SELECTED DEMOGRAPHIC FACTORS AND THEIR EFFECT ON THE NUTRIENT INTAKE OF THE ELDERLY ASSESSED IN HANES I

by

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INTRODUCTION

In 1900, there were three million elderly persons living in the United States; by the year 2000, 30.6 million people will be age 65 or over (1). One in 8 Americans will have reached this age group by the year 2000, an increase of 8 million or 35 percent more than the current older population (2). In 1900, life expectancy at birth was about 45 years for both sexes in the United States. In 1977, life expectancy at birth was 69.3 and 77.1 years for men and women respectively (1).

This growth is due in part to the medical advances in controlling infectious disease and in curbing or stabilizing chronic disease. An increase in preventive health care to further combat disease has also contributed to this growth.

As stated in Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention (3), prevention of disease as a major component of health care is "an idea whose time has come (3)." The three major reasons cited for emphasis of preventive health care are: 1) an expected decrease in mortality resulting from the initiation of preventive measures, 2) an improvement in the quality of life, and 3) the cost effectiveness of preventive measures. The Department of Health and Human Services developed a plan for health for the years 1978-1982 (4), with focus on health promotion through disease prevention as one of the primary health concerns for today, stated thusly, "the best hope of achieving any significant extension

of life expectancy lies in the area of disease prevention (4)."

Older people are not a homogeneous group. An individual has little, if any, control over some factors that determine longevity and state of health (e.g. heredity and exposure to some pathogens). However, non-institutionalized individuals do have some choice of food and health care. Daza and Read (5) expressed a need to establish special nutrition surveillance activities and to make these activities an integral part of the health information system and thus to locate and close important gaps in existing knowledge.

This study was designed to determine the nutrient intake of older Americans, aged 60-74, who participated in the First Health and Nutrition Examination Survey (HANES I) and to relate factors which affected dietary adequacy to these nutrient intakes. The demographic variables considered included: race, sex, poverty income ratio (PIR), education, household resources, number of people in the household, and vitamin and mineral supplementation.

LITERATURE REVIEW

THE ELDERLY AS A HIGH RISK POPULATION

Variations exist from culture to culture as to who constitutes the elderly segment of the population and the roles and stereotypes assigned to them. In some societies, elderly persons are revered, honored citizens and advisors, and accorded a significant place in the community. In other cultures, however, the elderly person is assigned a "back seat," forced into retirement, and even cut off from family or community participation. Sadly, the latter is often the case in the United States. Gradually, as a result of criteria set by the individual himself, by his family, society, or an agency or organization, one is considered to be elderly.

Once that arbitrary demarcation has been made, changing demands and expectations are placed on the individual. Increased physiological demands do not occur suddenly. Instead, they develop and surface in accordance with the level of wellness. Sometimes, psychological changes may be more pronounced than physical ones because of the categorization of the person as "elderly."

Stereotypes of older Americans often depict them as frail and sick. Such an image is not accurate since much variability in health status exists among elderly persons. Ninety-five percent of older Americans live in a community in a noninstitutionalized setting, with over 80 percent reporting no limitation of mobility and having had no hospitalization in the past year (5). In spite of

these facts, as a person ages, the likelihood of experiencing illness increases.

Improving the quality of health among the older population is a complex task. Solutions to health problems do not primarily lie in improving the health care system. Lifestyles, including exercise patterns, food habits, smoking behavior, and alcohol consumption, have a greater impact on health than the health care system, and the lifestyles of the older population are, in a large part, a reflection of lifetime patterns of behavior and habit.

Food consumption patterns in the United States have drastically changed over the past 50 to 80 years (6), greatly affecting present day food practices of the elderly. For example, the trend toward a greater use of refined and processed foods and the status associated with larger intakes of animal proteins and fats have brought about less emphasis on the use of whole grain cereals, vegetables, and fruits (6). From 1910 to 1976 the consumption of refined foods increased 50 percent, total fat consumption increased 31 percent, and the consumption of complex carbohydrates declined by 21 percent in the United States as a whole (6).

Before one can attain any significant understanding of the acceptance or lack of acceptance of food by an older person, those interacting factors in his environment that determine his food habits must be assessed. These factors include: economic situation, environment, socialization, religion, culture, health, housing, lifestyle, education, aesthetics and politics. Reasons for choices and eating patterns are related to time and location, those with whom

they eat, and the conditions under which they eat.

A NUTRITIONALLY ADEQUATE DIET IS FUNDAMENTAL TO HEALTH AND WELL-BEING

Several investigators have related the nutritional adequacy of the diet to the health and well-being of an older person (6,7,8). Kelley et al. (7) studied ninety-seven women between the ages of 40 and 88, and found that physical well-being was directly related to nutrient intake. Physical complaints, such as pains in the joints or unexplained tiredness, were more frequent among those with diets low in one or more nutrients. Mortality over a 7 year period was higher in those subjects who reported intakes less than 40 percent of the recommended level for at least one nutrient. A follow-up study of these subjects after 24 years revealed that survivors had significantly higher intakes of protein and ascorbic acid when surveyed in 1945 compared to those who died between 1948 and 1972. Furthermore, survivors, although decreasing their intakes of calories, fat, and carbohydrate, continued to consume recommended levels of other nutrients. Reasons for death were not considered in the report. In another longitudinal study (8), food intake records for 577 California residents 50 years of age and 14 years later at 64 years revealed that higher mortality rates were associated with lower intakes of Vitamin A, niacin, and ascorbic acid. Incidence of chronic disease or reason for death was not reported. Based on these studies, adequate nutrient intake appears to be a consideration for the maintenance of health in middle and old age, however,

methodological problems weaken these conclusions.

DIETARY FINDINGS OF NATIONAL STUDIES

United States Department of Agriculture Food Consumption Survey (USDAFCS)

Preliminary data from the most recent USDA food consumption survey (9) from the spring of 1977 yielded about 5,000 individual 24-hour recalls. Data indicated that average intakes of kilocalories, calcium, magnesium, and vitamin B_6 for those over 65 years were below the 1974 RDA. These reported intakes of kilocalories, vitamin A, and calcium were below the average levels found for the elderly in the 1965 Household Food Consumption Survey (10). In addition, at least one-third of the assessed individuals over 64 were below 70 percent of the 1964 RDA standards for calcium, magnesium and vitamins A and C.

The 1965 Household Food Consumption Survey included 7500 households representative of all types of Housekeeping in the United States. The 1965 study showed that half the households with elderly individuals had diets rated as good on the basis that they provided the recommended levels of all nutrients (Recommended Dietary Allowances, 1963). One-fifth of the families had diets rated as poor, since they provided less than two-thirds of the recommended levels for one or more nutrients. Diets were most often inadequate in calcium, and vitamins A and C, especially in families whose incomes were below $3,000. Intakes of protein, iron, thiamine and riboflavin

met the standard for adequacy for 90 percent of the families. Dietary adequacy improved as income increased, although an adequate income provided no assurance of a good diet, since 9 percent of households with incomes over $10,000 had poor diets.

Analysis of the 24-hour dietary recall records of food eaten at home and away from home for 14,500 elderly members of the household in 1965 (as reported by the homemaker) showed that calcium and iron were the nutrients most often with levels below the recommended allowances.

Many of the elderly assessed in this 1965 survey consumed meals that feel short of the dietary standards. Most consumed at least one serving of meat or meat alternate. Cereal products were generously used. However, vegetables and citrus fruits were often lacking while calcium-rich dairy products were often used in insignificant amounts (10).

Ten-State Nutrition Survey

The Ten-State Nutrition Survey (1968-1970) (11) was the first comprehensive attempt to assess the nutritional status of the American people. The primary goal of this survey was to obtain nutrition data about the disadvantaged in the United States. Three primary assumptions were made which directed the planning of the study:

1) malnutrition would be most prevalent in the poverty population,

2) this poverty population could be identified in specified geographical areas, and

3) within the poverty population one would expect nutrition problems to be found in certain groups (migrant workers, Spanish-speaking populations in the Southwest, those in inner cities, and industrial centers).

From the 10 states selected, each identified a specific region where low income individuals or high income individuals formed a majority of the population. Low-income-ratio states were South Carolina, Louisiana, Kentucky, Texas, and West Virginia. On the basis of Poverty Income Ratio (PIR) a measure of socioeconomic level, the overall median PIR of these states was less than 1.39, which was the median for all the surveyed states. High-income-ratio states, Michigan, California, Washington, Massachusetts, New York State and New York City, had an overall median PIR of greater than 1.39. Dietary intake and nutritional assessment was carried out on the 23,846 who participated in the study. Only 2,076 of those were above 59 years of age.

Measurements taken in the survey included various clinical assessments, biochemical evaluations, dental examinations, dietary evaluations, and related health and demographic factors. Data was analyzed in relation to 1) attendance at health clinics, 2) years of schooling completed, 3) socioeconomic levels, 4) race, 5) family size, 6) family makeup, and others. Results of the analysis indicated that although the prevalence of multiple dietary deficiencies

varied considerably from state to state, black individuals had consistently higher rates of multiple dietary deficiencies than did white individuals. Dietary intakes of individuals 60 years and older indicated that as a group they were at high nutritional risk. Their mean caloric intakes were lower than the standard for age, sex, and weight. Data showed a wide range of intakes for most nutrients, and a high percentage of individuals consumed specific nutrients below set standards. Generally, individuals in low-income-ratio states had lower intakes of kilocalories and nutrients than those residing in high-income-ratio states.

First Health and Nutrition Examination Survey (HANES I)

The First Health and Nutrition Examination Survey (HANES I) (12) was conducted on approximately 28,000 persons 1-74 years old. See Appendix 1 for a more complete description of the survey design used. Analyzed data from HANES I revealed that blacks have a higher prevalence than whites of low intakes of vitamins D, C, and A and of the minerals calcium, iron, and iodine, and a lower prevalence of high intakes of protein and niacin. Income made a greater difference than race for only 3 of the 8 nutrients and kilocalories that were found to be of inadequate levels in the diets of those assessed. Nutrient intakes which appeared to be influenced more by income than race were 1) protein, 2) niacin, and 3) vitamin A, all of which showed that intake was higher among persons above than below the poverty level.

OTHER RELEVANT STUDIES

The remaining relevant literature includes studies done with non-random samples of aging individuals in various locations. These studies cannot assist in quantifying the scope of nutritional problems nationally, but do give some insight on the factors predisposing to inadequate nutrition.

Kilocalories

There is evidence as well as theoretical basis for recommending the intake of fewer calories by older individuals. Older people become less active as they leave a relatively active job for the more sedentary life of retirement. This food energy restriction may be lessened somewhat by keeping active in later life. Changes also occur in the metabolism which reduce oxygen consumption and the expenditure of energy. Older individuals tend to lose lean body mass, mostly due to some wasting of muscle, which results in an increase in the ratio of fat to lean tissue (or a relative obesity). Since nutrient intake should not be reduced, the number of calories consumed requires a certain amount of discretion in the kinds of food chosen.

Although the approximate rate of decline of the resting metabolism is known to be about two percent per decade (13), it is difficult to estimate the degree of reduction in physical activity that is associated with advancing age. Men whose jobs require light

activity exhibited fairly constant patterns of energy expenditure between 25 and 45 years of age by the methods of one group of researchers (14). In this research, activity was found to decline 200 kcal/day between ages 45 and 75, and 500 kcal/day after age 75. Due to evidence such as this, the 1980 RDA provides energy allowances for persons between 51 and 75 years, which is reduced to 90 percent of the amount set for the younger adult, and for the group over 75 years of age, the reduction recommended was 75 to 80 percent.

Researchers (8,10,15-21) have reported that the intake of energy by the elderly segment of the United States population is frequently inadequate. The low energy intakes reported in the HANES I (12) and the Ten-State (11) surveys indicated that whites in the income group above poverty level had the highest energy intake, while blacks in the lower income groups had the lowest energy intakes. Data from the Household Food Consumption Surveys (9,10) indicated that the mean caloric intake of the elderly segment of the population was less than the standards used in the studies. Moak and Miller (20) reported that elderly persons of both races with "inadequate" income had lower energy intakes than those of both races who were above the cutoff level for "inadequate" income. Other studies (16,17,20,22-24) have found the caloric intakes of their population to be within the range set by the standards they used, which varied. Tables 1-6 are summaries of the findings from smaller studies done on noninstitutionalized older Americans. Each table

summarizes one of the nutrients or kilocalories assessed by these researchers. See Table 1 for details of studies done on kilocalories.

Protein

From data available at present, it is evident that meeting protein allowance was the least problem among all the nutrients assessed. The mean protein intake was found to be adequate in most of the studies reviewed (7,8,15-22,25-27), regardless of standard or dietary procedure used, except in the Ten-State Survey (11) and a study conducted by Singleton et al. (26). In Moak and Miller's Study (20), only 8 percent of the males and 10 percent of the females consumed diets with less than satisfactory protein, compared to 73 percent and 72 percent of males and females respectively, whose intakes of protein were above the standard used. The Ten-State Survey (11) revealed a protein intake for low income black males, all black females, low income white females and high income Spanish-American females to be below 1g/kg body weight (their standard). However, the mean intakes of these subjects equalled or exceeded the RDA of 0.8 g/kg body weight for all groups except low income black females. See Table 2 for more details on other studies.

Vitamin A

The average amount of vitamin A consumed by the subjects in

TABLE 1

Overall Findings of Kilocalorie Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Kilocalorie Standard		Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
				body weight	kcal			
Kelley et al.	(7)	117 females	47-92	55kg	1800	40 and 80% 1953 RDA	not given	80% yes 40% no
Steinkamp et al.	(8)	68 males	64-98	70kg	2200	67% 1964 RDA	1962 males	yes
		73 females		58kg	1600	67% 1964 RDA	no	yes
McGandy et al.	(15)	137 males	> 55	70kg	2200	100% 1964 RDA	yes, age 75-99	not given
Davidson et al.	(16)	42 males	51-97	58kg	1800	100% 1958 RDA	yes	no
		62 females		70kg	2550	100% 1958 RDA	yes	no
Harrill et al.	(17)	15 females	>65	58kg	1700	100% 1974 RDA	yes	no
Lyons and Trulson	(18)	30 males	>65	65kg	2600	100% 1953 RDA	yes	yes-75% RDA
		70 females		55kg	1800	100% 1953 RDA	no	no
Kohrs et al.	(19)	45 males	>59	70kg	2400	67 and 50% 1974 RDA	yes	no
		66 females		58kg	1800	67 and 50% 1974 RDA	yes	no
Moak and Miller	(20)	156 males	>59	70kg	2380	100% 1980 RDA	yes	79%
		238 females		58kg	1682	100% 1980 RDA	yes	71%
Clarke et al.	(21)	98 males	> 70	70kg	2400	100% 1968 RDA	yes	yes
		98 females		58kg	1700	100% 1968 RDA	no	(6 = 67% for 2 or more nutrients)
Fry et al.	(22)	26 females	68-80	58kg	1800	100% 1958 RDA	no	no
Todhunter et al.	(23)	186 males	>60	70kg	2400	67% 1974 RDA	not given	no
		343 females		58kg	1800	67% 1974 RDA	not given	no
Dibble et al.	(24)	179 males	avg-74	70kg	2200	67% 1964 RDA	not given	no
		227 females	avg-71	58kg	1600	67% 1964 RDA	not given	no
Guthrie et al.	(25)	40 males	> 60	70kg	2400	67% 1968 RDA	not given	55% low income
		69 females		58kg	1700	67% 1968 RDA	not given	over 1/3 total
Singleton et al.	(26)	49 females	mean 73	58kg	1700	100% 1974 RDA	yes-65% of std.	not given
LeBovit	(27)	33 males	>50	70kg	2200	67% 1964 RDA	no	yes
		67 females		58kg	1600	67% 1964 RDA	no	no

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes indicates the category heading was true for that sex, and no indicates the category heading was not true for that sex

TABLE 2

Overall Findings of Protein Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Protein Standard g	Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
Kelley et al.	(7)	117 females	47-92	55	80 and 40% 1953 RDA	no	no
Steinkamp et al.	(8)	68 males	>49	70	67% 1964 RDA	no	no
		73 females		58	67% 1964 RDA	no	no
McGandy et al.	(15)	137 males	>55	70	100% 1964 RDA	no	no
Davidson et al.	(16)	42 males	51-97	70	100% 1958 RDA	no	no
		62 females		58	100% 1958 RDA	no	no
Harrill et al.	(17)	15 females	>65	46	100% 1974 RDA	no	no
Lyons and Trulson	(18)	30 males	>65	65	100% 1953 RDA	no	no
		70 females		55	100% 1953 RDA	no	no
Kohrs et al.	(19)	45 males	>59	56	50 and 67% 1974 RDA	no	not given
		66 females		46	50 and 67% 1974 RDA	no	not given
Moak and Miller	(20)	156 males	>59	56	100% 1980 RDA	no	27% below
		238 females	>59	44	100% 1980 RDA	no	28% below
Clarke et al.	(21)	15 females	> 65	46	100% 1968 RDA	no	no
Fry et al.	(22)	26 females	68-80	58	100% 1958 RDA	no	no
Todhunter et al.	(23)	186 males	> 60	46	67% 1974 RDA	not given	no
		343 females		56	67% 1974 RDA	not given	no
Dibble et al.	(24)	179 males	avg 74	58	67% 1964 RDA	not given	no
		277 females	avg 71	70	67% 1964 RDA	not given	no
Guthrie et al.	(25)	186 males	>60	65	67% 1968 RDA	no	no
		343 females		55	67% 1968 RDA	no	47% low income
Singleton et al.	(26)	49 females	avg 73	46	100% 1964 RDA	yes	not given
Lebovit	(27)	33 males	>50	70	67% 1964 RDA	no	no
		67 females		58	67% 1964 RDA	no	no

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes indicates the category heading was true for that sex, and no indicates the category heading was not true for that sex

the Moak and Miller study (20) was 145 and 124 percent of their standard of 5000 IU, however, 42 percent of males and 38 percent of females had levels of vitamin A intake that were less than this minimum level. Kohrs et al. (19) found mean retinol equivalent (RE) intake to be 223 and 226 percent of the RDA (1000 RE for males and 800 RE for females) for individuals studied in Missouri. The findings of Davidson et al. (16) were similar with less than 7 percent of the subjects consuming diets containing less than the 1958 RDA standard (5000 IU). Supplements were taken by 12 percent of the subjects assessed in this study. Spanish-Americans over 59 years who were assessed in the Ten-State Nutrition Survey (11) had vitamin A intakes that ranged from 2622 to 3441 IU per day (standard was 5000 IU). The mean intake of vitamin A, however, was greater than two-thirds of this standard. In the study reported by Guthrie et al. (25), 65 percent of the females had intakes lower than 3330 IU (two-thirds the RDA). A number of researchers found that one-third of their subjects had intakes below the standard used (20,21,23,25, 27). See Table 3 for additional information.

Vitamin C

The mean intake of vitamin C was adequate in all studies assessed (15-22,24,25), with the exception of men over 74 years in the 1965 USDA Household Food Consumption Survey (10) and the Moak and Miller study (23) conducted in Virginia. The men over 74 years in the 1965 USDA-HFCS whose consumption averaged 55 mg daily still

TABLE 3

Overall Findings of Vitamin A Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Vitamin A Standard IU	Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
Kelley et al.	(7)	117 females	47-92	5000	80 and 40% 1953 RDA	not given	80% yes
Steinkamp et al.	(8)	1942 - 98 M	>50	5000	67% 1964 RDA	no	no
		131 F			67% 1964 RDA	no	no
		1966 - 68 M					
		73 F					
McCandy et al.	(15)	137 males	>55	5000	100% 1964 RDA	no	not given
Davidson et al.	(16)	42 males	51-97	5000	100% 1954 RDA	no	no
		67 females					
Harrill et al.	(17)	15 females	>65	5000	100% 1974 RDA	no	no
Lyons and Trulson	(18)	30 males	>65	5000	100% 1953 RDA	no	no
		70 females			100% 1953 RDA	no	no
Kohrs et al.	(19)	45 males	>59	5000	67 and 50% 1974 RDA	no	no
		65 females		4000	67 and 50% 1974 RDA	no	no
Moak and Miller	(20)	156 males	>59	3500	100% 1980 RDA	yes	yes
		238 females			100% 1980 RDA	yes	yes
Clarke et al.	(21)	98 males	>70	5000	100% 1968 RDA	no	1/3 < 6
		98 females			(Score 1-8)	no	1/3 < 6
Fry et al.	(22)	6 females	68-80	5000	100% 1958 RDA	no	no
Todhunter et al.	(23)	186 males	>60	5000	67% 1974 RDA	not given	yes
		343 females		4000	67% 1974 RDA		
Dibble et al.	(24)	129 males	avg 74	5000	67% 1964 RDA	not given	no
		277 females	avg 71		67% 1964 RDA	not given	no
Guthrie et al.	(25)	40 males	>60	5000	67% 1968 RDA	yes	yes
		69 females			67% 1968 RDA	yes	yes
Singleton et al.	(26)	49 females	avg 73	5000	100% 1964 RDA	no	no
LeBovit	(27)	33 males	>55	5000	67% 1964 RDA	no	yes
		67 females			67% 1964 RDA	no	yes

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes indicates the category heading was true for that sex, and no indicates the category heading was not true for that sex

consumed in excess of the 1974 RDA. Todhunter et al. (23), Dibble et al. (24) and Guthrie et al. (25) reported that at least one-third of their subjects consumed less than adequate levels of ascorbic acid (as assessed by their own standards). In the data reported by Kelley et al. (7), one-half of the white women and two-thirds of the black women fell below the standard (1953 RDA) used in this study (70 and 75 mg), which was higher than the standards used in the studies previously mentioned. See Table 4 for additional information.

Calcium

The intake of calcium is most often below standards set for persons past 59 years of age. This also seems to be more of a problem in women than men. The mean calcium intake for females fell short of two-thirds the standard set by the researchers for two studies (8,25), and below 100 percent of the set standards for others (15,20,21,26). Even more indicitive that a problem exists in regard to low calcium intake is the proportion of subjects whose intakes fell below these recommendations. In a Canadian survey in 1963 (28), authors reported that one-half of the general population and Indian women did not have an adequate intake of calcium as assessed. Among the male Eskimos assessed in this study, 99.9 percent consumed less than the researcher's set standards of calcium. Data from another study suggested (25) that at least one-third of the women subjects consumed levels of calcium below two-thirds of

TABLE 4

Overall Findings of Vitamin C Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Vitamin C Standard mg	Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
Kelley et al.	(7)	117 females	47-92	70	80 and 40% 1953 RDA	not given	80% yes
Steinkamp et al.	(8)	1942 - 98 M 131 F	>50	70	67% 1964 RDA	no	no
		1966 - 68 M 73 F			67% 1964 RDA	no	no
McCandy et al.	(15)	137 males	>50	70	100% RDA	no	not given
Davidson et al.	(16)	42 males	51-97	75	100% 1958 RDA	no	no
		62 females		70	100% 1958 RDA	no	no
Harrill et al.	(17)	15 females	>65	45	100% 1974 RDA	no	no
Lyons and Trulson	(18)	30 males	>65	75	100% 1953 RDA	no	no
		70 females		70	100% 1953 RDA	no	no
Kohrs et al.	(19)	45 males	>59	45	50 and 67% 1974 RDA	no	no
Moak and Miller	(20)	156 males	>59	60	100% 1980 RDA	yes	yes
		238 females		60	100% 1980 RDA	no	yes
Clarke et al.	(21)	98 males	>70	60	100% 1968 RDA	no	yes-score 6
		98 females		55	100% 1968 RDA (score of 1-8)	no	yes-score 6
Fry et al.	(22)	6 females	68-80	70	100% 1958 RDA	no	no
Todhunter et al.	(23)	186 males	>60	45	67% 1974 RDA	not given	yes
		343 females			67% 1974 RDA	not given	no
Dibble et al.	(24)	179 males	avg 74	70	67% 1964 RDA	not given	no
		277 females	avg 71		67% 1964 RDA	not given	no
Guthrie et al.	(25)	40 males	>60	60	67% 1968 RDA	no	yes
		69 females		55	67% 1968 RDA	no	yes
Singleton et al.	(26)	49 females	avg 73	45	100% 1964 RDA	no	no
LeBovit	(27)	33 males	>50	70	67% RDA	no	yes
		67 females			67% RDA	no	yes

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes indicates the category heading was true for that sex, and no indicates the category heading was not true for that sex

the level set as the standard. Of the respondents in the Ten-State Nutrition Survey (11), one-half of the women from high-income states consumed less than 50 percent of the calcium recommended. See Table 5 for additional details.

Iron

There are numerous studies which show a high incidence of low intake of iron in the United States population as a whole. This tends to be the general trend in older individuals as well. The mean intake of iron was less than the standard of 10gm for the group studied by Harrill et al. (17), for females over 59 years assessed in the Ten-State Nutrition Survey (11), those in the low income group from the HANES I (12), and in subjects assessed by Lyons and Trulson (18). In addition, various percentages of these subjects had intakes below the standard in a number of other studies (23,26) (Table 6).

A few researchers did not find iron intakes in the elderly segment of the populations they assessed to be low. Subjects in the Moak and Miller study (20) consumed 136 percent and 113 percent of their standard for this nutrient for males and females respectively. Only six percent of the female subjects consumed less than two-thirds the standard for iron. Kohrs et al. (19) found the intake of their assessed population to be 150 percent of the standard of 10 mg for males and 105 percent for females. Several researchers (15,16,19-21,25,27) showed that the mean intake of their sample was above

TABLE 5

Overall Findings of Calcium Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Calcium Standard mg	Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
Kelley et al.	(7)	117 females	47-92	800	80 and 40% 1953 RDA	not given	80 yes 40 yes-black F
Steinkamp et al.	(8)	1942 - 98 M 131 F 1966 - 68 M 73 F	64-98	800	67% 1964 RDA 67% 1964 RDA	no yes	no yes
McGandy et al.	(15)	137 males	> 55	800	100% 1964 RDA	yes-54-64 yrs	not given
Davidson et al.	(16)	42 males 62 females	51-97	800	100% 1958 RDA 100% 1958 RDA	no no	no no
Harrill et al.	(17)	15 females	> 65	800	100% 1974 RDA	yes	yes-2/3 RDA
Lyons and Trulson	(18)	30 males 70 females	> 65	800	100% 1953 RDA 100% 1953 RDA	no no	no no
Kohrs et al.	(19)	45 males 66 females	> 59	800	67 and 50% 1974 RDA 67 and 50% 1974 RDA	no no	no no
Moak and Miller	(20)	156 males 238 females	> 59	800	100% 1980 RDA 100% 1980 RDA	yes yes	yes no
Clarke et al.	(21)	98 males 98 females	> 70	800	100% 1968 RDA (score of 1-8)	yes yes	1/3 score 6 or less (47% for 2+ nutrients)
Fry et al.	(22)	26 females	65-85	800	100% 1958 RDA	no	none < 2/3 RDA
Todhunter et al.	(23)	186 males 343 females	> 60	800	67% 1974 RDA 67% 1974 RDA	not given not given	no no
Dibble et al.	(24)	179 males 277 females	avg 74 avg 71	800	67% 1964 RDA 67% 1964 RDA	not given not given	no no
Guthrie et al.	(25)	40 males 69 females	> 60	800	67% 1968 RDA 67% 1968 RDA	no yes	yes yes
Singleton et al.	(26)	49 females	avg 73	800	100% RDA	yes	75%-yes
Lebovit	(27)	33 males 67 females	> 50	800	67% 1964 RDA 67% 1964 RDA	no no	no no

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes intidates the category heading was true for that sex, and no indicates the category heading was not true for that sex

their standard (see Table 6). Numerous researchers (16,18,21,23) found that at least one-third of the populations assessed had intakes below their standards, with this problem again more prevalent in females. See Table 6 for additional information.

INCOME

We live in a socioeconomic reality which requires people to purchase health care services. At the lower income levels, people are living at and below subsistence levels which leave them without resources for purchasing adequate health services including nutritional counciling and care. The medicaid program, in operation now for over a decade, was initiated to provide subsidies for these services to the people in lower income brackets. This program has not eradicated medical indigency, however, since some medical services have not been covered. Also, the family income and resource requirements for participation in that program are such that a large number of people needing some subsidy cannot be beneficiaries of the program.

Generally, the elderly segment of the population is a low income group. Many persons reaching retirement age have always had a low income, and old age only compounds the problems of a lifetime of poverty of near poverty. Many other elderly individuals join the ranks of the poor after retirement. Since 1960, the elderly segment of the United States population has consistently had income levels almost half that of the younger population (29). Elderly

TABLE 6

Overall Findings of Iron Intake From Studies on Noninstitutionalized Older Americans

	Study	Number of Subjects	Age in Years	Iron Standard mg	Standard for Adequacy Used	Mean Standard[ac]	1/3 Standard[bc]
Kelley et al.	(7)	117 females	47-92	12	80 and 40% 1953 RDA	not given	80 yrs
Steinkamp et al.	(8)	1942 - 98 M	> 50	10	67% 1964 RDA	no	no
		131 F			67% 1964 RDA	no	no
		1966 - 68 M					
		73 F					
McGandy et al.	(15)	137 males	> 55	10	100% 1964 RDA	no	not given
Davidson et al.	(16)	42 males	51-97	10 & 12	100% 1958 RDA	no	yes
Harrill et al.	(17)	15 females	> 65	10	100% 1974 RDA	yes-69-75 yrs	no
Lyons and Trulson	(18)	30 males	> 65	12	100% 1953 RDA	no	no
		70 females			100% 1953 RDA	yes	75%
Kohrs et al.	(19)	45 males	>59	10	67 and 50% 1974 RDA	no	no
		66 females			67 and 50% 1974 RDA	no	no
Moak and Miller	(20)	156 males	>59	10	100% 1980 RDA	no	no
		236 females			100% 1980 RDA	no	no
Clarke et al.	(21)	98 males	>70	10	100% 1968 RDA	no	1/3 <6
		98 females			(score of 1-8	no	
Fry et al.	(22)	26 females	68-80	10	100% 1958 RDA	yes	no
Todhunter et al.	(23)	186 males	>60	10	67% 1974 RDA	not given	no
		343 females			67% 1974 RDA	not given	yes
Dibble et al.	(24)	179 males	avg 74	10	67% 1964 RDA	not given	no
		277 females	avg 71		67% 1964 RDA	not given	no
Guthrie et al.	(25)	40 males	>60	10	67% 1968 RDA	no	no
		69 females			67% 1968 RDA	no	no
Singleton et al.	(26)	49 females	avg 73	10	100% 1964 RDA	yes	not given
LeBovit	(27)	33 males	>50	10	67% 1964 RDA	no	no
		67 females			67% 1964 RDA	no	no

a - the mean intake was less than the standard used
b - intakes of one-third of the assessed individuals were below the standard
c - yes indicates the category heading was true for that sex, and no indicates the category heading was not true for that sex

individuals living alone are generally more deprived economically than elderly individuals living in a family setting. Persons living alone tend to be older, mostly widows, and are less likely to work or receive retirement benefits. Furthermore, there has been a recent trend toward an increasing number of elderly persons living alone and a decreasing number of elderly persons living in families (30).

Almost two out of three older families in 1975 subsisted on incomes of less than $11,000 whereas only about one in three older families in that same year, who were headed by a younger person, had incomes less than $11,000 (31). The economic situation of older people living alone or with non-relatives is more severe than older persons living in families or younger households. Four-fifths of these "unrelated older individuals" subsisted on incomes in 1975 of $6000 or less anually. In contrast, less than half of the older individuals living alone or with non-relatives had incomes under $6000 in 1975 (31).

Certain groups within the older population emerge as relatively more disadvantaged than others (32). Elderly black individuals and elderly females tend to be more economically disadvantaged than elderly white individuals or elderly males. The median family income levels in 1975 for both black individuals and white individuals 65 years of age and older were almost twice that of elderly females. This is due, in part, to the higher earnings of men when employed. The income of older women is often dependent on their husbands when employed. When a husband dies, the benefits received from Social

Security are greatly reduced, and often private pension income stops completely (33). Thus, the most economically disadvantaged subgroup within the aged population consists of black females living alone.

It is commonly asserted that the economic needs of the elderly in America are less than those of younger persons. Many expenses incurred by younger families are either reduced or eliminated when a person reaches retirement age. However, this reduction in income, usually about fifty percent, upon retirement does not correspond with a drop in monetary needs by the same percentage. Older people spend a smaller proportion of their income than do younger people on education and transportation, but they spend a greater proportion on food, housing, and medical care. These latter categories (food, housing, and medical care) are often the ones hardest hit by inflation. As a greater proportion of income is taken up with providing the necessities, less remains for nonessentials (luxuries) which contribute to the "quality of life".

PROCEDURE

Source of Data

Nutrient and kilocalorie intake analysis of various population segments of older Americans has been done (8-13). Few current studies have attempted to document demographic factors and their impact on nutrient and kilocalorie intakes. This study was designed to identify demographic characteristics which might be useful in predicting nutrient intakes of groups of aged Americans. This present study assessed the relationship of sex, race, income[1], total number of people in the household, grade level attained (education), and household resources, to nutrient intakes of a cross-section of American individuals age 60 to 74 in HANES I. The data was obtained through computer tapes compiled by the National Center for Health Statistics from data collected in HANES I, conducted 1971-1974 (12). Tapes were purchased with a Learning Resource Center Grant from Virginia Polytechnic Institute and State University.

Data collected nationwide on nutrient intake of the United States is primarily used:

1) to correlate with national health problems as well as health status findings from HANES I and other health studies, and

[1]As above and below poverty, measured by the Poverty Income Ratio. For additional details see Appendix 1.

2) to assess trends in nutrient consumption; to collect a data base for public health providers; to identify risk groups, and to establish critical programs and resources for target groups.

Only the second area will be addressed in this study.

Data Analysis

Data obtained from computer tapes was analyzed using the Statistical Analysis System (SAS). Two-way chi-square tests of statistical significance were calculated to test whether a dependant or independant relationship existed between the nutrients or kilocalories and demographic indexes considered. Test results were invalid in those instances in which over 20 percent of the chi-square cells contained fewer than 5 expected values.

The intake of nutrients and kilocalories, as a percentage of the HANES I standards, were grouped into 4 categories for evaluation:

1) > 100% of standard,
2) > 67% byt ≤100% of standard,
3) > 50% but ≤ 67% of standard, and
4) > 50% of standard.

For discussion, data in groups 3 and 4 were grouped together due to the volume of data generated. Each demographic characteristic assessed was also subdivided by race, sex, income level, and combinations of these.

Intakes of protein, vitamins A and C, calcium, iron, and

kilocalories, when assessed by household resources, were divided into 2 categories of percentage of intake of HANES I standard:

1) $>$ 67% of standard, and

2) $\geq$ 67% of standard.

A two-way chi-square test was done on each possible combination of household resources by each nutrient and kilocalories. The household resources used included:

1) piped water,

2) hot and cold piped water,

3) sink,

4) refrigerator, and

5) range.

Interviewers only recorded a presence or absence of these resources. Since 95 percent of the individuals assessed had all 5 of the household resources reported, those individuals who had less than all of these household resources were to provide meaningful statistical analysis. Household resources were subdivided by income level only when it became apparent that income level determined the number of household resources in the assessed households.

Highest garde of school ever attended was recorded by actual grade. Due to the bulkiness of testing this number of categories, and since the delineations between the grades were often not clearly distinguished, new groupings were used. Highest grade of regular school attended by the interviewee was restructured into 7 categories:

1) no school,

2) first through sixth grade,

3) seventh and eighth grade,

4) ninth through twelfth grade,

5) some college,

6) graduated from college, and

7) other (including special school, blank but applicable, and not applicable).

Since some subgroups of the population were oversampled at known rates, (the elderly, minority races, and low income individuals) relative weights were assigned to the data of each individual by the National Center for Health Statistics (12). The weights were distributed to allow the resulting sample to be more characteristic of the United States population of older people. Since the resulting numbers would have been excessively large for the computer at Virginia Polytechnic Institute and State University to handle, and thus undesirable rounding would have resulted, they were divided by 5228, the mean of the weights, to scale these numbers to a more managable size.

The number of individuals receiving dietary supplementation was reported by type and frequency of use of supplement. Supplement frequency was reported in 3 categories:

1) no supplementation,

2) regular supplementation, and

3) irregular supplementation.

"Regular supplementation" denoted the existence of regularity and not necessarily a daily intake pattern.

Type of supplement was reported in 10 categories:

1) unknown, prescriptions,
2) multiple vitamins,
3) multiple vitamins and minerals,
4) iron only,
5) multiple vitamins with iron,
6) vitamins A, E, and D,
7) vitamin C,
8) calcium,
9) not applicable or vitamin B, and
10) miscellaneous.

Protein supplements would have been included in "miscellaneous" and thus could not be separately assessed. Analysis of the data became complex when irregular ingestion was generally noted and not specified for each supplement.

The number of individuals in each category of type of supplementation were tabulated. It was assumed that multivitamin supplements included both vitamins A and C, and that mineral supplements included both iron and calcium. The number and percent taking supplements in each of the 4 applicable nutrients assessed in this study (vitamins A and C, calcium and iron) were calculated. A comparison was made between individuals taking a supplement and not taking a supplement for those whose intake exceeded 100% of the HANES I standard for a particular nutrient. Although quantitative dosage information was not available on the tapes used, these dosage levels were included

in the 24-hour recall. This was apparent since the highest ingestions of nutrient intake could not have been achieved without supplementation.

Data for which accuracy was questioned by the interviewers was not included in the analysis. Data for individuals over 59 years of age was transferred from the original tape to a temporary disc for analysis to reduce the amount of time required to read data tapes. The alpha level of significance used for the two-by-two chi-square tests of independence was 0.01 unless otherwise specified. Though those of other races were used in computations, they were omitted in reporting due to the small number of cases. The design of HANES I is included in Appendix 1.

Hypothesis

1) Individuals with a higher level of education consume food with nutrient components that meet a higher percentage of recommended allowances than those individuals with a lower level of education.
2) Individuals who participate in the food stamp program consume food with nutrient components that meet a higher percentage of recommended allowances than those individuals not participating in the program.
3) Individuals who have a poverty index ratio (PIR) below the standard for adequacy consume food with nutrient components that meet a smaller percentage of standard than individuals whose PIR is above the standard for adequacy.

4) Individuals living in households with more than one person consume food with nutrient components that meet a higher percentage of standard than those with one person.

5) A lack of household resources, singly or in combination, decrease the percentage of standards of the nutrients in the food consumed.

6) Females consume food with nutrient components that meet a higher percentage of the standard than males, independent of other variables.

7) Blacks, and those of "other" races consume food with nutrient components that contain a smaller percentage of standard for the nutrients assessed than whites.

RESULTS AND DISCUSSION

The results of analysis reported and discussed in the ensuing pages are from data on individuals age 60-74 collected in the First Health and Nutrition Examination Survey (HANES I, 1971-1974). This study was designed to assess which of selected demographic variables influenced kilocalorie and nutrient intake of these individuals.

Sex

No statistically significant difference was found between the sexes for percentage of standard met for kilocalories (see Table 7). This implies that although each sex has a different recommended intake of kilocalories, (2380 kcal for males and 1682 kcal for females) the difference in distribution of intake as a percentage of standard is not significantly different. Therefore, sex is not an important criterion in predicting caloric intake as a percentage of the HANES I standard met.

Protein intake was significantly different ($p<0.01$) between the sexes for the white individuals above poverty assessed (Appendix I). This indicates that the distribution of percentage of standard of protein consumed was as expected based on chi-square tests in all the groups except whites above poverty, although the standard level of intake is much greater for males (70 g) than females (58 g). The difference in recommended levels of protein for males and females is greater than the difference that could be attributed to differences

TABLE 7

INTAKE AS A PERCENTAGE OF INDIVIDUALS CONSUMING MORE THAN AND LESS THAN TWO-THIRDS OF THE HANES I STANDARD FOR NUTRIENTS AND KILOCALORIES FOR SEX BY POVERTY INDEX RATIO (PIR) AND RACE

	Kilocalories		Protein		Vitamin A		Vitamin C		Calcium		Iron	
	> 67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤ 67%
Above Poverty												
White Male	56.2	43.8	79.7	20.3	71.0	29.1	67.2	32.8	90.2	9.8	89.5	10.6
White Female	60.1	39.9	71.7	28.3	61.7	38.3	71.8	29.2	62.0	38.0	70.5	29.5
p-value[a]	.0385		.001		.0001		.0292		.0001		.0001	
Black Male	35.1	64.9	63.8	36.2	56.4	43.6	63.8	36.2	64.9	35.1	77.7	22.3
Black Female	47.2	52.8	64.8	35.2	51.7	48.3	60.2	39.8	46.6	53.4	54.5	45.5
p-value[a]	.0246		.3871		.0095		.0037		.0001		.0001	
Below Poverty												
White Male	43.8	56.2	66.8	33.2	53.1	46.9	42.9	57.1	83.2	16.8	80.1	19.9
White Female	52.0	48.0	63.1	36.9	53.4	46.6	58.8	41.2	58.3	41.7	56.3	43.7
p-value[a]	.0609		.2024		.9107		.0028		.0001		.0001	
Black Male	34.6	65.4	60.8	39.2	50.8	49.2	40.8	59.2	66.2	33.8	70.8	29.2
Black Female	37.9	62.1	53.3	46.7	50.9	49.1	58.6	41.4	43.2	56.8	45.0	55.0
p-value[a]	.3447		.5763		.7511		.0155		.0001		.0001	

a) These p-values are for four by four chi-square tables. These tables were reduced to the two by two tables shown for discussion purposes, p 0.01 was accepted as significant.

in recommended caloric intake. The recommendation of total kilocalories for males and for females were divided by a calculated value of kilocalories from the recommended protein intake. This established 8.5 percent of total kilocalories for males as protein and similarly 7.3 percent for females. Apparently, the white males above poverty consumed a much greater percentage of their diet in protein foods than any of the other groups assessed.

For black and white individuals above poverty, males were more likely than females to consume at least 67 percent of the HANES I standard for vitamin A. Analysis should be carried out on the intake of food groups to determine if the difference is due to the intake of fat or vegetable.

There was a significant difference ($p < 0.01$) between the intake of vitamin C by sex (whites above poverty $p < 0.03$); a greater percentage of females than males consumed diets whose vitamin C levels were greater than 67 percent of the HANES I standard except in black individuals above poverty. This may be due to the use of supplements. See section on supplementation for details.

For all race and income groups, a greater percentage ($p < 0.01$) of males than females consumed at least 67 percent of the HANES I standard for iron and calcium. Both of these nutrients can be related to the greater kilocalorie and protein consumption of males.

Race

Individuals designated as white were more likely than black individuals to consume at least 67 percent of the HANES I standard for the nutrients and kilocalories assessed (Table 8). White individuals of both income levels and sexes (low income males $p < 0.07$) were more likely than black individuals to consume levels of kilocalories meeting at least 67 percent of the HANES I standard. Protein intake was significantly different ($p < 0.01$) between the races for individuals above poverty. A statistically significant difference ($p < 0.01$) was found between the races for intakes of vitamin A for all individuals except males above poverty. There was no statistically significant difference between the races regarding vitamin C intake except in females above poverty ($p < .05$). Evidently vitamin C intake is unaffected by race. See section on supplementation for details (Figure 6).

White individuals consistently consumed diets whose calcium levels were significantly higher ($p < 0.01$) than were intakes of black individuals. This could have been due to the reported higher rate of lactose intolerance among black individuals, or cultural influences on food patterns.

Findings regarding iron intake and race correlate with those found for protein. This is not surprising, since many foods high in protein are also often high in iron.

TABLE 8

INTAKE AS A PERCENTAGE OF INDIVIDUALS CONSUMING MORE THAN AND LESS THAN TWO-THIRDS OF THE HANES I STANDARD FOR NUTRIENTS AND KILOCALORIES BY RACE FOR POVERTY INDEX RATIO (PIR) AND SEX

	Kilocalories		Protein		Vitamin A		Vitamin C		Calcium		Iron	
	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%
Above Poverty												
White Male	56.2	43.8	79.7	20.3	71.0	29.0	67.2	32.8	90.2	9.8	89.5	10.5
Black Male	35.1	64.9	63.8	36.2	56.4	43.6	63.8	36.2	64.9	35.1	77.7	22.3
p-value[a]	.0001		.0001		.0055		.2190		.0001		.0001	
White Female	61.1	38.9	71.7	28.3	61.7	38.3	71.8	28.2	62.0	38.0	70.5	29.5
Black Female	47.2	52.8	64.8	35.2	51.7	48.3	60.2	39.8	46.6	53.4	54.5	45.5
p-value[a]	.0007		.0138		.0024		.0466		.0011		.0001	
Below Poverty												
White Male	43.8	56.2	66.8	33.2	53.1	46.9	42.9	57.1	83.2	16.8	80.1	19.9
Black Male	34.6	65.4	60.8	39.2	50.8	49.2	40.8	59.2	66.2	33.8	70.8	29.2
p-value[a]	.0665		.2764		.8781		.7098		.0010		.1698	
White Female	52.0	48.0	63.1	36.9	53.4	46.6	58.9	41.1	58.3	41.7	56.3	43.7
Black Female	37.9	62.1	53.3	46.7	50.9	49.1	58.6	41.4	43.2	56.8	45.0	55.0
p-value[a]	.0010		.1484		.0073		.1528		.0003		.1779	

a) These p-values are for four-by-four chi-square tables. These tables were reduced to the two by two tables shown for discussion purposes, $p < 0.01$ was accepted as significant.

Poverty Income Ratio

Individuals above poverty were more likely than individuals below poverty to consume at least 67 percent of the HANES I standard for kilocalories and the nutrients assessed except calcium, where there was no difference in intake (Table 9). A greater percentage of white individuals above poverty than white individuals below poverty consumed at least 67 percent of the HANES I standard for kilocalories, protein, vitamins A and C, and iron. However, for white females there was a difference ($p < 0.02$) in kcal consumption between those above and below poverty. There was no difference between the income categories for black individuals in consumption of kilocalories or any of the nutrients assessed. No difference between the income levels was found in calcium intake.

With the exception of black individuals, results from analysis in this study indicate that intake of kilocalories and those nutrients evaluated were positively correlated to income, as was shown in the preliminary data from the 1977 USDA-HFCS (35). Once again, in our data iron intakes were related to protein intake. The finding of no difference between the two income levels for calcium intake indicates that it is not income dependent.

Household Resources

Almost 95 percent of the assessed individuals had all 5 of the household resources reported in HANES I. Three other groupings

TABLE 9

INTAKE AS A PERCENTAGE OF INDIVIDUALS CONSUMING MORE THAN AND LESS THAN TWO-THIRDS OF THE HANES I STANDARD FOR NUTRIENTS AND KILOCALORIES BY POVERTY INDEX RATIO (PIR) FOR RACE AND SEX

	Kilocalories		Protein		Vitamin A		Vitamin C		Calcium		Iron	
	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%	>67%	≤67%
Males												
White Above Poverty	62.5	37.5	82.8	17.2	73.0	27.0	70.0	30.0	89.2	10.8	90.8	9.2
White Below Poverty	49.6	50.4	68.1	31.9	64.9	35.1	49.3	50.7	86.6	13.4	81.4	18.6
p-value[a]	.0007		.0001		.0013		.0001		.4495		.0001	
Black Above Poverty	34.5	65.5	61.5	38.5	75.0	25.0	64.9	35.1	67.6	32.4	82.8	17.2
Black Below Poverty	37.9	62.1	59.8	40.2	60.4	39.6	40.8	59.2	68.7	31.3	71.6	28.5
p-value[a]	.3518		.1956		.3627		.3729		.7364		.1576	
Females												
White Above Poverty	62.0	38.0	74.9	25.1	60.1	39.9	73.7	26.3	58.7	41.3	73.4	26.6
White Below Poverty	57.7	47.3	64.7	35.3	53.6	46.4	59.3	40.7	57.7	42.3	60.2	39.8
p-value[a]	.0211		.0001		.0138		.0001		.3754		.0001	
Black Above Poverty	51.6	48.4	63.4	36.6	58.2	41.8	64.0	36.0	40.3	59.7	56.6	43.4
Black Below Poverty	41.6	58.4	60.4	39.6	49.6	50.4	57.7	42.3	48.7	51.3	48.9	51.1
p-value[a]	.3967		.5577		.0267		.6711		.5472		.3325	

a) These p-values are for four-by-four chi-square tables. These tables were reduced to the two by two tables shown for discussion purposes, $p < 0.01$ was accepted as significant.

of household resources contained sufficient numbers of individuals to test in two by two chi-square tests for validity. Groups compared were:

1) range and refrigerator vs. all the resources,
2) range, refrigerator, and piped water vs. all the resources,
3) sink, range, refrigerator, and piped water vs. all the resources,
4) range, refrigerator and piped water vs. range, refrigerator, piped water, and sink, and
5) range and refrigerator vs. range, refrigerator and piped water.

Results of the analysis of data indicated that poverty status influenced nutrient and kilocalorie intake more than the availability of household resources. This was evident since the individuals with less than five household resources were found predominantly in the low income groups.

Level of Education

Level of education of the respondent was positively associated with the percentage of individuals meeting or exceeding 67 percent of the HANES I standard for each nutrient and kilocalories in some groups (Tables 10-15). The relationship was both true and statistically significant for kilocalories (Table 10), protein (Table 11) and vitamins A and C (Tables 12 and 13) in females, and true in males for both vitamins (Tables 12 and 13) and minerals (Tables 14

TABLE 10

INTAKE OF KILOCALORIES AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO THIRDS OR MORE OF THE HANES I STANDARD BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

	Level of Education						
Population	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	53.6	53.8	62.8	63.9	69.0	53.2	.0001
Sex							
Male	53.2	52.1	63.8	62.8	60.7	73.6	.0001
Female	54.2	55.3	62.0	64.7	76.4	48.8	.0001
Race							
White	59.6	55.8	64.1	63.9	69.2	55.7	.0001
Black	43.6	41.6	41.5	76.7	43.3	35.5	.7177
Other	41.3	23.8	70.1	4.3	100.0	100.0	.8572

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

TABLE 11

INTAKE OF PROTEIN AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO THIRDS OR MORE OF THE HANES I STANDARD (g/kg) BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

	Level of Education						
Population	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	61.6	71.2	77.6	81.6	89.0	66.4	.0001
Sex							
Male	67.9	77.1	80.7	79.9	90.6	77.5	.0001
Female	50.8	65.9	75.1	82.8	87.4	64.1	.0001
Race							
White	71.2	71.8	79.4	81.7	89.3	67.8	.0001
Black	51.3	67.2	49.3	84.4	43.3	55.8	.0139
Other	0	81.4	78.6	37.4	100.0	100.0	.6938

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

TABLE 12

INTAKE OF VITAMIN A, AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO-THIRDS OR MORE OF THE HANES I STANDARD (3500 IU) BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

	Level of Education						
Population	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	61.2	60.5	66.2	69.6	74.5	59.1	.0001
Sex							
Male	63.2	66.1	75.0	79.3	85.9	65.7	.0004
Female	57.7	55.5	59.3	62.8	64.3	57.7	.0001
Race							
White	60.5	60.8	66.3	69.5	74.7	60.0	.0001
Black	66.9	59.7	66.1	76.9	53.4	52.2	.8991
Other	28.3	36.0	45.3	73.5	100.0	100.0	.8278

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

TABLE 13

INTAKE OF VITAMIN C AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO-THIRDS OR MORE OF THE HANES I STANDARD (60 mg) BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

	Level of Education						
Population	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	40.2	59.3	73.9	79.2	88.3	71.2	.0001
Sex							
Male	32.3	57.0	72.4	84.7	84.7	64.2	.0001
Female	53.9	61.4	75.1	75.4	91.5	72.8	.0001
Race							
White	42.8	59.2	74.1	79.3	88.7	72.1	.0001
Black	40.7	61.2	72.6	77.3	44.1	62.2	.4670
Other	0	21.2	53.7	26.9	0	100.0	.9258

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

TABLE 14

INTAKE OF CALCIUM AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO-THIRDS OR MORE OF THE HANES I STANDARD (400 mg) BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

Population	Level of Education						
	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	70.9	68.3	72.7	71.2	77.3	59.9	.0001
Sex							
Male	79.6	83.8	88.0	93.6	95.8	77.8	.0001
Female	53.4	54.3	60.8	55.4	60.7	56.0	.0004
Race							
White	79.2	70.6	73.6	71.0	77.2	64.8	.0001
Black	52.0	54.2	59.0	87.7	100.0	25.7	.0016
Other	71.6	38.1	74.2	30.8	0	100.0	.7304

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

TABLE 15

INTAKE OF IRON AS A PERCENTAGE OF INDIVIDUALS CONSUMING TWO-THIRDS OR MORE OF THE HANES I STANDARD (10 mg) BY YEARS OF SCHOOL ATTENDED BY INTERVIEWEE

Population	Level of Education						
	None	1-8 yrs	9-12 yrs	College	Graduate	Other	p-value[1]
Total	69.8	75.2	79.8	83.1	90.5	67.1	.0001
Sex							
Male	76.6	87.5	89.7	90.3	90.4	89.4	.0020
Female	58.3	63.9	72.0	78.0	90.6	62.2	.0001
Race							
White	73.3	76.3	81.5	83.1	90.9	66.6	.0001
Black	68.6	67.0	53.0	85.9	43.4	70.2	.3382
Other	28.3	95.6	73.6	63.8	100.0	100.0	.9179

[1]This value was taken from six by four chi-square tables. The data presented is a combination of two of the four categories.

and 15) assessed. This implies that the level of education of the female may be more important for obtaining adequate levels of kilocalories, protein, and both vitamins A and C, while education of the male influenced intakes of kilocalories and the vitamins and minerals assessed. All these were significant at $p < 0.0001$, except intake of vitamin A by males ($p < 0.0004$).

Though black individuals had a lower intake of calcium (Table 14) than white individuals, calcium intake was positively related to educational level in black individuals ($p < .001$). Perhaps the difference in level of education for calcium intake is due to increased awareness in black individuals of the need for this essential nutrient with increasing levels of education. These differences could also be due to differences in cultural food patterns. This population group consumes more bread containing baking powder as a leavener and more leafy greens. The magnitude of the effect of avoidance of milk products due to lactose intolerance in black individuals is unknown. Perhaps through education, these lactose intolerance black individuals find other ways to obtain dietary calcium or alleviate milk absorption problems. The nutrients positively influenced by level of education in white individuals were protein (Table 11), both vitamins (Tables 12,13), and iron (Table 15)

Supplementation

The data presented here related to supplementation was not

tested for statistical significance, but is presented to illustrate the possible impact on reported intake (Table 16). Females, white individuals, and individuals above poverty used supplements more than did males, black individuals, and individuals below poverty. Individuals were more likely to supplement vitamin A than vitamin C, vitamin C than iron, and iron than calcium. Approximately the same percentage (one to two) of individuals in all categories ingested either prescribed or miscellaneous supplements. As income level, race, and sex are categorized further, it was apparent that black individuals supplemented less than white individuals, regardless of sex or income level, categories by whereas sex and income level were related to consumption of supplements by white individuals.

The diet intake patterns for vitamins A and C were not influenced by the same factors as the other nutrients assessed. These vitamins were also the ones most frequently supplemented. It is postulated that individuals who were supplemented were more likely to meet at least 67% of the HANES I standard for these vitamins.

Differences in the number of individuals above and below poverty who consumed over 100 percent of the HANES I standard for vitamins A (Figure 4) and C (Figure 6) and iron (Figure 10) were lower when supplementation was not considered. In some cases the relationship was even reversed, more of those below than above poverty consumed diets containing at least 100 percent of the HANES I standard for each nutrient. Perhaps those below poverty who did not use supplements made wiser food choices than did those with a higher

TABLE 16

PERCENTAGES OF INDIVIDUALS SUPPLEMENTING THEIR DIETS
AND PERCENTAGES OF INDIVIDUALS SUPPLEMENTING EACH OF FOUR NUTRIENTS

	Vitamin A	Vitamin C	Calcium	Iron	No Supplement	Regular Supplementation	Irregular Supplementation
White	33	23	8	14	40	30	32
Black	19	12	5	4	72	15	7
Male	28	19	6	10	69	24	7
Female	35	24	9	16	23	32	47
Below Poverty	24	18	7	10	71	23	6
Above Poverty	33	22	8	14	38	30	34

income to meet nutrient needs. Although males are more likely than females to consume diets containing over 100 percent of the HANES I standard for the vitamins and minerals assessed, females were more likely to use supplements, thus narrowing any differences. This tendency of females to use supplements more liberally than males may account for the findings that more females than males consumed diets containing 67 to 100 percent of the HANES I standard for the vitamins. This relationship was also true between races. It appeared that black individuals made wiser food choices in meeting vitamin A and C needs than did white individuals, if supplementation was not included.

These findings are in agreement with those of the USDA 1965 Household Food Consumption Survey (HFCS)(10). Among adults reported in this survey, those who used supplements with high frequency were over 75 years old, and as income increased, a greater proportion of individuals used supplements. In addition, in younger adults, more women than men reported the use of a supplement. Moak and Miller (20) found that 19.8 percent of their total sample supplemented their diets. Extent of supplementation of the vitamins and minerals assessed in the USDA survey study was different from the Moak and Miller study. In some of their subjects, supplementation did not raise intakes to 100 percent of the recommended dietary allowance.

Kilocalories

These test results concur with those of Davidson et al. (16), Guthrie et al. (25), Kelley et al. (7), and Lebovit et al. (27), among other researchers. HANES I data revealed that elderly individuals frequently ingest an inadequate amount of kilocalories. The two extremes of intake were white individuals above poverty, who had the highest distribution of intake, and black individuals below poverty, who had the lowest distribution of intake (Figure I). This was also found in the Ten-State Survey (11) and USDA Household Food Consumption Survey (10).

The percentage of individuals consuming over 100 percent of the HANES I standard for kilocalories ranged from 10.7 to 19.6. Intakes ranged from 8 percent to 231 percent of HANES I standard.

Protein

In white individuals above poverty, there was a difference ($p < 0.01$) in percent of HANES I standard met for protein between the sexes (Figure 2). The difference in protein intake between white males and white females above poverty exceeded the difference that could be due to kilocalorie intake. White individuals of both sexes differed in protein intake between the income categories. Perhaps protein intake is culturally consistent in black low income individuals regardless of income level, but not in white individuals. White males, regardless of income, as previously stated, consumed a greater

Figure 1 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Kilocalories

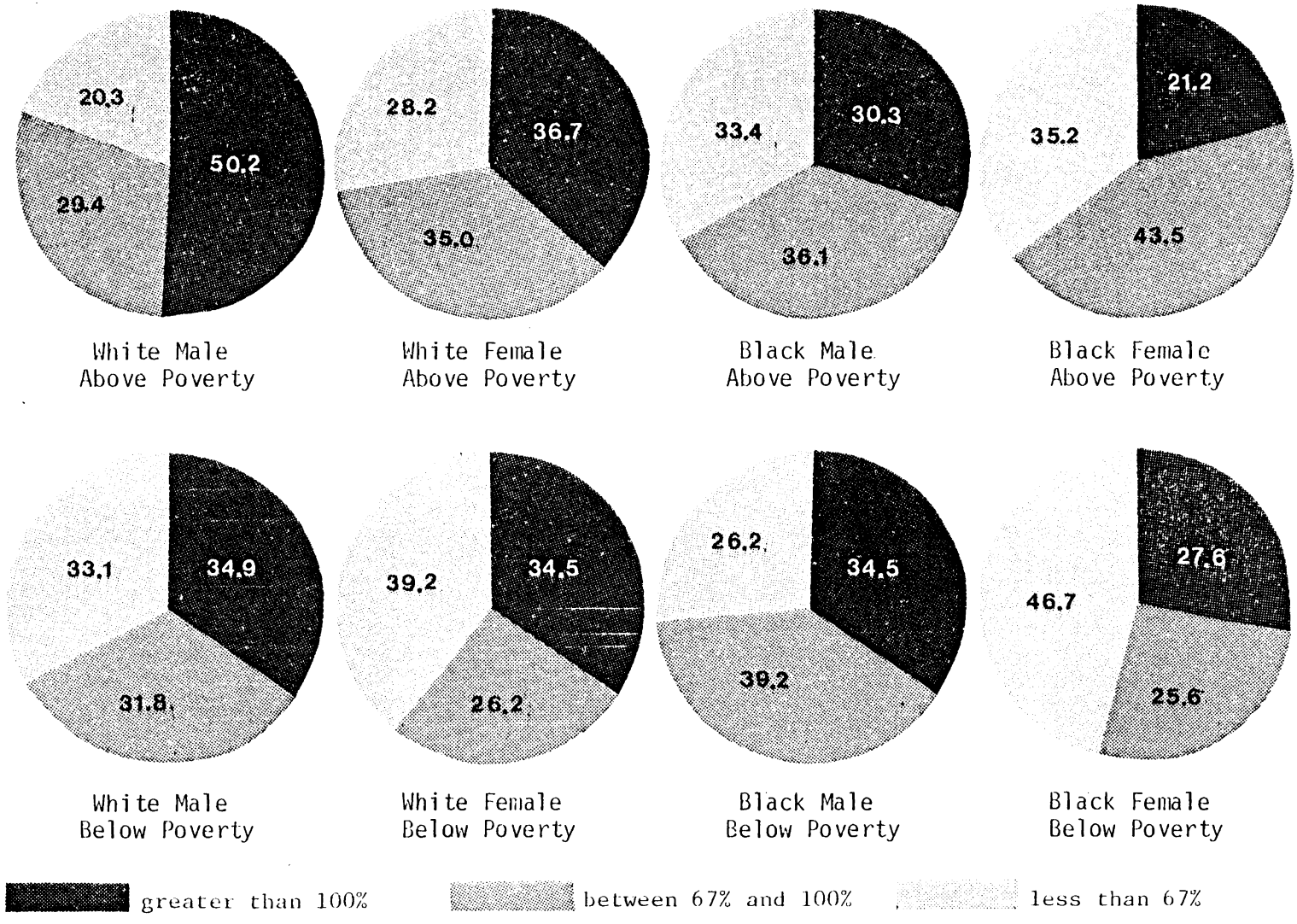

Figure 2 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Protein

percentage of the HANES I standard of protein than black individuals.

From data available, it was evident that meeting protein standards was the least problem among all the nutrients assessed. Over one-third, or 5 of the 8 groups assessed met less than two-thirds of the HANES I standard. Additional research needs to be initiated to determine the cause of this. This concurs with findings of Steinkamp (8), Guthrie (25), Clarke (21) and others mentioned previously. In addition, preliminary data on food consumption from the 1977 USDA-HFCS revealed that elderly males consumed more meat, poultry and fish than did women, and that white individuals consumed more milk and meat, poultry and fish than do black individuals (36). However, only direct food consumption patterns from HANES I would reveal which foods contribute to the differences. More than half (50.2) percent) of the white males above poverty consumed at least 100 percent of the HANES I standard for protein. More black females (46.7 percent) than any of the other groups consumed less than 67 percent of the HANES I standard for protein.

Between 21.3 and 50.2 percent of the assessed individuals consumed diets with protein intakes in excess of 100 percent of the HANES I standard for this nutrient. Intakes ranged from 4 to 415 percent of the HANES I standard for protein.

Vitamin A

White individuals above poverty (regardless of sex) had a larger percentage of individuals consuming at least 67 percent of the HANES

I standard for vitamin A than any of the other groups (Figure 3). Nearly half of the individuals in the other categories, race, sex, and income, consumed less than 67 percent of the HANES I standard for this vitamin. It is apparent from Figure 3 that those white females (regardless of income level) who ingested over 100 percent of the HANES I standard for vitamin A achieved that through nutrient supplementation.

Between 35.2 and 53.8 percent of the individuals assessed consumed this nutrient in excess of the HANES I standard. Intakes ranged from 0 to 6500 percent of the HANES I standard.

These results concur with the general findings of Moak and Miller (20), Davidson et al. (16) and Kohrs et al. (19), cited in the review of literature. Although a large percentage of individuals consumed diets containing less than the minimum level of vitamin A set by each team of researchers, this was overcompensated for by the percentage of individuals who consumed over 100 percent of the standard (Figure 4). Mean values reported for the smaller studies were high and showed wide variation, as in this research.

Vitamin C

Individuals above poverty are more likely than those below to consume over 100 percent of the HANES I standard for vitamin C (Figure 5). In addition, fewer individuals than for any of the other nutrients or kilocalories consumed 67 to 100 percent of the HANES I standard for vitamin C. Even more important is the finding

Figure 3 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Vitamin A

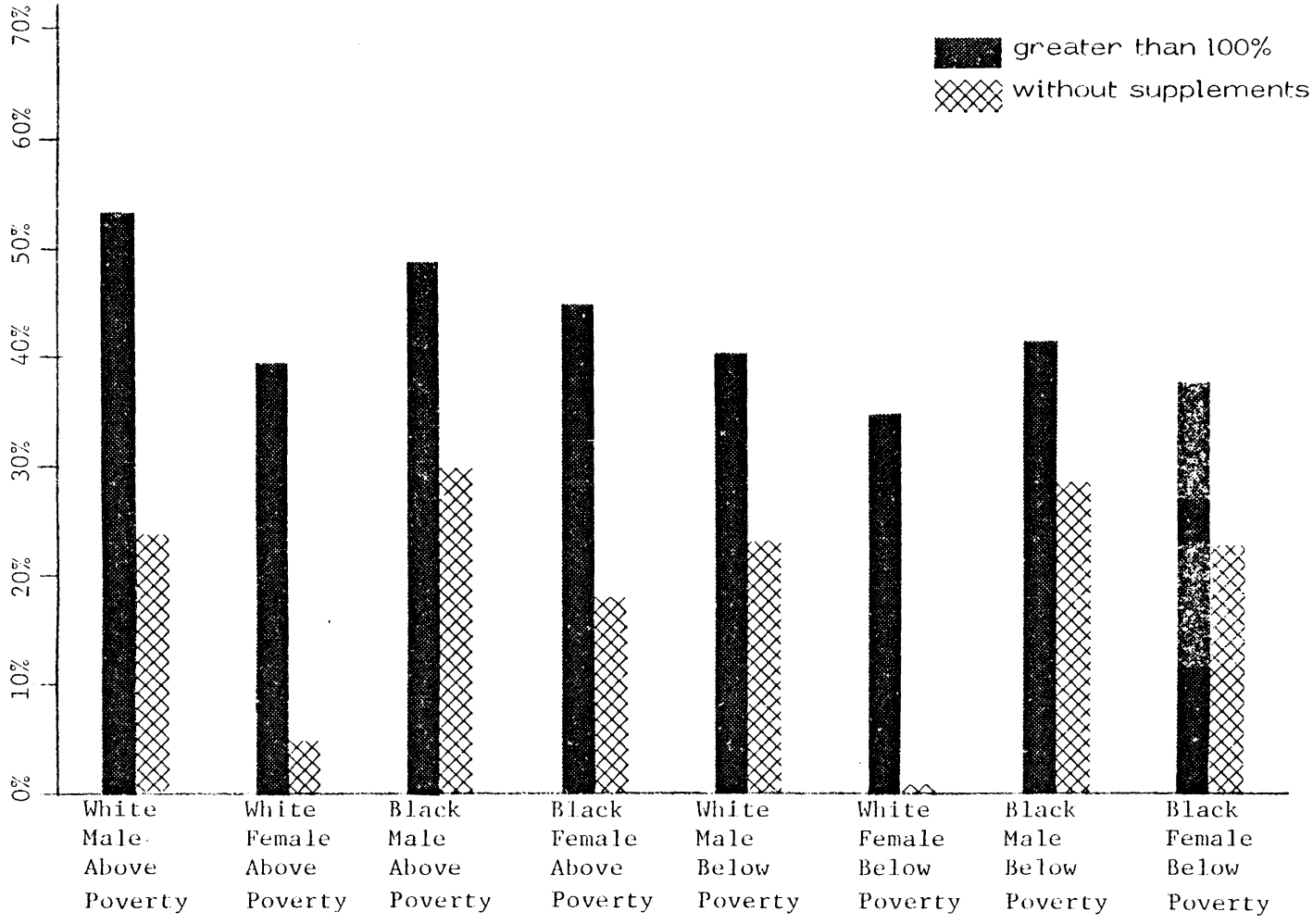

Figure 4 Percentages of Individuals Consuming Over 100% of the Hanes I Standard for Vitamin A and the Percentage Achieving this Level without Supplements[1]

1 This number is theoretical. It was achieved by subtracting the percentage supplemented from the total number of individuals whose intakes were over 100% of the standard. There is no assurance that all individuals who supplemented were over 100% of the standard for the nutrient supplied.

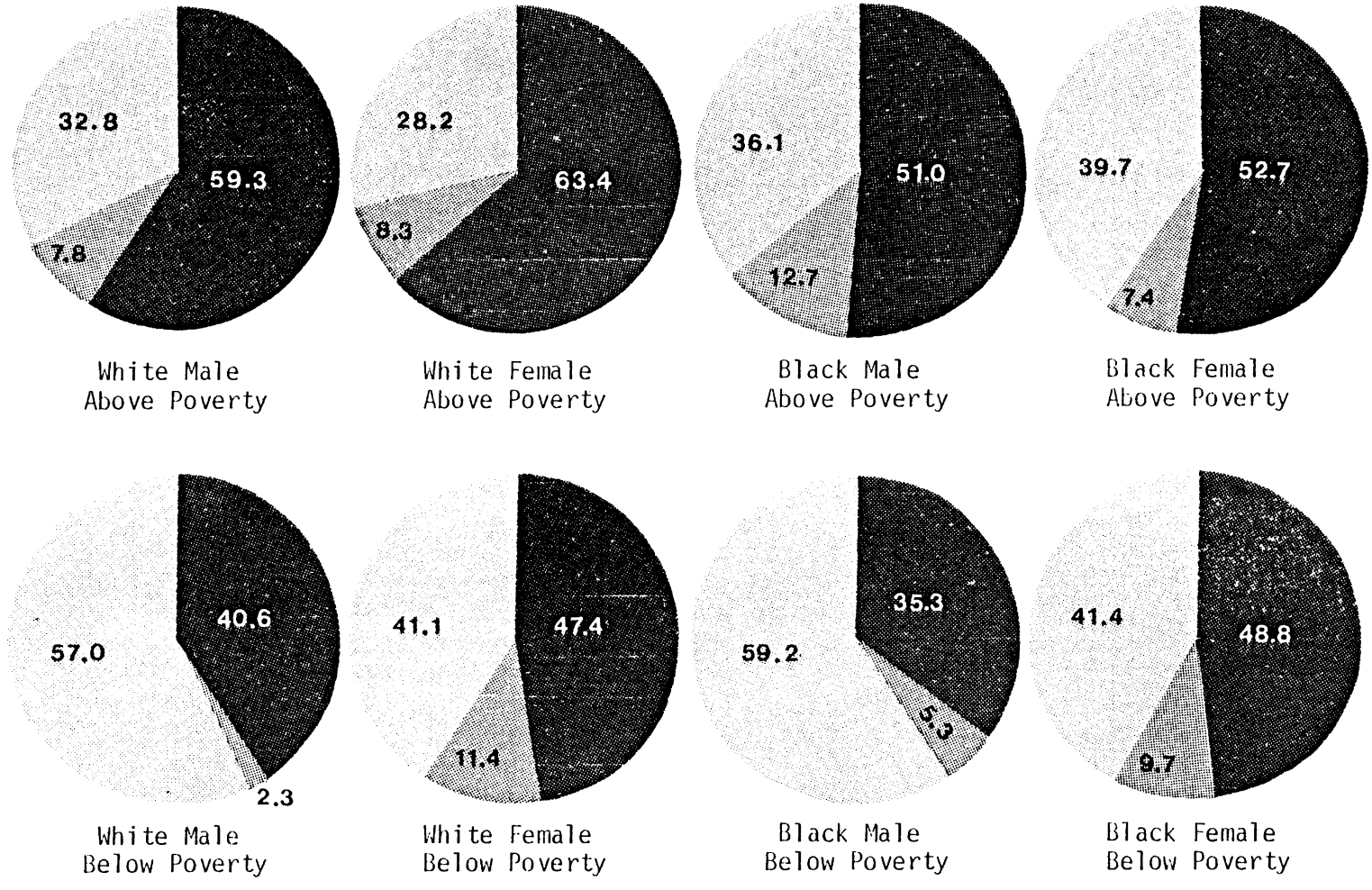

Figure 5 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Vitamin C

that from 28.2 to 59.2 percent of the individuals were below 67 percent of the standard with the white and black males below poverty having the greatest number of individuals low in vitamin C intake. Seven of the 8 groups had at least one third not meeting 67 percent of the HANES I standard. With the exception of females below poverty, more white individuals consumed in excess of 100 percent of HANES I standard for vitamin C that did black individuals (Figure 6). A higher percentage of black males achieved this without supplementation.

Between 40.5 and 62.7 percent of the individuals assessed consumed in excess of the HANES I standard level for vitamin C. Intakes ranged from 0 to 1400 percent of the HANES I standard.

Calcium

A very small percentage of white males (10.6 percent) consumed less than 67 percent of the HANES I standard for calcium. At the other extreme, the largest percentage of individuals (Figure 7) consuming below 67 percent of the HANES I standard were all females below poverty (whites 43.7 percent and blacks 55.0 percent) and black females above poverty (45.5 percent). In numerous other studies, females were less likely to have an adequate calcium intake than were males (7,8,11,17,25,26). Data from the 1977 USDA-HFCS indicated that black and low income individuals consumed more fruit and vegetables containing vitamin A (including calcium-rich greens) than the other groups, and that white individuals consume

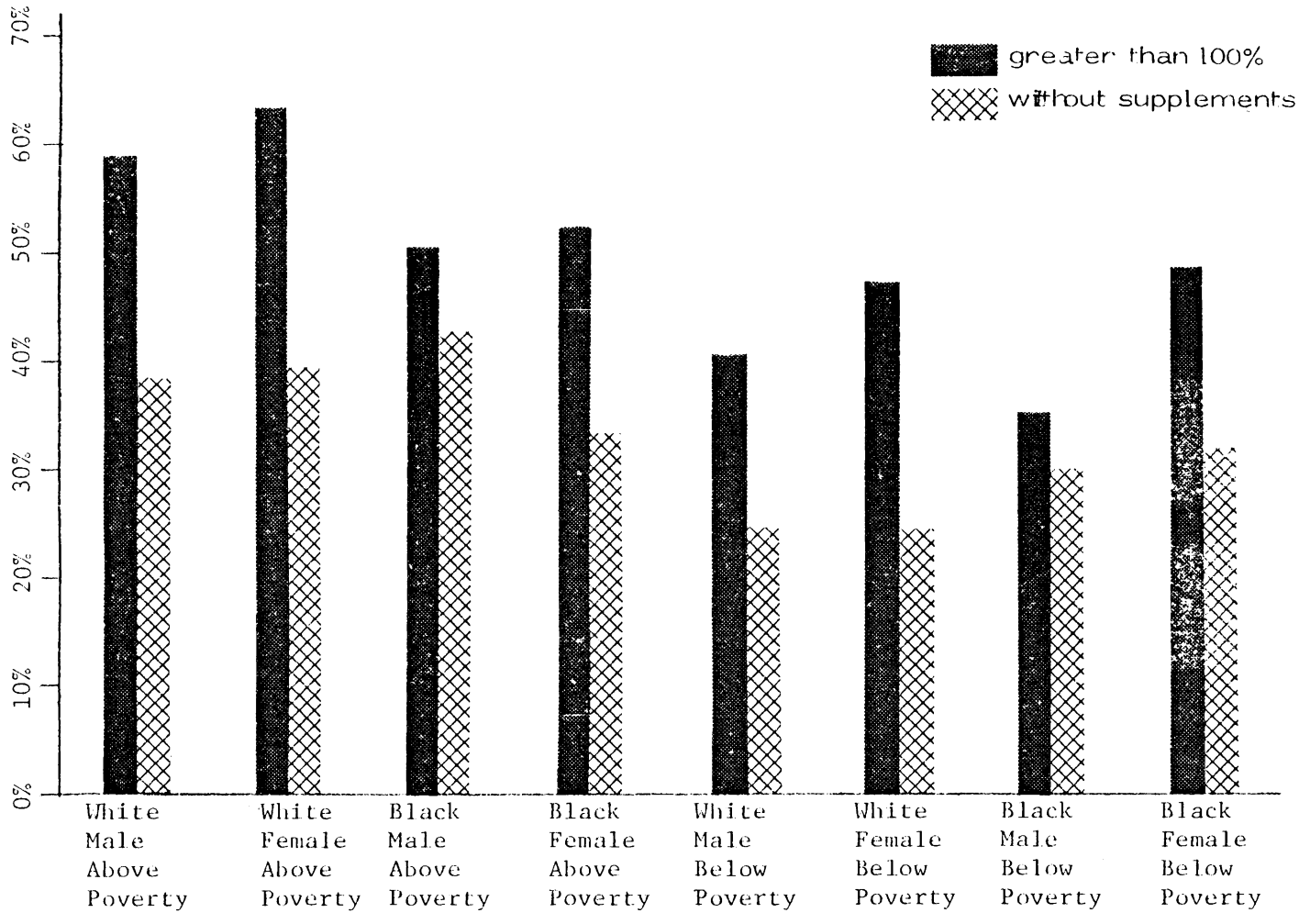

Figure 6 Pecentages of Individuals Consuming Over 100% of the Hanes I Standard for Vitamin C and the Percentage Achieving this Level without Supplements[1]

1 This number is theoretical. It was achieved by subtracting the percentage supplemented from the total number of individuals whose intakes were over 100% of the standard. There is no assurance that all individuals who supplemented were over 100% of the standard for the nutrient supplied.

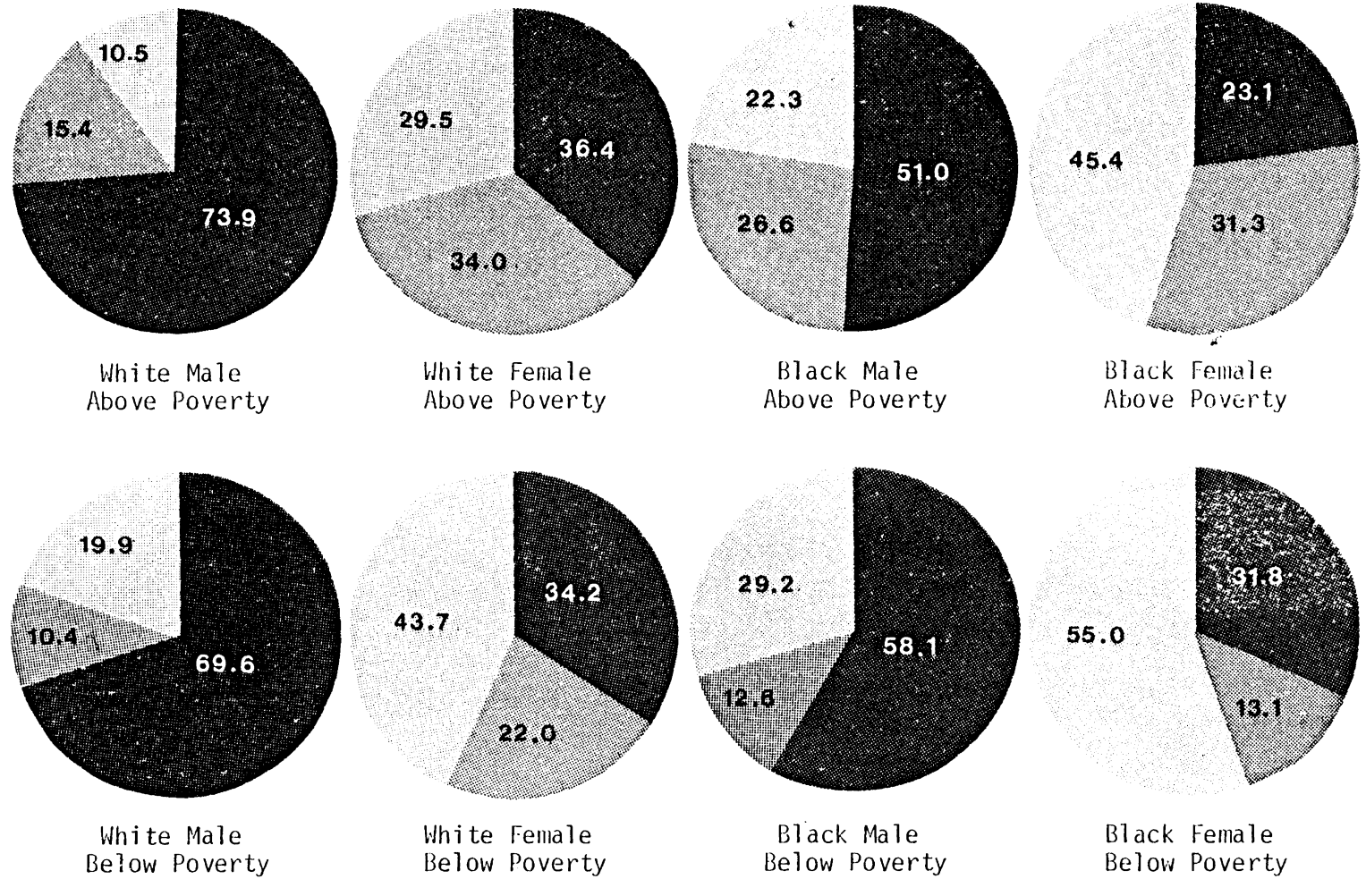

Figure 7 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Calcium

more milk than black individuals (36). In all groups, individuals whose intakes were the highest (Figure 8) supplemented, although few individuals used calcium supplements.

The percentage of individuals consuming greater than 100 percent of HANES I standard for calcium ranged from 23.2 percent in black females above poverty to 74.0 percent in white males above poverty. Intakes ranged from two to 1000 percent of the HANES I standard.

Iron

Fewer white males (10.6 percent) than any other group consumed less than 67 percent of the HANES I standard for iron. Fifty-five percent of the black females below poverty, 45.5 percent of the black females above poverty, and 43.7 percent of the white females below poverty did not even meet 67 percent of the HANES I standard (Figure 9).

From Figure 10 it can be seen that a greater percentage of males than females consumed over 100 percent of the HANES I standard for iron. In addition, all males above poverty and black males below poverty consumed these high levels without much supplementation. Females are less likely to consume over 100 percent of the HANES I standard than males, and they are more likely to supplement iron. The percentage of individuals exceeding the HANES I standard for iron ranged from 19.3 percent in black females above poverty, to 66.5 percent in white males above poverty. Intakes ranged from 0

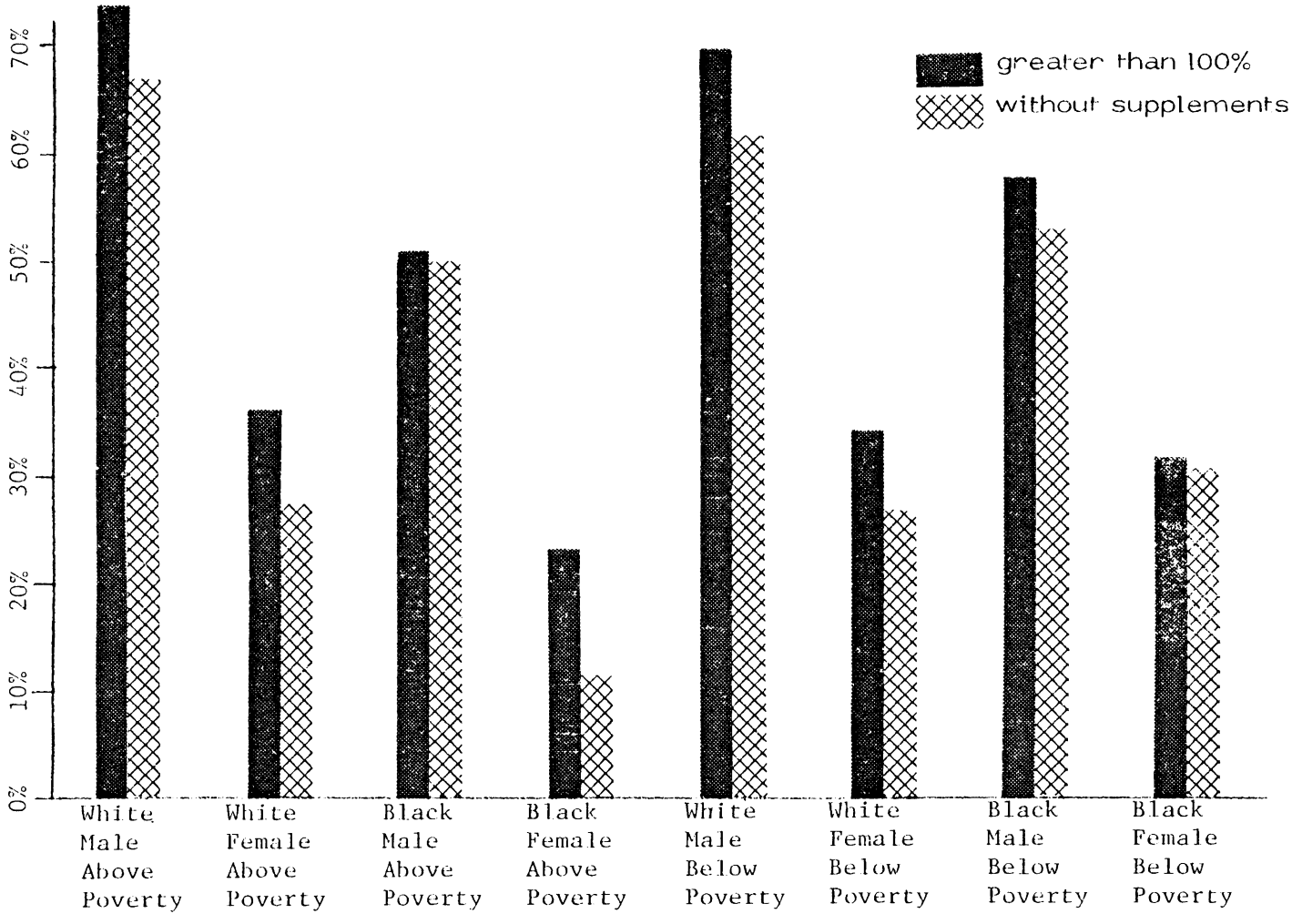

Figure 8 Percentages of Individuals Consuming Over 100% of the Hanes I Standard for Calcium and the Percentage Achieving this Level without Supplements[1]

1 This number is theoretical. It was achieved by subtracting the percentage supplemented from the total number of individuals whose intakes were over 100% of the standard. There is no assurance that all individuals who supplemented were over 100% of the standard for the nutrient supplied.

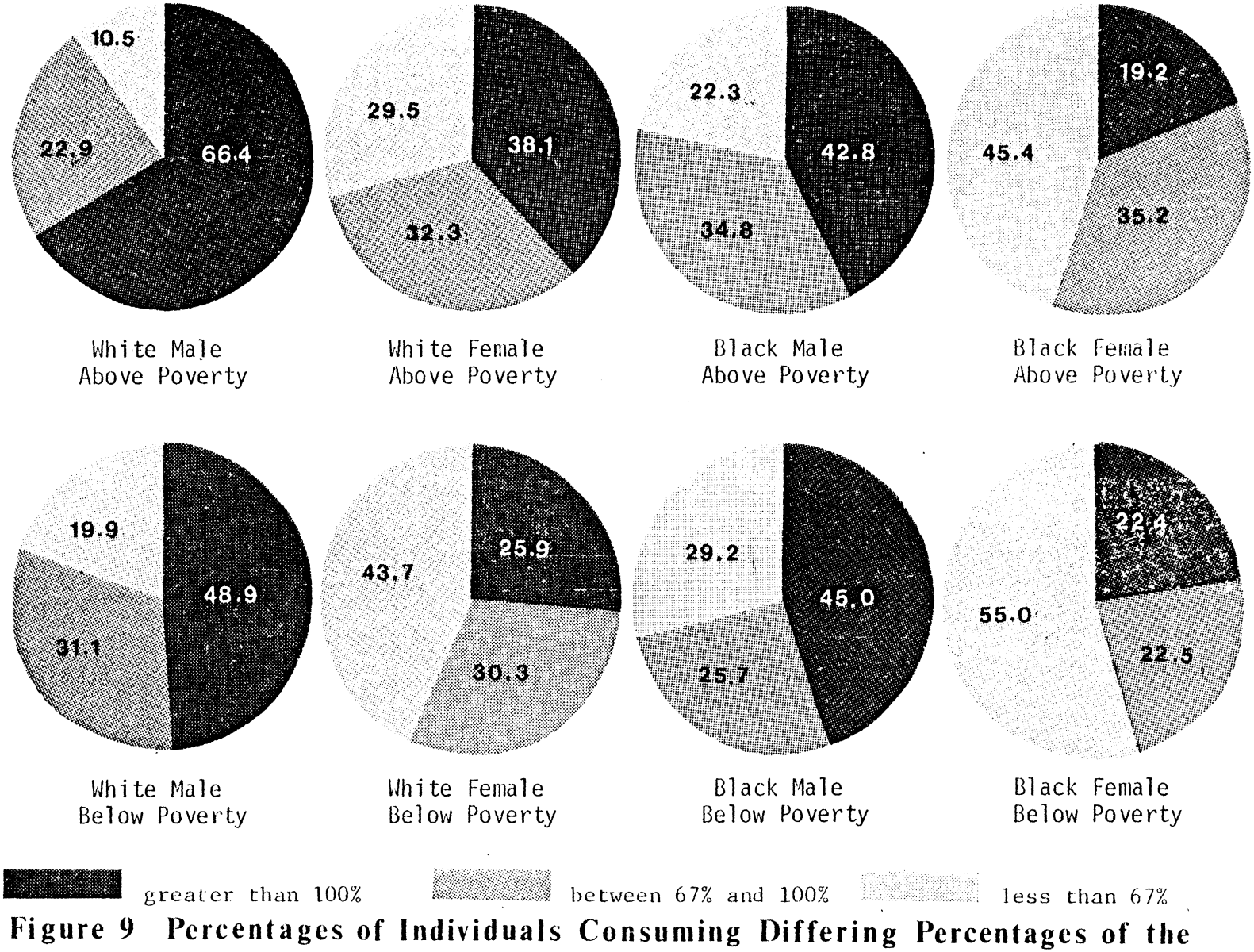

Figure 9 Percentages of Individuals Consuming Differing Percentages of the Hanes I Standard for Iron

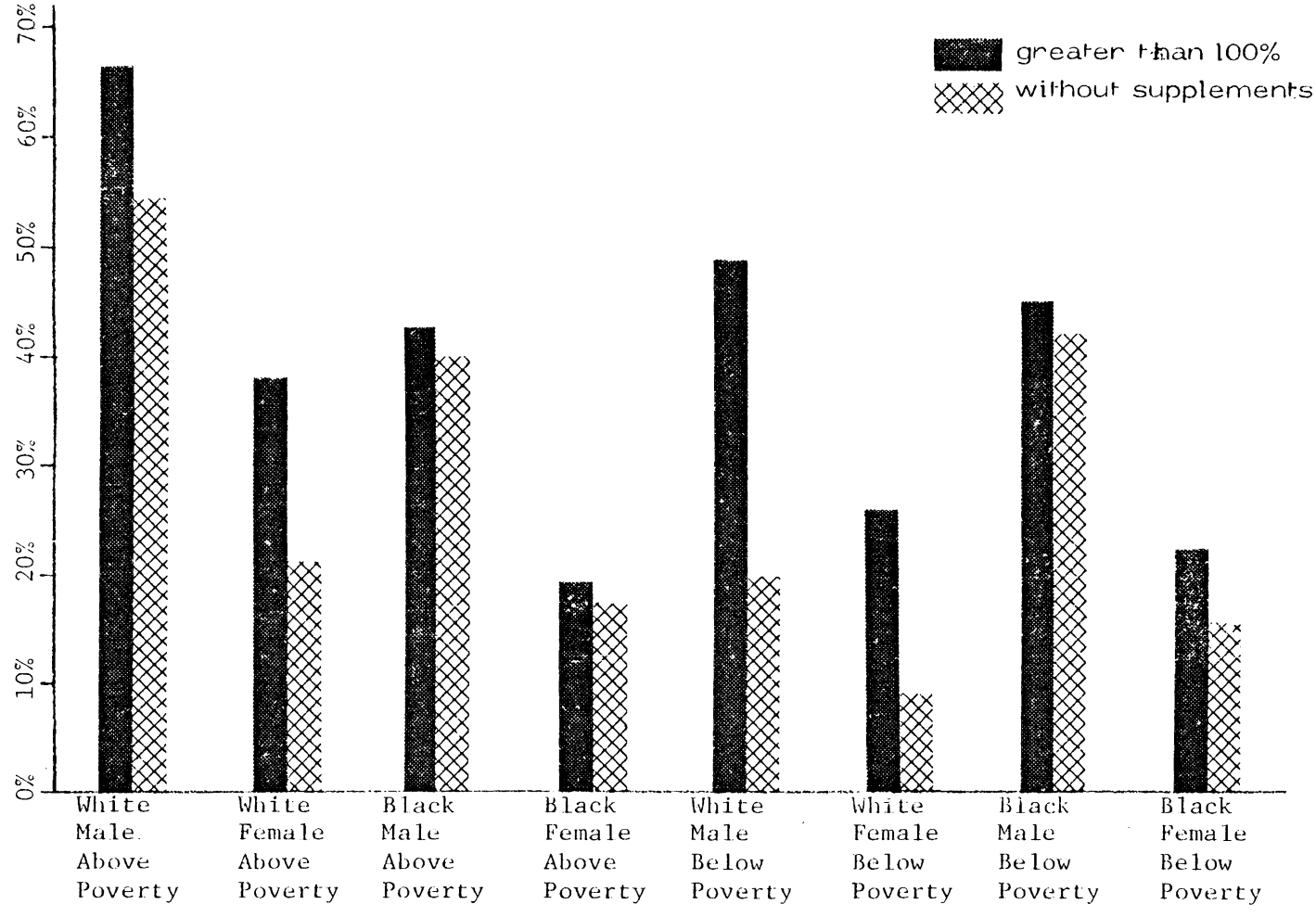

Figure 10 Percentages of Individuals Consuming Over 100% of the Hanes I Standard for Iron and the Percentage Achieving this Level without Supplements[1]

1 This number is theoretical. It was achieved by subtracting the percentage supplemented from the total number of individuals whose intakes were over 100% of the standard. There is no assurance that all individuals who supplemented were over 100% of the standard for the nutrient supplied.

to 744 percent of HANES I standard.

USE OF THE DATA

Nutrient Consumption

Standards used in the HANES I study (1971-1974), the Ten-State Nutrition Survey (1968-1970), and the USDA-HFCS (1965) were similar (Table 17). Of the three nationwide studies, only the HANES I and Ten-State studies reported the percentage of individuals who met or exceeded 67 percent of their standards for kilocalories. These percentages were very similar for both sexes and poverty levels (Table 18).

The percentage of elderly individuals found to be above 67 percent of the standard used in these studies for protein were different (Table 18). Ninety-nine percent of the older individuals assessed in the 1965 USDA-HFCS were found to be 67 percent of the standard or above for protein intake, whereas between 60 and 79 percent of the individuals assessed were in this category from the other two studies. This difference could be due partially to the differences in standards used for protein between the studies (Table 17). The 1965 study used 65 grams of protein for males, and 55 grams of protein for females, while both the HANES I and the Ten-State Nutrition Survey used standards of 7 grams for males and 58 grams for females. Therefore the greater percentage of individuals meeting at least two-thirds of the standard in the USDA study may be due to the

TABLE 17

DAILY DIETARY INTAKE STANDARDS FOR THE AGED USED IN NATIONAL STUDIES

	HANES I	Ten-State Nutrition Survey[1]	USDA Household Food Consumption Survey	
			1955	1965
Calories	34 cal/kg BW-Males(2380)	34 cal/kg BW-males(2380)	2600 cal-males	2400 cal-males
	24 cal/kg BW-Females(1082)	29 cal/kg BW-females(1682)	1800 cal-females	1700 cal-females
Protein	1.0 g/kg BW	1.0 g/kg BW	65 & 55 g	65 & 55 g
Calcium	400 mg	400 mg	800 mg	800 mg
Iron	10 mg	10 mg	12 mg	10 mg
Vitamin A	3,500 IU	3,500 IU	5,000 IU	5,000 IU
Vitamin C	60 mg	30 mg	70 & 75 mg	55 mg - females

1) Reference weights used for the Ten-State study (1968-1970): 70 kg male and 58 kg female

2) Standards based on 1968 and 1953 Recommended Dietary Allowances (RDA), published by the National Academy of Science, National Research Council: 1968 (7th edition), and 1953 (6th edition).

TABLE 18

THE DIFFERENCE[1] BETWEEN THE PERCENTAGE OF INDIVIDUALS CONSUMING AT LEAST SIXTY-SEVEN PERCENT OF THE HANES I STANDARD AND THE TEN-STATE STANDARDS

	Male		Female	
	Low	High	Low	High
Kilocalories	.1	-4.5	.7	1.0
Protein	-4.6	-1.1	-2.9	-7.2
Vitamin A	-6.7	5.4	4	1.8
Vitamin C[2]	-18.8	1.1	-6.5	-2.4
Calcium	3.2	2.6	-10.5	-14.6
Iron	-.2	5.0	-2.9	-2.9

1) Negative numbers indicate that a greater percentage of individuals in the Ten-State survey met or exceeded sixty-seven percent of the standard than individuals in HANES I and vise versa.

2) The standard for vitamin C in HANES I was 60 mg, and in the Ten-State survey it was 30 mg.

lower standard used. Differences in the percentage of individuals meeting at least 67 percent of the standard for protein in the HANES I and Ten-State surveys were between 6.2 percent for high income females, and 1.1 percent for males in high income ratio states. Compared to the HANES I study, a greater percentage of older individuals throughout the Ten-State Survey consumed at least 67 percent of the standard.

The recommended standard for daily intake of vitamin A for individuals in the USDA study was 5000 IU per day. The standard for the two other studies was 3500 IU per day. In spite of this, a larger percentage of individuals assessed in the USDA study consumed at least 67 percent of the standard than in the two other studies. For vitamin A, the HANES I individuals consumed diets meeting or exceeding the HANES I standard for this nutrient more frequently than did individuals assessed in the Ten-State Survey, except low income males (Table 19).

The standards among these three studies for vitamin C intake ranged from 30 milligrams in the Ten-State Survey, to 60 milligrams for males and 50 milligrams for females in the USDA study, to 60 milligrams for both sexes in HANES I. Confusingly, 87 and 90 percent of females and males respectively met at least 67 percent of the standard for vitamin C. In addition, lower, but approximately equivalent percentages of individuals met the same level of intake in the HANES I study in the Ten-State Survey, although recommended standard of intake for this nutrient in the HANES I study was twice

TABLE 19

A COMPARISON OF NUTRIENT INTAKE FROM HANES I, TEN-STATE,
AND USDA (1965) FOOD INTAKE STUDIES

	HANES I (60-74 yrs) 1971-1974				Ten-State (60 yrs and older) 1968-70				USDA Household Food Consumption Survey (60-74 yrs) 1965	
	Males		Females		Males		Females			
	Below Poverty	Above Poverty	Below Poverty	Above Poverty	Low Income-Ratio State	High Income-Ratio State	Low Income-Ratio State	High Income-Ratio State	Male	Female
Kilocalories	40.67	53.40	47.60	59.51	40.5	57.9	46.9	58.5	-	-
Protein	64.62	77.49	59.89	70.98	69.3	78.6	62.8	78.2	99	99
Vitamin A	52.09	69.11	52.40	60.54	58.8	63.7	48.4	58.7	94	90
Vitamin C	42.06	66.47	58.73	70.47	60.9	65.3	58.4	72.9	90	87
Calcium	77.16	86.67	53.55	60.15	73.9	84.0	64.1	74.8	95	92
Iron	76.60	87.92	52.59	68.60	76.8	82.9	55.5	71.5	99	98

the recommended level in the Ten-State Survey (Table 19).

The standard recommended intake for calcium was the same (400 mg) in the HANES I and Ten-State nutrition studies, and twice that level (800 mg) for the USDA study. Again, the percentage of individuals consuming diets containing levels of calcium that met at least 67 percent of the designated standard was much higher in the USDA study, even though the standard used in this survey was twice that used in the other two. In the Ten-State survey, a greater percentage of females and a lower percentage of males had calcium intakes above 67 percent of the standard, in contrast to the findings in the HANES I study which showed the opposite relationship (Table 19).

Standards for iron were the same for all three studies discussed. Intakes were similar between the Ten-State and HANES I studies, bu the percentage consuming diets with at least 67 percent of the standard for individuals in the USDA study was higher (Table 19).

Comparing the differences between intakes in the Ten-State and HANES I studies was difficult due to the different methods used for calculating poverty status. In the Ten-State Survey the statistics were calculated using males and females in low income-ratio states, whereas low-income individuals were grouped for statistical purposes in reporting the HANES I data. Therefore, data in the Ten-State study includes individuals with high income who lived in states rated as low income ratio states were rated with the data of low-income-state individuals, and thus the data from the Ten-State and

HANES I surveys are not comparable. Those designated as low-income individuals in the HANES I study had a PIR of less than 1.0. Those in low income ratio states used in the Ten-State Nutrition Survey had a median PIR of 1.4. If the relationship between nutrient intake and PIR is somewhat linear, the percentage of individuals meeting or exceeding 67 percent of the standards should be slightly higher in the Ten-State survey than in HANES I. Though this is predominantly the case, it is more pronounced in the low-income group.

A Base for Evaluation of the National Nutrition Programs for the Elderly

The Title VII Nutrition Program for Older Americans (NPOA) was begun in response to a growing awareness of unique nutrition needs and problems. Expert advice from the White House Conference on Food, Nutrition, and Health (37), and from the Administration on Aging (38) were used in the formulation of Title VII program directions. This program was not the first to intervene in the nutrition and health problems of older Americans, but was the first to identify these persons as a target for governmental intervention programs. The objectives of the program called for further development of congregate feeding programs for the elderly through which supportive social and health services could be provided by Administrations on Aging. Technical and financial aid were provided to groups desiring to establish a program (39,40).

In 1971, the Title VII ammendment (41) was attached to the Older

Americans Act of 1955 to establish these Nutrition Programs for Older Americans, but funding was not appropriated until the end of fiscal year 1973, which set into motion the complex task of implementing the program. Since data collection for HANES I was conducted between 1971 and 1974, few of the respondents were asked about participation in the congregate meal programs, because the congregate meal programs were being started when the HANES I study was designed and implemented. The data analyzed in the study reported here, when compared with data obtained in HANES II (when it becomes available), will provide information concerning the impact these nutrition programs have made on the nutritional health of older Americans.

SUMMARY AND CONCLUSIONS

Data for elderly individuals from the First Health and Nutrition Examination Survey (HANES I) was analyzed to determine the connection of selected demographic variables to the patterns of intake of kilocalories, protein, vitamins A and C, calcium and iron, expressed as a percentage of the HANES I standards.

Standards for recommended levels of selected nutrients and kilocalories consumed daily were developed for HANES I by an ad hoc advisory group. This advisory group utilized data on standards from the World Health Organization, the Interdepartment Committee on Nutrition for the National Defense Manual, the Food and Nutrition Board, National Research Councils Recommended Daily Allowances, and the Ten-State Nutrition Survey, and set the recommended levels by age or caloric intake. None of the nutrients observed here required a standard set on a per kilocalorie basis. Determinations based on body weight were calculated using a reference man and woman weighing 70 and 58 kg respectively. These levels set as standards were designed to be adequate for the maintenance of good nutrition and allowed for some individual variability, thus making them more all inclusive.

Standards for assessing protein and kilocalorie allowances for adults were based on a calculated expected median body weight for sex and height between ages 20 and 29 for reference weight individuals. Height-sex specific weight at this age was chosen because the weight at those ages is thought to closely approximate the body's

lean mass, which is the metabolically active part of the body.

For this study, percentages of HANES I standards were divided into four categories for analysis:

1) > 100% of standard,

2) ≤ 100% but > 67% of standard,

3) ≤ 67% but > 50% of standard, and

4) ≤ 50% of standard.

These subdivisions were chosen so the researchers could ascertain ranges of intake of these individuals. The first category (>100% of standard) indicated excessive intake, the second (≤100% but >67% of standard) was deemed as an adequate or acceptable level of intake, the third (≤67% but >50% of standard) was deemed as inadequate but not as poor an intake as the fourth (< 50% of standard). The patterns of intake were similar whether reporting data in four categories or the two used (combinations of one and two, and three and four). Intakes over 100 percent of HANES I standards were also noted in relation to excesses of intake.

Demographic variables used in the analysis included: race, sex, poverty income ration (PIR), household resources, level of education of the respondent, and use of nutrient supplementation by the respondent. Of these, all but household resources were related to total kilocalorie and nutrient intake.

Based on the data reported, the following conclusions were made:

Independent of the other variables tested, male individuals consistently consumed a diet higher in the assessed nutrients than

did females. The percentages of HANES I standard for kilocalories consumed adjusted for sex was approximately the same for both sexes.

As reported previously (9,10,11), black individuals assessed in HANES I consistently consumed levels of kilocalories and nutrients that were less than the levels consumed by the white individuals assessed. However, for these black individuals categorized as PIR 1, the differences were slight.

Individuals categorized as PIR 1 were consistently more likely than the other individuals to have a consumption pattern below standards set for the nutrients and kilocalories assessed.

This data was inadequate to determine whether household resources were related to the nutrient intake of older Americans.

Diets for respondents with a higher level of education more nearly met the standards. In black individuals, the differences were slight for four out of the six nutrients and kilocalories assessed.

Number of people in the household was not related to the nutrient intake of the individuals assessed.

Supplementation of the diet was related to kilocalorie and nutrient intake of the assessed population. Vitamin A intake was the most supplemented, then intake of vitamin C, then intake of iron, with intake of calcium the least supplemented. Quantities of supplementation were unknown. Females used supplement more than did males, white individuals more than black, and those above PIR = 1 more than those below.

The present study confirms needs in several areas for further research as well as needs for correlates with additional HANES I data. These include:

1) Future data should include multifactoral analysis to determine which variables have the greatest influence on kilocalorie and nutrient intake.

2) Further research is needed to develop standards for dietary needs that are suited specifically for the elderly.

3) Foods which contributed to nutrient intake need to be identified to better understand dietary habits of the elderly and factors which affect them.

4) Results emphasize the need for the inclusion of the study of nutrition in the curriculum at all levels, as well as continuing education after formal schooling is stopped.

The two major points for nutrition intervention that were identified were:

1) decreasing overconsumption of protein and kilocalories, primarily in high income white individuals,

2) increase general quality of food consumption, especially in low income and black populations.

It is the belief of this author that all measures, that is: food intake patterns, nutrient consumption data, demographic information, and nutritional assessment methods should be focused on identifying needs of the aging population group.

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Appendix 1

The methods presented here are for the entire HANES I survey, however, analyses for this study dealt only with the nutrient intake of Americans age 60 to 74.

HANES I

Target Population

Data for HANES I was collected on noninstitutionalized civilian Americans, age one to 74, excepting individuals living in Indian Reservations. The survey began in April of 1971 and was completed in June of 1974. It was administered to a nationwide probability sample of 28,000 American people. Individuals who were at high risk of malnutrition (those with low income, preschool children, women of childbearing age, and the elderly) were oversampled at known rates. The standard for assigning sampling weights was designated at the midpoint of the survey.

Although the main emphasis of HANES I was on nutrition, a but-set of the sampled population also received a health examination. These health examinations were on individuals aged 25 to 74 and were completed in October of 1975. This health data will not be utilized for analysis in this study.

Data Collection Procedure

All persons examined for HANES I gave information by means of a household interview, a general medical history, a 24-hour dietary

intake recall interview, a food frequency interview, a food frequency interview, a food program questionnaire, a general medical examination, dental, dermatological and opthalmological examinations, anthropometric measurements, hand-wrist x-rays (of those one to 17 only) and 24 hematological, blood chemistry, and urological determinations. Data used in this study included: 24-hour diet intake record and selected demographic data from the household interview.

In addition, a more detailed examination for a subset included; a medical history of supplement, additional questionnaires concerning prevalence of specific chronic disease, a health care needs questionnaire, a general well-being questionnaire, an extended medical examination, audiometry, electrocardiography, goniometry, spiriometry, pulmonary diffusion and teberculin tests, and additional laboratory tests.

Demographic Information

Each sample household was mailed a letter announcing the upcoming visit by the interviewer prior to the interviewer's scheduled time of arrival. The interviewer visited the household to administer a questionnaire. The primary purpose of this questionnaire was to gather demographic information on the household and to ascertain household composition. If a potential interviewee was not at home at the time of the interview, any responsible adult in the same household was asked to respond to questions for the absent individual.

Poverty Index Ratio (PIR)

This was calculated from two components, the total income of the household (the numerator), and a multiple of the total income necessary to maintain a family with specific characteristics on a nutritionally adequate food plan (the denominator). The food plan used was the "economy plan" designed by the Department of Agriculture for temporary use when funds are low. The denominator value was adjusted for size of household, sex of household head, place of residence, and age of head of household if the household has two or fewer individuals within it. No adjustments for government assistance or location were made.

Race

The race of the responding individual was marked by observation, unless it was not possible to ascertain race by this method: race was asked when necessary. The race categories were "white," "negro," and "other." All persons not included in the white or black categories were referred to as "other." Mexicans were included with white unless they were definitely of nonwhite race (Indian, for example).

Completion of Questionnaire

When a satisfactory interview had been completed, the interviewer designated this by using a "1" for the completion code. If

the interviewer felt the interview was inaccurate or unsatisfactory for any reason, the interviewer designated this by using a "2" for the completion code. The assessment was based on the sample person's physical and mental inability to complete the interview. These physical and mental limitations included: blindness, deafness, muteness, language barrier (when an interpreter was not available), and mental retardation. If the respondent was belligerent, intoxicated, uncooperative, or indifferent about giving necessary information, the completion code was also designated as a "2." Only those having a completion code of "1" were included in our analysis.

Standards Used

A set of standards for recommended levels of nutrients and kilocalories consumed daily was developed for HANES I by an ad hoc advisory group. After reviewing the standards set by other organizations, both on a national and international level, they set recommended levels related to age, physiological state, or caloric intake. These standards were designed for the maintenance of good nutrition and allow for some margin above actual needs to allow for individual variability and to make them more all-inclusive.

Standards for assessing protein and kilocalorie allowances for adults are based on a calculated expected median body weight for sex and height at age 20 to 29 years, for reference men and women weighing 70 and 58 kilograms, respectively. Height-sex specific weight at ages 20 to 29 was chosen because weight at those ages is

thought to closely approximate boty lean mass, which is the metabolically active part of the body. Because it is metabolically active, body lean mass (to a great extent) can be used to determine needs. Weight gain past that age is presumed to be fat with lettle increase in body lean mass. In addition, body lean mass decreases with age, even if weight is kept constant. Thus these standards may overestimate needs of older individuals. However, this bias is much less than the calculation of nutrient and kilocalorie intake per kilogram of body weight.

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NUTRIENT AND KILOCALORIE INTAKE OF OLDER AMERICANS ASSESSED IN HANES I AND THEIR RELATIONSHIP TO SELECTED DEMOGRAPHIC VARIABLES

by

Mary Ann Hoskin

(ABSTRACT)

The influence of selected demographic variables on the kilocalorie and nutrient intake of Americans over fifty-nine years of age assessed in HANES I was analyzed. A retrospective study design was used. Data on sex, race, poverty level (using PIR as the standard), number of people in the household, education, number and type of household resources, and nutrient and kilocalorie intakes were taken from the HANES I data tapes. Chi square analysis were used to determine if relationships existed between the kilocalorie and nutrient intake and the variables selected.

The results indicate that race, sex, and poverty level were the most predictive of nutrient intake. Males, white individuals, and those above poverty generally had a greater percentage of individuals meeting at least sixty-seven percent of the HANES I standards for kilocalories and the assessed nutrients. The other demographic variables influenced intakes of some of the nutrients, but no distinct patterns emerged. Large percentages of these individuals were found to be below sixty-seven percent of the HANES I standards as well as above one hundred percent of the HANES I standards.