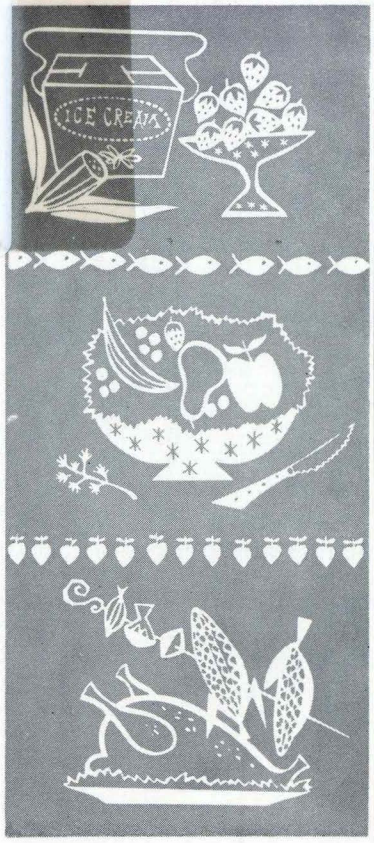

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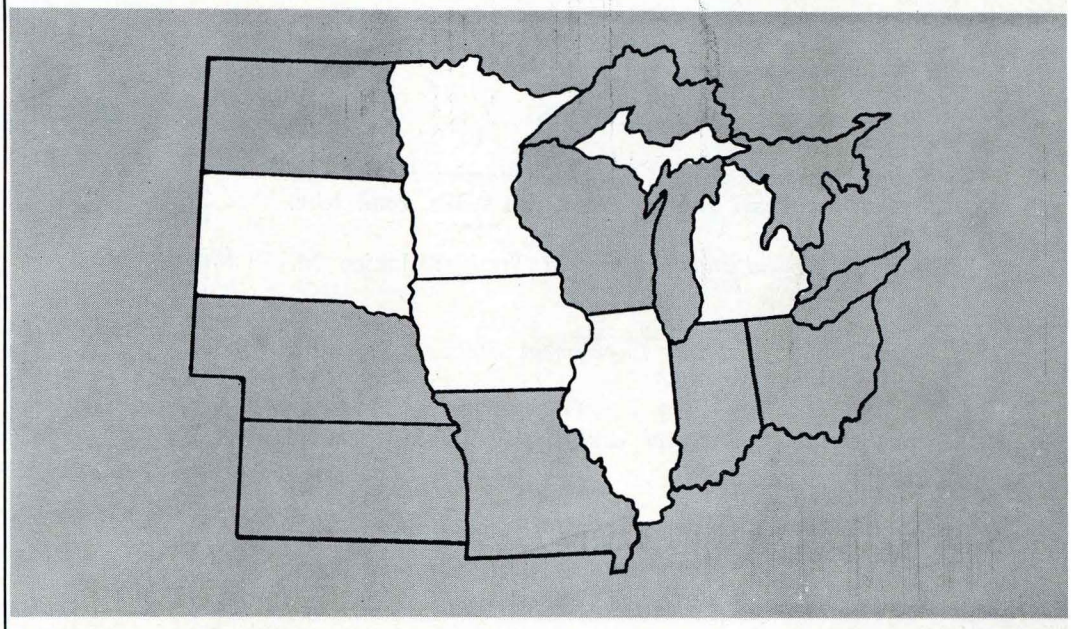
FOOD INTAKES OF 2,189 WOMEN IN FIVE NORTH CENTRAL STATES



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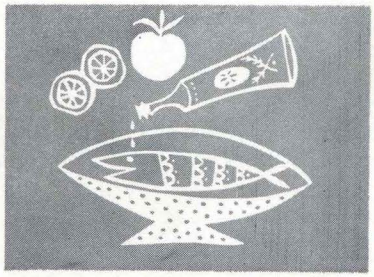

IOWA AGRICULTURAL AND HOME ECONOMICS EXPERIMENT STATION

IOWA STATE COLLEGE, AMES, IOWA

RESEARCH BULLETIN 468

MAY 1959

TECHNICAL COMMITTEE FOR COOPERATIVE NUTRITIONAL STATUS STUDIES IN THE NORTH CENTRAL AREA

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This bulletin is Contribution No. 19, Subproject 1, "The Nutritional Status and Dietary Needs of Older People," of the North Central Regional Cooperative Project NC-5, "Nutritional Status and Dietary Needs of Population Groups."

CONTENTS

SUMMARY

Nearly 2,200 women, ranging in age from 30 to more than 90 years, living in five North Central states, provided the 24-hour dietaries from which data summarized in this bulletin were obtained. The women interviewed in Iowa and South Dakota were selected by area-probability sampling methods, so that they represented all women over 29 years of age in each of these two states. Four other samples were drawn from three urban centers: one from Urbana, Illinois; two (one white, one Negro) from Lansing-East Lansing, Michigan; and one from St. Paul, Minnesota.

The mean nutritive values of 24-hour dietaries reported by the white women in the five samples were similar: Food energy values ranged from 1,665 to 1,780 Cal.; protein values from 53 to 64 gm.; calcium, from 0.44 to 0.64 gm.; iron, from 9.9 to 11.9 mg.; ascorbic acid, from 53 to 75 mg.; thiamine, from 0.9 to 1.1 mg.; riboflavin, from 1.1 to 1.4 mg.; niacin, from 9.2 to 11.0 mg.; vitamin A value, from 4,425 to 6,730 I.U. Individual intakes within each sample varied considerably.

Days' diets of Negro women in the Lansing-East Lansing sample supplied mean amounts of food energy and of all nutrients except vitamin A that were lower than those of dietaries of any group of white women studied.

A considerable number of women in each sample reported days' diets of markedly low nutritive value even though mean amounts of most nutrients in the dietaries from the five groups of white women approximated the allowances recommended by the National Research Council for groups of moderately active women 45 years old. For example, in one sample 30 percent of the 24-hour dietaries provided less than 1,400 Cal., and 20 percent, less than 40 gm. of protein. In another, 83 percent of the dietaries furnished less than 0.60 gm. of calcium and 54 percent, less than 2,500 I.U. of vitamin A. In still another sample, 52 percent provided less than 50 mg. of ascorbic acid. Thus the diets of many women in this age group apparently need improvement, especially in regard to calcium, ascorbic acid and vitamin A.

A special study of data from the Iowa sample indicated that within the dietary pattern characteristic of this group, daily food intakes providing more than 60 gm. of protein in general furnished amounts of iron, thiamine, riboflavin and niacin that met the recommendations of the National Research Council. Conversely, diets of lower protein value were likely to be deficient in these nutrients. The data suggest, therefore, that appraisal of the over-all nutritive value of food intakes falling in the dietary pattern of these women can be made satisfactorily in terms of food energy and four nutrients—protein, calcium, ascorbic acid and vitamin A.

The foundation of the diets of many of the women consisted of bread, butter or margarine, meat and potatoes, and dessert other than fruit. In the Iowa sample, foods reported in more than 90 percent of the days' dietaries were: bread or breakfast cereal, table fat, and meat, poultry and fish. White potatoes appeared in 80 percent of the dietaries; desserts other than fruits, in 73 percent. Vitamin-rich vegetables, vitamin-rich fruits, "other" vegetables, and eggs, cheese and legumes were used in 58 to 69 percent of the dietaries. Fluid milk was present in only 50 percent of the dietaries; "other" fruits in 44 percent.

The percentages of total food energy provided by selected food groups represented in the dietaries were similar in the five samples of white women. Among the dietaries reported in one sample, three of these food groups (meat, poultry and fish; eggs, cheese and legumes; white potatoes) furnished about the same percentage of total food energy in dietaries of high caloric value as in those of low caloric value. Percentages of total energy furnished by fluid milk, fats, sweets and desserts increased as total energy value of dietaries increased, while percentages from cereal products and from both vitamin-rich and "other" fruits and vegetables were lower in dietaries with high caloric value than in those of low value.

Women in each sample were classified in five age groups (i.e., 30-39, 40-49 years, etc.). Mean intakes of most nutrients decreased slightly from the fourth through the seventh decade. Beyond this age, decreases in intakes were more marked. Analysis of data from the Iowa sample indicated that regressions of food energy, protein and calcium values of dietaries on age were significant, but those of ascorbic acid and vitamin A value were not.

In general, the various food groups furnished about the same percentages of total food energy in dietaries of the older women as in those of the younger. The two exceptions were meat, fish and poultry (a less important source of energy in diets of older women than in those of younger) and cereal products (a more important source in diets of older women).

In the two state-wide samples, women in each group living in the open country zone reported dietaries with mean values for energy and nutrients that were generally higher than those of dietaries reported by women of the same age living in rural place zone and urban zone.

Data from five of the samples indicated a possible association of the protein value of the dietary with estimated family net income. No such relationship between energy value of dietaries and family income was apparent.

From 14 to 28 percent of the women in the five samples of white women were more than 20 percent above desirable weight. The mean energy values of diets of these overweight women were from 100 to 200 Cal. below the corresponding values for diets of all women in each sample: 1,440 to 1,650 Cal. compared with 1,665 to 1,780 Cal.

Mean daily food energy values of the diets reported by women, in all of the five samples and in all age groups, whose body weight was within 10 percent of desirable weight were approximately 1,800 Cal. In one area-probability sample, women of normal weight in their 30's reported dietaries with a mean value about 150 Cal. above this figure; women in their 70's, dietaries with a mean value about 200 Cal. below it. These data suggest that 1,600 to 2,000 Cal. per day may be adequate for the maintenance of normal body weight in women more than 30 years old following patterns of activity characteristic of modern life—the requirement decreasing with age.

Food Intakes of 2,189 Women in Five North Central States

Between 1900 and 1950, the total population of the United States increased from about 76 million to 150 million, an increment of 98 percent. During the same period, the number of persons who were 65 years old and older increased by about 270 percent (1). It is estimated that there will be 20 million people in this age bracket by 1975 (2).

Problems—many of them of national significance—are emerging out of this situation. Conservation of human resources is one of the most important of these (3). The productivity and progress of modern society rests, in part at least, on what research can accomplish in prolonging the health, vigor, potential work capacity, satisfactory mental outlook and contentment of older people. Gerontologists and students of nutrition agree that the incidence of these desirable characteristics in older people may be related to their nutritional state (4, 5, 6, 7).

This belief has its basis in present-day concepts of aging. Aging is a process of change that goes on continuously from the time of conception until death. Each developmental level represents a different phase of the aging process. The dramatic changes occurring in infancy and childhood present special problems of nutrition. So do the changes characteristic of senescence. The role of nutrition in this latter period presents a fertile field for investigation.

It has been assumed rather generally that certain changes in physical attributes and mental outlook, commonly found in persons beyond middle age, are inevitable accompaniments of the aging process. But modern research suggests that some of these changes are the result not of aging as such, but of impairment in the nutrition of body cells. Furthermore, certain progressive chronic diseases of late middle life may be the consequence of inadequate cellular nutrition (4, 5).

The nutritional state of an individual is the end point of a series of physiological and biochemical events. It is determined by the kind and quantity of food ingested, the efficiency with which this food is digested, absorbed and transported to the tissue cells, and the adequacy with which it is utilized and its metabolic debris excreted. Aging may produce alterations at one or more points in this chain of events.

The effect of aging on the nutritional needs and status of women over age 30 has engaged the attention of a group of nutritionists from eight of the agricultural experiment stations in the North Central region since 1947. In cooperation with the former Bureau of Human Nutrition and Home Economics, now the Institute of Home Economics of the Agricultural Research Service, USDA, these nutritionists have investigated the following aspects of the problem:

(1) Food intakes of women living in their customary environments and eating their self-chosen diets, and the changes that occur in these intakes as women grow older;

(2) Physical, physiological and nutritional patterns that define apparently healthy women in successive age brackets; and

(3) The effectiveness with which nutrients in self-chosen diets are utilized in meeting physiological requirements.

This bulletin, which deals with the first phase of the investigation, reports the findings from dietary surveys in which information was obtained about the food intakes of 2,189 women ranging in age from 30 to over 90 years, living in five North Central states.

METHODS

A general plan of procedure was developed cooperatively by workers in the five states. The data obtained and the number and kinds of analyses made at each station depended on personnel and other resources available, on responsibilities for other research programs and on the type of sample studied in each state.

Sampling Methods

Six samples were obtained representing groups of women in Illinois, Iowa, Michigan, Minnesota and South Dakota. The characteristics of the populations from which the six samples were drawn within the states and differences among the sampling procedures followed are shown in table 1. Detailed descriptions of the area-probability sampling plans developed for Iowa and South Dakota are on file at the office of the Assistant Director, Iowa Agricultural and Home Economics Experiment Station, MacKay Hall, Ames, and are available upon request.

TABLE 1. POPULATIONS STUDIED AND SAMPLING PROCEDURES USED IN STUDIES OF FOOD INTAKES OF OLDER WOMEN IN FIVE NORTH CENTRAL STATES.

Participating state	Population studied	Sampling procedure	No. of women interviewed
Iowa	All Iowa women, 30 yr. old and over	Area-probability sampling	1,072
South Dakota	All South Dakota women, 30 yr. old and over	Area-probability sampling	339
Illinois	Urbana, Illinois women, 30 yr. old and over	Systematic list sampling with substitution permitted	457
Michigan	Lansing-East Lansing White women, 40 yr. old and over	Systematic block sampling, random subsampling with substitution permitted	97
	Negro women, 40 yr. old and over	Selected nonprobability sampling	104
Minnesota	St. Paul women, 30 yr. old and over	Random block sampling with quota subsampling modified by cooperation and eligibility considerations	120

Collection of Data

INTERVIEWING PROCEDURE

Interviewers visited the women designated in the various samples and obtained the information called for by the schedules. These interviewers were members of research or extension staffs or professional interviewers with considerable experience. They were carefully instructed on the procedures for locating a household and for taking an interview. In some states, special training sessions were held. Details of the interviewing procedures used in the five states are reported in table 2.

Interviewers in Iowa, Minnesota and South Dakota used a schedule prepared in cooperation with the Statistical Laboratory of Iowa State College. Schedules used in Urbana and Lansing-East Lansing, developed in cooperation with statisticians at the two experiment stations, were designed to obtain essentially the same information although they differed from the other schedule in arrangement and detail. Copies of the schedules used are on file at the office of the Assistant Director, Iowa Agricultural and Home Economics Experiment Station, MacKay Hall, Ames.

COLLECTION OF SUPPORTING DATA

Descriptive data about each respondent and her family obtained during the interview provided information about the populations represented by the samples. Some of these data contributed also to the interpretation of the dietary findings.

COLLECTION OF DIETARY DATA

The objective of the present survey was to obtain information about the kinds of diets selected by women living in their customary environments. The 24-hour

TABLE 2. SOME CHARACTERISTICS OF INTERVIEWING PROCEDURE IN THE SIX SAMPLES.

Sample	Interviewers		No. of interviews taken	Days of the week on which interviews were taken	Period within which interviews were taken
	Type	Number			
Iowa	Professional interviewers	3	564	Monday through Saturday*	May-November 1948
	Extension staff	64	472		
	Research staff	3	27		
	Homemaker	1	9		
South Dakota	Extension staff	5	181	Monday through Saturday*	June-November 1949
	Research staff	2	114		
	High school teacher of Home Economics	1	44		
Urbana, Illinois	Research staff	1	457	Monday through Saturday	April-August 1950
Lansing-East Lansing, Michigan					
White women	Research staff	4	97	Tuesday through Friday	December 1947-May 1950
Negro women	Research staff	4	104	Tuesday through Friday	December 1947-May 1949
St. Paul, Minnesota	Research staff	1	120	Monday through Saturday	March 1949-July 1952

*In Iowa, seven interviews were taken on Sunday; in South Dakota, one.

dietary recall was chosen as the tool for obtaining this information. The dietary data collected for each woman consisted of the menus for 1 day's meals and any between-meal snacks eaten during the course of that day. Each woman was asked to recall the kinds and quantities of food eaten at the meal or snack just prior to the interview, then to work backward, meal by meal, over the 24 hours preceding the interview and to report food eaten at or between meals. Respondents estimated the size of servings and described the way the food was prepared.

Although the 24-hour recall is of limited usefulness as a basis for estimating food intakes of *individuals,* it may be used without undue sacrifice of accuracy when information about *groups* of persons is desired (8, 9). The economy in time, effort and monetary cost associated with this method makes possible an increase in both the size and representativeness of the samples from which information is obtained.

Analysis and Presentation of Data

Data from each state were analyzed and summarized separately. Inherent differences in the sampling procedures and in the nature of the six samples made this treatment appropriate.

analysis of supporting data

Information obtained from respondents about themselves and their households was summarized with respect to the following items: age, height, body weight,[1] location of household,[2] marital status, occupation, national extraction, education and estimated family net income.

analysis of dietary data

The nutritive value of the 24-hour recall dietaries obtained from women in each of the six samples was estimated in terms of (1) food energy and 8 nutrients, and (2) food groups represented in the day's meals. Calculations were based solely on food sources of nutrients even though a few women were using vitamin and mineral supplements.

Evaluation in Terms of Nutrients Present

Amounts of food energy and nutrients supplied by the individual food items reported in each dietary and by the entire dietary were found. In this calculation, either the "short method" developed by Donelson and Leichsenring (11, 12) or a modification thereof by Lowenberg et al. (13) was used. The nutritive values of dietaries in a trial sample as determined by these methods checked satisfactorily with data obtained when calculations were based on standard food tables (14).

Mean food energy value, and mean concentrations of protein, calcium, iron, thiamine, riboflavin, niacin, ascorbic acid and vitamin A value are reported, together with standard deviations, for dietaries of the women in each of the six samples. Vitamin A value includes the units of vitamin A provided by the vitamin and by its precursor, carotene. Hereafter the term "vitamin A" will be used instead of "vitamin A value."

The average amounts of the various nutrients supplied by the dietaries were compared with the daily allowances of these nutrients recommended by the National Research Council in 1953 (15). Also, the percentage of women in each sample that failed to obtain amounts of each nutrient equal to specified fractions of the recommended allowances (i.e., two-thirds, one-half, etc.) were calculated.

Evaluation in Terms of Food Groups Represented

A further evaluation of the diets reported by the women in certain samples was based on the extent to which important food groups were represented in them.

In this type of analysis, foods appearing in the diet are often classified in terms of the "Basic Seven" groups (16). In the present study a modification of this classification was used so that the contribution made by certain foods not singled out in this plan might be determined. The modified plan also accounted for total calories and nutrients supplied by the 24-hour dietaries. The 11 groups into which the foods were classified follow:

1. Meat, fish, poultry;
2. Eggs, cheese, legumes;
3. Fluid milk (i.e., milk used as a beverage or on cereals and fruit);
4. Cereal products;
5. Fats;
6. White potatoes;
7. Vegetable sources of vitamin A and ascorbic acid;
8. Other vegetables;
9. Fruit sources of vitamin A and ascorbic acid;
10. Other fruits; and
11. Sweets, pastries and desserts.

A residual group, "soups and miscellaneous," included the few foods that did not belong in one of these 11 groups.

The number and percentage of dietaries in which each of the food groups was represented served as a rough indication of the importance of these groups in diets of older women. For certain of the food groups (meat, fish and poultry, vegetable sources of vitamin A and ascorbic acid, other vegetables, fruit sources of vitamin A and ascorbic acid, and other fruits), the number of times individual foods were reported in dietaries from several of the samples was determined. Estimates of the mean number of calories and percentage of total calories supplied by each food group in dietaries from different samples and in dietaries classified according to their total energy value and by the age of the women

[1] For an estimate of the incidence of overweight, each respondent was assigned to a weight category according to the deviation of her reported body weight from her "desirable weight," defined as average weight of women of her height at age 30 (10).

These categories were: (1) Underweight: more than 10 percent below desirable weight; (2) Normal weight: within 10 percent of desirable weight; (3) Moderately overweight: 11-20 percent above desirable weight; and (4) Excessively overweight: more than 20 percent above desirable weight.

Body weights were estimated by respondents except in the St. Paul sample.

[2] In the classification of households by location, the three following "zones" were defined: (1) Urban zone: all incorporated places of 2,500 or more population (1940 census); (2) Rural place zone: all incorporated places with population less than 2,500 and other places with 1940 population density of at least 100 persons per square mile; and (3) Open country zone: all the area of the state not included in (1) and (2).

reporting them made possible comparisons of the importance of these food groups in the several groups of dietaries.

ANALYSIS OF RELATIONSHIP OF INTAKE OF SPECIFIED NUTRIENTS TO GENERAL CHARACTERISTICS OF RESPONDENTS OR THEIR HOUSEHOLDS

Calculations of the mean energy value and mean protein content of dietaries of women in the Iowa sample grouped according to characteristics of the respondents and their households indicated that only age of respondent, location of household, estimated family net income and classification of body weight were associated with differences in food energy or protein values of the dietaries. On the assumption that the same relationships held in other states, analyses were confined to these four characteristics.

RESULTS

General Characteristics of the Populations Sampled

AGE, HEIGHT, WEIGHT

Data pertaining to the age of the women interviewed in the six samples reflect the differences in the populations sampled and in the sampling methods used. Mean ages of women in the several samples ranged from 49 to 61 years. Age distributions in the Iowa, South Dakota and Urbana samples were roughly similar, with women under age 50 accounting for between 46 and 58 percent of the total (table 3). In the other three samples, women in this age group made up a much smaller percentage of the total (from 1 to 34 percent).

These data on age distributions were useful in the assessment of the validity of the two area-probability samples (table 4). The similarity between the estimates of the number of women in each age group in these two states and corresponding figures from the 1950 Census of Population, together with the internal estimates of reliability obtainable from the data suggest that the dietary information from these samples gave a good picture of the food intakes of all women over age 29 in Iowa and South Dakota in 1948 and 1949.

The 2,189 women ranged in reported height from 53.5 to 72 inches and in reported weight from 75 to 300 pounds. When body weights of the respondents were evaluated in terms of desirable body weights, the percentage of women in the samples of white women who were of normal weight ranged from 39 to 53 percent (table 5). Relatively few women in these samples were underweight (11 to 18 percent). About one-fourth of the women were classified as excessively overweight except in the case of the St. Paul sample.

The tendency toward overweight was more marked in the group of Negro women than in the white samples. Only about one-fourth were of normal weight, and more than 40 percent were excessively overweight. However, standards used for estimating incidence of overweight in a white population may not apply to one of Negro women (17).

LOCATION OF HOUSEHOLD (ZONE)

Four of the six samples were made up entirely of women in urban households. The Iowa and South Dakota samples, however, included women from open country and rural place zones in the proportions in which these groups were represented in the state populations (table 6).

There were marked differences among the three zones in the two statewide samples in distribution of women by age (table 7). In both Iowa and South Dakota, a higher percentage of the women in the rural place zone than in the open country and urban zones were 60 years of age and over. Also the percentages of women under age 40 were less in this zone.

OTHER GENERAL CHARACTERISTICS

Other characteristics of the respondents and their households are of interest not only in themselves but also as they may contribute to the interpretation of data about food intakes of individuals. Certain of these data, summarized in table 8, are of major interest. From 67 to 85 percent of the women in the five samples in which data regarding marital status were obtained were married. From 62 to 88 percent were full-time homemakers. Of the respondents in the Iowa, South Dakota and St. Paul samples, only 10 to 13 percent were gainfully employed. Nearly all of these employed women also carried on homemaking activities. The high degree of industrialization in Lansing-East Lansing probably accounted for the higher proportion (25 percent) of women employed outside their homes in the two samples from this area.

Data about national extraction are not directly comparable (see table 8). The Iowa, South Dakota and Urbana samples, however, resembled each other more than any one of them resembled the St. Paul or the Lansing-East Lansing groups.

More than half of the respondents in the five groups of white women had had more than 8 years of formal education. However, within this broad similarity there was wide variation. The number of years of schooling reported by the Negro women was markedly less than that of the white women.

Information about family net income suitable for presentation in tabular form was not obtained from respondents in all samples. It was clear, however, that the percentage of respondents reporting family net incomes of $4,000 or over was considerably higher in St. Paul than in the other samples, and that the percentage reporting incomes of less than $1,000 was higher in the sample of Negro women than in the other groups.

Dietary Findings

NUTRIENTS PROVIDED BY 24-HOUR DIETARIES

Mean nutritive values of the dietaries reported in the five samples of white women were similar for the most part (table 9) and, except in the case of food energy and of calcium, approached the daily dietary allowances recommended by the National Research Council for women 45 years old, 121 pounds in weight

TABLE 3. DISTRIBUTION OF RESPONDENTS IN THE SIX SAMPLES BY AGE.

Age (years)	Iowa		South Dakota		Urbana, Illinois		Lansing-E. Lansing, Michigan				St. Paul, Minnesota	
							White		Negro			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
30-39	282	26	91	27	122	27	....	....	....	....	20	17
40-49	241	22	105	31	88	19	21	21	1	1	20	17
50-59	232	22	73	22	96	21	28	29	50	48	20	17
60-69	170	16	45	13	96	21	27	28	36	35	20	17
70 and over	147	14	25	7	55	12	21	21	17	16	40	33
All ages	1,072	100	339	100	457	100	97	99	104	100	120	101

TABLE 4. DISTRIBUTION BY AGE OF WOMEN 30 YEARS OLD AND OLDER IN IOWA AND SOUTH DAKOTA AS ESTIMATED FROM SAMPLE SURVEYS, 1948 AND 1949, AND AS REPORTED IN 1950 CENSUS OF POPULATION.

Age (years)	Iowa women, 30 years old and older				South Dakota women, 30 years old and older			
	Sample survey, 1948		1950 Census of Population		Sample survey, 1949		1950 Census of Population	
	No.	%	No.	%	No.	%	No.	%
30-39	167,830	26	178,881	26	34,050	27	42,269	28
40-49	142,010	22	156,621	23	39,090	31	36,201	24
50-59	142,010	22	143,164	21	27,740	22	31,520	21
60-69	103,280	16	111,605	17	16,390	13	23,464	16
70 and over	90,370	14	90,679	13	8,830	7	15,743	11
All ages	645,500	100	680,950	100	126,100	100	149,197	100

TABLE 5. DISTRIBUTION OF RESPONDENTS IN THE SIX SAMPLES BY BODY WEIGHT.

Body weight classification*	Iowa		South Dakota		Urbana, Illinois		Lansing-E. Lansing, Michigan				St. Paul, Minnesota	
							White		Negro			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
More than 10% below desirable weight	121	11	38	11	59	13	17	18	8	8	22	18
Within 10% of desirable weight	467	44	144	42	216	47	38	39	27	26	63	53
11-20% above desirable weight	199	18	63	19	75	16	16	16	18	17	18	15
More than 20% above desirable weight	267	25	94	28	107	24	25	26	44	42	17	14
No information about weight	18	2	0	0	0	0	1	1	7	7	0	0
All classifications	1,072	100	339	100	457	100	97	100	104	100	120	100

*Based on deviation of reported weight from "desirable weight," defined as average weight of women of specified height at age 30.

TABLE 6. DISTRIBUTION OF RESPONDENTS IN THE SIX SAMPLES BY LOCATION OF HOUSEHOLD (ZONE).

Zone*	Iowa		South Dakota		Urbana, Illinois		Lansing-E. Lansing, Michigan				St. Paul, Minnesota	
							White		Negro			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Open country	312	29	168	49	0	0	0	0	0	0	0	0
Rural place	251	23	84	25	0	0	0	0	0	0	0	0
Urban	509	48	87	26	457	100	97	100	104	100	120	100
All zones	1,072	100	339	100	457	100	97	100	104	100	120	100

*See footnote 2, p. 479, for definition of zones.

TABLE 7. DISTRIBUTION OF RESPONDENTS BY LOCATION OF HOUSEHOLD (ZONE)* AND AGE OF RESPONDENT (IOWA AND SOUTH DAKOTA SAMPLES).

Age (years)	Iowa					South Dakota				
	All zones (n = 1,072 respondents)		Open country (n = 312)	Rural place (n = 251)	Urban (n = 509)	All zones (n = 339 respondents)		Open country (n = 168)	Rural place (n = 84)	Urban (n = 87)
	No.	%	%	%	%	No.	%	%	%	%
30-39	282	26	33	20	26	91	27	27	17	36
40-49	241	22	29	17	21	105	31	36	29	23
50-59	232	22	22	20	22	73	22	22	20	22
60-69	170	16	12	20	16	45	13	12	20	9
70 and over	147	14	4	23	15	25	7	3	14	10
All ages	1,072	100	100	100	100	339	100	100	100	100

*See footnote 2, p. 479, for definition of zones.

TABLE 8. DISTRIBUTION OF RESPONDENTS IN THE SIX SAMPLES BY GENERAL CHARACTERISTICS.

Characteristic	Iowa		South Dakota		Urbana, Illinois		Lansing-E. Lansing, Michigan				St. Paul, Minnesota	
							White		Negro			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Marital status												
Single	75	7	14	4			1	1	2	2	6	5
Married	835	78	287	85			71	73	73	70	81	67
Widowed	142	13	33	10	No data		20	21	23	22	31	26
Divorced	12	1	2	*	obtained		3	3	1	1	2	2
Separated	5	1	3	1			2	2	5	5	0	0
No information	3	*	0	0			0	0	0	0	0	0
All classifications	1,072	100	339	100			97	100	104	100	120	100
Occupation												
Homemaker only	874	82	298	88			68	70	65	62	97	81
Homemaker and worker outside home	122	11	34	10			24	25	16	15	12	10
Worker outside home only	23	2	3	1	No data		0	0	10	10	0	0
Helper in home	46	4	2	*	obtained		2	2	5	5	11	9
No occupation	0	0	0	0			3	3	8	8	0	0
No information	7	1	2	*			0	0	0	0	0	0
All classifications	1,072	100	339	99			97	100	104	100	120	100
National extraction†												
Central and Western European	429	40	141	42	142	31	0	0	0	0	12	10
British and Irish	377	35	61	18	226	50	0	0	0	0	9	7
American or don't know	115	11	42	12	56	12	91‡	94	102§	98	67	56
Scandinavian	107	10	83	24	9	2	1	1	0	0	32	27
Others**	27	2	5	2	20	4	5	5	2	2	0	0
No information	17	2	7	2	4	1	0	0	0	0	0	0
All classifications	1,072	100	339	100	457	100	97	100	104	100	120	100
Number of years of formal education												
None	4	*	2	*	0	0	0	0	0	0	0	0
Less than eight	108	10	53	16	36	8	18	19	49	47	7	6
Eight	378	35	98	29	76	17	22	23	18	17	18	15
Nine through eleven	157	15	54	16	79	17	16	16	21	20	8	7
Twelve	228	21	45	13	105	23	15	15	10	10	24	20
More than twelve††	197	19	87	26	157	34	22	23	5	5	63	52
No information	0	0	0	0	4	1	4	4	1	1	0	0
All classifications	1,072	100	339	100	457	100	97	100	104	100	120	100

*Less than 1 percent.
†Respondents in the two Michigan samples were asked where they were born; all others were asked to report their national or racial extraction.
‡Includes five Canadians.
§Includes eight Canadians.
**Includes: Eastern and Southern European, Latin American, Caribbean, Negro and others.
††Includes: attended college, graduated from college, did graduate work, took nurse's training, attended business college.

TABLE 9. NUTRIENTS PROVIDED BY 24-HOUR DIETARIES REPORTED BY WOMEN IN THE SIX SAMPLES: MEANS AND STANDARD DEVIATIONS (s).

Nutrient	Iowa	South Dakota	Urbana, Illinois	Lansing-E. Lansing, Michigan		St. Paul, Minnesota	Recommended daily allowance (1953)*
				White	Negro		
Food energy (Calories)							
Mean	1,735	1,705	1,780	1,665	1,070	1,780	2,100
s	600	545	585	490	395	490	
Protein (gm.)							
Mean	57	57	64	53	43	62	55
s	22	20	23	17	18	17	
Calcium (gm.)							
Mean	0.50	0.50	0.57	0.44	0.34	0.64	0.80
s	0.33	0.33	0.34	0.27	0.23	0.34	
Iron (mg.)							
Mean	11.2	10.9	11.9	9.9	7.8	11.3	12
s	4.3	3.5	4.3	2.8	3.4	3.0	
Thiamine (mg.)							
Mean	1.11	0.96	1.07	0.91	0.66	1.04	1.1
s	0.53	0.40	0.47	0.35	0.38	0.42	
Riboflavin (mg.)							
Mean	1.24	1.20	1.37	1.13	0.86	1.36	1.4
s	0.62	0.59	0.69	0.53	0.53	0.57	
Niacin (mg.)							
Mean	11.0	10.6	10.8	9.2	7.3	10.3	11
s	4.6	3.9	4.7	3.7	3.5	3.7	
Ascorbic acid (mg.)							
Mean	65	55	72	53	44	75	70
s	44	35	51	33	35	44	
Vitamin A value (I.U.)†							
Mean	4,720	4,565	6,585	4,425	4,820	6,710	5,000
s	5,055	4,510	7,230	5,740	7,010	6,290	

*National Research Council's recommendations for normally vigorous women, 45 years of age, and weighing 121 pounds.
†"Vitamin A value" includes the units of vitamin A provided by the vitamin and by its precursor, carotene.

and moderately active (15). Variation in the amount of each nutrient provided by the day's meals of the women within any one of the groups was wide, as indicated by the standard deviations. Although differences among mean nutritional values for these samples were relatively unimportant, the fact that dietaries from the St. Paul and Urbana samples had mean values for most nutrients that were higher than those of dietaries from the other samples suggests their general superiority.

The over-all nutritive value of the dietaries reported by Negro women in the Lansing-East Lansing area was lower than that of the dietaries of any group of white women except for vitamin A. Nutritionists working with this group observed that the pattern of food intake followed a cycle determined by paydays. Thus, meals consumed on Saturdays and Sundays—days not covered by this survey—may have been better nutritionally than those eaten during the rest of the week.

Food Energy

The mean energy values of the 24-hour diets reported by the five groups of white women fell between 1,665 and 1,780 Cal., with standard deviations from 490 to 600 Cal. The mean caloric value of the food intakes reported by the Negro women was 1,070 Cal. per day, with a standard deviation of 395 Cal. The suggestion, implicit in these data, that women today are selecting diets of low caloric value was supported by determinations of the heats of combustion of weighed diets chosen by another group of women in the same age bracket (18). The average energy value of the diets of this group, after correction for energy losses in stools and urine, was 1,710 Cal. per day.

The average energy values of the self-chosen diets as recalled by groups of women in the various North Central states were also similar to estimates made by other investigators. Clark and Fincher (19) studied the nutritive value of 1-day dietaries of more than 1,000 homemakers in four cities in 1948. Average caloric values of dietaries collected from these four groups of women ranged from 1,720 to 1,850 Cal. These authors also reported mean food energy values for diets of 17 groups of women studied in eight other investigations. The mean values ranged from 1,150 to 2,050 Cal. Only one of the average values was below 1,600 Cal.; eight were between 1,600 and 1,800 Cal. In more recently reported studies (20, 21), mean energy values of diets recorded for 7-day periods by women living in several western states were: for 21 Utah women 25 to 49 years of age, 1,885 Cal.; for 96 Colorado women 50 to 89 years of age, 1,535 Cal.; and for 274 California women over 50 years of age, 1,680 Cal.

It appears, therefore, that the daily caloric allowances as defined by the National Research Council (15) for moderately active women exceed the mean energy values of diets customarily chosen by several groups of women past age 30.

The mean values, presented thus far in this report as estimates of caloric intake, indicate central tendencies and provide useful summaries of diverse data. However, the dispersion of the data in any one sample is itself important. This may be measured by the size of the standard deviation (table 9) and by the frequency distributions of individual intakes. The latter are useful in that they suggest the extent to which under- and overnutrition may be present in the population group being studied.

For example, it is apparent from fig. 1 that a considerable proportion of the women in each sample reported day's dietaries supplying fewer than 1,400 Cal. —that is, less than two-thirds of the recommended daily allowance for moderately active women 45 years of age. Relatively few dietaries furnished more than 2,800 Cal. per day.

To summarize the situation, the data were collected in broader class intervals (table 10). Most striking is the large percentage of dietaries (ranging from 52 to 96 percent in the six samples) providing fewer than 1,800 Cal.

Caloric intakes below 1,200 Cal. are not considered adequate for meeting the energy needs of healthy, active women. A fairly large number of diets fell in this caloric bracket. Chronic or temporary ill health, efforts to lose weight, low income, and advanced age as well as other special circumstances like housecleaning, husband's absence from home, or crowded social schedule

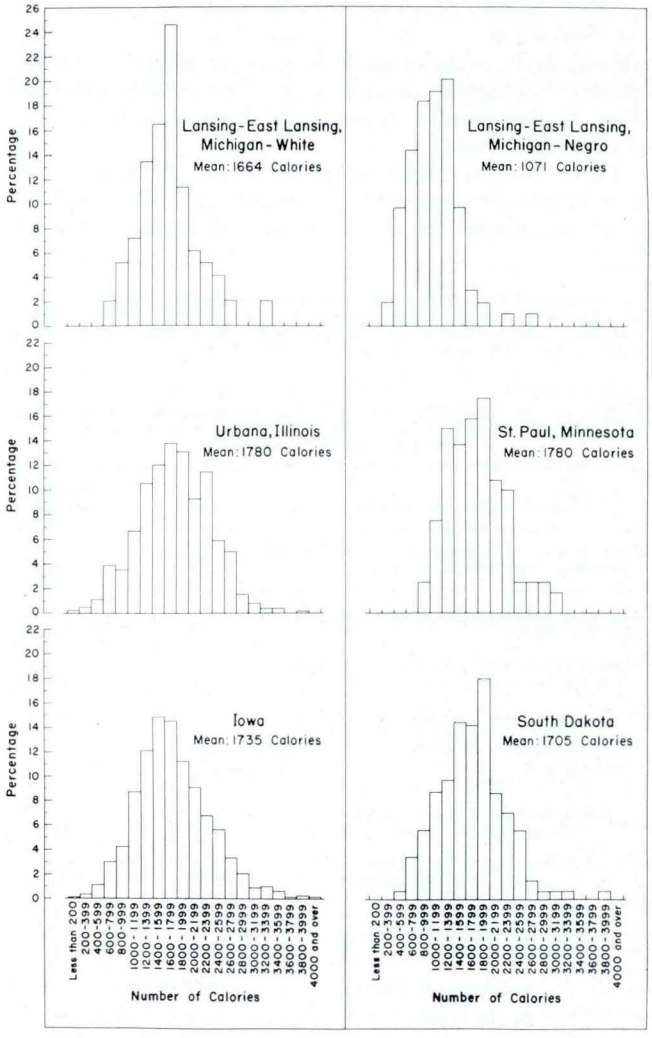

Fig. 1. Percentage of daily diets of specified food energy value—six samples.

TABLE 10. PERCENTAGE DISTRIBUTION OF RESPONDENTS IN THE SIX SAMPLES BY NUTRIENT VALUE OF 24-HOUR DIETARIES.

Value of nutrient in dietaries	Iowa	South Dakota	Urbana, Illinois	Lansing-E. Lansing, Michigan		St. Paul, Minnesota
				White	Negro	
No. of respondents	(1,072)	(339)	(457)	(97)	(104)	(120)
FOOD ENERGY						
Fewer than 1,400 Cal.	30%	28%	26%	28%	84%	25%
1,400 - 1,799 Cal.	29	29	26	41	12	28
1,800 - 2,199 Cal.	20	27	22	18	2	28
2,200 Cal. and over	21	16	26	13	2	19
PROTEIN						
Less than 20 gm.	3	2	3	2	9	0
20 - 39 gm.	17	17	10	18	38	10
40 - 59 gm.	40	36	36	46	36	38
60 gm. and over	40	45	51	34	17	52
CALCIUM						
Less than 0.30 gm.	23	30	20	33	49	14
0.30 - 0.59 gm.	45	40	42	50	36	44
0.60 - 0.89 gm.	19	18	23	10	13	24
0.90 gm. and over	13	12	15	7	2	18
ASCORBIC ACID						
Less than 50 mg.	44	52	37	42	62	26
50 - 99 mg.	36	38	39	52	31	52
100 mg. and over	20	10	24	6	7	22
VITAMIN A						
Less than 2,500 I.U.	34	36	21	54	56	24
2,500 - 4,999 I.U.	39	38	42	25	16	33
5,000 - 9,999 I.U.	17	15	20	10	14	18
10,000 I.U. and over	10	11	17	11	14	25

appear to have accounted, in part, at least for the extremely low energy value of more than two-thirds of the diets in this bracket reported by Iowa and South Dakota women (table 11).

Diets low in energy value are likely to be deficient also in protein and other nutrients (22, 23). Values[3] of r^2, calculated for the regression of protein value on calorie value of dietaries in the Iowa, South Dakota, Lansing-East Lansing and St. Paul samples, showed that variation in food energy value accounted for 46 to 64 percent of the variation in protein value of the dietaries. Other analyses, to be discussed later, showed a close association of values for iron and the B-vitamins with protein value. Hence, diets of low energy value like those reported by women studied in these surveys represent a complex nutritional problem.

The relationship between caloric value of dietaries and body weight of respondents is discussed in a later section.

The percentages of total calories provided by protein, carbohydrate and fat were similar in the six samples (table 12). Percentages supplied by protein ranged from 13 to 17; by carbohydrate, from 43 to 47; and by fat, from 39 to 43 percent. In 1948, approximately the time when the present surveys were made, estimates of comparable percentages based on amounts of protein, carbohydrate and fat available for consumption per capita per day in the United States were 12, 49 and 39 percent, respectively (24).

Mean grams of protein, carbohydrate and fat provided by dietaries consumed by groups of women have been reported by several workers. Youmans et al. studied 229 white and 96 colored women (25); Beaudoin and Mayer, 269 women (26); Gillum and others, 274 women in seven age groups (27); and Wilcox et al., 21 Utah women and 96 Colorado women (20). Percentages of total calories provided by protein varied between 13 and 16 percent among the several groups of women studied. Division of the remaining energy value between carbohydrates and fat showed wider variation. Percentage of total calories supplied by carbohydrates was as low as 40 percent and as high as 55; percentage from fat, as low as 29 (for the group of colored women studied by Youmans) and as high as 46 percent.

3 r^2=square of the simple product moment correlation=proportion of the variation in the variable estimated (in this case, protein value) associated with the predictor variable (in this case, food energy value). This statistic is often described as the coefficient of determination.

TABLE 11. SUGGESTED REASONS FOR CONSUMPTION OF FOOD PROVIDING FEWER THAN 1,200 CALORIES DAILY (IOWA AND SOUTH DAKOTA SAMPLES).

Information from schedules	Iowa	South Dakota
Total number of schedules reporting dietaries providing less than 1,200 Cal.	187	58
Number of schedules providing *no* explanation for low intakes	53	18
Number of schedules providing *some* explanation for low intake	134	40*
Respondent ate *less than usual* on day of dietary report because of:		
Temporary ill health	9	0
Other reasons	23	9
Respondent ate *as usual* but was:		
Chronically ill	42	12
Attempting to lose weight—		
Under medical direction	10	8
On her own initiative	19	5
Limited in choice of food by—		
Low income	6	2
Poor dental conditions	4	5
70 years old or older	21	9

*Seven South Dakota women provided more than one possible explanation of their low caloric intakes.

TABLE 12. MEAN INTAKES OF PROTEIN, CARBOHYDRATE AND FAT, AND PERCENTAGES OF TOTAL FOOD ENERGY PROVIDED BY EACH NUTRIENT IN 24-HOUR DIETARIES (SIX SAMPLES).

Sample	Number of women reporting	Mean intake				Percentage of total food energy		
		Food energy	Protein	Carbohydrate	Fat	Protein	Carbohydrate	Fat
		(Cal.)	(gm.)	(gm.)	(gm.)	(%)	(%)	(%)
Iowa	1,072	1,735	57	202	80	13	46	41
South Dakota	339	1,705	57	198	76	13	47	40
Urbana, Illinois	457	1,780	64	191	86	14	43	43
Lansing-E. Lansing, Michigan								
White	97	1,665	53	187	79	13	45	42
Negro	104	1,070	43	113	47	17	43	40
St. Paul, Minnesota	120	1,780	62	213	77	14	47	39

Protein

On the average, the protein intakes of the five groups of white women appeared to be good, ranging from 53 to 64 gm. per day (table 9). On the other hand, the Negro women in Lansing-East Lansing selected diets providing only 43 gm. daily.

The protein values of diets of 21 groups of women have been reported in 11 other studies (19-23, 25, 28-32). The lowest mean value was 34 gm. per day for 24 women in a low-income group in Texas (28); the highest, 69 gm. for 277 homemakers in San Francisco (19). Fifteen of the 21 means fell between 53 and 64 gm.; i.e., within the range of the mean values reported in the present study for the five samples of white women.

Distribution of the North Central dietaries by their protein values indicated that a substantial number of individuals in each sample chose diets providing less than the recommended daily amounts of protein (fig. 2). Even in the Urbana and St. Paul samples, in which the dietaries reported contained on the average more than 60 gm. per day, 13 and 10 percent of the women, respectively, obtained less than 40 gm. daily (table 10). In the other samples of white women, 19 to 20 percent of the dietaries provided less than 40 gm. of protein daily. In the case of the Negro women (mean protein value of dietaries, 43 gm.), 47 percent obtained less than 40 gm. of protein.

Forty grams of protein is a little less than three-quarters of the daily allowance of 55 gm. recommended for middle-aged women by the National Research Council. In the light of recent research it may be questioned whether women whose diets supply less than this amount are adequately nourished in terms of protein (23, 33, 34).

In addition to furnishing inadequate nitrogen, low dietary protein is likely to be accompanied by inadequacies in other nutrients. Certain B-vitamins and iron are found chiefly in natural foods rich in protein. Studies by Jeans, Smith and Stearns (35) suggested that mean daily protein intake might be used as an index of the adequacy of the "entire diet" for groups with dietary patterns similar to those of the pregnant women of low income who were their subjects. The relationship between protein and other nutrients in diets chosen by women in the less specialized samples used in the present study indicated that the hypothesis of Jeans et al. applied in modified form within the meal patterns represented: Protein intake was a satisfactory index of the adequacy of thiamine, riboflavin, niacin and iron, but not of the adequacy of calcium, ascorbic acid and vitamin A.

For example, as protein values of the Iowa dietaries increased from less than 30 gm. to 100 gm. and over, mean intakes of the three B-vitamins, iron and calcium all increased fourfold (table 13). Mean values of thiamine and niacin equalled or exceeded amounts recommended by the National Research Council in all groups of diets with protein levels of 50 gm. or more, but were below these amounts in groups of diets with lower protein values. Mean values of iron and riboflavin

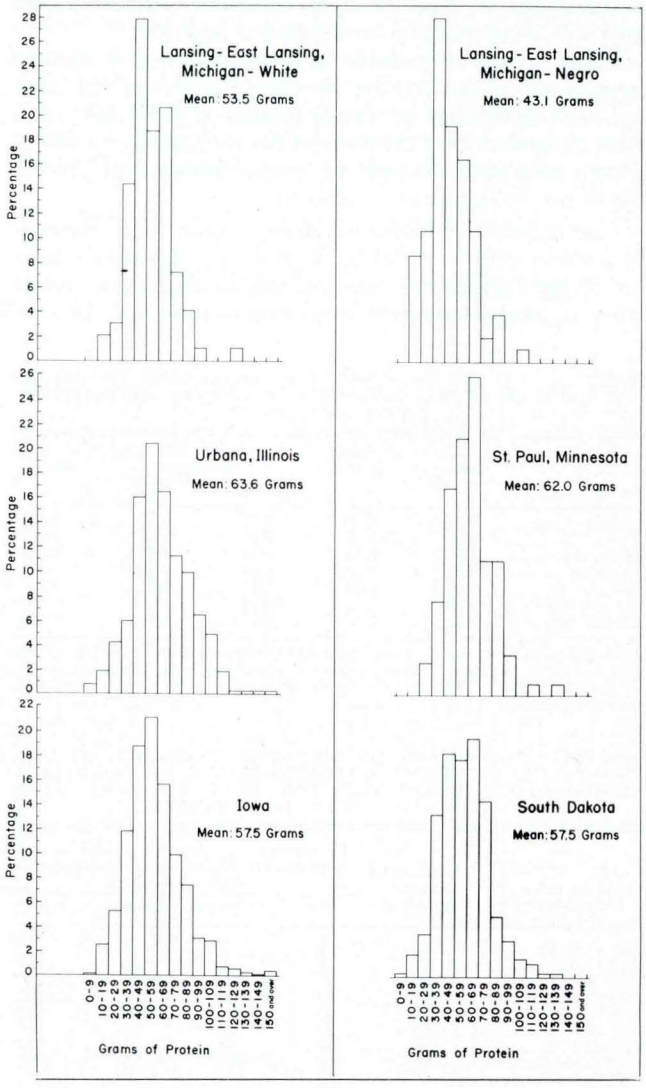

Fig. 2. Percentage of daily diets of specified protein value—six samples.

TABLE 13. ENERGY AND SEVEN NUTRIENTS PROVIDED BY 24-HOUR DIETARIES CLASSIFIED BY PROTEIN VALUE (IOWA SAMPLE).

Protein value of dietaries	Number of dietaries reported	Mean values							
		Food energy	Thiamine	Riboflavin	Niacin	Iron	Calcium	Ascorbic acid	Vitamin A
(gm.)		(Cal.)	(mg.)	(mg.)	(mg.)	(mg.)	(gm.)	(mg.)	(I.U.)
Less than 30	85	855	0.49	0.53	4.6	5.1	0.22	37.5	2,910
30-39	125	1,185	0.72	0.79	7.0	7.1	0.30	49.2	3,360
40-49	201	1,485	0.88	0.93	8.9	9.1	0.36	57.5	4,030
50-59	226	1,690	1.09	1.17	10.7	10.9	0.46	69.3	4,750
60-69	167	1,910	1.17	1.42	12.2	12.5	0.58	72.4	5,465
70-79	105	2,100	1.40	1.55	13.7	13.9	0.62	74.3	4,870
80-89	79	2,400	1.64	1.82	15.8	15.7	0.74	87.7	5,580
90-99	33	2,545	1.59	2.13	16.4	16.9	0.96	91.4	6,730
100 and over	51	2,860	2.10	2.29	20.1	20.4	0.98	69.6	8,325
All dietaries	1,072	1,735	1.11	1.24	11.0	11.2	0.50	65.2	4,720

equalled or exceeded recommended levels in groups of diets providing more than 60 gm. of protein daily.

Mean calcium intakes reached the recommended level of 0.8 gm. only in the groups of diets with protein values of 90 gm. or more, although calcium values increased steadily as dietary protein increased. The low mean calcium values of diets supplying adequate amounts of protein in large part are a reflection of the meager use of milk by Iowa women. Except for milk, foods rich in protein supply little calcium. Hence in diets like those reported in the Iowa sample, adequate protein intake does not insure satisfactory calcium intake.

Mean values of ascorbic acid and vitamin A also increased as protein intakes increased. However, the high standard deviations for mean intakes of these two vitamins suggested that differences between mean values of groups of dietaries supplying graded amounts of protein might not be important (table 9).

Coefficients of determination, which are presented for five samples in table 14, provide a statistical measure of the associations between intakes of protein and of other nutrients that were suggested in table 13. In general, variation in protein intake accounted for more than 40 percent of the variation in intakes of iron, thiamine, riboflavin and niacin. Corresponding values for calcium were definitely lower, and those for ascorbic acid and vitamin A suggested that values for these vitamins were almost wholly unrelated to the protein in the diet.

Data in table 15 based on the Iowa sample further support the hypothesis that adequacy of iron, thiamine, riboflavin and niacin may be assumed in diets supplying generous amounts of protein. About 90 percent of the diets supplying 60-69 gm. of protein provided at least two-thirds of the recommended allowances of thiamine and riboflavin, and more than 95 percent of the diets provided more than these amounts of niacin and iron. At higher levels of protein intake, practically 100 percent of the diets furnished two-thirds of the allowances for all four nutrients.

On the basis of these findings regarding the relation of values of iron, thiamine, riboflavin and niacin to levels of dietary protein, adequacy of diets in terms of these nutrients has not been discussed in detail in this bulletin. It is believed that the total nutritive value of the diets can be assessed satisfactorily in terms of food energy, protein, calcium, ascorbic acid and vitamin A.

TABLE 14. VALUES OF r^2 FOR THE REGRESSION OF INTAKE OF EACH OF SEVEN NUTRIENTS ON INTAKE OF PROTEIN (FIVE SAMPLES).*

Nutrient	Iowa	South Dakota	Lansing-E. Lansing, Michigan		St. Paul, Minn.
			White	Negro	
Iron	0.71	0.75	0.52	0.37	0.62
Niacin	0.62	0.47	0.55	0.57	0.50
Riboflavin	0.50	0.54	0.42	0.29	0.46
Thiamine	0.49	0.51	0.31	0.42	0.42
Calcium	0.34	0.38	0.42	0.22	0.37
Ascorbic acid	0.06	0.02	0.04	0.005	0.09
Vitamin A	0.05	0.05	0.02	0.001	0.03

*r^2=square of the simple product-moment correlation=proportion of the total variation of the variable estimated associated with variation in the predictor variable. This statistic, r^2, is often referred to as the coefficient of determination.

TABLE 15. PERCENTAGE OF DIETARIES, CLASSIFIED BY PROTEIN VALUE, PROVIDING APPROXIMATELY ⅔ OF THE RECOMMENDED DAILY ALLOWANCES FOR IRON, THIAMINE, RIBOFLAVIN AND NIACIN (IOWA SAMPLE).

Protein value of dietaries (gm.)	Number of dietaries reported	Percentage of dietaries providing approximately two-thirds of recommended daily allowances			
		Iron	Thiamine	Riboflavin	Niacin
Less than 20	28	0	0	0	0
20-29	57	12	9	10	10
30-39	125	37	41	26	38
40-49	201	84	63	38	79
50-59	226	99	84	66	89
60-69	167	99	92	87	96
70-79	105	100	99	97	97
80-89	79	100	100	97	100
90-99	33	100	100	100	100
100 and over	51	100	100	100	100
All dietaries	1,072	82	74	66	78

Calcium

The calcium values of the diets were less satisfactory than those of any other nutrient—an observation in accord with findings of Clark and Fincher (19), Wilcox et al. (20) and Young and Pilcher (32).

Mean daily calcium intakes of the five groups of white women participating in the present study ranged from 0.44 to 0.64 gm. with standard deviations from 0.27 to 0.34 gm. (table 9). The mean intake of the Negro women was 0.34 gm. with a standard deviation of 0.23 gm. Thus, mean values for the diets in all samples were well below the recommended allowance of 0.8 gm. daily. Only the St. Paul women reported dietaries that, on the average, supplied as much as three-quarters of this allowance; i.e., 0.6 gm.

In eight studies reported in the literature covering 15 groups of women, six groups had dietaries with mean daily calcium values of 0.6 gm. or less (the lowest being 0.38 gm.). Four of the groups reported dietaries with mean calcium values above 0.6 gm. but below 0.8 gm.; the remaining five groups had mean calcium values between 0.91 and 1.03 gm. (19, 20, 22, 23, 28, 29, 31, 32).

Many women in each of the North Central samples chose diets strikingly low in calcium (fig. 3). The percentage of women obtaining less than 0.6 gm. of calcium from their 24-hour dietaries ranged from 58 percent

(St. Paul) to 85 percent (Lansing-East Lansing, Negro) (table 10). In all but one sample (St. Paul), at least 20 percent of the women selected diets providing less than 0.3 gm. of calcium.

Within the dietary pattern characteristic of adult women in the United States, foods other than milk and milk products can be expected to supply, on the average, in the neighborhood of 0.3 gm. of calcium daily. This means that the equivalent of about 2 cups of milk needs to be included in the diet if an intake of 0.8 gm. daily is to be insured. The milk consumption by women in three of the samples studied throws light on the low mean calcium values characteristic of their diets: The dietaries of only 13, 16 and 19 percent of the women in Iowa, South Dakota and St. Paul, respectively, contained 2 cups of milk or more, even when the milk in cream soups, puddings, white sauce or ice cream was taken into account.

Ascorbic Acid

Mean amounts of ascorbic acid supplied by food sources in 24-hour dietaries reported by the five groups of white women ranged from 53 to 75 mg. with standard deviations from 33 to 51 mg. (table 9). Mean intake for the Negro women was 44 mg. with a standard deviation of 35 mg. The diets of women in samples in Urbana and St. Paul were markedly superior in ascorbic acid: For both of these groups of women, mean daily intakes of this nutrient were above the 70 mg. recommended by the National Research Council.

Mean ascorbic acid values of dietaries of 10 other groups of women reported in five studies (19, 20, 31, 32, 36) ranged from 36 to 86 mg. Values for seven of the 10 groups were below the recommended 70 mg. The two mean values above 80 mg. (81 and 86 mg.) were reported for dietaries of groups of women living in California.

There was wide variation in the individual intakes in each of the six samples (fig. 4 and table 10). More than 100 mg. of ascorbic acid daily were provided by about 20 percent of the dietaries from the Iowa, Urbana and St. Paul samples. On the other hand, less than 50 mg. were supplied by more than one-third of the dietaries from five of the six samples. Similarly, among the individuals in the four urban samples of homemakers studied by the U. S. Department of Agriculture (19), percentages of dietaries providing 110 mg. of ascorbic acid or more ranged from 23 to 37 percent; percentages providing less than 50 mg., from 34 to 51 percent.

High variability in individual intakes of ascorbic acid undoubtedly is related to the fact that very few foods

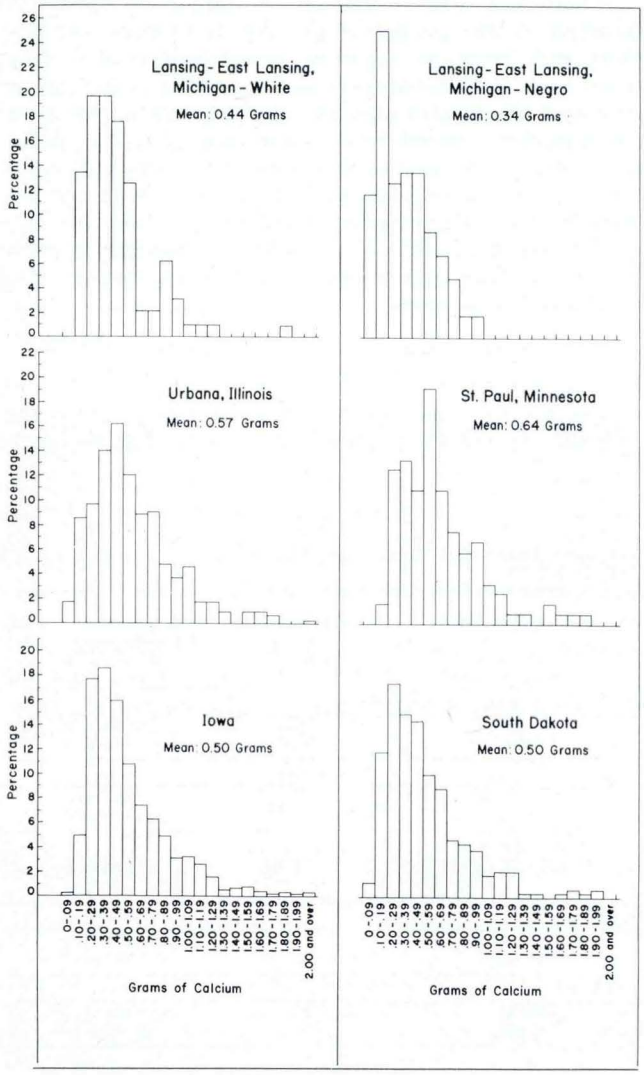

Fig. 3. Percentage of daily diets of specified calcium value—six samples.

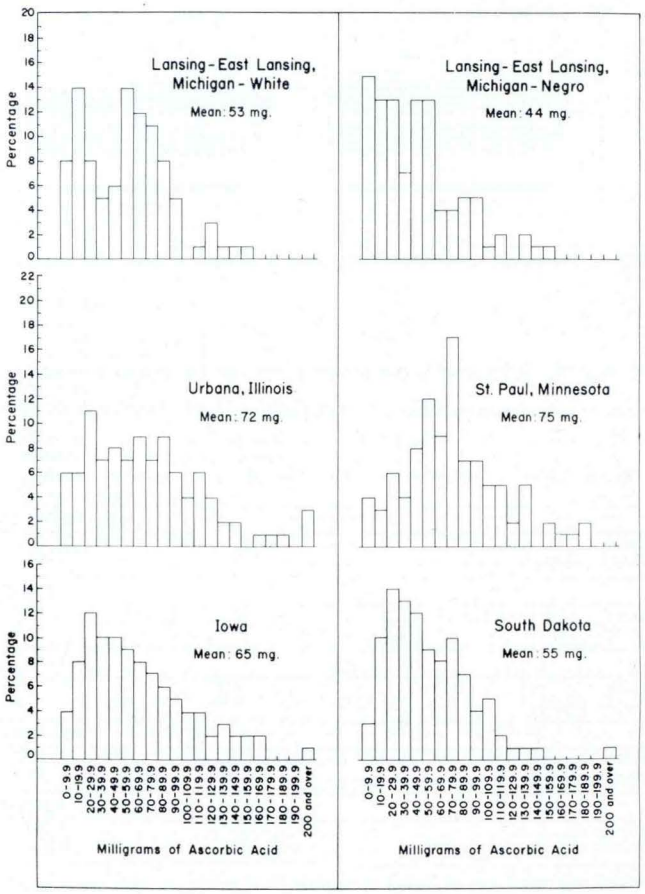

Fig. 4. Percentage of daily diets of specified ascorbic acid value—six samples.

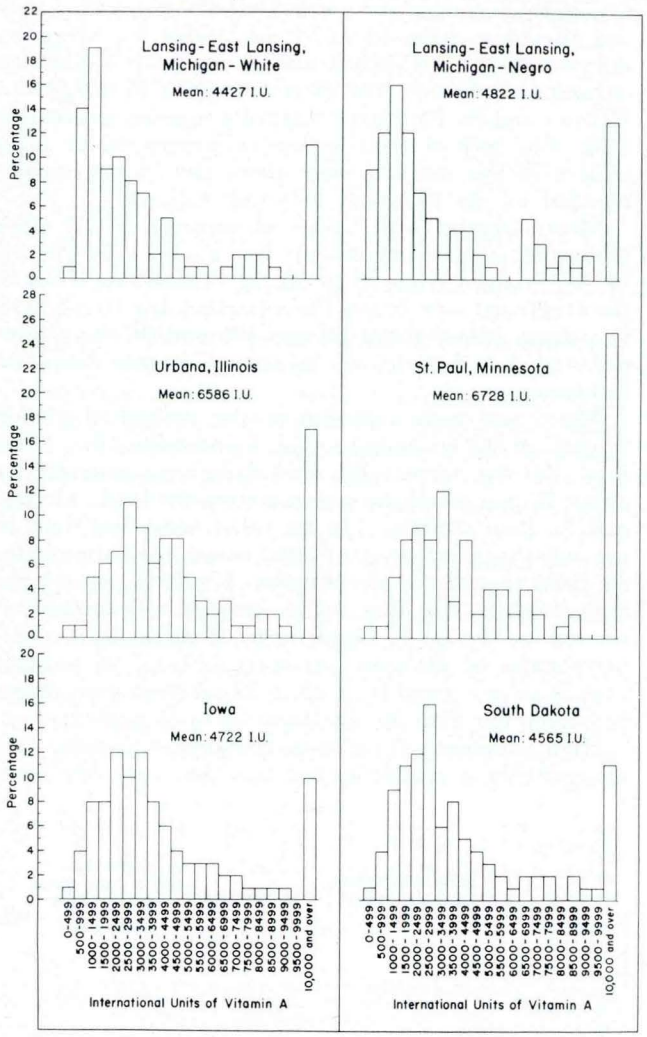

Fig. 5. Percentage of daily diets of specified vitamin A value—six samples.

are rich in this nutrient. In a group of dietaries, a few individual intakes above 100 mg. may offset a considerable number of dietaries with low values. Hence, as was the case among the North Central women, mean intakes may appear satisfactory for groups of dietaries in which a large proportion of individual intakes are considerably below desirable levels.

Vitamin A

Mean daily intakes of vitamin A by the groups of women in Urbana and St. Paul were well above the recommended 5,000 I.U. and only for the white women in Lansing-East Lansing did the mean vitamin A value of the food ingested fall below 4,500 I.U. daily (table 9). Despite the fact that mean daily intakes of other nutrients by Negro women were very low, mean values for vitamin A were good.

In five other studies covering dietaries of 10 groups of women, mean values for vitamin A concentrations were above 5,000 I.U. for all groups. For all but one group, mean values were above 6,300 I.U., and for four of the groups, they were above 8,400 I.U. (19, 20, 31, 32, 37).

There was wide variation in individual intakes of vitamin A by women in the North Central samples: Standard deviations in some instances exceeded mean values. A large proportion of the women in each group received inadequate amounts of this nutrient from food on the day covered by the interview (fig. 5). About one-third of the women interviewed in Iowa and South Dakota and more than half of the women in the two samples from Lansing-East Lansing reported diets supplying less than 2,500 I.U. (table 10). Smaller fractions of the dietaries of the women in Urbana and St. Paul fell into this category.

State Estimates of Mean Nutritive Values of Diets

Dietary findings reported thus far have related specifically to the six populations studied. The design of

TABLE 16. ESTIMATES OF MEAN INTAKES OF FOOD ENERGY AND FOUR NUTRIENTS FOR ALL WOMEN 30 YEARS OLD AND OLDER IN IOWA AND SOUTH DAKOTA.

State	Simple mean $\overline{X}$	Weighted mean* R_s	Mean square error $V(R_s)$	Root mean square error $s(R_s)$	95% confidence interval for state mean intake $R_s \pm 2_s (R_s)$
FOOD ENERGY (Cal.)					
Iowa	1,735	1,745	428	20.67	1,705-1,785
South Dakota	1,705	1,710	1,218	34.90	1,640-1,780
PROTEIN (gm.)					
Iowa	57.5	57.7	0.58	0.76	56.2-59.2
South Dakota	57.5	57.5	1.58	1.26	55.0-60.0
CALCIUM (gm.)					
Iowa	0.50	0.50	0.0001	0.011	0.48-0.52
South Dakota	0.50	0.51	0.0003	0.017	0.48-0.54
ASCORBIC ACID (mg.)					
Iowa	65.2	65.2	2.49	1.6	62.0-68.4
South Dakota	54.9	54.9	4.21	2.1	50.7-59.1
VITAMIN A (I.U.)					
Iowa	4,720	4,760	34,141	185	4,390-5,130
South Dakota	4,565	4,575	55,689	236	4,105-5,050

*Ratio for the state, estimated by applying weights to the zone ratios as follows:

	Open country	Rural place	Urban
Iowa	0.3221	0.2282	0.4497
South Dakota	0.4926	0.2533	0.2541

the Iowa and South Dakota samples, however, provided statistically reliable estimates of the nutrient intakes of all women 30 years of age and older in these two states.

Thus, the mean daily protein intake, for instance, of the 1,072 women in the Iowa sample was a reliable estimate of the mean daily protein intake of about 645,000 Iowa women over 29 years of age. Similarly, the mean daily protein intake of the 339 women in the South Dakota sample was a reliable estimate of the mean daily protein intake of about 126,000 South Dakota women in the same age group.

The best estimates of mean daily intakes of food energy, protein, calcium, ascorbic acid and vitamin A by all women over 29 years of age in Iowa and South Dakota are the weighted mean values for the two states appearing in table 16. The 95-percent confidence intervals shown in the last column (table 16) indicate the range below and above each estimate within which the value for the universe is located unless a 1-in-20 chance occurred in the sampling. These intervals are somewhat wider for estimated values for South Dakota than for corresponding values for Iowa because the South Dakota sample was smaller than the Iowa one.

The procedures used in obtaining the sample of women interviewed in Urbana and the sample of white women interviewed in Lansing-East Lansing made it impractical to calculate similar measures of the precision of estimates based on data from these samples, although data obtained in these two cities may be thought of as reasonably typical of all white women in the specified age groups in the cities where the samples were selected.

Data obtained from the group of St. Paul women and from Negro women interviewed in Lansing-East Lansing applied only to the individuals from whom they were obtained.

SELECTED FOOD GROUPS IN DIETARIES

The extent to which important food groups are represented in the day's diet is another index for estimating nutritional adequacy of food eaten. Indeed, this approach may be more effective in educational programs than one based on nutrients provided. This procedure seemed justifiable and useful in an evaluation of the dietary adequacy of the meals of the individuals in population groups studied in this survey, even though it is recognized that the number of foods appearing in a single day's menu is smaller than the numbers that would be included if a longer period of time were covered.

Frequency With Which Items in Food Groups Appeared in Dietaries

Numbers and percentages of the 1,072 women in the Iowa sample whose 24-hour dietaries included foods from the various food groups are shown in table 17. Many of the dietaries consisted largely of bread and butter, meat and potatoes and desserts. Bread and breakfast cereals, table fats and meats were present in more than 90 percent of the dietaries. White potatoes appeared in 80 percent of the dietaries; desserts other than fruit, in 73 percent. On the other hand, certain foods of special nutritional importance appeared less frequently.

TABLE 17. NUMBER AND PERCENTAGE OF WOMEN WHO REPORTED USE OF FOOD FROM SELECTED FOOD GROUPS IN THEIR 24-HOUR DIETARIES (IOWA SAMPLE).

Food group	Iowa women	
	Number	Percent
Bread and breakfast cereals*	1,039	97
Table fat†	1,028	96
Meat, poultry and fish	971	91
White potatoes	858	80
Desserts other than fruits	778	73
Vitamin-rich vegetables	738	69
Vitamin-rich fruits	633	59
Other vegetables	616	58
Eggs, cheese and legumes	616	58
Fluid milk‡	534	50
Other fruits	469	44

*Does not include such cereal products as macaroni, rice, etc.
†Includes cream, butter, margarine.
‡Includes milk used as beverage and on cereals and fruits.

TABLE 18. MOST FREQUENTLY REPORTED ITEMS IN SELECTED FOOD GROUPS APPEARING IN 24-HOUR DIETARIES (THREE SAMPLES).

Items in food groups	Percentage of total reports		
	Iowa	S. D.	St. Paul, Minn.
Meat (No. of times rept'd)	(1,629)	(589)	(168)
Pork (inc. bacon)	34	25	32
Beef	31	25	28
Luncheon meat, sausage, wieners	13	21	7
Fowl	7	10	9
Fish	6	8	12
Mixed dishes cont. meat	6	5	5
Eggs, cheese, legumes (No. of times rept'd)	(835)	(227)	(142)
Eggs	61	57	42
Cheese	21	27	42
Legumes	15	12	4
Vitamin-rich fruits (No. of times rept'd)	(927)	(267)	(128)
Citrus fruits & juices	51	43	77
Peaches	25	25	13
Berries*	9	10	5
Melons	5	12	1
Other fruits (No. of times rept'd)	(648)	(229)	(133)
Apples & crabapples	27	19	25
Mixed fruit†	17	17	19
Bananas	13	17	15
Pears	10	6	9
Rhubarb	10	5	5
Berries‡	7	10	4
Vitamin-rich vegetables (No. of times rept'd)	(1,148)	(367)	(146)
Tomatoes & juice	34	40	26
Carrots	10	10	22
Peas	14	13	8
Green beans	14	11	8
Cabbage	11	9	6
Other vegetables (No. of times rept'd)	(1,063)	(229)	(140)
Lettuce	32	30	48
Corn & hominy	16	24	7
Onions	16	5	11
"Salad greens"§	7	10	0
Cucumbers	4	9	7

*Includes strawberries, loganberries and gooseberries.
†Includes fruits listed in dietaries as "fruit salad," "fruit jello," "fruit cocktail," "fresh fruits," "canned fruit."
‡Includes "berry sauce," blackberries, boysenberries, cranberries, mulberries, raspberries.
§Includes vegetables listed in dietaries as "chef's salad," "combination salad," "salad greens," "green salad," "mixed vegetable salad," "vegetable salad."

Table 18 shows the frequency with which individual kinds of meat, fruits and vegetables were included in dietaries of women in the Iowa, South Dakota and St. Paul samples. The dominance of muscle cuts of pork and beef among kinds of meat in the dietaries is clear: Lamb, veal and "organ meats" were reported in only a few dietaries. Eggs appeared in more of the menus than did cheese or legumes.

Citrus fruits and their juices, and peaches (fresh and canned) were used much more commonly than were any other fruit sources of ascorbic acid and vitamin A. Among the "other fruits," apples, "mixed fruit," and

bananas were the only ones accounting for more than 10 percent of the reports.

Tomatoes and tomato juice were the major items represented in the group of vitamin-rich vegetables: Carrots, peas, green beans and cabbage were the only other vegetables commonly used. Lettuce was used more often than any other item in the "other vegetable" group. Corn also was popular among the Iowa and South Dakota women.

These data afford a partial explanation, at least, of the high percentage of dietaries furnishing small amounts of ascorbic acid and vitamin A. Few women in the Iowa, South Dakota or St. Paul samples included in their dietaries any of the deep green leafy vegetables that are excellent sources of vitamin A, or the vitamin-C-rich members of the cabbage family. Fewer still included liver or other organ meats that would have provided generous amounts of vitamin A.

Contributions of Food Groups to Total Energy Value of Dietaries

Percentages of total food energy value supplied by the food groups in dietaries reported in four of the samples of white women were similar, for the most part (table 19).[4] Cereal products, fats, sweets and desserts contributed from 58 percent (St. Paul) to 65 percent (Lansing- East Lansing, white women) of the total calories. They provided about the same percentage of total calories in the diets of Negro women. Meat, poultry and fish contributed 11 and 12 percent of total food energy in dietaries from samples of white women, but in dietaries of low caloric value reported by the group of Negro women, meat, poultry and fish supplied 16 percent—as much as was furnished by sweets and desserts.

Many of the day's dietaries had energy values below 1,200 Cal.; a few had values above 3,000 Cal. In the case of the Iowa sample, the mean number of calories supplied by each food group except "soups and miscellaneous" increased as total calories increased, and the relative importance of the food groups as sources of energy remained about the same (table 20). Furnishing somewhat higher percentages of total calories in the dietaries of higher energy value were fluid milk, fats, sweets and desserts, which supplied more than four times as many calories on the average in dietaries with energy values above 3,000 Cal. as in those with energy values below 1,200 Cal. On the other hand, percentages of food energy derived from cereal products and from fruits and vegetables—both vitamin-rich and "other"—decreased with the increase in total food energy value.

Food Groups in Dietary Evaluation

The Institute of Home Economics of the Agricultural Research Service recently published a basic plan for developing an adequate diet around four groups of food

[4]Fruit and vegetable sources of ascorbic acid and vitamin A were combined in a single group, and "other" fruits and vegetables into another, so that the 11 groups originally defined were reduced to nine. The residual group, "soups and miscellaneous," was added so that total calories might be accounted for. A total of 10 food groups, therefore, are used in this tabulation and in tables 20 and 24.

TABLE 19. CONTRIBUTIONS OF FOOD GROUPS TO TOTAL ENERGY VALUE OF 24-HOUR DIETARIES (FIVE SAMPLES).

Food group	Percentage of total calories supplied by food groups in dietaries				
	Iowa	South Dakota	Lansing-E. Lansing, Michigan		St. Paul, Minnesota
			White	Negro	
Mean energy value of dietaries	(1,735 Cal.)	(1,705 Cal.)	(1,665 Cal.)	(1,070 Cal.)	(1,780 Cal.)
Meat, fish & poultry	12	12	11	16	11
Eggs, cheese, legumes	4	4	5	6	5
Fluid milk	6	7	5	6	9
Cereal products	19	19	19	26	19
Table & cooking fats	21	19	24	18	15
White potatoes	8	8	5	3	5
Vitamin-rich fruits and vegetables	5	4	4	5	5
Other fruits and vegetables	4	3	4	3	5
Sweets and desserts*	20	23	22	16	24
Soups and miscellaneous	1	1	1	1	2

*Does not include fruit desserts.

TABLE 20. MEAN AMOUNTS OF FOOD ENERGY AND PERCENTAGES OF TOTAL FOOD ENERGY PROVIDED BY SELECTED FOOD GROUPS IN 24-HOUR DIETARIES CLASSIFIED BY CALORIC VALUE (IOWA SAMPLE).

Caloric value of dietaries	No. of dietaries reported	Meat poultry fish	Eggs cheese legumes	Fluid milk	Cereal products	Fats	White potatoes	Vitamin-rich fruits & vegs.	Other fruits & vegs.	Sweets and desserts*	Soups and miscel.
MEAN FOOD ENERGY PROVIDED (Cal.)											
Under 1,200	187	108	42	43	202	191	68	67	47	149	18
1,200 - 1,799	445	187	58	69	309	300	116	83	55	302	30
1,800 - 2,399	291	227	85	119	369	462	169	84	82	451	15
2,400 - 2,999	118	296	125	190	448	576	220	96	92	580	10
3,000 and over	31	356	180	247	578	819	281	92	79	694	7
All dietaries	1,072	201	73	97	330	370	138	82	66	357	21
PERCENTAGE OF TOTAL FOOD ENERGY PROVIDED											
Under 1,200	187	12	4	5	22	20	7	7	5	16	2
1,200 - 1,799	445	12	4	5	20	20	8	5	4	20	2
1,800 - 2,399	291	11	4	6	18	22	8	4	4	22	1
2,400 - 2,999	118	11	5	7	17	22	8	4	4	22	—†
3,000 and over	31	11	5	7	17	25	9	3	2	21	—†
All dietaries	1,072	12	4	6	19	21	8	5	4	20	1

*Does not include fruit desserts.
†Less than 1 percent.

TABLE 21. MEAN AMOUNTS OF NUTRIENTS PROVIDED BY THE NUMBER OF SERVINGS FROM EACH FOOD GROUP SPECIFIED IN THE DAILY FOOD PLAN* AND BY THE FOODS PRESENT IN CORRESPONDING GROUPS IN THE 24-HOUR DIETARIES OF WOMEN IN THE IOWA SAMPLE.†

Food groups	Food energy	Protein	Calcium	Iron	Vitamin A	Ascorbic acid	Thiamine	Ribo-flavin	Niacin
	(Cal.)	(gm.)	(gm.)	(mg.)	(I.U.)	(mg.)	(mg.)	(mg.)	(mg.)
Meat group									
Food plan	405	27	0.05	4.6	930	0	0.33	0.40	6.0
Iowa dietaries	274	25	0.07	4.2	915	0	0.33	0.33	4.3
Milk group									
Food plan	320	16	0.51	0.3	870	trace	0.13	0.69	0.4
Iowa dietaries	97	5	0.17	0.3	248	1	0.06	0.26	0.2
Vegetable-fruit group									
Dark green, yellow and citrus									
Food plan	80	2	0.05	1.0	2,730	66	0.12	0.07	0.6
Iowa dietaries	82	3	0.04	1.2	2,394	41	0.12	0.09	0.9
Others, including potatoes									
Food plan	160	3	0.04	1.5	640	20	0.11	0.10	1.3
Iowa dietaries	204‡	4	0.06	1.7	167	20	0.23	0.13	2.3
Bread-cereals group									
Food plan	290	9	0.06	2.1	30	0	0.30	0.16	2.5
Iowa dietaries	330	10	0.04	2.3	0	0	0.23	0.16	2.3
Total									
Food plan	1,255	57	0.71	9.5	5,200	86	0.99	1.42	10.8
Iowa dietaries	987	47	0.38	9.7	3,724	61	0.97	0.97	10.0

*Page, L. and Phipard, E. F. Essentials of an adequate diet. Agr. Inf. Bul. 160. ARS. USDA. 1956 (38). Table 6.
†Values estimated from dietaries of 1,072 Iowa women.
‡Includes 138 Cal. from white potatoes.

which it designated as the milk, meat, vegetable-fruit and bread-cereals groups (38). This plan specifies that the diets of adults should supply each day:

— Two or more cups of milk;

— Two or more servings from the meat group Beef, veal, pork, lamb, poultry, fish, eggs, with dry beans and peas and nuts as alternates;

— Four or more servings from the vegetable-fruit group including

A dark-green or deep-yellow vegetable important for vitamin A at least every other day;

A citrus fruit or other fruit or vegetable important for ascorbic acid;

Other fruits and vegetables including potatoes; and

— Four or more servings of the bread-cereals group (whole grain, enriched, restored).

Eaten in the quantities indicated, foods from these groups will provide 90 percent or more of the National Research Council's recommended allowances of the essential nutrients. The accompanying energy value is about 1,250 Cal. Additional calories needed are obtained from the foods ordinarily included in the day's menus to round out meals and to satisfy the appetite; i.e., butter, margarine, other fats, oils, sugars and unenriched grain products eaten alone or combined with the essential foods in mixed dishes, baked goods, desserts and other recipe dishes.

The Institute's plan provides a yardstick for measuring the adequacy of a day's food intake. Estimates were made of the average energy and nutrient values furnished by roughly the same groups of foods in the meals and snacks actually chosen by women in the Iowa sample.

The nutrients supplied by the four food groups in the amounts suggested in the Institute's basic food plan and those supplied by the same food groups in the diets commonly selected by these Iowa women may be compared in table 21.

Even though the items in the food groups used in the analyses of the dietaries do not correspond exactly with those listed in the groups of the food plan, certain differences between the actual dietaries and the recommended plan are clear.

Most conspicuous is the low consumption of milk by the Iowa women reporting. Milk and milk equivalents furnished 0.51 gm. of calcium in the dietary plan, and fluid milk only 0.17 gm. in the actual diets. If cheese and ice cream had been combined with fluid milk, as they are in the food plan, in the analyses of the Iowa diets, the calcium value of the milk group would have been increased at best by only 0.1 gm.

Milk also is an important source of riboflavin. Bringing the daily milk consumption up to the recommended levels would insure an adequate intake of this vitamin as well as of the mineral, calcium (table 21).

The other major difference between the two diets lies in the amounts of vitamin A and ascorbic acid furnished by the vegetables and fruits eaten. They furnished 2,560 I.U. and 61 mg., respectively, in the diets of Iowa women compared with 3,370 I.U. and 86 mg. in the daily food plan. The fact that total energy from these foods was somewhat higher in the Iowa dietaries than in the food plan (286 vs. 240) suggested that deficiencies in the Iowa meals were associated not so much with failure to eat sufficient *quantities* of vegetables and fruits as with failure to select vegetables and fruits having high concentrations of these vitamins (table 18). It may be recalled that potatoes occupied an important place in the average Iowa dietary.

Thus, whether dietary analysis is in terms of individual nutrients or of food groups, the same conclusion is reached: The most serious nutritional shortages in the food eaten by this group of women relate to the amounts of calcium, riboflavin, ascorbic acid and vitamin A provided.

Nutrient Intake and Selected Characteristics of Respondents

AGE

A downward trend with age was apparent in mean intakes of food energy, protein, calcium, ascorbic acid and vitamin A (table 22). Mean values of most nutrients were definitely lower in the diets of groups of women 70 years old and older than they were in those of women in their 30's. The same general trend may be observed in data reported by others (19, 20, 21, 32) with differences less regular in the smaller samples.

Values for the regression coefficient (b) based on age in units of 1 year afford a quantitative measure of the relationship between intake of nutrients and age in the Iowa sample (table 23). For every increase of 10 years in age, the nutritive value of diets of Iowa women decreased, on the average, by about 85 Cal., 4 gm. of protein, 0.03 gm. of calcium, 1.4 mg. of ascorbic acid and 194 I.U. of vitamin A.

Confidence intervals calculated for the unknown average linear change in intake of the nutrients with age indicated that the regression of intakes of food energy, protein and calcium on age were significant. Similar confidence intervals for ascorbic acid and vitamin A, however, included positive as well as negative values. Hence these data taken as a whole did not establish the significance of the decrease of intakes of these two latter nutrients with age.

A further measure of the association of nutrient intakes with age was supplied by the correlation coefficient (r) (table 23). From a sample of the size used in this survey, correlation coefficients of food energy, protein and calcium intakes with age were significant, although low. For ascorbic acid or vitamin A intakes with age the correlations were not significant.

Values for r^2 indicated that, in spite of significant

TABLE 22. NUTRIENTS PROVIDED BY 24-HOUR DIETARIES CLASSIFIED BY AGE OF RESPONDENT: MEANS AND STANDARD DEVIATIONS (s) (SIX SAMPLES).

Age (years)	Iowa		South Dakota		Urbana, Illinois		Lansing-East Lansing, Michigan				St. Paul, Minnesota	
							White		Negro			
	Mean	s	Mean	s	Mean	s	Mean	s	Mean	s	Mean	s
FOOD ENERGY (Cal.)												
30-39	1,850	630	1,840	555	1,860	660	....	....	....	....	2,090	490
40-49	1,815	560	1,770	535	1,845	555	1,740	620	1,440	*	1,955	635
50-59	1,740	590	1,610	490	1,785	560	1,770	485	1,110	385	1,755	400
60-69	1,695	600	1,630	550	1,655	580	1,600	410	1,035	440	1,785	360
70 and over	1,425	510	1,355	460	1,705	475	1,535	430	1,005	315	1,550	390
All ages	1,735	600	1,705	545	1,780	585	1,665	490	1,070	395	1,780	490
PROTEIN (gm.)												
30-39	64	23	64	22	68	25	....	....	....	....	75	23
40-49	61	22	59	21	66	22	55	17	66	*	69	14
50-59	57	21	55	16	66	25	59	12	44	19	61	15
60-69	55	23	52	18	59	21	51	19	42	18	53	13
70 and over	44	17	42	15	53	17	45	24	43	18	57	14
All ages	57	22	57	20	64	23	53	17	43	18	62	17
CALCIUM (gm.)												
30-39	0.56	0.4	0.62	0.4	0.66	0.4	....	....	....	....	0.89	0.5
40-49	0.51	0.3	0.52	0.3	0.57	0.3	0.45	0.3	0.20	*	0.62	0.3
50-59	0.46	0.3	0.41	0.2	0.53	0.3	0.44	0.2	0.36	0.2	0.50	0.2
60-69	0.49	0.3	0.46	0.3	0.55	0.3	0.48	0.3	0.36	0.3	0.51	0.2
70 and over	0.43	0.3	0.40	0.2	0.47	0.2	0.38	0.2	0.26	0.2	0.64	0.3
All ages	0.50	0.3	0.50	0.3	0.57	0.3	0.44	0.3	0.34	0.2	0.64	0.3
ASCORBIC ACID (mg.)												
30-39	67	49	52	27	66	40	....	....	....	....	80	46
40-49	67	44	59	40	71	50	65	23	71	*	68	29
50-59	66	40	56	38	80	54	69	40	45	36	77	35
60-69	65	40	62	33	71	59	36	27	48	36	72	33
70 and over	57	46	34	22	74	55	41	26	29	24	77	56
All ages	65	44	55	35	72	51	53	33	44	35	75	44
VITAMIN A (I. U.)												
30-39	4,935	5,330	4,780	5,280	6,740	8,625	....	....	....	....	7,345	5,370
40-49	4,810	4,950	5,230	4,980	6,860	7,290	4,605	5,635	1,720	*	9,370	8,410
50-59	5,115	6,045	4,060	3,470	5,680	4,950	4,965	5,700	4,475	4,730	5,120	3,505
60-69	4,655	4,520	4,690	3,935	7,115	7,975	3,010	2,905	5,235	6,785	6,685	5,515
70 and over	3,630	3,035	2,235	1,195	6,455	5,650	5,350	8,215	5,150	11,890	5,870	6,745
All ages	4,720	5,055	4,565	4,510	6,585	7,230	4,425	5,740	4,820	7,010	6,710	6,290

*Sample includes only one person between 40 and 49 years.

TABLE 23. SUMMARY OF STATISTICS OBTAINED FROM ANALYSIS OF REGRESSION OF FOOD ENERGY AND SELECTED NUTRIENTS ON AGE IN YEARS (IOWA SAMPLE).

Nutrient	Mean value $\overline{Y}$	Regression coefficient (b)	Standard error of regression coefficient (S_b)	Regression equation: $\hat{Y} = \overline{Y} - b(X-\overline{X})$	Standard error of estimate ($S_{y.x}$)	Coefficient of correlation (r)	r^2
Food energy (Cal.)	1,735	–8.47	1.24	1,735–8.47(X–51.4)	587	–0.204	0.042
Protein (gm.)	57	–0.40	0.05	57–0.40(X–51.4)	22.5	–0.259	0.067
Calcium (gm.)	0.50	–0.0029	0.0006	0.50–0.0029(X–51.4)	0.328	–0.126	0.016
Ascorbic acid (mg.)	65	–0.14	0.0933	65–0.14(X–51.4)	44	–0.046	0.002
Vitamin A (I.U.)	4,720	–19.4	10.71	4,720–19.4(X–51.4)	5,048	–0.055	0.003

correlations between intakes of food energy, protein or calcium and age, the percentage of total variation in intake of each of these nutrients associated with variation in age was below 10 percent (table 23).

Further inspection of mean values showed that, in general, there was relatively little difference between mean nutrient intakes of women in successive decade groups up to age 70, but a marked decrease beyond this age (table 22). This fact is illustrated in figs. 6 through 10, in which the lines represent the regression equations reported in table 23.

Examination of the figures suggests that these lines do not give the best representation of the data; they do, however, show the linear component of the trend. They also depict clearly the marked variation in the mean nutrient intakes of women grouped according to age in years, even in a sample of this size. Nevertheless, despite this variation, the decrease in the nutrient value of the diet after age 70 is striking. The nature of the data obtained in these surveys limits the usefulness of further analysis. Longitudinal studies are needed if the relationship between nutrient intake and age is to be more thoroughly understood.

The extent to which patterns of food consumption changed from one age group to another is indicated in table 24 where the percentages of total energy provided by each of the 10 food groups is recorded for the Iowa and South Dakota samples. With the exception of cereals, meat, poultry and fish, the food groups made about the same relative contribution to total energy of the diet in all age decades. Consumption of cereal food increased on the relative basis; that of meat, fish and poultry declined absolutely and relatively.

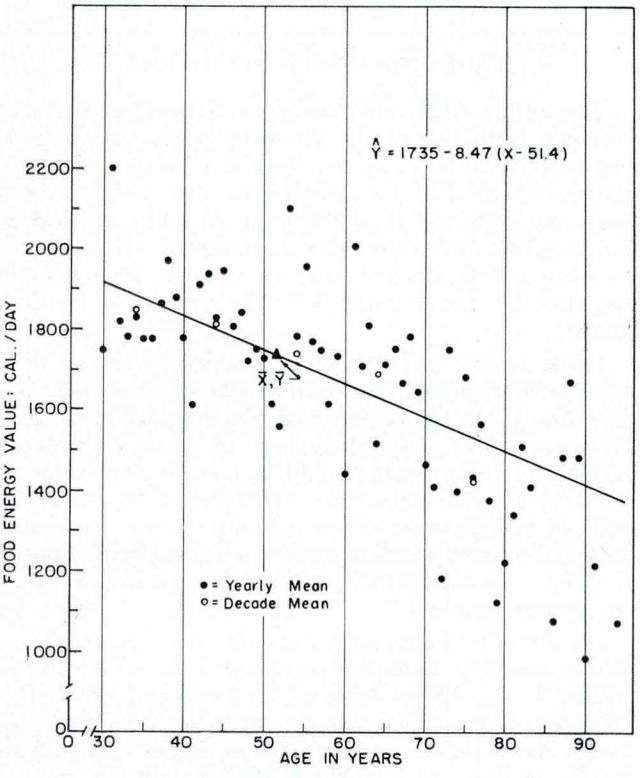

Fig. 6. Mean daily intake of food energy by 1,072 Iowa women grouped by age.

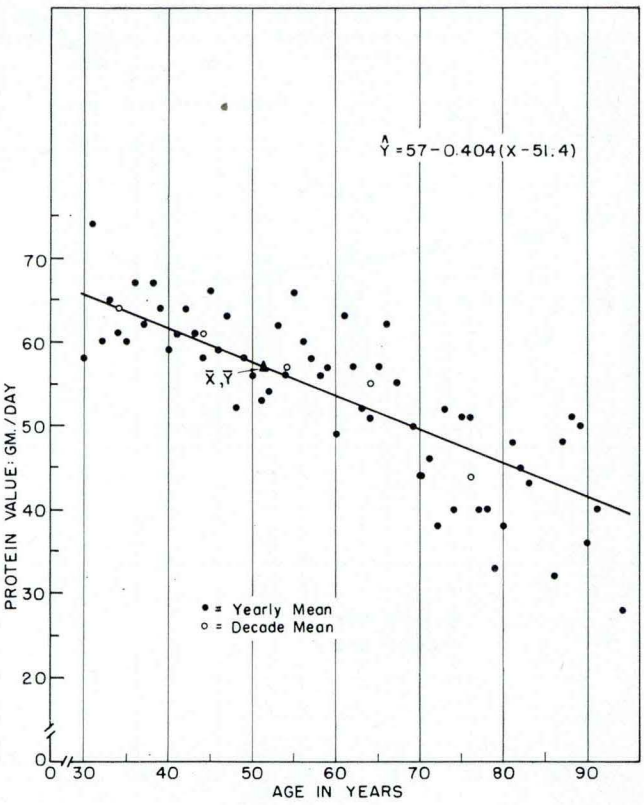

Fig. 7. Mean daily intake of protein by 1,072 Iowa women grouped by age.

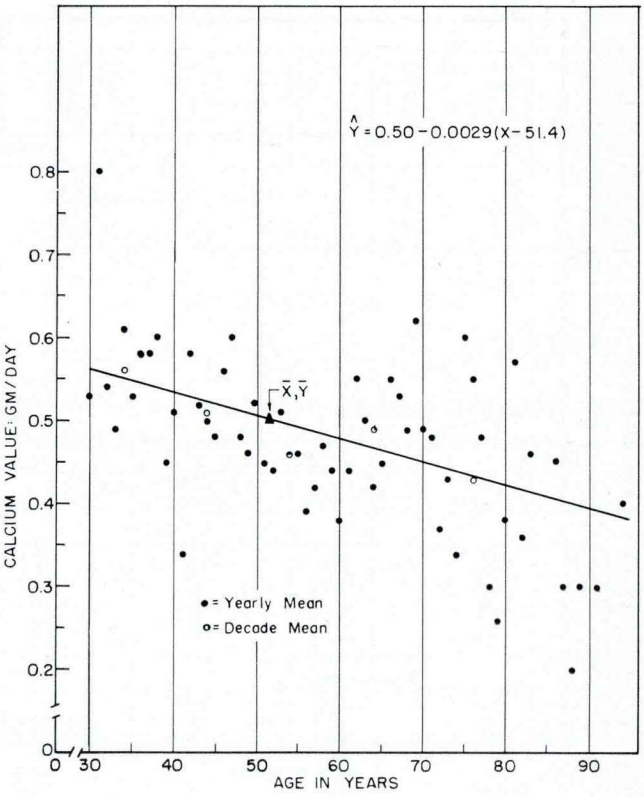

Fig. 8. Mean daily intake of calcium by 1,072 Iowa women grouped by age.

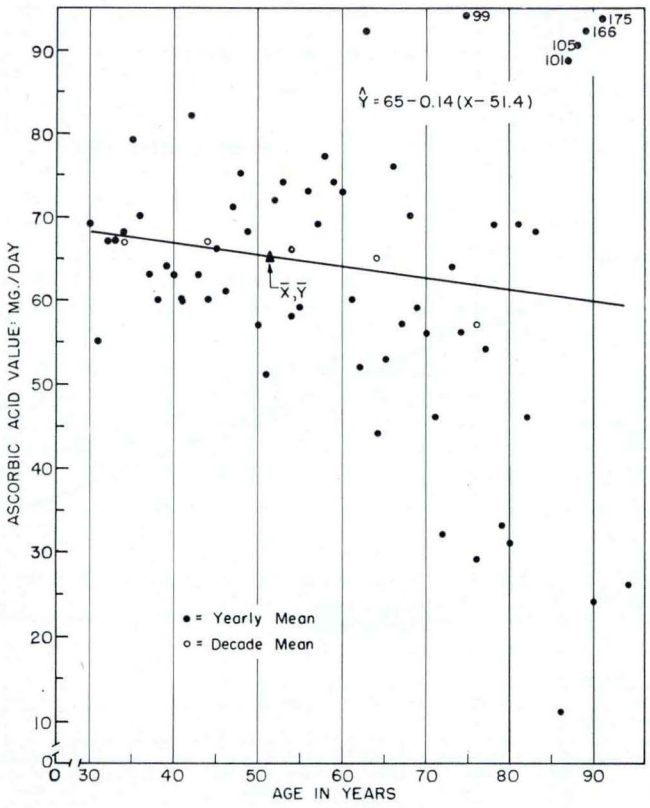

Fig. 9. Mean daily intake of ascorbic acid by 1,072 Iowa women grouped by age.

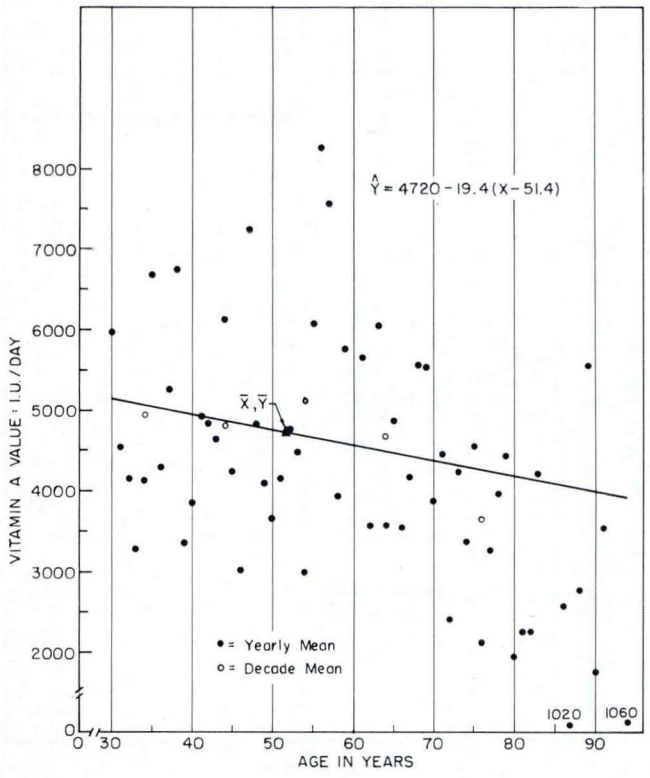

Fig. 10. Mean daily intake of vitamin A by 1,072 Iowa women grouped by age.

LOCATION OF HOUSEHOLD (ZONE)

The design of the Iowa and South Dakota samples made it possible to determine whether differences in the dietaries reported by women from these states were associated with the degree of urbanization of the communities in which respondents lived. In both samples women living in the open country zone reported dietaries having the highest mean values for food energy, protein and calcium (table 25). In Iowa, urban women reported diets having the lowest mean values for food energy and all four nutrients; in South Dakota, the lowest values for some nutrients were reported by women from the rural place zone, for others, by women from the urban zone.

Part of the difference observed in the nutritive value of diets reported by women in the three zones may have been associated with differences in age distribution. In both Iowa and South Dakota, the rural place zone included higher percentages of women over 60 years of age and lower percentages of women under 40 years of age than did open country and urban zones (table 7); the decrease of mean intakes of most nutrients with age has already been presented (table 22).

Not all the difference in nutrient intake among zones can be accounted for by the different age distributions in the zones. Classification of the diets of women according to age and place of residence of respondents showed that mean energy value was higher for dietaries of women in any age group who lived in the open country zone than for dietaries of women of the same age from rural place or urban zones (table 26). Similar tables (not presented here) for the other nutrients revealed the same general relationship between nutrient value of dietaries reported and place of residence.

ESTIMATED FAMILY NET INCOME

The mean daily food energy and protein values of dietaries from five of the six samples grouped according to estimated family net income of respondents are shown in table 27. (Comparable data on family income were not obtained in the sample of white women in Lansing-East Lansing.) The mean age of the women in each income group also is given so that differences in age may be noted along with differences in nutrient intake.

Mean caloric value generally was higher for diets of women reporting net family incomes above $2,000 than for those of women with incomes below $2,000. However, mean nutrient values of diets of younger women tended to be higher than those of diets reported by older persons (table 22). Thus, some of the difference in energy value of dietaries apparently associated with difference in family income may be attributable to the differences in mean age of the women in the different income brackets.

On the other hand, data from the two highest income brackets suggest that protein value of the diets may be related to family net income. In Iowa and South Dakota the mean age of women reporting family net incomes above $4,000 was the same as that of women with family incomes of $2,000 to $3,999, but the protein value of dietaries of women in the higher income group

TABLE 24. MEAN AMOUNTS OF FOOD ENERGY AND PERCENTAGES OF TOTAL FOOD ENERGY PROVIDED BY SELECTED FOOD GROUPS IN 24-HOUR DIETARIES CLASSIFIED BY AGE OF RESPONDENT (IOWA AND SOUTH DAKOTA SAMPLES).

Sample	Age (years)	No. of dietaries reported	Mean total calories	Meat poultry fish	Eggs cheese legumes	Fluid milk	Cereal products	Fats	White potatoes	Vitamin-rich fruits and vegetables	Other fruits and vegetables	Sweets and desserts*	Soups and miscellaneous
						MEAN FOOD ENERGY PROVIDED (Cal.)							
Iowa	30-39	282	1,848	237	75	125	322	380	144	80	67	388	30
	40-49	241	1,817	207	80	93	344	399	149	83	74	367	21
	50-59	232	1,739	218	72	77	328	372	136	83	59	381	13
	60-69	170	1,697	174	78	91	337	377	140	87	72	325	16
	70 and over	147	1,426	123	56	85	317	297	112	76	54	284	22
	All ages	1,072	1,735	201	73	97	330	370	138	82	66	357	21
South Dakota	30-39	91	1,840	243	74	171	337	322	142	71	57	408	15
	40-49	105	1,770	207	67	116	334	335	143	85	48	415	20
	50-59	73	1,608	215	66	79	273	313	141	73	69	371	8
	60-69	45	1,630	152	62	103	360	299	119	77	72	355	31
	70 and over	25	1,353	138	47	102	336	261	98	46	41	273	11
	All ages	339	1,705	206	66	120	325	317	136	75	58	385	17
						PERCENTAGE OF TOTAL FOOD ENERGY PROVIDED							
Iowa	30-39	282	1,848	13	4	7	17	20	8	4	4	21	2
	40-49	241	1,817	11	5	5	19	22	8	5	4	20	1
	50-59	232	1,739	13	4	4	19	21	8	5	3	22	1
	60-69	170	1,697	10	5	6	20	22	8	5	4	19	1
	70 and over	147	1,426	9	4	6	22	21	8	5	4	20	1
	All ages	1,072	1,735	12	4	6	19	21	8	5	4	20	1
South Dakota	30-39	91	1,840	13	4	9	18	18	8	4	3	22	1
	40-49	105	1,770	12	4	6	19	19	8	5	3	23	1
	50-59	73	1,608	13	4	5	17	19	9	5	4	23	1
	60-69	45	1,630	9	4	6	22	18	7	5	5	22	2
	70 and over	25	1,353	10	4	8	25	19	7	3	3	20	1
	All ages	339	1,705	12	4	7	19	19	8	4	3	23	1

*Does not include fruit desserts.

TABLE 25. NUTRIENTS PROVIDED BY 24-HOUR DIETARIES CLASSIFIED BY LOCATION OF RESPONDENT'S HOUSEHOLD (ZONE): MEANS AND STANDARD DEVIATIONS (s) (IOWA AND SOUTH DAKOTA SAMPLES).

Zone*	Food energy (Cal.)		Protein (gm.)		Calcium (gm.)		Ascorbic acid (mg.)		Vitamin A (I.U.)	
	Mean	s	Mean	s	Mean	s	Mean	s	Mean	s
					IOWA					
Open country	1,925	655	63	24	0.54	0.4	65	43	5,575	6,315
Rural place	1,740	540	55	20	0.52	0.3	69	46	4,405	4,145
Urban	1,615	560	55	22	0.46	0.3	64	44	4,355	4,510
All zones	1,735	600	57	22	0.50	0.3	65	44	4,720	5,055
					SOUTH DAKOTA					
Open country	1,810	565	62	21	0.53	0.4	58	39	4,720	4,690
Rural place	1,580	525	52	19	0.45	0.3	56	33	5,050	4,570
Urban	1,620	480	55	19	0.50	0.3	47	25	3,795	4,025
All zones	1,705	545	57	20	0.50	0.3	55	35	4,565	4,510

*See footnote 2 for definition of zones.

TABLE 26. MEAN ENERGY VALUES OF 24-HOUR DIETARIES CLASSIFIED BY AGE OF RESPONDENT AND ZONE (IOWA AND SOUTH DAKOTA SAMPLES).*

Age (years)	All zones		Open country		Rural place		Urban	
	Number reporting	Calories	Number reporting	Calories	Number reporting	Calories	Number reporting	Calories
				IOWA				
30-39	282	1,850	102	2,040	50	1,860	130	1,690
40-49	241	1,815	92	1,935	42	1,915	107	1,675
50-59	232	1,740	69	1,860	51	1,780	112	1,645
60-69	170	1,695	38	1,855	50	1,800	82	1,560
70 and over	147	1,425	11	1,465	58	1,420	78	1,425
All ages	1,072	1,735	312	1,925	251	1,740	509	1,615
				SOUTH DAKOTA				
30-39	91	1,840	46	1,890	14	1,920	31	1,735
40-49	105	1,770	61	1,850	24	1,705	20	1,600
50-59	73	1,610	37	1,735	17	1,440	19	1,510
60-69	45	1,630	20	1,680	17	1,540	8	1,705
70 and over	25	1,355	4	1,585	12	1,210	9	1,440
All ages	339	1,705	168	1,810	84	1,580	87	1,620

*See footnote 2 for definition of zones.

TABLE 27. MEAN VALUES OF FOOD ENERGY AND PROTEIN IN 24-HOUR DIETARIES AND MEAN AGE OF RESPONDENTS, CLASSIFIED BY ESTIMATED FAMILY NET INCOME (FIVE SAMPLES).

Estimated family net income	Iowa			South Dakota			Urbana, Illinois			Lansing-E. Lansing, Michigan (Negro women)			St. Paul, Minnesota		
	No. of women rept'g.	Mean value	Mean age (yr.)	No. of women rept'g.	Mean value	Mean age (yr.)	No. of women rept'g.	Mean value	Mean age (yr.)	No. of women rept'g.	Mean value	Mean age (yr.)	No. of women rept'g.	Mean value	Mean age (yr.)
FOOD ENERGY (Cal.)															
Less than $1,000	127	1,695	64	41	1,470	60	24	1,775	60	23	1,050	65	9	1,805	76
$1,000-$1,999	235	1,655	53	59	1,700	52	22	1,490	59	20	1,175	61	15	1,435	77
$2,000-$3,999	494	1,755	47	129	1,715	46	127	1,815	48	41	1,085	58	44	1,655	58
$4,000 and over	146	1,865	48	63	1,780	46	123	1,935	45	1	1,210	54	52	1,980	52
No response or don't know	70	1,665	60	47	1,780	48	161	1,670	58	19	945	63	0	....	....
All incomes	1,072	1,735	51	339	1,705	49	457	1,780	52	104	1,070	61	120	1,780	59
PROTEIN (gm.)															
Less than $1,000	127	53	64	41	49	60	24	59	60	23	41	65	9	57	76
$1,000-$1,999	235	56	53	59	54	52	22	53	59	20	47	61	15	52	77
$2,000-$3,999	494	58	47	129	58	46	127	63	48	41	44	58	44	61	58
$4,000 and over	146	63	48	63	62	46	123	72	45	1	58	54	52	67	52
No response or don't know	70	55	60	47	62	48	161	60	58	19	37	63	0	....	....
All incomes	1,072	57	51	339	57	49	457	64	52	104	43	61	120	62	59

was greater than that of dietaries of women with lower incomes.

Clark and Fincher (19) in their study of diets of homemakers in four cities found that, for most of the nutrients, mean values were higher for dietaries of homemakers from upper income groups than for those of homemakers from lower income groups. Relationships between nutrient intake and income were not the same for all nutrients nor for all cities. The authors pointed out that income-consumption relationships might be expected to be less clear for homemakers than for their families, since individual likes and dislikes affect consumption of some kinds of food by individuals more than they do consumption by the entire family. The food group most likely to be influenced by family income, they suggested, was meat, poultry and fish.

BODY WEIGHT CLASSIFICATION

The mean energy values of 24-hour dietaries reported by women grouped according to the deviation of reported body weight from "desirable body weight" are presented in table 28.[5] Mean energy values of diets reported by white women of normal weight[6] suggest that 1,800 Cal. daily approaches the average energy expenditure of women over age 30 living under modern conditions. The energy requirement, however, is related to age, and Iowa women of normal weight, classified by age, reported dietaries with mean energy values ranging from 1,940 Cal. daily for women in their 30's to 1,580 Cal. for women 70 years old and older (18).

For the most part, lower mean calorie values were found for diets reported by overweight women than for those by women of either normal or less-than-normal weight. These values may reflect the tendency toward underestimation of food intake by obese women observed by Beaudoin and Mayer (26). However, analyses of data from women in the Iowa and South Dakota samples who were more than 20 percent overweight suggested that not all the low caloric values were attributable to inaccuracies in reporting. Schedules of many of these women recorded special circumstances, some temporary, others more or less permanent, that explained in part, at least, the low caloric value of diets reported (table 29). Some of the women were experiencing ill health, either temporary or chronic; some ate less than usual on this day, and a fairly large number apparently were trying to effect weight reduction by cutting calories.

Of special interest is the group of 118 excessively overweight Iowa women who apparently were not trying to reduce and whose customary diets had a mean value of 1,895 Cal. compared with 1,650 Cal. for diets reported by the entire group of women who were excessively

[5]"Desirable body weight" is defined as the average weight of women of specified height at age 30 (10).

[6]Normal weight: within 10 percent of desirable weight.

TABLE 28. MEAN ENERGY VALUES OF 24-HOUR DIETARIES CLASSIFIED BY RESPONDENT'S BODY WEIGHT (SIX SAMPLES).

Body weight classification*	Iowa		South Dakota		Urbana, Illinois		Lansing-E. Lansing, Michigan (White)		Lansing-E. Lansing, Michigan (Negro)		St. Paul, Minnesota	
	No. reptg.	Mean intake (Cal.)	No. reptg.	Mean intake (Cal.)	No. reptg.	Mean intake (Cal.)	No. reptg.	Mean intake (Cal.)	No. reptg.	Mean intake (Cal.)	No. reptg.	Mean intake (Cal.)
More than 10% below desirable weight	121	1,790	38	1,895	59	1,990	17	1,510	8	1,140	22	1,890
Within 10% of desirable weight	467	1,815	144	1,765	216	1,835	38	1,810	27	1,075	63	1,785
11-20% above desirable weight	199	1,660	63	1,645	75	1,735	16	1,840	18	1,130	18	1,760
More than 20% above desirable weight	267	1,650	94	1,575	107	1,585	25	1,440	44	1,035	17	1,635
No information about weight	18	1,525	0	0	0	0	1	1,535	7	1,060	0	0
All classifications	1,072	1,735	339	1,705	457	1,780	97	1,665	104	1,070	120	1,780

*"Desirable weight" is defined as the average weight of women of specified height at age 30.

TABLE 29. MEAN ENERGY VALUES OF 24-HOUR DIETARIES REPORTED BY WOMEN WHO WERE MORE THAN 20 PERCENT OVERWEIGHT, CLASSIFIED BY SUGGESTED EXPLANATION OF LOW CALORIC VALUE OF DIETARIES (IOWA AND SOUTH DAKOTA SAMPLES).

	Iowa		South Dakota	
Suggested explanation	No. of women reporting	Mean energy value of diet (Cal.)	No. of women reporting*	Mean energy value of diet (Cal.)
Respondent ate less than usual				
Temporary ill health	7	1,245	0	....
Other reasons	19	1,495	10	1,420
Respondent's chronic illness affected diet	23	1,395	12	1,540
Respondent was trying to lose weight				
Under doctor's direction	17	1,270	8	1,070
On self-directed diet	25	1,390	5	1,450
Respondent omitted food items or an entire meal served	46	1,575	20	1,300
Respondent stated that				
Low income affected diet	10	1,585	1	1,345
Poor dental condition affected diet	2	1,360	9	1,685
Respondent suggested no explanation	118	1,895	36	1,740

*Some South Dakota women suggested more than one explanation.

overweight (table 28). A similar study of the schedules of the 467 Iowa women of normal weight revealed 287 women in this group whose schedules suggested no special circumstances affecting their days' diets. Meals and snacks reported by these women furnished an average of 1,810 Cal.

The difference of 85 Cal. between the mean energy value of dietaries reported by women of normal weight and that of dietaries of women more than 20 percent overweight eating customary diets and not trying to lose weight probably is negligible, in view of the large amount of individual variation observed. Nevertheless, if such a difference characterized the diets of these two groups of women day after day and year after year, it could account for a considerable difference in body weight. Eighty-five unneeded calories daily would result in an extra pound of body fat in little more than 6 weeks—or about 8 pounds in a year.

The prevalence of overweight among groups of persons reporting dietaries with low caloric value was noted by Youmans et al. (25) and by Winters (28, 29). Considerable attention has been given to the problem recently (39, 40, 41, 42). Johnson, Burke and Mayer (42), in their study of obese high school girls, found that "When caloric intakes and activity indices were compared for each group to determine the salient energy factors in the development and maintenance of obesity, it appeared that on a statistical basis, inactivity was much more important than 'overeating' " (42, p. 42).

The number of "work hours" each woman spent "standing on her feet" afforded an index of the activity of women in the Iowa sample. When allowance was made for differences in work hours associated with age and place of residence, there was no clear evidence that overweight women were less active, on the average, according to this index, than were women of normal weight. Indeed, among women in their 30's living in the open country zone, average work hours were highest for those who were moderately and excessively overweight. These observations suggest the desirability of further investigations designed to distinguish between overweight resulting from muscular development and that associated primarily with deposition of fat (43)—only one phase, but a perplexing one, of the whole problem of the energy requirements of mature women.

Needed also are extensive studies dealing with the energy costs of the activities commonly carried on by women living in this modern world.

We also found in this survey, evidence of the "creeping" overweight that is characteristic of people as they grow older. Whereas 17 percent of Iowa women in their 30's classified as excessively overweight, 35 percent of those 20 years older fell in this category. The highest incidence of overweight occurred among women in the sixth decade of life; thereafter overweight was less common.

People in early adulthood apparently adjust to planes of calorie intake more or less in line with their activities at that time and establish eating habits that may continue throughout life. But as time goes on, there is a lowering of the basal metabolism requirement coupled with a decrease in total activity that add up to a decreased need for energy-producing food.

A woman continuing to eat the diet of her earlier life more than satisfies her decreasing requirements and slips into positive caloric balance. In other words, the food furnishing the extra calories is transformed into body fat with an increase in body weight.

Thus, if 1,800 Cal. covers the energy requirement in early adulthood, a high incidence of overweight in middle life may be expected if intake of food continues at this level. Physiological changes taking place in the human body demand readjustment of work and play habits and special attention to food intake. In the words of Pollack et al. (44), "small increments of excess intake and small decrements of decreased output together can be responsible for much adult obesity."

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