Seven of the

13 cases apparently ate from 300 to 800 fewer calories per day during the period of weighed intake. Much eating between meals was recorded on the recall diets. Such piecing becomes inconvenient when it is necessary to preweigh each mouthful and was seldom found on the weighed

TABLE 2

Results of calculation¹ and laboratory analysis of a 10 day weighed diet sample from each of 18 subjects

Age of Subject	Protein		Calcium	
	Computed gm./day	Analyzed gm./day	Computed gm./day	Analyzed gm./day
48	69	72	1.02	1.01
51	75	67	0.51	0.42
52	91	105	0.99	1.10
53	45	71	0.29	0.63
56	75	80	0.50	0.84
56	64	73	0.70	0.89
59	32	34	0.21	0.31
59	56	60	0.75	0.86
60	31	38	0.23	0.37
60	73	72	0.93	1.11
61	70	78	0.66	0.85
67	60	56	0.69	0.94
68	49	46	0.56	0.55
69	53	51	0.45	0.51
72	34	34	0.20	0.37
74	62	64	0.60	0.81
77	43	71	0.28	0.70
77	52	54	0.51	0.83
Mean	57	63	0.56	0.73

1. Calculations by the short method of Donelson and Leichsenring, 1945.

diet records. The size of portion selected by many aging women appears to be smaller than that of younger women whose food habits formed the basis for the calculations of the Donelson and Leichsenring food composition table. This point is being explored further.

Last, for certain women of limited education who fear social rejection if a mistake is made, the first weighed diet and collection period is one of emotional tension, even though each subject was reassured that deviation from the directions provided was not important as long as the record stated exactly what had happened; and in no case was a reproof administered.

Emotional tensions apparently are reflected in lowered food intakes in certain cases. Others, for instance the 61 year old woman who is the seventh case in Table 1, responded with a greatly increased appetite. This woman was overweight and had been advised to eat 1,200 calories or less per day. During the year following our observations, she lost 25 pounds on the prescribed routine but she found the strain of dieting too difficult to continue while she was cooperating with the laboratory.

Table 2 presents the protein and calcium in 18 10 day weighed diets as calculated by the same method as that employed in the previous table in comparison with the amounts determined by chemical analysis. Laboratory analyses resulted in slightly larger average intakes of both protein and calcium. However, there were only 3 cases in which the deviation was more than 10 per cent, and these 3 cases account for most of the mean differences. The 52 year old subject was a vigorous active woman who ate generously of a diet containing many prepared dishes which are notoriously difficult to evaluate by calculation. Her protein intake was underestimated by 14 gm. per day in the calculated figures. The 53 year old subject (fourth in the table), and the 77 year old subject who

is second from the end of the table, both ate diets restricted in variety, in which bread and the luncheon type of prepared meat accounted for a large proportion of the ingested calories. It has been the experience of this laboratory * that both of these products can contain sufficient dry milk solids to influence protein and calcium intakes to the degree shown in the table when the diet is limited in other foods. The use of a detailed food table for calculation of certain complex home prepared foods would tend to result in somewhat better agreement with analyzed figures but would be much more time consuming and would not greatly increase the accuracy of the prediction of the composition of processed foods such as luncheon meats. It is obvious that the results of the paper and pencil analysis described is in good agreement with laboratory figures when the diet is conventional in food choices and the food has been simple in preparation. In other cases, laboratory analysis is to be recommended.

Table 3 presents a summary of the analysis of 100 consecutive recall diets from the first survey series. It is obvious that in a large series the total calories ingested are the determining factor in the ingestion of other nutrients. This has been reported previously² but deserves reëmphasis. At low calorie intakes, the analysis of the diet follows the pattern of the starvation routines characteristic of Europe during the war. Except for a few low hemoglobin values, only two women were thought to show clinical evidences of specific nutritional deficiencies, although 40 cases ingested less than 1,500 calories on the day studied, with correspondingly low intakes of specific nutrients. Complaints of chronic fatigue, nonspecific ill health, and lack of energy were common, and certainly many of these 100 women lacked an appearance of thriftiness.

* Unpublished data.

TABLE 3

The relation of calories ingested with intake of specific nutrients (100 cases)

Calories	Computed mean daily intake					
	Protein gm.	Calcium gm.	Thiamin mg.	Riboflavin mg.	Vitamin A I. U.	Ascorbic Acid mg.
2,400 to 3,500	65	0.63	1.31	1.54	4,222	53
2,000 to 2,399	75	0.56	1.29	1.50	4,286	63
1,500 to 1,999	55	0.44	0.91	1.13	4,766	53
1,000 to 1,499	42	0.36	0.70	0.87	3,225	53
Less than 1,000	33	0.21	0.61	0.57	1,931	29

One day recall diets analyzed by the short method of computation of Donelson and Leichsenring, 1945.

Similar symptoms have been reported under conditions of partial starvation occurring in middle Europe during and following the war.

Studies of deficiency states are made in the experimental laboratory under conditions in which a diet is carefully compounded to be adequate in all respects except for the nutrient in question. The experimental animal that does not eat quantitatively of the imbalanced mixture seldom develops deficiency symptoms. When an individual chose to eat less than the calories of food defined as characteristic of a healthy population, one of two adjustments was made. Either a few foods popularly thought to be high in calories; i.e., milk, potatoes, bread, were eliminated entirely or the individual ate less of all foods. In any case, the result was a reduction of all nutrients as illustrated in the table. The dietary imbalances which precipitate deficiency states did not develop.

OBSERVATIONS ON NUTRITIONAL STATUS

Basal metabolism tests were done on 15 of the 18 balance subjects discussed above. Basal calorie expenditures ranged from 1,130 to 1,735 for 24 hours. The mean was 1,367 calories. The subject who expended 1,735 basal calories was a typical fat woman as described by Short and Johnson,⁴ and her basal undoubtedly reflected the increased thyroid activity observed in certain obese individuals. Three women in the 70's expended 1,195, 1,402, and 1,504 basal calories, respec-

tively. These are higher values than one would expect from earlier studies of aging women done on subjects chosen from institutions caring for the aged.

In 10 cases, the food ingested for 10 days on self selected diets exceeded the basal needs of the individual by 13 to 84 per cent, values in keeping with previous observations on this age group.² The subjective judgments of the laboratory personnel concerning the relative activity of these 10 women correlated well with the estimates of calories ingested above those required for basal needs. At least 1,550 calories per day were eaten by each of these 10 women.

One woman ate an average of 13 per cent fewer than basal calories for 10 days. This subject was a high-strung, nervous woman whose caloric intakes from day to day and from period to period varied widely. Since there were no overall weight losses in 2 months of study, she apparently was able to compensate in the intervals between balance periods with increased intakes.

Four women appeared to be eating an amount which would just satisfy basal needs. None showed weight changes over a 4 month period although the intermittent visits to the laboratory did not allow a daily check on weight. Two of these 4 were also irregular in food habits and apparently ate 50 to 60 per cent more calories in the intervals when not "on balance." The other 2 were 72 and 77 years of age and were relatively inactive individuals. In both cases

the estimation of the basal seemed high and tests on 3 days spaced at monthly intervals deviated by 10 and 15 per cent respectively. If we may assume some overestimation of the basal requirements and underestimation of calculated food intake, an energy allowance of 15 to 20 per cent in excess of the basal could be assumed. Such an allowance would not be unreasonable to cover the limited activities of these women. That they both were in protein equilibrium is further evidence that their food needs were met by approximately 1,500 calories per day.

Table 4 presents the mean intakes and

body wastage of protein, calcium, or phosphorus. However, in contrast to the mean values quoted in Table 3 for 1,500 calorie diets, these women ingested between 55 and 60 gm. of protein and 0.65 gm. calcium per day. Such figures would require the daily use of about 1½ cups of milk, which results in a satisfactory intake of phosphorus and riboflavin and contributes significantly to the intake of several other nutrients. Few concentrated fats and sugars were used. In other words, some selection was practised in the choice of foods and regular meals were the rule. The 74 year old who ate 1,912 calories per day was a

TABLE 4

Mean intakes and retention of nitrogen, calcium and phosphorus of 18 women 48 to 77 years on self selected diets

No. Cases	Age Group	Nitrogen			Calcium			Phosphorus		
		Mean Intake gm./day	Mean Retention gm./day	No. subjects Retaining	Mean Intake gm./day	Mean Retention gm./day	No. subjects Retaining	Mean Intake gm./day	Mean Retention gm./day	No. subjects Retaining
8	48-59	11.25	0.71	5	0.86	0.015	5	1.24	-0.038	5
6	60-69	9.06	-1.17	2	0.72	-0.053	2	0.99	-0.14	2
4	70-77	8.94	0.75	4	0.68	0.052	4	1.07	0.01	4

retentions of nitrogen, calcium, and phosphorus of 18 women 48 to 77 years on self selected diets. It is of some interest that all women over 70 years were in equilibrium or retaining all three nutrients on intakes of 1,451, 1,488, 1,552, and 1,912 calories per day. In the age groups 48 through 69 years, 7 subjects were in equilibrium or retaining the three nutrients listed on calorie intakes which ranged from 1,869 to 2,480 per day. Seven subjects were losing nutrients and for at least 5 of them, the losses were significant in amount during the 10 days of study. Intakes for these subjects ranged from 925 to 1,599 calories per day, the 2 who showed minimum losses ingested 1,627 and 1,687 calories per day.

Three out of 4 healthy subjects in the 70's were able to maintain themselves on approximately 1,500 calories without

trimly slender, vigorous woman who looked much younger and was as active as many women twenty years younger. She consumed 65 gm. protein and 0.81 gm. calcium per day and retained small amounts of nutrients during the period of study.

On the other hand, no one of the younger women was completely successful in balancing intake and outgo of protein and minerals on less than 1,800 calories per day although two subjects lost insignificant amounts while consuming 1,627 and 1,687 calories respectively. It should be recalled that these were completely self selected diets, neither the kind or amounts of food or the distribution of meals being prescribed. Five women were losing large amounts of nutrients on calorie intakes below 1,600. None of these women could be considered to be eating a well balanced diet

TABLE 5

Typical menus chosen from the records of 2 subjects

Description of subject	<i>Mrs. P</i>		<i>Mrs. S</i>	
	Height 5' 1"	Weight 186 lbs.	Height 5' 4"	Weight 135 lbs.
	Age 53, appears much older, blood pressure elevated, "trying to reduce"		Age 74, vigorous, appears 15 years younger. No complaints	
Breakfast	None		$\frac{3}{4}$ c fruit juice 1 poached egg 1- $\frac{1}{2}$ slices bread $\frac{1}{2}$ pat butter 1 cup coffee 1 oz. cream 1 tsp. sugar	
Noon	2 large hamburgers 4- $\frac{1}{2}$ oz. canned peas 2 slices bread 1 pat butter 1 cup coffee		3 crackers $\frac{1}{2}$ slice bread $\frac{1}{2}$ oz. cheese 1 pat butter 1 cup milk 1 large dish canned peaches 1 large apple	
Night	3 rolls 4 oz. balogna 1 slice onion 2 slices bread 1 pat butter 1 c coffee		2 slices bread 1 pat butter 3 frankfurters 1 oz. cheese 1 oz. pickles 4- $\frac{1}{2}$ oz. green lima beans 1/6 lemon pie 2 cups tea	
Bedtime	3 crackers $\frac{3}{4}$ c milk		None	

in terms of food choices. Table 5 illustrates a typical days' menus as eaten by subject P, age 53 years as contrasted with a menu chosen from the records of subject S, age 74 years, discussed above.

The laboratory staff were in daily contact with this group of 18 aging women for periods of three to four months and intermittent contacts have been maintained in some cases for four years. Each member of the staff was trained, previous to her association with the study, to observe and record but not to take a position of leadership in suggesting performance in the selection or preparation of food. Laboratory notes on each woman fill several notebooks. While it is generally accepted that the menopause constitutes a period of change in the life of a woman which may affect both her nutrition and general health, our records would suggest that the late fifties and early sixties also demand adjustments of a social and sometimes

economic character which impose strain on the woman's nutritional structure. This was the period when the family group was reduced, retirement or even loss of the husband frequently minimized the number of outside interests which the woman continued to use and, more importantly, the stimulus for establishing new interests was removed. There is no doubt from our records that purposeful activity stimulated appetite and in the North Central area the food pattern is such that the quantitative consumption of 1,600 to 1,800 calories per day tended to result in a diet providing a satisfactory amount and distribution of specific nutrients.

The one food which gave the greatest factor of safety to a diet of 1,600 calories or less was milk or its equivalent in buttermilk or cheese. No diet without milk provided over 0.5 gm. calcium daily. A pint of milk per day will serve to increase the intake of protein, calcium,

phosphorus, and several vitamins to the point where the metabolic performance of the woman suggested that she was in equilibrium with her environment if her total intake did not go below 1,600 calories per day. At lower total caloric intakes, self selection of diet was not successful in this series except after the age of 70.

SUMMARY

Studies of the food intake and nutrition of older women of the Lansing area have been made.

No one technique of evaluating food consumption gave an entirely complete and reliable pattern of the characteristic intake of the individual. The 24 hour recall diet record, though less quantitative than a weighed diet, also imposed the least restriction on activity and resulted in apparently higher intakes of food. Diets computed by the short method of Donelson and Leichsenring (1945) accurately reflected the results of laboratory analyses for nitrogen, calcium, and phosphorus except in cases of limited food intakes or where predominance of bread, processed meats or intricate cookery mixtures were found.

The dietary patterns of this area are such that the total calories ingested per 24 hours may be taken as an index of the adequacy of the supply of specific

nutrients of that diet if the food selected is reasonably varied and some milk is included daily. A minimum of 1,600 to 1,800 calories per day was required for equilibrium of protein, calcium, and phosphorus in balance studies on 14 women under 70 years. Since three out of four women over 70 were able to maintain body reserves on approximately 1,500 calories, it is possible that total food needs may be lower after 70. It would appear that the reduction occurs rather abruptly in response to a decreasing number of activities and interests.

Outside interests and activities as well as freedom from tension and strain are factors which must be evaluated in the instruction and feeding of aging women if nutritional adequacy is to be expected.

Aging women are individuals. The arts as well as the science of nutrition are necessary to understand their nutritional needs.

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