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Evaluation of the Self-Chosen Weighed Diets of 402 Women 30-97 Years of Age in Seven North Central States

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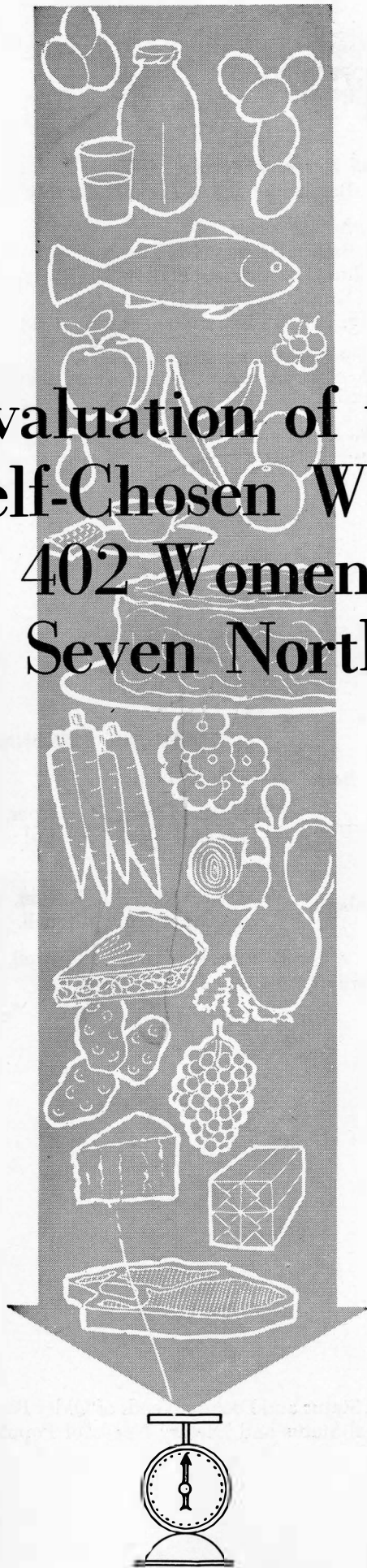
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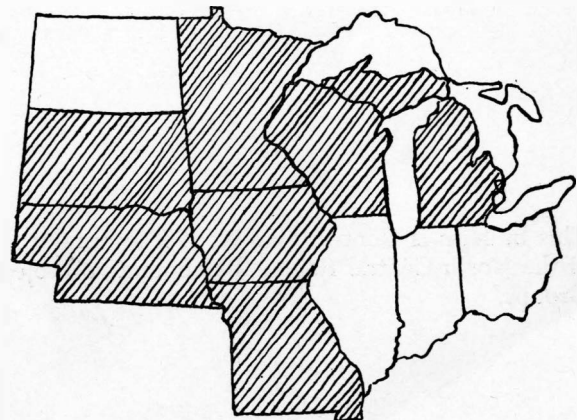
HOME ECONOMICS DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE COLLEGE, BROOKINGS

Evaluation of the Self-Chosen Weighed Diets of 402 Women 30-97 Years of Age in Seven North Central States



NORTH CENTRAL REGIONAL PUBLICATION NO. 105

Agricultural Experiment Stations of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.



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Evaluation of the Self-Chosen Weighed Diets of 402 Women 30-97 Years of Age in Seven North-Central States

Introduction

Nutrition research workers in the agricultural experiment stations of the North Central Region and the Home Economics Nutrition Research Branch, USDA, entered into cooperative arrangements in October 1947 to investigate the nutritional status and dietary needs of older women and of school children. This was a part of a nation-wide study of the nutritional status of various population groups for which partial financial support was provided by the Research and Marketing Act of 1946.

One of the first phases of the work with older women consisted of dietary surveys of approximately 2,100 women in Illinois, Iowa, Michigan, Minnesota, and South Dakota (11). The surveys in Iowa and South Dakota were made on statewide area probability samples. Workers in Michigan and Minnesota, on the other hand, interviewed urban women only, samples being obtained in the cities in which the experiment stations were located. "Systematic block sampling" was used in Michigan, with "random subsampling with substitution permitted." Minnesota used "random block sampling with quota subsampling modified by cooperation and eligibility considerations." Information about the food intake of these women was obtained by the 24-hour recall method. The nutritional value of the meals and snacks reported were then calculated from food composition tables.

This report deals with a second phase of the work. It is a more precise study than the first phase of the

nutritive value of diets chosen by women in the North Central Region. Participating in the study were 402 women 30 to 97 years of age, residing in seven urban centers in which the state experiment stations were located.

The diets were all obtained from weighed dietary records collected between 1948 and 1951, a period of comparative prosperity and liberal food supplies. The 402 diets collected in Ames, Iowa; Lansing and East Lansing, Michigan; St. Paul, Minnesota; Lincoln, Nebraska; Brookings, South Dakota; and Madison, Wisconsin, were 7-day records; the 25 collected in Columbia, Missouri, were 10-day records. The nutritive value of these diets was calculated and evaluated in terms of calories and 11 individual nutrients and in terms of food groups.

Only a few of the earlier studies on nutrient intakes of women will be noted in this report, as the principal ones have been cited by Swanson et al (11).

Procedure

Subjects Studied

Four hundred and two women, ranging in age from 30 to 97 years, were chosen for this study in seven of the North Central States: Iowa, Michigan, Minnesota, Missouri, Nebraska, South Dakota, and Wisconsin. In some instances diet records were collected twice from the same woman, but she was considered a new subject if at least 1 year had elapsed between observations. Table 1 shows the distribution by age decades of these subjects.

Methods of selecting women to serve as subjects varied from state to state. However, all subjects met the following criteria:

- 1) 30 years of age or older.
- 2) Lived in or near one of the cities in which the laboratories were located.
- 3) Was willing and interested in cooperating.
- 4) Lived in own home and selected own food.
- 5) Appeared to be in good health, free from observable signs of disease.

The studies were conducted so that the women were observed in their usual home environment. Food intake and other habits of living were interrupted only to the degree necessary to obtain food intake records and to arrange for a visit to the nutrition laboratories for chemical and physiological tests. The women were visited frequently so that detailed and accurate records of unusual situations were obtained. Physical examinations were made by competent physicians. Each subject was given a small remuneration to compensate her for the time she spent weighing and recording her foods.

Collection of Dietary Data

In the original contact with the subjects, each woman was interviewed by trained laboratory workers who obtained information concerning economic and social status, history of illness, operations, pregnancies, and dietary habits. The woman was instructed in the techniques of weighing her diet. She recorded her self-selected dietary intake in terms of weighed food

Table 1. Distribution by Age Decades of Subjects Studied in Seven North Central States

Location	Age Decade (Years)						Total
	30-39	40-49	50-59	60-69	70-79	80-over	
Ames, Iowa	18	29	24	12	12	1	96
East Lansing, Mich.	0	1	7	6	4	0	18
St. Paul, Minn.	20	20	20	20	20	20	120
Columbia, Mo.	1	5	12	5	2	0	25
Lincoln, Neb.	14	15	14	8	2	0	53
Brookings, S. D.	11	11	18	12	17	9	78
Madison, Wis.	9	2	0	1	0	0	12
Total	73	83	95	64	57	30	402

portions for 7 or 10 consecutive days. During the weighing period, at least 1 morning was spent in the laboratories, where basal metabolism and various chemical and physiological tests were made. The results of these tests will be presented in other publications.

All dietary records were taken from September to July, which should have excluded any extremely hot weather. This time period differs from that of the recent study of 24-hour recall diets (11) where data were collected from June to November. Though in this country, particularly in urban populations, most foods are available on a year around basis, it was felt that the time of year at which the survey was conducted might have some influence on eating patterns. In cases where a woman ate an occasional meal outside her home, she was instructed to estimate and record amounts of the foods she ate.

Calculation of Dietary Data

Calculation of values for calories and 11 nutrients were made for dieters from six states. Nebraska omitted values for four nutrients—carbohydrate, fat, iron, and niacin.

The calculations from Iowa, Minnesota, and South Dakota were based on values from USDA Miscellaneous Publication 572 (12) and Bowes and Church, 6th Ed. (2). Those from Michigan, Missouri, and Wisconsin were made using the short method of Donelson and Leichsenring (4, 5). Those from Nebraska were made using values for calories from USDA Handbook No. 8 (13); vitamin A, thiamine, riboflavin, and ascorbic acid were

calculated using the percentage counter developed by Leverton (6); analyzed values were used for protein, calcium, and phosphorus.

The term vitamin A as used in this report is synonymous with vitamin A value, which includes both vitamin A and precursors.

Nutrient intakes were compared with recommended daily allowances of the Food and Nutrition Board of the National Research Council as published in 1953 (8). These recommendations will be cited as NRC allowances. They are indicated in figure 2. The 1958 revision of the Recommended Allowances was not available at the time that the dietary calculations for this study were made and the small changes involved did not seem to justify recalculation.

All foods that appeared on the food records of Minnesota, Nebraska, and South Dakota women were classified under the following 10 headings: meats, meat alternates, milk as a beverage and on cereals and fruits, cereal products, table fats, white potatoes, vitamin rich fruits and vegetables, other fruits and vegetables, sweets and desserts, soups, and miscellaneous.

The mean daily energy value of each food group and the percentage of total calories furnished by each were calculated. The frequency of the appearance of different food groups in the diets of Minnesota and South Dakota women and preferences for individual foods within the groups were also studied. A limited study of the nutrient as well as the calorie contribution to the diets of certain foods was also made.

Results and Discussion

The mean daily values for calories and 11 nutrients for six successive age decades for the different states are presented in table 2. Since there were only two subjects in the 90's, they were included in the 80 and over age group. Only three states—Iowa, Minnesota, and South Dakota—studied subjects in the highest age decade, and the Iowa study included only one subject in this group. The Michigan study did not include the 30 to 39 year group and Wisconsin had no subjects in the 50 to 59 and 70 to 79 year groups. There were a few instances other than the one mentioned for the 80 and over age group in which the means were based on one, two, or three subjects. This should be considered in evaluation of the results.

MEAN CALORIE AND NUTRIENT CONTENT OF DIETS

Energy and Protein

The mean daily calorie value of the diets of the 402 subjects was 1,748 (table 2). Calorie distribution among the organic nutrients was as follows: protein furnished 13% of the total calories, carbohydrate 48%, fat 39%.

The range for the mean calorie value of the diets was 1,422 for the age group 80 or over to 1,925 for the age group 40 to 49. Mean calories for the 30 to 39 decade were approximately the same as for the 40 to 49. The mean protein intakes for the corresponding decades ranged from 46 grams to 63, with a mean for all age groups of 56 grams. There was a consistent decrease in mean calorie and protein values of the diets with succeeding age decades after the 40 to 49 decade. The percentage of total calories furnished by protein, carbohydrate, and fat showed little variation for the different decades. The percentage of calories provided by protein ranged from 12 to 13, by carbohydrate from 48 to 53, and by fat from 36 to 41.

Mean energy and protein values found in this study fall within the

range reported in the earlier study on older women of the North Central Region in which information on food intake was obtained using the 24-hour recall method (11). The mean calorie values reported from five states totaling over 2,100 women aged 30 to 90 years ranged from 1,665 to 1,780 and the mean protein intakes from 53 to 64 grams. Mean intakes were found to decrease in

the decades beyond the fourth. The range in percentage of calories provided by protein, carbohydrate, and fat differed little in the two studies.

Calcium, Phosphorus, and Iron

The mean mineral intakes of the 402 subjects were: calcium 662 milligrams, with a range from 531 milligrams for the 70 to 79 decade to 809 milligrams for the 30 to 39

decade; phosphorus 1,007 milligrams, with a range from 845 to 1,162 for the corresponding decades; iron 10 milligrams, with a range from 8.4 milligrams for the 80 or over age group to 11.0 milligrams for the 40 to 49 age group. While most of the low values were found in the older age groups, the decrease in intakes from the lower to the higher decades was less consistent than in the case of calories and protein.

The range in mean intakes of calcium was slightly higher than the range of 440 to 640 milligrams obtained from estimates based on the 24-hour recall method for approximately 2,100 women (11). But the range for iron was somewhat lower than the 9.9 to 11.9 milligrams reported in that study.

Vitamins¹

The overall mean intake of five vitamins and the ranges for the different age groups were:

VITAMIN	MEAN	RANGE
A, I.U.	5900	5200-6800
Thiamine, mg.	0.98	0.87-1.07
Riboflavin, mg.	1.30	1.10-1.53
Niacin, mg.	10	8.0-11.2
Ascorbic Acid, mg.	85	64-100

COMPARISON OF NUTRIENT INTAKES WITH NRC RECOMMENDED ALLOWANCES, BY AGE GROUPS

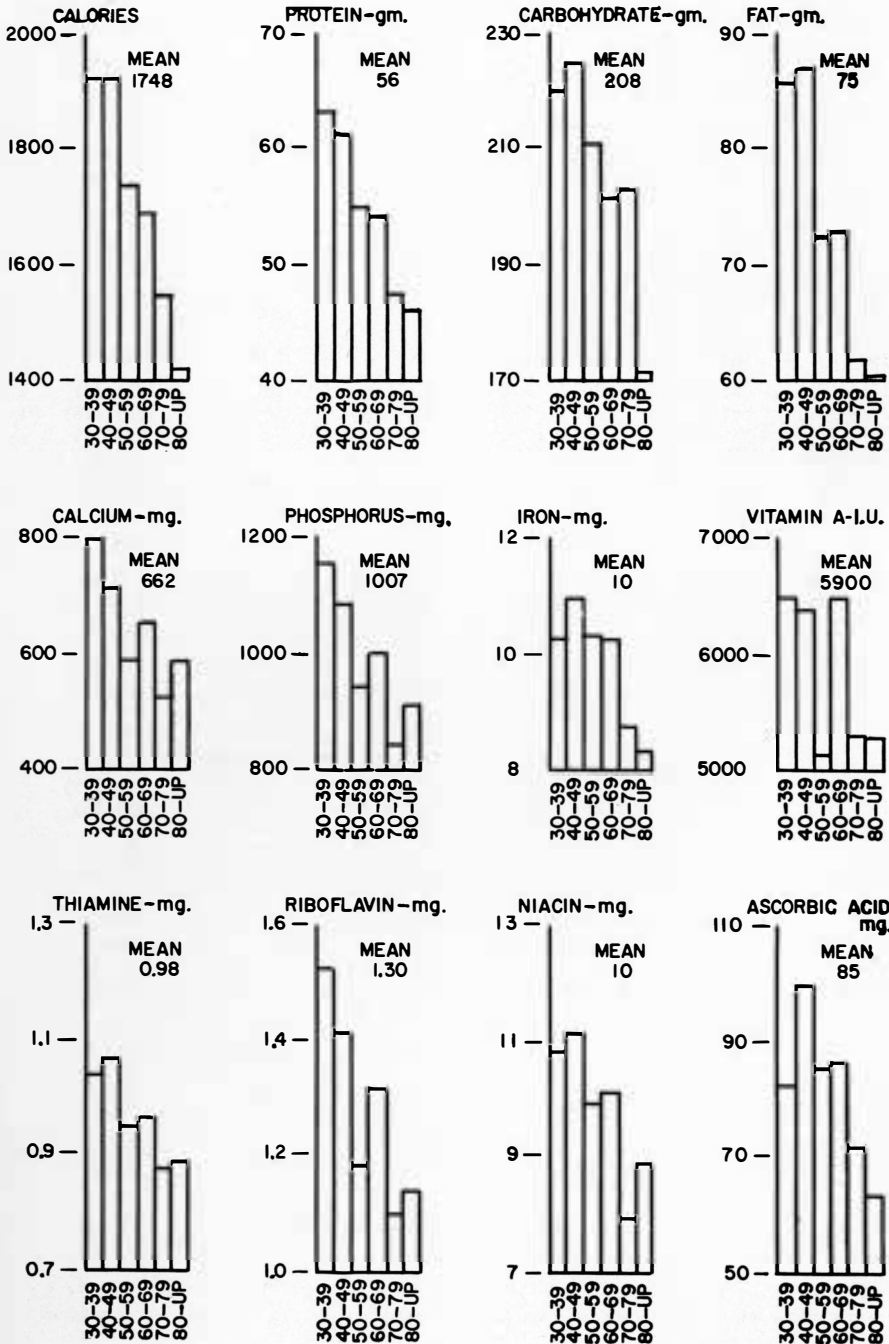
A comparison of the nutrient intakes of women in this study with the 1953 National Research Council's Recommended Dietary Allowances for women is presented in table 3. The percentages of subjects whose diets furnished less than 50%, 50 to 66%, 67 to 99%, and 100% or above of the 1953 recommended allowances for calories and eight nutrients are shown.

There was a great deal of variation in percentages of diets that met or exceeded recommendations. The ranges in the percentage of women in the six age groups whose diets furnished at least 67% of the NRC allowances for calories and the different nutrients were: calories, 84 to 94%; protein 72 to 100%; calcium,

¹The vitamin values are those of the diet only and do not include supplementary sources.

FIGURE 1.

MEAN DAILY CALORIE AND NUTRIENT VALUES OF DIETS OF SUBJECTS BY AGE DECADE



45 to 79%; iron, 57 to 95%; thiamine, 77 to 94%; riboflavin, 57 to 89%; niacin, 70 to 95%; and ascorbic acid, 71 to 93%. Eight to 32% of the women had intakes of calcium that were less than 50% of the recommended allowance for calcium and, with the exception of the 30 to 39 age group, approximately 20% had intakes between 50 and 66%.

Recent studies show low levels of calcium intake by a considerable portion of the population. In a study of four urban samples of homemakers in 1948 (3), almost one-fourth had calcium intakes below 0.3 gram daily—less than 50% of the recommended amount. An estimation of dietary levels based on a 1955 family food consumption survey (1)

showed that 29% of all the families' food supplies and 25% of those for the North Central Region failed to meet NRC recommendations for calcium. Only 8%, however, of all family food supplies provided less than two-thirds of the recommended amount. The latter figure is low compared with findings of surveys on adults only. Perhaps the differ-

Table 2. Mean Daily Calorie Value of Diets and 11 Nutrients by Age Decade for Each State

Age Decade, Years	State	No.	Food Energy, Calories	Protein, gm.	Carbo-hydrate, gm.	Fat, gm.	Calcium, mg.	Phosphorus, mg.
30-39	Iowa	18	1990(52)*	62.5(2.1)	223.6(7.8)	94.4(3.3)	768(67)	1138(52)
	Michigan	0	—	—	—	—	—	—
	Minnesota	20	1927(240)	63.2(3.3)	224.2(11.0)	86.6(3.6)	848(83)	1228(83)
	Missouri	1	2272	71.1	321.9	90.2	800	1150
	Nebraska	14	2004(80)	71.0(3.0)	—	—	1035(89)	1316(79)
	South Dakota	11	1773(55)	53.3(1.9)	200.7(5.8)	83.3(3.5)	560(45)	922(50)
	Wisconsin	9	1805(123)	66.0(4.4)	217.0(26.0)	71.0(5.0)	759(89)	1123(88)
	All states	73	1924	63	220	86	809	1162
40-49	Iowa	29	1887(59)	57.4(1.3)	220.0(9.0)	85.9(2.9)	611(44)	985(34)
	Michigan	1	2480	68.9	293.4	111.3	1016	1276
	Minnesota	20	1963(114)	61.1(3.4)	225.5(16.6)	90.7(5.4)	755(65)	1152(71)
	Missouri	5	1641(141)	59.4(6.2)	205.3(19.0)	62.6(7.0)	728(164)	996(139)
	Nebraska	15	1877(74)	69.0(2.0)	—	—	951(61)	1217(60)
	South Dakota	11	1942(132)	58.8(4.4)	226.2(18.7)	88.8(5.7)	630(78)	1018(97)
	Wisconsin	2	1844	68.0	207.5	84	711	1106
	All states	83	1925	62	226	88	725	1092
50-59	Iowa	24	1764(56)	52.5(1.5)	207.9(7.8)	80.4(3.5)	497(28)	891(34)
	Michigan	7	1730(212)	62.6(7.5)	207.2(26.3)	69.7(9.1)	563(102)	1005(118)
	Minnesota	20	1671(77)	51.6(2.4)	208.0(10.8)	70.0(4.5)	511(45)	921(54)
	Missouri	12	1631(101)	59.4(4.2)	201.6(11.8)	65.4(5.4)	660(90)	997(87)
	Nebraska	14	1866(86)	63.0(2.0)	—	—	969(81)	1128(67)
	South Dakota	18	1754(83)	53.1(2.4)	226.4(14.9)	70.4(2.3)	504(40)	888(46)
	Wisconsin	0	—	—	—	—	—	—
	All states	95	1738	56	211	72	597	953
60-69	Iowa	12	1676(106)	58.6(3.1)	190.6(19.7)	76.2(7.2)	602(41)	1070(50)
	Michigan	6	1606(120)	55.0(5.7)	183.7(13.8)	69.8(7.8)	590(96)	949(112)
	Minnesota	20	1791(71)	53.4(2.0)	215.0(11.1)	79.6(3.4)	639(47)	1013(44)
	Missouri	5	1539(102)	57.1(4.8)	187.6(15.9)	59.6(3.7)	822(127)	1058(71)
	Nebraska	8	1714(103)	58.0(5.0)	—	—	933(144)	1107(122)
	South Dakota	12	1666(112)	51.3(3.0)	212.8(13.4)	67.7(5.5)	553(62)	903(65)
	Wisconsin	1	1233	29.0	154.0	43.0	470	610
	All states	64	1690	55	202	73	660	1006
70-79	Iowa	12	1464(71)	44.7(2.1)	179.0(10.6)	63.4(4.6)	437(51)	763(48)
	Michigan	4	1642(122)	47.9(6.2)	217.7(12.9)	65.6(5.1)	399(96)	760(119)
	Minnesota	20	1558(65)	49.5(1.6)	204.6(10.3)	60.1(3.8)	651(39)	994(66)
	Missouri	2	1163	35.6	155.8	45.4	490	610
	Nebraska	2	1579	55.0	—	—	626	850
	South Dakota	17	1615(84)	46.4(2.9)	211.7(11.4)	64.7(4.1)	483(52)	776(55)
	Wisconsin	0	—	—	—	—	—	—
	All states	57	1548	47	204	62	532	845
80-over	Iowa	1	1531	59.0	170.8	68.1	927	1309
	Michigan	0	—	—	—	—	—	—
	Minnesota	20	1461(80)	47.5(3.0)	174.7(9.5)	63.2(5.0)	641(63)	970(71)
	Missouri	0	—	—	—	—	—	—
	Nebraska	0	—	—	—	—	—	—
	South Dakota	9	1324(99)	42.7(3.0)	165.3(17.2)	54.7(5.5)	460(50)	749(54)
	Wisconsin	0	—	—	—	—	—	—
All states	30	1422	47	172	61	596	915	
All ages	Iowa	96	1792	56	208	82	592	976
	Michigan	18	1711	57	206	71	560	947
	Minnesota	120	1729	54	209	75	674	1046
	Missouri	25	1602	57	201	63	698	984
	Nebraska	53	1872	66	—	—	963	1189
	South Dakota	78	1690	51	210	71	528	873
	Wisconsin	12	1764	63	210	71	736	1078
	All states, all ages	—	1748	56	208	75	662	1007

*The numbers in parentheses indicate standard error of the mean and the figure given in the column may be plus or minus the number in parentheses.

ence may be accounted for by the fact that the family records included diets of children, who are more likely to have liberal intakes of milk than are adults. In the North Central Region study of 24-hour recall diets (11) 23% of the women studied failed to obtain as much as 0.3 gram calcium daily.

The findings of this study and

others cited and the fact that X-ray studies on adults "past the age 45 to 50 years" frequently show demineralization of the bones (10) suggest that intakes of calcium and/or phosphorus may be inadequate for the maintenance of optimum bone mineralization. Inadequate protein intakes for maintenance of the bone matrix as well as other factors may

also be involved (9). Failure to meet recommended allowances for iron was also frequently encountered in this study.

An average of about 20% of all subjects consumed less than two-thirds of the recommended amounts of vitamin A, riboflavin, and ascorbic acid. The study of urban homemakers in 1948 (3) showed that 40%

Table 2 (continued)

Age Decade, Years	State	No.	Iron, mg.	Vitamin A I.U. ÷ 1000	Thiamine, mg.	Riboflavin, mg.	Niacin, mg.	Ascorbic Acid, mg.
30-39	Iowa	18	12.4(0.7)	7.8(1.0)	1.31(0.15)	1.74(0.18)	12.7(1.4)	75(8)
	Michigan	0	—	—	—	—	—	—
	Minnesota	20	10.9(0.5)	6.8(0.6)	1.14(0.06)	1.69(0.14)	11.3(0.5)	108(8)
	Missouri	1	30.2	7.5	1.28	1.80	16.6	329
	Nebraska	14	—	7.0(0.9)	0.77(0.04)	1.50(0.1)	—	80(14)
	South Dakota	11	9.5(0.3)	5.1(0.5)	1.01(0.05)	1.18(0.06)	9.7(0.4)	58(3)
	Wisconsin	9	10.2(2.6)	4.9(2.0)	0.88(2.03)	1.49(1.25)	9.6(6.6)	60(9)
	All States	73	10.3	6.5	1.04	1.53	10.9	83
40-49	Iowa	24	10.8(0.3)	6.5(0.6)	1.14(0.04)	1.32(0.07)	11.5(0.4)	94(6)
	Michigan	1	10.7	6.6	0.98	1.56	10.6	73
	Minnesota	20	10.7(0.6)	6.3(0.6)	1.10(0.06)	1.52(0.10)	11.0(0.7)	96(8)
	Missouri	5	9.8(0.8)	8.2(2.4)	0.96(0.07)	1.57(0.29)	8.7(1.2)	85(23)
	Nebraska	15	—	4.9(0.8)	0.83(0.03)	1.30(0.1)	—	119(10)
	South Dakota	11	11.7(0.8)	6.6(1.4)	1.18(0.08)	1.40(0.17)	11.2(0.8)	97(12)
	Wisconsin	2	10.9	5.6	1.14	2.78	10.8	80
	All states	83	11.0	6.4	1.07	1.42	11.2	100
50-59	Iowa	24	10.8(0.4)	5.4(0.5)	1.06(0.04)	1.15(0.06)	10.2(0.3)	83(6)
	Michigan	7	10.1(1.4)	4.2(1.2)	0.85(0.10)	1.30(0.22)	9.4(1.4)	59(11)
	Minnesota	20	9.8(0.5)	5.4(0.5)	1.04(0.06)	1.17(0.08)	10.5(0.6)	91(7)
	Missouri	12	11.1(0.8)	5.3(0.6)	0.89(0.08)	1.32(0.20)	9.3(0.7)	80(12)
	Nebraska	14	—	4.4(0.4)	0.83(0.04)	1.30(0.1)	—	120(16)
	South Dakota	18	10.2(0.6)	5.5(0.7)	0.91(0.04)	1.16(0.07)	10.0(0.5)	71(6)
	Wisconsin	0	—	—	—	—	—	—
	All states	95	10.4	5.2	0.95	1.19	10.0	86
60-69	Iowa	12	11.6(0.6)	12.6(4.3)	1.29(0.24)	1.75(0.25)	14.8(2.4)	113(14)
	Michigan	6	8.7(1.2)	5.8(8.4)	0.76(0.09)	1.22(0.17)	8.1(1.3)	62(9)
	Minnesota	20	10.1(0.5)	6.1(0.4)	1.10(0.06)	1.34(0.06)	10.0(0.6)	94(9)
	Missouri	5	9.5(1.1)	8.7(1.4)	0.91(0.10)	1.66(0.16)	9.6(1.5)	104(22)
	Nebraska	8	—	6.8(1.6)	0.78(0.05)	1.20(0.1)	—	92(16)
	South Dakota	12	10.8(1.1)	4.7(0.9)	1.04(0.09)	1.18(0.12)	9.9(0.6)	62(6)
	Wisconsin	1	5.7	3.0	0.49	0.90	5.4	36
	All states	64	10.3	6.8	0.97	1.32	10.2	87
70-79	Iowa	12	9.0(0.4)	6.2(0.8)	0.81(0.03)	1.12(0.10)	8.6(0.5)	56(5)
	Michigan	4	9.1(1.9)	3.1(3.8)	0.70(0.06)	0.85(0.17)	7.4(1.3)	58(10)
	Minnesota	20	9.3(0.4)	5.3(0.5)	0.96(0.04)	1.28(0.06)	8.8(0.4)	92(12)
	Missouri	2	7.0	5.6	0.61	0.84	6.7	59
	Nebraska	2	—	6.5	0.72	0.90	—	29
	South Dakota	17	9.1(0.6)	5.1(0.7)	0.94(0.06)	0.99(0.09)	8.6(0.5)	68(5)
	Wisconsin	0	—	—	—	—	—	—
	All states	57	8.8	5.3	0.88	1.10	8.0	72
80-over	Iowa	1	10.6	10.6	1.01	1.95	10.9	60
	Michigan	0	—	—	—	—	—	—
	Minnesota	20	8.6(0.7)	5.3(0.6)	0.90(0.05)	1.20(0.11)	9.2(0.7)	69(8)
	Missouri	0	—	—	—	—	—	—
	Nebraska	0	—	—	—	—	—	—
	South Dakota	9	7.7(0.5)	4.8(1.0)	0.79(0.07)	0.92(0.08)	8.2(0.8)	54(9)
	Wisconsin	0	—	—	—	—	—	—
	All states	30	8.4	5.3	0.87	1.14	8.9	64
All ages	Iowa	96	11	6.7	1.07	1.34	11	85
	Michigan	18	9	4.6	0.79	1.19	9	60
	Minnesota	120	10	5.9	1.05	1.36	10	92
	Missouri	25	11	6.7	0.90	1.37	9	94
	Nebraska	53	—	5.7	0.80	1.33	—	102
	South Dakota	78	10	5.3	0.97	1.13	10	69
	Wisconsin	12	10	4.8	0.89	1.46	9	61
	All states, all ages	10	5.9	0.98	1.30	10	85	

were consuming less than two-thirds of the recommended amounts of vitamin A and ascorbic acid and that about 25% failed to reach this level for iron and riboflavin. In the 1955 family survey (1) 25% of the family food supplies provided less than the NRC recommendations for ascorbic acid, 15 to 20% for vitamin A and riboflavin, and 10% for iron.

MEAN CALORIE AND NUTRIENT CONTENT BY AGE DECADE

Figure 1 shows the mean daily calorie and nutrient content of the diets of women in all seven states by age decades.

The bar graphs representing calories and nutrients by age decade follow a somewhat similar pattern with decreasing values in the later decades. Mean values for calories, protein, carbohydrates, and fats were highest in the younger age groups and showed a consistent decline in succeeding decades after the 40 to 49 decade. This downward trend also became evident for calcium, phosphorus, and iron either following the 30 to 39 or 40 to 49 age decade, though with less consistency. The mean intake of vitamin A showed a marked drop in the 50 to 59 decade but rose to higher levels in the next decade and again dropped markedly in the last two decades. The downward trend does not become clearly evident for intakes of thiamine, riboflavin, niacin, and ascorbic acid until the last two decades.

Figure 2 shows the distribution of the subjects for the various age decades according to individual values

of the diets in calories and nutrients. These cumulative frequency curves indicate that many individuals had low nutrient intakes even though many of the averages suggested that mean intakes were adequate.

Approximately 10% of the women between the ages of 30 and 49 had diets that furnished less than 1,500 calories, the percentage of low calorie diets increasing in succeeding decades. Diets that furnished less than 40 grams of protein, 8 milligrams of iron, 6 milligrams of niacin, 0.6 milligram of thiamine and riboflavin, 30 milligrams of ascorbic acid, and 2,500 international units of vitamin A were found in all age groups. All ages had diets that furnished less than 400 milligrams of calcium. The diets supplying less than 400 milligrams of calcium ranged from 8% in the 30 to 39 decade to approximately 32% in the 70 to 79 decade.

The increase in percentages of diets of very low nutrient content from the earlier to later decades was consistent, with few exceptions, for protein, calcium, and iron, but not for the vitamins.

In the earlier study of 24-hour recall diets (11), mean intakes of most nutrients were found to decrease slightly from the fourth through the seventh decade. Analysis of the data from the Iowa sample indicated that regressions on age for food energy, protein, and calcium values of dietaries were significant, but those for ascorbic acid and vitamin A value were not.

The part played by inadequate nutrient intake in the physiological

changes which result in impaired vigor, reduced potential work capacity, and poor health in older people is little understood. There is reason to believe, however, that nutrition problems are involved in the aging process. This is of special interest in a population where increasing numbers of people are living to age 65 and beyond.

MEAN CALORIE AND NUTRIENT CONTENT BY STATES

Calories and Proteins

The downward trend with age in mean calorie and protein content of diets could be observed in each of the states (table 2), but there was less consistency than in the overall picture (figure 1).

Diets of Iowa, Missouri, and Nebraska subjects showed decreasing values after the 30 to 39 year decade, but this was not evident for Michigan, Minnesota, South Dakota, or Wisconsin until after the 40 to 49 year decade. However Michigan had no subjects in the 30 to 39 decade. Wisconsin did not study any subjects in the 50 to 59 year group, but intakes were markedly lower in the 60 to 69 year group than in the 40 to 49.

The highest mean calorie values (above 2,000) were found in Missouri in the 30 to 39 and in Michigan in the 40 to 49 decades (one subject in each case) and the lowest in South Dakota (1,321) and Minnesota (1,461) for the 80 years and over group.

The relationship of the calorie value of the diets to age found in this study and by Swanson et al.

Table 3. Percentage of Women by Age Decade Whose Diets Furnished Selected Levels of the National Research Council's Recommended Allowances

	49% or less						50%-66%						67%-99%						100% or above					
	Age Decades						Age Decades						Age Decades						Age Decades					
	30-39 (73)*	40-49 (83)	50-59 (95)	60-69 (64)	70-79 (57)	80-over (30)	30-39 (73)	40-49 (83)	50-59 (95)	60-69 (64)	70-79 (57)	80-over (30)	30-39 (73)	40-49 (83)	50-59 (95)	60-69 (64)	70-79 (57)	80-over (30)	30-39 (73)	40-49 (83)	50-59 (95)	60-69 (64)	70-79 (57)	80-over (30)
Calories	---	---	2	---	---	---	5	9	9	8	6	16	74	60	62	58	65	57	21	31	27	34	29	27
Protein	---	1	---	---	---	---	---	12	15	14	28	23	48	41	61	69	58	54	52	46	24	17	14	23
Calcium	8	13	23	11	32	27	13	19	28	20	21	23	30	23	29	42	35	33	49	45	20	27	12	17
Iron†	---	1	4	5	6	20	5	6	9	16	29	23	63	65	64	57	56	47	32	28	23	21	9	10
Vitamin A	---	7	5	8	9	16	9	11	14	3	12	17	29	22	40	20	33	20	62	60	41	69	46	47
Thiamine	4	---	1	3	---	3	13	8	5	8	11	20	59	51	55	50	63	47	24	41	39	39	26	30
Riboflavin	1	3	5	3	12	16	10	17	25	13	23	27	30	31	40	38	47	30	59	49	30	46	18	27
Niacin†	2	2	1	4	---	7	3	4	7	5	13	23	71	50	41	43	67	37	24	44	51	48	20	33
Ascorbic Acid	7	2	6	6	7	23	17	5	19	14	16	7	22	17	21	13	40	27	54	76	63	67	37	43

*Numbers in parentheses indicate the number of women in each group.

†No data on iron and niacin were submitted by the Nebraska Station; therefore, the number of cases for these nutrients for the different age groups were: 30-39, 59; 40-49, 68; 50-59, 81; 60-69, 56; 70-79, 55; 80-over, 30.

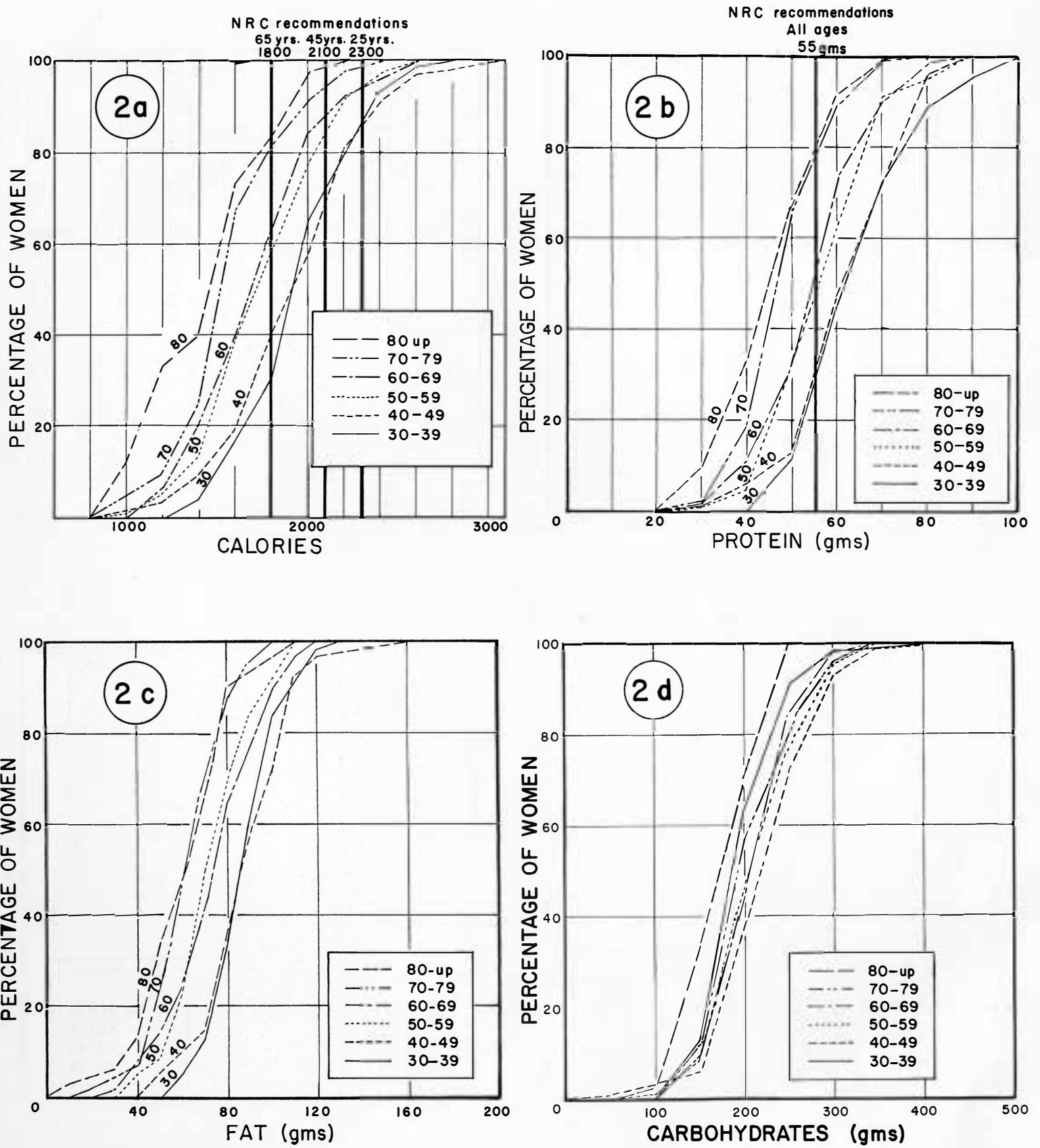
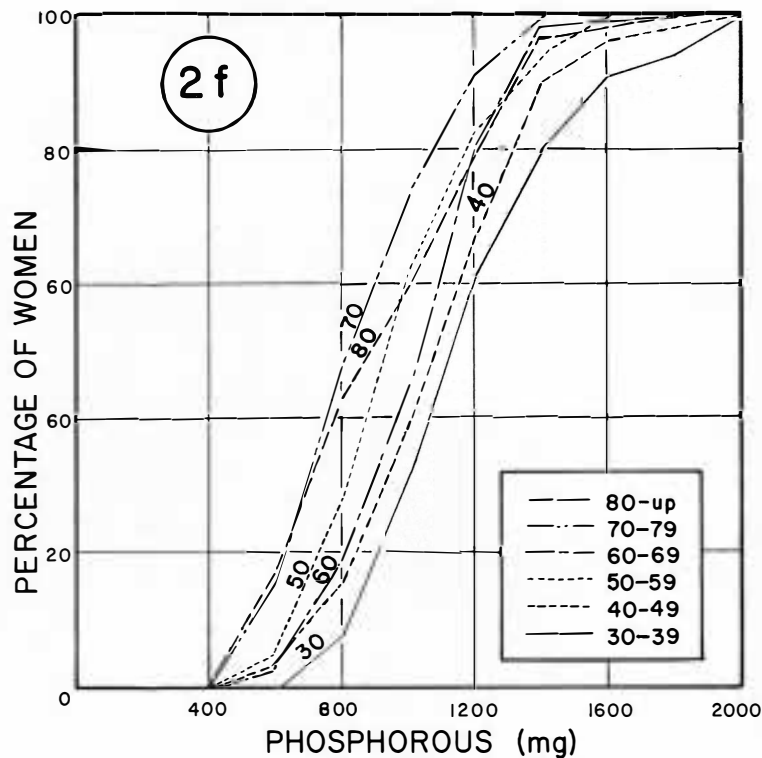
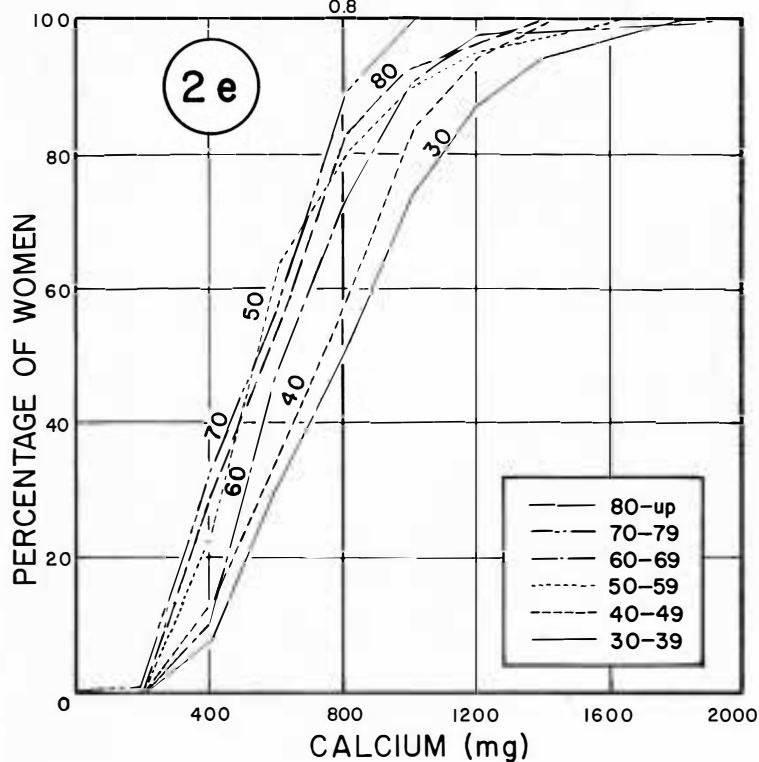


Figure 2. Cumulative curves showing the percentages of subjects having diets of average daily calorie values below and above the levels indicated. NRC recommendations cited are from the 1953 revision of the recommended dietary allowances.

NRC recommendations

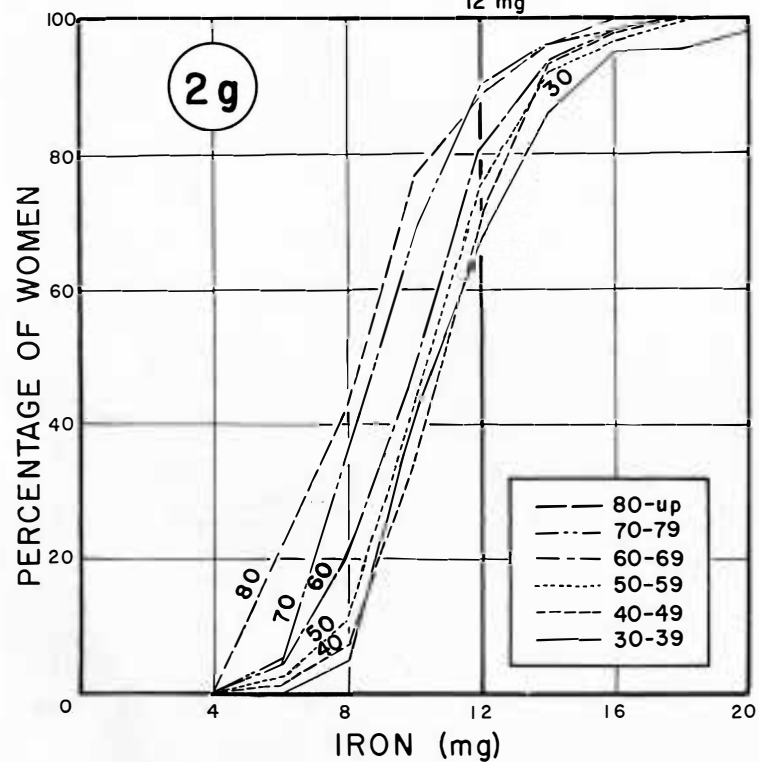
All ages

0.8



NRC recommendations

12 mg



NCR recommendation

5000

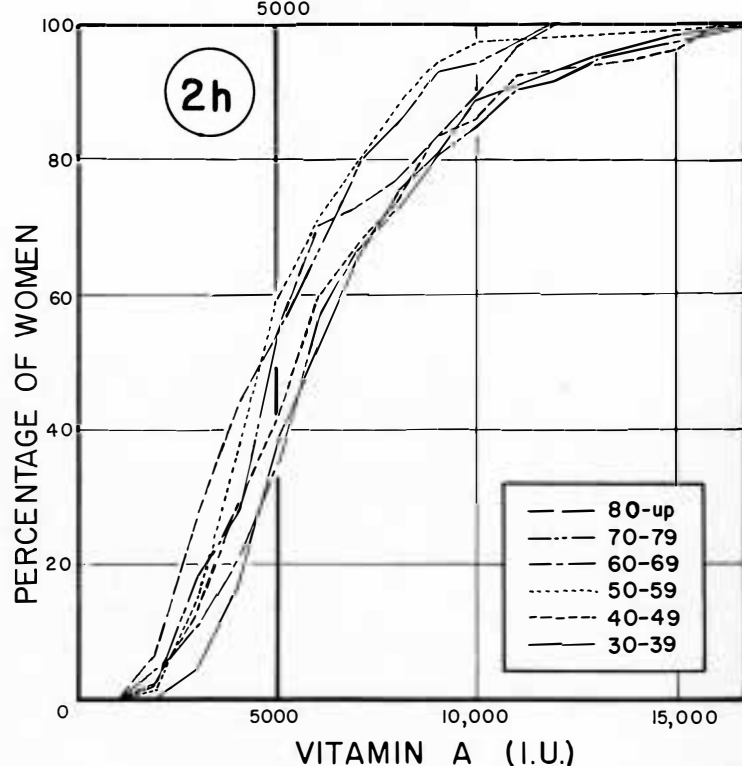


Figure 2 (continued). Cumulative curves showing the percentages of subjects having diets of average daily caloric values below and above the levels indicated. NRC recommendations cited are from the 1953 revision of the recommended dietary allowances.

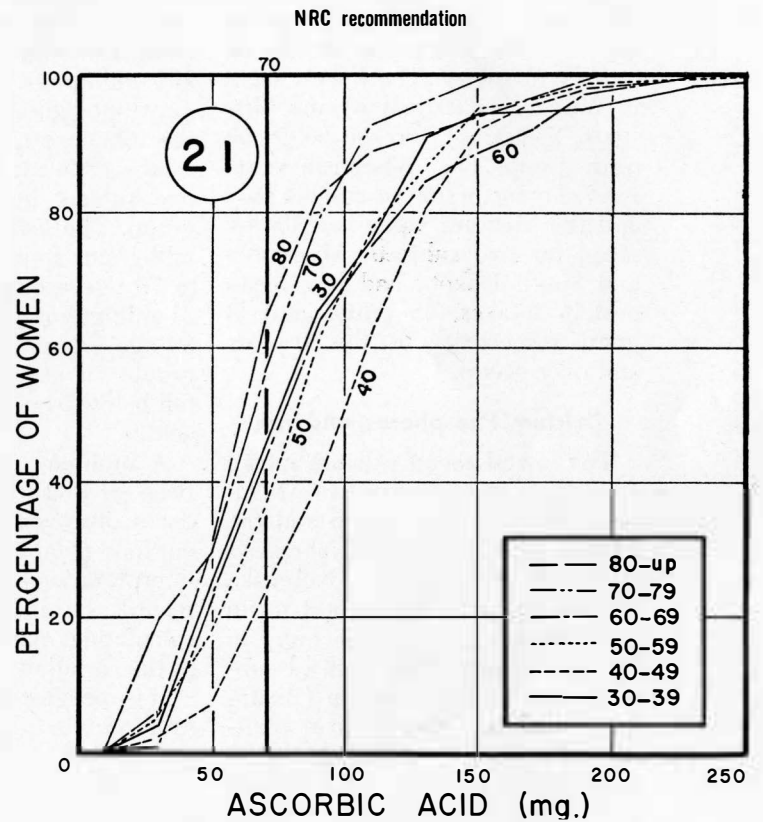
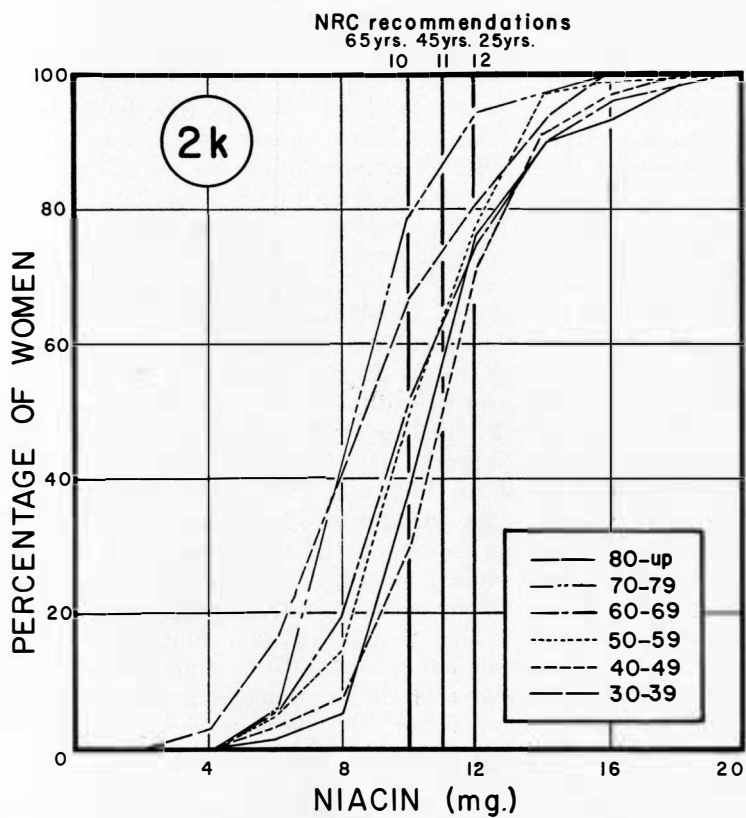
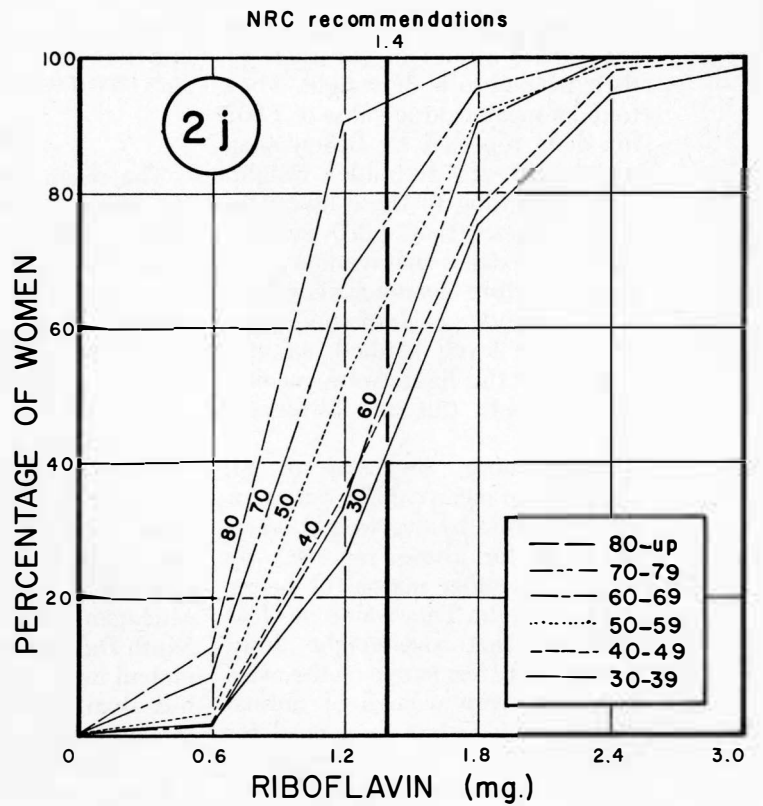
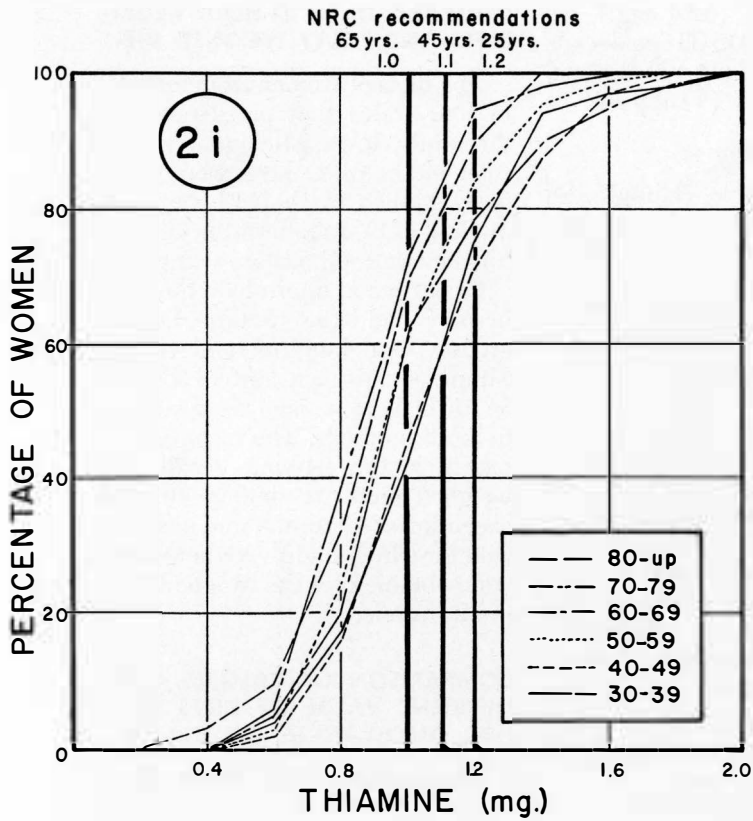


Figure 2 (continued). Cumulative curves showing the percentages of subjects having diets of average daily caloric values below and above the levels indicated. NRC recommendations cited are from the 1953 revision of the recommended dietary allowances.

(11) was previously cited. Swanson et al. also studied the relationship of the calorie values of the diets of their women to body weight. They found a mean calorie value of 1,802 for diets reported by 928 women within 10% of "desirable" weight. This, according to these investigators, suggests that 1,800 calories daily approaches the average energy expenditure of women above age 30 living under modern conditions. At all age levels studied, calories well below this figure were encountered in both this and Swanson's study.

Furthermore, Swanson et al. found lower mean calorie values for diets reported by overweight women than for those reported by women of either normal or below normal weight. They found no clear evidence that overweight Iowa women were less active on the average than were women of normal weight. This points to a need for further study of the energy costs of activities commonly engaged in by women today.

Highest mean daily protein intakes were observed in Missouri and Nebraska, 71 grams for the 30 to 39 year group. The lowest were in Wisconsin (29 grams) and Missouri (36 grams), for the 60 to 69 year group. The Wisconsin value is a 7-day mean for one subject only and the Missouri value is a 10-day mean for two subjects. Minnesota and South Dakota had low mean protein intakes, 48 grams and 43 grams respectively for the 80 years and over group.

Calcium, Phosphorus, and Iron

The lowest mean calcium intake (399 mg.) was observed in Michigan's 70 to 79 year group and the highest (1,035 mg.) in Nebraska's 30 to 39 year group. Nebraska women also had the highest mean phosphorus intake (1,316 mg.) in the latter group. Wisconsin (1 subject) and Missouri women (2 subjects) had the lowest mean phosphorus intakes (610 mg.) in the 60 to 69 and 70 to 79 decades, respectively. Calcium and phosphorus mean intakes for all ages combined were highest in Nebraska and lowest in South Dakota. The highest

mean iron intake (12.4 mg.) occurred in Iowa's 30 to 39 age decade and the lowest (5.7 mg.) in Wisconsin's 60 to 69 decade (1 subject).

Vitamins

The mean vitamin A intake for the different states for the six age decades combined ranged from a high of 6,700 I.U. for Iowa to a low of 4,800 I.U. for Wisconsin. Mean values for all age groups in most samples were 5,000 I.U. or above.

Mean thiamine, riboflavin, and niacin intakes were highest in Iowa, with the exception of riboflavin, which was slightly higher in Wisconsin than in Iowa. Riboflavin intakes ranged from a mean of 1.13 for South Dakota women to 1.46 milligrams for Wisconsin women. Michigan, Missouri, Nebraska, South Dakota, and Wisconsin women had mean intakes of thiamine of less than 1 milligram, and niacin intakes ranged from 9 milligrams in Wisconsin to 11 in Iowa.

Mean ascorbic acid intakes were 69 milligrams or above for all states except Wisconsin and Michigan. Means for the different states ranged from 60 milligrams for Michigan to 102 milligrams for Missouri. This very high figure for Missouri reflects the influence of an extremely high intake (329 mg.) reported for the one subject in the 30 to 39 age group. The lowest intakes were 29 milligrams found in Nebraska's 70 to 79 age group (2 subjects) and 31 milligrams in Wisconsin's 60 to 69 age group (1 subject). No age groups in any of the other states fell below 54 milligrams of ascorbic acid.

A number of factors may have been involved in the state differences observed. The use of different food composition tables and the interpretation of items in the dietary records by individuals doing the calculating may account for some of the variation among states.

It is recognized that the relatively small numbers involved in some of the age groups raises a question as to the value of certain of the comparisons made. The low intakes cited for age groups with less than 10 subjects may represent unusual cases.

COMPARISON OF 24-HOUR RECALL DIETS AND 7-DAY WEIGHED DIETS

The diets of women from samples in four states that participated in this study, Iowa, Michigan, Minnesota, and South Dakota, were previously studied by the 24-hour recall method (11). In table 4 the findings for the two methods are compared.

Of particular interest are the Minnesota and the South Dakota groups. One hundred and twenty Minnesota women and 78 of the South Dakota women were studied by both methods. The mean values based on the 24-hour recall and weighed diets are similar with the exception of vitamin A and ascorbic acid for which slightly higher values were obtained for the weighed diets in all instances.

COMPARISON OF CALORIE AND NUTRIENT VALUE OF DIETS WITH NRC ALLOWANCES, BY STATES

Figure 3 shows the percentage of women in each of the seven states with diets of calorie and nutrient content at various levels of the National Research Council's Recommended Dietary Allowances.

Only three states, Michigan, Minnesota, and South Dakota, reported calorie values less than 50% of the NRC recommendation for the 45-year-old woman of 55 kilograms. The percentages of women failing to meet even this low level were small—11% in Michigan, 1% in Minnesota, and 4% in South Dakota. On the other hand over 80% of the women in Michigan, Minnesota, Missouri, South Dakota, and Wisconsin, and over 90% in Iowa and Nebraska, reported diets furnishing 67 to 100% and over of the NRC allowance for calories. Since the information on the activities of the women was lacking, their actual calorie needs were not known.

The ranges in percentage of women meeting 67 to 100% and above of the recommended allowances for the various nutrients were: protein, 72% in Michigan to 100% in Wisconsin; calcium, 44% in South Dakota to 93% in Nebraska; iron, 61% in Michigan to 96% in Iowa; vitamin A, 61% in Michigan to 94% in Iowa; thiamine, 67% in Michigan

Table 4. Mean Calorie and Nutrient Content of Diets of Women in Four States Based on 24-Hour Recall Diets and 7-Day Weighed Diets—All Age Groups

	No. of women	Food energy, calories	Protein, gm.	Calcium, gm.	Iron, mg.	Vitamin A, I.U.	Thiamine, mg.	Riboflavin, mg.	Niacin, mg.	Ascorbic Acid, mg.
Iowa										
24-hr. recall	1,072	1,735	57.5	0.50	11.2	4,722	1.11	1.24	11.0	65
Weighed	96	1,718	55.8	0.64	10.8	8,200	1.10	1.50	11.4	80
Michigan										
24-hr. recall	97	1,664	53.5	0.44	9.9	4,427	0.91	1.13	9.2	53
Weighed	18	1,832	58.5	0.64	9.3	4,900	0.88	1.23	9.6	63
Minnesota										
24-hr. recall	120	1,780	62.0	0.64	11.3	6,728	1.04	1.36	10.3	75
Weighed	120	1,728	54.4	0.67	9.9	7,600	1.07	1.31	10.7	91
South Dakota										
24-hr. recall	{ 339	1,705	57.5	0.50	10.9	4,565	0.96	1.20	10.6	55
	{ 78	1,595	55.2	0.47	10.2	4,726	0.93	1.18	9.4	56
Weighed	78	1,690	51.0	0.53	9.9	5,293	0.97	1.13	9.6	69

to 100% in Wisconsin; riboflavin, 67% in South Dakota to 84% in Wisconsin; niacin, 66% in Michigan to 98% in Wisconsin; ascorbic acid, 61% in Michigan to 87% in Iowa. Michigan had, in most instances, the smallest percentage of women consuming 67 to 100% and over of the recommended allowances.

A larger percentage of mean daily calcium intakes than any other nutrient fell below 50% of the NRC allowances in all states except Nebraska. In Michigan, 28% of the women had intakes of both calcium and riboflavin that were less than 50% of the recommended amounts.

CALORIES FURNISHED BY MAJOR FOOD GROUPS

In addition to the evaluation of the dietaries in terms of calories and specific nutrients, the dietary records from Minnesota, Nebraska, and South Dakota were evaluated according to the percentage contribution of 10 important food classes to the total energy value of the diet. The 10 classes were 1) meat, fish, poultry; 2) meat alternates (eggs, cheese, legumes); 3) milk as a beverage and on cereals and fruit; 4) table fats; 5) cereal products; 6) white potatoes; 7) vitamin-rich fruits and vegetables²; 8) other fruits and other vegetables; 9) sweets and desserts; 10) soups and miscellaneous.

²Important sources of ascorbic acid and/or vitamin A.

The number and percentage of total calories provided by each class of foods in the dietaries were calculated. Then the evaluation was carried out in two ways: first, mean calorie values for major food groups for each decade, disregarding states, were compared; second, a comparison of mean calorie values for major food groups for each state, disregarding age, was made.

The mean energy value and percentage of total energy provided by specified food groups for all women of the three states in six age decades are presented in table 5.

The percentage of calories from meats declined slightly in the later decades and the percentage from

cereal products increased. The percentage of calories derived from milk was highest in the 30 to 39 and in the 80 and above age groups.

As observed by Leverton et al. (7), differences in the source of calories in the diets of the women of the different age groups were small. In agreement with the findings of these investigators, sweets and desserts were found to supply a larger proportion of total calories than any other food group. This was true for all age decades. The range for percentage of calories derived from sweets and desserts in this study was 19 to 26% with a mean of 23.3% for the 250 women. Leverton et al. have reported a like figure.

Below in descending order are the major sources of calories in the dietaries of the three states:

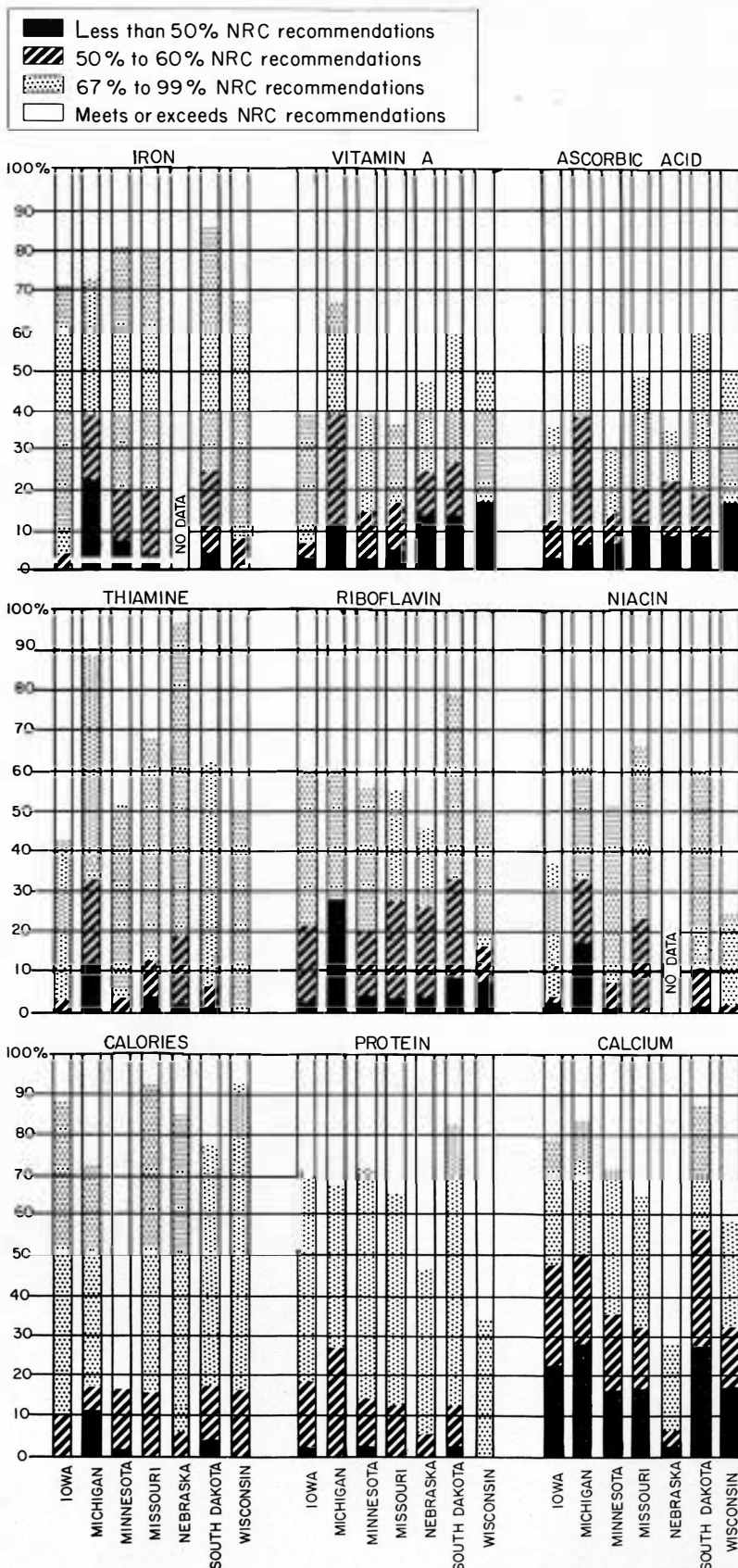
- MINNESOTA
 - Sweets and desserts
 - Cereal products
 - Table fats
 - Meats
 - Milk
- NEBRASKA
 - Cereal products
 - Sweets and desserts
 - Meats
 - Table fats
 - Milk
- SOUTH DAKOTA
 - Sweets and desserts
 - Cereal products
 - Table fats
 - Meats
 - Milk

Table 5. Mean of Calories and Percentage of Total Calories Provided by Specified Food Groups in 7-Day Weighed Diets of 250 Women in Minnesota, Nebraska, and South Dakota Grouped According to Age

Food Group	Age Decade											
	30-39		40-49		50-59		60-69		70-79		80-over	
	Cal.	%	Cal.	%	Cal.	%	Cal.	%	Cal.	%	Cal.	%
Meats	251	13	244	13	226	13	192	11	161	10	146	10
Meat alternates	107	6	106	5	84	5	90	5	66	4	82	6
Milk*	205	11	165	8	111	6	131	8	122	8	161	11
Cereal products	342	18	361	19	351	20	356	20	362	23	342	24
Table fats	267	14	307	16	222	13	251	14	249	16	228	16
White potatoes	66	3	79	4	65	4	62	4	74	5	46	3
Vitamin-rich fruits and vegetables	85	4	94	5	86	5	83	5	94	6	77	5
Other fruits and vegetables	94	5	91	5	112	6	95	5	70	4	54	4
Sweets and desserts	428	23	422	22	453	26	444	26	356	22	266	19
Soups, miscellaneous	66	3	54	3	40	2	33	2	26	2	15	1
Total	1,911		1,923		1,750		1,737		1,580		1,417	

*As beverage and on cereals and fruits.

FIGURE 3. PERCENTAGE OF WOMEN WITH DIETARY INTAKES AT SELECTED LEVELS



As can be seen in table 6, there was not a great deal of variation among state dietaries in the percentage calorie contribution of each food group. Nebraska's records indicated higher percentage calorie contributions from meats, milk, and other fruits and vegetables, but a lower percentage from table fats and sweets and desserts than the other two state groups. The South Dakota dietaries were highest in percentage calorie contribution of sweets and desserts.

The higher milk intake by Nebraska women resulted in a higher mean calcium intake by this group. When the percentages of calories from milk and mean calcium intakes are compared for the three states, the results are as follows:

STATE	% TOTAL CALORIES FROM MILK	CALCIUM MG.
Nebraska	10	963
Minnesota	8	674
South Dakota	7	582

The 24-hour recall records of dietary intake (11) indicated that the South Dakota women were getting 7% of their total calories from milk, while the percentages of total calories furnished by milk in the Minnesota dietaries was 9%.

The low consumptions of milk in the diet and the need for increased intakes to meet calcium needs calls for special emphasis on milk consumption as a point in nutrition education. Foods other than milk in the usual dietary pattern in the United States supply only about 0.3 gram of calcium daily. Therefore to meet the recommended allowance of 0.8 gram, 0.5 gram must be supplied by milk or milk products other than butter. The equivalent of an additional pint of milk would furnish the 0.5 gram needed to bring the calcium value of a day's meals up to the recommended 0.8 gram.

FREQUENCY OF SPECIFIED FOOD GROUPS IN DIETS OF 197 MINNESOTA AND SOUTH DAKOTA WOMEN

The dietary records obtained in Minnesota and South Dakota were analyzed for information on food groups and foods within each group which were commonly eaten by

Table 6. Mean of Calories and Percentage of Total Calories Provided by Specified Food Groups in 7-Day Weighed Diets of 250 Women in Minnesota, Nebraska, and South Dakota Grouped According to State of Residence

Food Group	Minnesota		Nebraska		South Dakota	
	Cal.	%	Cal.	%	Cal.	%
Meats	181	11	275	15	208	12
Meat alternates	100	6	92	5	73	4
Milk*	150	8	186	10	122	7
Cereal products	359	21	371	20	329	20
Table fats	285	16	193	10	252	15
White potatoes	52	3	71	4	85	5
Vitamin-rich fruits and vegetables	96	6	76	4	80	5
Other fruits and vegetables	74	4	159	9	62	4
Sweets and desserts	398	23	357	19	429	26
Soups and miscellaneous	33	2	81	4	24	1
Total	1,728		1,862		1,673	

*As a beverage and on cereals and fruits.

women of this area. The food groups studied for this purpose were:

1. Meat, fish, and poultry
2. Meat alternates (cheese, eggs, legumes)
3. Breakfast cereals
4. White potatoes
5. Vitamin-rich fruits
6. Vitamin-rich vegetables
7. Other fruits
8. Other vegetables
9. Desserts
10. Snacks—any food eaten between regular meals

The number of times these specified food groups appeared in the diets was calculated. The number of women in the different age decades who reported eating the different food groups a specified number of times during the 7-day period is shown in table 7.

Meat, Fish, and Poultry

Only a small number of the diets included fewer than seven servings of meat weekly except in the 80 and over age group where 10 of the 29 subjects had fewer than seven servings per week. Eight of the 31 subjects in the 30 to 39 years group reported 14 to 21 servings weekly, as compared with only 3 of the 37 subjects in the 70 to 79 year group and 1 of the 29 in the 80 and over age group. This indicates that the majority of the women were eating at least one serving of meat daily regardless of age decade, but after age 60 there was some decline in use of meat with succeeding age decades.

Meat Alternates

Approximately one-half to three-fourths of the women in the different age decades reported using meat alternates at least seven or more times per week, but only a small number used them 14 to 21 times weekly. There was a slight trend toward less frequent use of meat alternates with increasing age.

Breakfast Cereals

Breakfast cereals were not very popular as an everyday part of the diets except in the oldest age group, where half of the women had breakfast cereal seven or more times a week. There were some in each age group who ate no breakfast cereal at all, but the majority ate breakfast cereals between one and six times a week.

White Potatoes

Use of white potatoes was limited to less than seven times a week in approximately two-thirds to three-fourths of the diets of all age groups. The 30 to 39 and 40 to 49 year groups reported the most frequent use of potatoes, with over one-third eating them 7 to 13 or more times a week. Very few diets included potatoes oftener than 13 times a week.

Vitamin-Rich Fruits and Vegetables

Over four-fifths of the women in the 30 to 39, 40 to 49, 50 to 59, and 70 to 79 age groups and about two-thirds in the 60 to 69 and 80 and over age groups consumed seven or

more servings of vitamin-rich fruits weekly. A much smaller proportion of the women included vitamin-rich vegetables seven or more times per week. However, three-fourths or more of the women had them four or more times a week.

Other Fruits and Vegetables

Approximately one-half of the women in the age groups below 80 years had "other" fruits seven or more times weekly, while about one-fifth to one-half had them less than four times per week. There was a great deal of variation in number of servings of "other" vegetables with from one-fourth to three-fourths of the women receiving seven or more servings weekly. The 80 and over age groups had the highest percentage of women who were low in servings of both "other" fruits and "other" vegetables.

Desserts and Snacks

Desserts were included in the diet 14 or more times per week by approximately one-third of the women in the 30 to 39 and 80 and over age groups to about two-thirds of the women in the other age groups.

A higher proportion of the younger than of the older women reported snacks 7 to 14 times and oftener weekly. Approximately one-half or more of the women in the 30, 40, and 50 year decades, but fewer than one-tenth of the women 80 years old and above, reported snacks at the above level. The proportion of the women not consuming snacks at all was higher in the 60 years and later decades than in the three earlier decades.

FREQUENCY SPECIFIED FOODS WERE REPORTED IN MINNESOTA AND SOUTH DAKOTA DIETS

Table 8 records the frequency with which the individual foods of the different food groups were consumed. Among the meats, beef ranked highest, representing from 26 to 33% of the meat choices. Pork and ham were next in order. Mixed meat dishes, organ meats, lamb, veal, and game were seldom eaten. Fish was eaten more often by wom-

Table 7. Percentage of Minnesota and South Dakota Women by Age Decade Who Included Various Food Groups Specified Numbers of Times Weekly in Their Diets

A. Meat, Fish, and Poultry					B. Meat Alternates				
Age decade, yrs.	Servings weekly				Age decade, yrs.	Servings weekly			
	0-3	4-6	7-13	14-21		0-3	4-6	7-13	14-21
30-39	—	—	74	26	30-39	6	23	58	13
40-49	—	7	77	16	40-49	10	19	61	10
50-59	—	—	82	18	50-59	16	24	55	5
60-69	3	6	75	16	60-69	9	25	66	—
70-79	3	11	78	8	70-79	16	32	49	3
80-over	3	32	61	4	80-over	21	25	43	11

C. Breakfast Cereals					D. White Potatoes				
Age decade, yrs.	Servings weekly				Age decade, yrs.	Servings weekly			
	0	1-3	4-6	7-over		0-3	4-6	7-13	14-21
30-39	10	42	29	19	30-39	13	52	35	—
40-49	16	42	19	23	40-49	3	55	39	3
50-59	21	42	21	16	50-59	21	63	11	5
60-69	22	31	25	22	60-69	25	53	19	3
70-79	16	32	22	30	70-79	16	54	24	6
80-over	11	25	14	50	80-over	28	54	18	—

E. Vitamin C-rich Fruits					F. Other Fruits				
Age decade, yrs.	Servings weekly				Age decade, yrs.	Servings weekly			
	0-3	4-6	7-13	14-over		0-3	4-6	7-13	14-21
30-39	—	16	65	19	30-39	33	23	42	3
40-49	—	19	52	29	40-49	36	19	45	—
50-59	8	10	61	21	50-59	18	37	40	5
60-69	3	28	60	9	60-69	25	31	25	19
70-79	5	14	54	27	70-79	24	30	35	11
80-over	21	18	54	7	80-over	43	25	32	—

G. Vitamin A-rich (Carotene) Vegetables					H. Other Vegetables				
Age decade, yrs.	Servings weekly				Age decade, yrs.	Servings weekly			
	0-3	4-6	7-13	14-21		0-3	4-6	7-13	14-21
30-39	10	26	61	3	30-39	10	16	58	16
40-49	19	49	19	13	40-49	3	39	52	6
50-59	24	42	34	—	50-59	16	37	37	10
60-69	25	44	31	—	60-69	22	25	50	3
70-79	22	24	51	3	70-79	27	24	46	3
80-over	25	39	32	4	80-over	54	21	21	4

I. Desserts					J. Snacks				
Age decade, yrs.	Servings weekly				Age decade, yrs.	Servings weekly			
	0-6	7-13	14-20	21-over		0	1-6	7-13	14-over
30-39	3	64	23	10	30-39	3	29	36	32
40-49	13	22	39	26	40-49	3	48	36	13
50-59	—	37	47	16	50-59	5	42	32	21
60-69	6	38	47	9	60-69	34	41	19	6
70-79	8	27	51	14	70-79	27	43	22	8
80-over	4	61	28	7	80-over	64	29	7	—

en in the older decades than by those under 50 years of age. In general, however, there was little variation among the different age groups in the choice of meats.

Of the meat alternates, eggs and cheese were most frequently eaten. Eggs represented from 38 to 48% of the meat alternates used and cheese from 40 to 50%. Eggs were consumed by women in the 30 to 39 age dec-

ade through the 60 to 69 decade approximately three and one-half times weekly and by women in the last two decades approximately three times weekly. The consumption of cheese by the different age groups showed little variation.

Ready-to-serve cereals were more popular than those cooked at home with all age groups except the 70 to 79 age groups. Of the ready-to-serve

type, wheat cereals were most frequently chosen, and of the type requiring cooking, oatmeal was first choice.

The vitamin C-rich fruits most frequently reported were oranges, tomatoes, and grapefruit. It should be noted that these were the principal vitamin C-rich fruits available at the season of this study. Oranges were chosen 30 to 39% of the time, tomatoes 15 to 29%, and grapefruit 12 to 21%. Among "other" fruits, apples were first choice followed by bananas and pears. Apples represented from 28 to 37, bananas 9 to 21, and pears 4 to 14% of the "other" fruit choices.

Of the vitamin A-rich (carotene) vegetables, carrots were the most frequently eaten, peas were second in order, cabbage third, and green beans fourth. Carrots accounted for 25 to 32% of the choices from this group, peas 8 to 19%, cabbage 9 to 14%, and green beans 7 to 14%. Among "other" vegetables, lettuce appeared most frequently, 28 to 45% of the number of times that this group was reported; celery, 12 to 33%; and corn, 6 to 13%.

Cakes and cookies combined constituted the dessert 28 to 38% of the time. But vitamin-rich and other fruits were frequently eaten for dessert, the former accounting for 9 to 14% of the choices and the latter 16 to 27%. Ice cream was chosen for dessert 4 to 10% of the time and pie 3 to 9%.

CALORIE AND NUTRIENT CONTRIBUTIONS OF MILK, POTATOES, AND CEREALS AND BREADSTUFFS

The diets of the 78 South Dakota women were studied to determine the percentage of calories and nutrients derived from three commonly used foods—milk, potatoes, and cereal products. The findings are recorded in table 9 in terms of the means for each age decade and the range in individual values (in parentheses).

Mean intakes of calories and nutrients for each of the three types of foods were similar for the different age decades with the exception of cereals and breadstuffs. The calo-

rie and nutrient contributions of breadstuffs increased slightly in the decades following the 50-59 decade, reflecting the relatively higher cereal consumption of the older age groups. Wide individual variations in calories and nutrients were encountered for all age groups for all three foods.

Milk made important contributions to the protein (6 to 12%), calcium (22 to 37%), phosphorus (10 to 18%), and riboflavin (15 to 25%) content of the diets. Potatoes contributed 13 to 22% of the ascorbic acid, 8 to 12% of the niacin, and 7 to 10% of the thiamine.

Cereals and breadstuffs contributed appreciably to the calories and all nutrients of the diet with the exception of vitamin A and ascorbic acid. Cereals and breadstuffs contributed 16 to 25% of the total calories, 16 to 24% of the protein, 11 to 16% of the calcium, 14 to 23% of the phosphorus, 22 to 38% of the iron, 24 to 39% of the thiamine, 13 to 20% of the riboflavin, and 20 to 36% of the niacin.

These figures indicate a higher nutritional contribution to the American diet by cereals and modern bread than is usually accorded these foods.

Summary

This bulletin deals with an investigation of the nutritive intakes of older women estimated from records of weighed diets. It reports one phase of a North Central cooperative study involving women of similar age groups. Data obtained in the other investigations were based on 7-day measured diets (7) and 24-hour recall diets (11).

Subjects for this study were 402 urban women who ranged in age from 30 to 97 years and resided in seven of the North Central States. Cities and states represented were Ames, Iowa; Lansing and East Lansing, Michigan; St. Paul, Minnesota; Lincoln, Nebraska; Columbia, Missouri; Brookings, South Dakota; and Madison, Wisconsin. Trained laboratory workers taught the women to weigh the foods in their

Table 8. Frequency with Which Specified Foods Were Reported in 7-Day Weighed Diets, Minnesota and South Dakota Combined

(Expressed as Percentage of the Number of Times the Food Group Was Reported)

	MEATS (2,010)*						
	Age decades						Total
	30-39	40-49	50-59	60-69	70-79	80-over	
	%	%	%	%	%	%	%
Beef	26	32	31	33	33	32	31
Pork and ham	24	16	16	23	22	17	20
Bacon	11	14	11	12	13	10	12
Lunch meat	16	13	13	5	9	11	11
Fowl	9	10	7	8	4	10	6
Fish	3	3	11	8	10	8	10
Mixed dishes	4	6	4	4	4	6	5
Organ meat	4	4	3	4	2	3	3
Veal	1	1	1	1	2	2	1
Lamb	2	1	2	1	1	1	1
Game	—	—	1	1	—	—	—
Total	100	100	100	100	100	100	100
	VITAMIN A-RICH (CAROTENE) VEGETABLES (1,275)*						
Asparagus	6	9	6	5	7	9	7
Green beans	14	7	8	10	11	12	10
Cabbage	10	11	14	14	9	10	12
Carrots	32	25	30	28	29	29	29
Mixed vegetables	6	8	8	9	6	4	7
Peas	16	16	19	12	17	8	15
Spinach	5	4	3	3	2	3	3
Winter squash	1	5	3	3	4	2	3
Sweet potatoes	3	3	1	2	6	7	4
Others	7	12	8	14	9	16	10
Total	100	100	100	100	100	100	100
	OTHER VEGETABLES (1,386)*						
Beans, lima and wax	3	3	2	1	1	7	3
Beets	4	5	7	4	10	5	6
Celery	24	16	22	28	33	12	23
Cucumbers	—	1	2	1	1	6	1
Corn and hominy	11	6	9	13	9	12	10
Lettuce	39	45	42	35	32	28	28
Onions	6	4	4	8	6	6	6
Parsnips	—	1	—	—	—	2	—
Radishes	—	1	5	3	1	7	2
Miscellaneous	13	18	7	7	7	15	11
Total	100	100	100	100	100	100	100
	VITAMIN C-RICH FRUITS (1,979)*						
Orange and grapefruit juice	—	—	2	3	2	2	2
Grapefruit	17	19	19	21	20	12	18
Lemons	1	1	—	1	2	2	1
Oranges	35	31	33	30	34	39	33
Tangerines	3	2	—	2	1	1	2
Tomatoes	29	23	22	24	19	15	22
Apricots	—	3	3	3	3	4	3
Peaches	9	12	10	7	10	12	10
Prunes	3	4	4	4	3	6	4
Berries	3	5	5	2	—	5	3
Miscellaneous	—	—	2	3	6	2	2
Total	100	100	100	100	100	100	100

(Table 8 continued on next page)

Table 8 (continued)

	MEAT ALTERNATES (1,506)*						
	Age decades						Total
	30-39	40-49	50-59	60-69	70-79	80-over	
%	%	%	%	%	%	%	
Eggs	38	42	48	48	46	39	44
Cheese	43	47	42	40	44	50	44
Legumes	7	4	6	7	4	2	5
Peanut butter	12	7	3	5	6	9	7
Nuts			1				
Total	100	100	100	100	100	100	100
OTHER FRUITS (1,271)*							
Apples	28	29	28	29	37	33	31
Mixed	15	11	11	13	6	11	11
Banana	21	20	16	19	9	18	17
Rhubarb	4	2	2	4	5	8	4
Pears	4	14	8	11	10	14	10
Berries	6	5	11	5	3	3	6
Pineapple, canned	6	10	8	10	5	1	7
Plums	2	4	2	1	1	3	2
Grapes	5	2	3	1	9	3	4
Dried fruit	6	2	3		11	3	4
Figs, fresh	1		3	5	3		2
Miscellaneous	2	1	5	2	2	3	2
Total	100	100	100	100	100	100	100
CEREALS (464)*							
Cooked							
Oatmeal	22	11	18	28	27	18	21
Wheat	8	16	7	12	21	13	13
Corn-meal	1		1	1	2		1
Rice		1	2		14	4	4
Unidentified			1		4		1
Total	31	28	29	41	68	35	40
Cold							
Wheat	36	31	17	22	16	22	23
Corn	14	30	27	12	9	15	17
Bran		5	21	4	1	13	8
Rice	12	1	4	16	3	3	6
Oats	6	5	1	3	3	12	5
Unidentified	1		1	2			1
Total	69	72	71	59	32	65	60
Grand total	100	100	100	100	100	100	100
DESSERTS (2,839)*							
Vitamin rich fruit	11	13	13	9	14	14	12
"Other" fruit	17	16	18	19	22	27	20
Cake	19	20	17	17	18	12	18
Pie	8	6	8	9	3	3	6
Cookies	16	18	19	18	16	16	17
Ice cream	10	8	10	7	5	4	7
Puddings	6	6	4	6	7	6	6
Jello	1	11	1	3	2	5	2
Breads and crackers	1	4	2	4	5	6	4
Fruits and pastry,							
strawberry short cake	1	1	1	2		1	1
others	2		1		1	3	1
Doughnuts				1			
Miscellaneous	8	7	6	5	7	3	6
Total	100	100	100	100	100	100	100

*Numbers in parentheses indicate number of times food group was reported.

self-chosen diets. Each woman recorded the amount she ate daily for 7 or 10 consecutive days.

An evaluation of the nutritive value of the diets reported was made in terms of energy value and 11 nutrients. Calories and nutrients were calculated from tables of food composition in most instances. One state, Nebraska, obtained analyzed values for protein, calcium, and phosphorus.

The foods reported were divided into 10 groups and the percentage of total calories provided by each group was calculated for the 7-day weighed dietaries of the 250 women of Minnesota, Nebraska, and South Dakota. The frequency with which the different food groups and individual foods within each group were eaten was studied. Energy and nutrient contributions of milk, potatoes, and cereal products to the diets of the 78 South Dakota women were calculated.

In the evaluation of data, women of the entire age range in all seven states were considered together and by states. Data for six different age decades 30 to 39 years, 40 to 49, 50 to 59, 60 to 69, 70 to 79, and 80 and above were also evaluated.

Evaluation of Nutritive Intake

The mean daily energy value of the diets of the 402 subjects was 1,748 calories. Mean values for the six age groups ranged from 1,422 for age 80 and over to 1,925 for age 40 to 49. The mean calorie value of the diets of the women in the 30 to 39 year group was approximately the same as for those in the 40 to 49 decade. Protein provided 13% of the total calories, carbohydrate 48%, and fat 39%. The percentage of calories furnished by protein, carbohydrate, and fat showed little variation with age for the different decades.

The mean nutrient intakes for all age groups and the ranges for the groups were:

NUTRIENT	MEAN	RANGE
Protein, gm.	56	46-63
Calcium, mg.	662	531-809
Phosphorus, mg.	1007	845-1162
Iron, mg.	10	8.4-11.0
Vitamin A, I.U.	5900	5200-6800
Thiamine, mg.	0.98	0.87-1.07
Riboflavin, mg.	1.30	1.10-1.53
Niacin, mg.	10	8.00-11.2
Ascorbic Acid, mg.	85	64-100

Mean calorie and protein values of the diets showed a rather consistent decrease from the earlier to the later decades. Most of the low values for calcium, phosphorus, and iron were found in the older age groups, but decreased intakes from the lower decades to the higher were less consistent than with calories and protein. Consistency of pattern as related to age was lacking in vitamin intakes, but with the exception of vitamin A, the lowest intakes were observed in the two oldest decades.

Comparison with NRC Allowances

The mean daily calorie value of the diets of 90% of the women equalled at least 67% of the NRC allowances. The percentage of women with intakes of the various nutrients representing approximately two-thirds or more of the NRC allowances were: protein, 80%; calcium, 60%; iron, 85%; vitamin A, 80%; ascorbic acid, 82%; thiamine, 89%; riboflavin, 76%; and niacin, 99%. Approximately 18% of the women had intakes that were less than one-half of the recommended allowances for calcium, while one-fifth had intakes between 50 and 66%. The highest percentage of women consuming diets that furnished 67 to 99% of the recommended allowances was usually found in the 30 to 39 age group and the lowest in the 70 to 79 or 80 and above age groups.

Mean values do not always give an accurate picture of the nutrient level of diets since low values may be offset by high ones. A study of the distribution of the subjects according to individual dietary intakes showed calorie levels of 1,000 or below at all age decades above 30 to 39. In all age decades some women reported diets with calorie levels between 1,000 and 1,500, the percentage of these low calorie diets increasing in the later decades.

Approximately 10% of the women between the ages of 30 and 49 had diets that furnished less than 1,500 calories. Diets furnishing less than 40 grams of protein, 8 milligrams iron, 6 milligrams niacin, 0.6 milligrams thiamine and riboflavin, 30 milligrams ascorbic acid, and 2,500

Table 9. Calorie and Nutrient Contribution of Milk, Potatoes, and Cereal Products, Percentage of Total to the Diets of 78 South Dakota Women

Age Decade	Cal-ories	Pro-tein	Cal-cium	Phos-phorus	Iron	Vita-min A	Thi-amin	Ribo-flavin	Nia-cin	Ascorbic Acid
Milk										
30-39	7 (0-19)*	11 (0-28)	31 (0-67)	16 (0-43)	1 (0-4)	0 (0-20)	7 (0-19)	24 (0-56)	2 (0-5)	2 (0-7)
40-49	5 (0-11)	9 (0-22)	33 (0-96)	14 (0-30)	0 (0-2)	2 (0-6)	5 (0-12)	18 (9-42)	1 (0-3)	2 (0-3)
50-59	3 (0-11)	6 (0-16)	22 (0-49)	10 (0-21)	0 (0-2)	3 (0-25)	4 (0-13)	15 (0-40)	0 (0-2)	2 (0-26)
60-69	7 (1-15)	12 (2-24)	37 (8-60)	18 (2-32)	1 (0-2)	8 (0-26)	8 (1-15)	25 (4-44)	2 (0-8)	3 (0-6)
70-79	6 (0-19)	10 (0-25)	31 (1-71)	16 (0-40)	0 (0-3)	4 (0-19)	6 (0-19)	22 (0-54)	2 (0-4)	2 (0-6)
80-over	7 (0-18)	9 (0-23)	29 (2-61)	15 (1-35)	1 (0-3)	4 (0-13)	7 (0-22)	21 (1-49)	2 (0-5)	3 (0-10)
Potatoes										
30-39	3 (2-4)	3 (2-4)	1 (0-2)	4 (2-5)	4 (2-6)	0	7 (4-10)	2 (1-4)	8 (5-12)	13 (1-19)
40-49	4 (3-7)	3 (2-6)	2 (0-3)	5 (2-9)	5 (2-10)	0 (0-1)	8 (4-14)	3 (1-5)	9 (5-15)	15 (6-13)
50-59	4 (0-9)	3 (0-8)	1 (0-3)	5 (0-12)	4 (0-14)	0 (0-3)	9 (1-19)	2 (0-6)	9 (1-22)	16 (1-32)
60-69	4 (2-10)	3 (1-8)	2 (2-6)	4 (1-11)	4 (2-11)	0 (0-2)	8 (3-20)	3 (1-9)	8 (3-18)	18 (5-73)
70-79	5 (1-12)	4 (1-9)	2 (0-4)	6 (1-14)	6 (1-15)	0 (0-1)	10 (1-25)	4 (1-8)	12 (2-24)	20 (2-43)
80-over	4 (1-8)	3 (0-7)	1 (0-3)	4 (1-10)	4 (1-10)	0 (0-1)	8 (2-17)	3 (0-6)	8 (2-18)	22 (4-91)
Cereal and Bread Stuffs										
30-39	18 (10-24)	17 (11-24)	11 (5-17)	14 (6-18)	23 (15-32)	1 (0-5)	26 (18-39)	13 (6-19)	21 (2-36)	0
40-49	16 (9-22)	16 (8-22)	11 (5-24)	15 (9-26)	22 (9-44)	1 (0-3)	24 (11-35)	13 (4-22)	20 (8-29)	0
50-59	20 (13-33)	20 (10-34)	14 (6-39)	19 (11-35)	23 (2-49)	12 (0-15)	32 (19-48)	16 (18-40)	29 (11-45)	0
60-69	23 (14-36)	22 (14-39)	16 (9-39)	22 (11-48)	32 (21-50)	2 (0-4)	32 (17-55)	18 (6-36)	30 (12-58)	0
70-79	22 (7-31)	23 (9-38)	16 (3-30)	21 (10-34)	30 (14-54)	1 (0-4)	32 (15-22)	20 (4-32)	27 (12-38)	0
80-over	25 (17-30)	24 (14-31)	16 (8-28)	23 (10-36)	38 (24-48)	2 (0-10)	39 (27-52)	19 (10-31)	36 (22-47)	0

*Figures in parentheses indicate range.

I.U. vitamin A were found in all age groups. Some women in all age groups reported diets furnishing less than 400 milligrams of calcium. These low calcium diets ranged from 8% in the 30 to 39 year decade to 32% in the 70 to 79 year decade.

Differences Among States Noted

Some state differences were observed in the percentage of women whose diets provided 67 to 100% and above of the NRC allowances. A number of factors may have influenced the results. There were small differences in the sampling proce-

dures. The total number of subjects studied and number in each age group varied for the different states. Also there existed some differences in the composition of the population from which samples were drawn and traditional eating patterns may have differed.

A study of the dietaries reported by Minnesota, Nebraska, and South Dakota women revealed only small differences among these states in the calorie contributions of 10 major food groups.

The relatively high milk consumption of the Nebraska women was reflected in a higher mean cal-

cium intake. When percentages of calories from milk were compared with mean calcium levels for the three states, the results were as follows: Nebraska women, with calories from milk representing 10% of total calories, had a mean daily calcium intake of 963 milligrams; Minnesota women, with milk representing 8% of total calories, a mean daily calcium intake of 674 milligrams; and South Dakota women, with milk representing 7% of total calories, a mean daily calcium intake of 528 milligrams.

Food Practices Vary

The majority of the Minnesota and South Dakota women of all ages had at least one serving of meat, fish, or poultry daily. Beef was eaten more frequently than any of the other meats. Meat alternates, usually eggs or cheese, were included in the diet by over half of the women seven or more times per week. A more frequent use of meats and meat alternates was recorded by a higher proportion of the younger age groups than the older ones.

The situation with cereals was reversed: more of the Minnesota and South Dakota women in the older age groups than in the younger consumed cereals once a day or oftener. Ready-to-serve cereals were preferred to cooked cereals by all ages. Wheat cereals were most commonly chosen from among the ready-to-serve cereals and oatmeal from among the home-cooked cereals.

Over half of the women ate potatoes fewer than seven times a week. The 30 to 39 and 40 to 49 age groups reported the most frequent use of potatoes, with over a third eating potatoes 7 to 13 or more times per week.

Vitamin C-rich fruits were included in two-thirds to four-fifths of the diets seven or more times a week. Those usually included were oranges, tomatoes, and grapefruit. Vitamin A-rich (carotene) vegetables were consumed less frequently than the fruits. Carrots were reported more often than any other vegetable in this group, with peas second in order, cabbage third, and green beans fourth.

Vitamin C-rich and other fruits were frequently chosen for dessert, but cakes and cookies were more often the choice. Between meal snacks were more frequent with the younger than the older groups.

Dietary Contributions of Certain Foods

A study of the dietary contributions of three commonly used foods—milk, potatoes, and bread and other cereal products—to the calorie and nutrient content of the diets of South Dakota women emphasized the importance of these foods in the diet. The mean calorie and nutrient contributions from the three foods were similar for the different age decades with the exception of cereals and breadstuffs. The calorie and nutrient contribution of the cereal products increased slightly in the decades following the 50 to 59 year

decade. This reflects the relatively high cereal consumption of the older age group.

Wide individual variations were encountered for all age groups for all three foods. Milk made important contributions to the protein, calcium, phosphorus, and riboflavin content of the diets; potatoes to the ascorbic acid, thiamine, and niacin content; and cereals and breadstuffs to all nutrients with the exception of vitamin A and ascorbic acid.

Enrichment of bread and often other cereal products with the three vitamins and iron and the use of fat-free milk solids in bread have increased the nutritional value of this food group to an extent that often is not fully appreciated.

The need for improvement of many diets at all ages is evident, but this is particularly true of the older age groups. The quality of the diet is, no doubt, one of the important factors in the maintenance of health and vigor in the later decades of life. With increasing numbers of people reaching the age of 65 and over, this has become of great concern.

A similarity was found between the mean nutritive values of the 7-day weighed diets of the 402 women participating in this study and the 24-hour recall diets reported by Swanson et al (11). This similarity becomes striking when a comparison is made of the nutritive values of diets of women in four states studied by both methods.

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