8228848

Sumner, Sheron Keel

VITAMIN A AND ASCORBIC ACID NUTRITURE AND SNACKING PATTERNS OF FEMALE ADOLESCENTS

The University of North Carolina at Greensboro PH.D. 1982

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

VITAMIN A AND ASCORBIC ACID NUTRITURE AND SNACKING PATTERNS OF FEMALE ADOLESCENTS

by

Sheron Keel Sumner

A Dissertation Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
1982

Approved by

Dissertation Adviser

SUMNER, SHERON KEEL. Vitamin A and Ascorbic Acid Nutriture and Snacking Patterns of Female Adolescents. (1982) Directed by: Dr. Lucille Wakefield. Pp. 211.

A cross-sectional nutritional survey of 198 adolescent females in Guilford County, North Carolina, was conducted to assess vitamin A and ascorbic acid nutritional status and to investigate and describe snacking patterns. Subjects included black and white girls, ages 12, 14, and 16 years. Data collected included measurement of serum levels of vitamin A and beta-carotene, dietary analysis of meals and snacks from 24-hour food recalls, investigation of snacking patterns from a dietary history interview, and frequency intakes and preferences for 56 food items high in vitamin A and ascorbic acid.

Mean dietary intakes for vitamin A (5995 IU) and ascorbic acid (155 mg) exceeded the RDA, but ascorbic acid intake was marginal for 21 percent of the subjects and vitamin A intake was marginal for 12 percent. Twelve-year-old girls had better nutritional status for vitamin A than did older girls. White girls consumed more ascorbic acid than did blacks. Vitamin supplements contributed significantly to nutrient intake.

Mean serum vitamin A (44 mcg/100 ml) and beta-carotene (129 mcg/100 ml) levels were within a normal range, but marginal vitamin A serum levels were observed for 20 percent of the subjects. Age differences were observed in both serum vitamin A and beta-carotene. A relationship between dietary intake and serum levels was not observed for either vitamin A for beta-carotene.

Frequency of intake of foods high in vitamin A and ascorbic acid reflected preference for a food. Very low preference was observed for vegetables. Favorite foods of adolescent girls were fruits, baked potato or french fries, milk, cereals, and fruit punch beverages.

Ninety-eight percent of the girls snacked and reported an average of two or more snacks each day, primarily at home. Sixteen percent (965 IU) and 22 percent (35 mg) of the total intake of vitamin A and ascorbic acid, respectively, was from snacks. Race and income were significantly related to frequency of snacking. The reasons most often cited for snacking were "hungry" and "food looks good."

Evidence from this study supported the findings of other researchers and confirmed the incidence of vitamin A and ascorbic acid nutritional risk among one-fifth of the selected adolescents.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina at Greensboro.

Dissertation Adviser Lucille Wakefield

Committee Members Elizabeth L. Schiller

Mildred Johnson

Robert Nelson

June 23, 1982
Date of Acceptance by Committee

June 23, 1982
Date of Final Oral Examination

ACKNOWLEDGMENTS

Sincere appreciation is expressed to Dr. Lucille Wakefield, adviser and friend, for her support, encouragement, and guidance throughout the duration of graduate study and this research. Appreciation is also extended to committee members, Dr. Elizabeth Schiller, Dr. Barbara Clawson, and Dr. Roland Nelson, for their constructive evaluation and interest. Special recognition is made to Dean Naomi Albanese, School of Home Economics, for granting the writer the opportunity to pursue graduate study and to complete this research.

Special thanks is extended to Dr. Michael Liebman, S-150 Project Director, for his expertise and assistance in conducting the laboratory analyses and for his continued support. The writer is indebted to Marje Wright, statistical consultant, for her valuable technical assistance in statistical analysis.

My deepest gratitude goes to my husband, Emmett A. Sumner, Jr., and to our children, Lisa and Emmett III, for their patience, understanding, assistance, and continued support.

TABLE OF CONTENTS

	Page
APPROVAL PAGE	ii
ACKNOWLEDGMENTS	iii
LIST OF TABLES	vi
CHAPTER	
I. INTRODUCTION	1
Background of the Study	3
Purposes of the Study	3
Statement of Hypotheses	4
Definition of Terms	6
Limitations of the Study	7
II. REVIEW OF RELATED LITERATURE	8
Nutritional Status of Vitamin A and Ascorbic Acid in Adolescents	9
Snack and Meal Patterns of Adolescents	15
Other Factors Affecting Nutritional Status of Adolescents	18
Biochemical Measurement of Vitamin A and Ascorbic Acid	23
Dietary Survey Methods	25
Summary	28
III. METHODS OF PROCEDURE	30
Sample and Selection of Subjects	31
Interview Procedures	33
Research Instruments	35
Anthropometric Measurements	39
Biochemical Nutrient Analysis	39
Analysis of Data	42
Reference Notes	46

Page

CHAPTER

IV. RESULTS AND DISCUSSION 47

Description of the Participants 47
Description of Nutritional Status 49
Tests of Hypotheses for Nutritional Status . . . 58
Food Frequency Intake for Meals and Snacks . . . 76
Food Preferences 86
Description of Snacking Patterns 96
Tests of Hypotheses for Snacking Patterns 104
Discussion 120

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 128

Summary 128
Conclusions 130
Recommendations 131

BIBLIOGRAPHY 133

APPENDICES

A. Data Collection 141

B. Food Sources 175

C. Biochemical Nutrient Analysis 181

D. Supplementary Anslysis Tables 194

LIST OF TABLES

TABLE		Page
1.	Race and Age of Subjects	31
2.	Mean Dietary Intake Based on 24-Hour Recall	50
3.	Percentage of Girls Whose Intakes Were 67 Percent or Less of RDA	52
4.	Percentage of Total Mean Intake From Supplements . .	54
5.	Percentage of Total Mean Intake From Supplements for Users of Supplements	55
6.	Serum Vitamin A Levels for Adolescent Girls	57
7.	Serum Beta-Carotene Levels for Adolescent Girls . .	58
8.	ANOVA for Vitamin A, Retinol Equivalents/ 1000 kcalories and Age of Girls	60
9.	_t_-Test Values, Means, and Levels of Significance for Ascorbic Acid Intake and Race	61
10.	Pearson's Correlation Coefficients of Vitamin A and Ascorbic Acid Intake with Income	62
11.	Kendall's Tau-B Correlation Coefficients of Vitamin A Intake and Actual Frequency of Snacking	64
12.	Summary of Relationships Between Total Dietary Intake and Preference for Selected Vitamin A and Ascorbic Acid-Rich Foods	66
13.	_t_-Test Values, Means, and Levels of Significance for Vitamin A and Ascorbic Acid Intake and Use of Supplements	68

Page

TABLE

14. ANOVA for Serum Vitamin A Levels and Ages of Girls 71

15. ANOVA for Serum Beta-Carotene Levels and Ages of Girls 71

16. Summary of Hypotheses Tests for Nutritional Status. 74

17. Frequency of Intake of Foods High in Vitamin A at Meals 77

18. Frequency of Intake of Foods High in Vitamin A at Snacks 80

19. Frequency of Intake of Foods High in Ascorbic Acid at Meals 83

20. Frequency of Intake of Foods High in Ascorbic Acid at Snacks 87

21. Most Preferred Foods of Adolescent Girls and Vitamin A and Ascorbic Acid Nutrient Rating . . 90

22. Least Preferred Foods of Adolescent Girls and Vitamin A and Ascorbic Acid Nutrient Rating . . 91

23. Foods Never Eaten by Adolescent Girls 94

24. Frequency of Daily Snacking of Adolescent Girls . . 97

25. Mean Nutrient Intake From Snacks 98

26. Reasons Adolescent Girls Snack 100

27. Percentage of Snacks Eaten at Home and Away by Adolescent Girls 103

28. ANOVA for Calories from Snacks and Age of Girls . . 108

Page

TABLE

29. Summary of Relationships Between Snack Dietary Intake and Preference for Selected Vitamin A and Ascorbic Acid-Rich Foods 110

30. Relationships Between Snack and Total Dietary Intake of Vitamin A and Ascorbic Acid 116

31. t-Tests for Intake of Vitamin A and Ascorbic Acid and Place Snacks Eaten 117

32. Relationship Between Vitamin A and Snacking to be Social 118

33. Summary of Hypotheses Tested for Snacking Patterns. 121

A. Food Sources of Vitamin A 176

B. Food Sources of Ascorbic Acid 178

C. Individual Data for Vitamin A and Beta-Carotene . . 190

D. Descriptive Summary of Income and Dietary Intake Based on 24-Hour Recall by Age of Girls . 195

E. Descriptive Summary of Income and Dietary Intake Based on 24-Hour Recall by Race 196

F. Percentile Ranks of Serum Beta-Caro-ene Levels for Adolescent Girls 197

G. ANOVA for Dietary Intake and Serum Levels of Vitamin A and Ascorbic Acid and Age of Girls. 198

H. t-Tests for Dietary Intake and Serum Levels for Vitamin A and Ascorbic Acid and Race 199

I. Rank Order of Vitamin A and Ascorbic Acid Foods Most Preferred by Adolescent Girls 201

Page

TABLE

J. Rank Order of Vitamin A and Ascorbic Acid Foods Lease Preferred by Adolescent Girls 203

K. Food-Preference Responses for Selected Foods . . . 205

L. Chi-Square Analysis of "Social" Snacking 208

M. Chi-Square Analysis of Snacking for Reason "Food Looks Good" 208

N. Chi-Square Analysis of Snacking for Reason "Something To Do" 209

O. Chi-Square Analysis of Race and Place Snacks Were Eaten 209

P. Chi-Square Analysis of Age and Snacks Eaten at Home and Away Before Lunch 210

Q. Summary of Positive Correlations Between Snack and Total Intake of Vitamin A and Ascorbic Acid 211

CHAPTER I

INTRODUCTION

Adolescence is a time of dramatic change, of strong emotions, and of departure from established norms. At a time when rapid physicological development requires increased need for essential nutrients, there is also a strong likelihood that an inadequate diet will be eaten. Popular opinion is that nutrient requirements are high for this group because of the growth spurt, increased activity, and stress. Few data are available to support estimates of the quantities of nutrients needed. Information about what and how this group eats is limited. This age group is vulnerable to fads and peer pressure, thus making it difficult to adequately and accurately estimate what adolescents actually consume in terms of nutrition (James, Sjolin, & White, 1981).

Adolescent females are recognized as a high-risk population group for poor nutritional health. The desire to be slim, and the individual limiting of food choices often create inadequate nutrient intake by many girls. Several national studies of nutritional status (National Center for Health Statistics, 1977; Pao, 1980; U.S. Department of HEW, 1972) indicated adolescents, and particularly females, had dietary intakes below the recommended levels for several nutrients, including vitamin A and ascorbic acid. An in-depth evaluation of food intake and habits and their impact on the nutritional health of adolescents is needed. The effects of a changing lifestyle on adolescent diets, irregular meal and snack patterns, eating more food away from home, individual concerns about their body images, and the fortification of certain popular foods among adolescents have not been evaluated comprehensively.

Eating away from home and irregular meal patterns such as meal skipping and between-meal snacking have become common and accepted parts of American family life. Snacks, those foods consumed between the three main meals of the day, are considered by some individuals to be a health threat, particularly if the snack foods have low-nutrient density. On the other hand, estimates are that from one-fourth to one-third of the adolescent's total calories come from snacks, which indicates that a significant amount of other nutrients may also come from this source (Thomas, 1973). Snack nutrient intake may, in fact, determine the difference between an adequate or inadequate intake of specific nutrients. More information is needed, however, about snacking behavior of adolescents, and how snack foods contribute to the nutritional adequacy of their diets.

The development of good food patterns in the adolescent should be encouraged, because these habits become the more stable food habits of adulthood. The adolescent period is a time particularly vulnerable to the initiation of nutrition-related problems in later life. In order to retard the process of nutrition-related health problems, preventive measures should be initiated early in life and continued. The adolescent needs guidance in making appropriate food choices. Knowledge about food preferences, meal and snack patterns, and food intake can provide information for a practical and acceptable approach to educating youth about nutritional health.

Background of the Study

This study evolved from a larger study in the Southern Region, "The Nutritional Health of Adolescent Females," administered by the S-150 Technical Committee under the auspices of the U.S.D.A. Agricultural Research Service. North Carolina's cooperative effort was directed by Dr. Michael Liebman at the University of North Carolina at Greensboro. The objectives of the regional project were twofold:

1. To assess the nutritional health of adolescent females in the Southern region.
2. To relate nutritional health of adolescent females to socioeconomic factors, food habits, nutrition knowledge, behavioral characteristics, physiological development, and other appropriate factors.

All methodological procedures and instruments were standardized for use by all eight cooperating states: Arkansas, Oklahoma, Louisiana, Alabama, Tennessee, Virginia, South Carolina, and North Carolina. Additional research objectives and instruments were developed for use in the North Carolina study by this author and other graduate students who assisted with the project. The data used in this study were from the 198 adolescent girls from Greensboro and Guilford County who participated in the North Carolina study.

Purposes of the Study

The purposes of this study were to assess vitamin A and ascorbic acid nutritional status of adolescent girls in Guilford County, North Carolina, and to investigate and describe snacking patterns and related factors which may affect nutritional health. The specific objectives outlined for this study to proceed as follows:

1. Measure serum levels of vitamin A and ascorbic acid of adolescent girls.
2. Analyze dietary intakes of vitamin A and ascorbic acid for meals and snacks from two 24-hour dietary recalls.
3. Determine adolescent girls' preferences for foods high in vitamin A and ascorbic acid.
4. Determine adolescent girls' frequencies of intake of foods high in vitamin A and ascorbic acid for meals and snacks.
5. Investigate and describe snacking patterns of adolescent girls.
6. Analyze statistically the relationship between nutritional status of adolescent girls for vitamin A and ascorbic acid and several variables--age, race, income, use of supplements, body fat, food preferences, snacking patterns, weight concerns, and other situational factors.
7. Analyze statistically the relationship between snacking patterns of adolescent girls and several variables--age, race, income, use of supplements, body fat, food preferences, concerns about weight, and other situational factors.

Statement of Hypotheses

The following hypotheses were presented for this study:

H_1 There is no relationship between adolescents' dietary intake of vitamin A and ascorbic acid and selected variables, including (1) age, (2) race, (3) family income, (4) frequency of snacking, (5) preference for vitamin A and ascorbic acid-rich foods, (6) weight concerns, (7) use of nutritional supplements, (8) body fat, (9) self-esteem rating, and (10) regularity of eating a family evening meal.

H_2 There is no relationship between serum vitamin A, beta-carotene, and ascorbic acid levels among adolescent girls and selected variables, including (1) age, (2) race, (3) family income, (4) frequency of snacking, (5) weight concerns, (6) use of nutritional supplements, (7) body fat, (8) self-esteem rating, and (9) regularity of eating a family evening meal.

H_3 There is no relationship between total daily nutrient intake and serum levels for vitamin A and beta-carotene.

H_4 There is no relationship between total snack nutrient intake and serum levels for vitamin A and beta-carotene.

H_5 There is no relationship between frequency of intake and preference for foods high in vitamin A and ascorbic acid.

H_6 There is no relationship between adolescent snacking patterns (frequency, nutrient intake, reasons, place) and selected variables, including (1) age, (2) race, (3) family income, (4) preference for vitamin A and ascorbic acid-rich foods, (5) weight concerns, (6) use of nutrition supplements, (7) body fat, (8) self-esteem rating, and (9) regularity of eating a family evening meal.

H_7 There is no relationship between adolescent snacking patterns and total daily nutrient intake of vitamin A and ascorbic acid.

Definition of Terms

The following definitions are provided to assure understanding of certain terms throughout this study.

Actual frequency of snacking is the total number of snacks eaten in one day as determined by 24-hour recall.

Adolescent, for the purposes of this study, refers to girls 12, 14, and 16 years of age.

Frequency of intake is a term used to describe how often vitamin A and ascorbic acid-rich foods were eaten for meals and snacks.

Meal denotes any food or beverage consumed at regular times during the day and reported by the subject as a meal.

Nutritional status includes an assessment of both dietary intake and biochemical measurement of serum levels of vitamin A and beta-carotene.

Preference describes the notion of liking one food better than another and choosing that food when it was available.

Snack denotes any food or beverage consumed between meals and reported by the subject as a snack.

Snacking pattern refers to the frequency with which snacks were eaten, the place where snacks were eaten, the reasons snacks were eaten, and the nutrient intake of the snacks.

Usual frequency of snacking is the total number of snacks usually eaten in one week as determined by a diet history.

Limitations of the Study

Several limitations of the study were acknowledged. The study was limited to adolescent girls, who were 12, 14, and 16 years of age at the time of recruitment for the study. The available pool of subjects was limited to those volunteer participants who responded to the defined recruitment procedures for the project. All subjects were enrolled in public schools, primarily urban. As is the case with many sample populations, representativeness was a concern.

Other possible limitations to the study involved the difficulty in obtaining reliable dietary information; limitations imposed by the skill of interviewers, particularly in the 24-hour recall; laboratory error in biochemical analyses; and coding errors in analyzing dietary data.

This study made no attempt to investigate total snack intake. Few conclusions can be made from this study about snack consumption except as it relates to vitamin A and ascorbic acid.

CHAPTER II

REVIEW OF RELATED LITERATURE

Adolescents are very vulnerable to nutritional problems. Their rapid rate of growth, extra activities, desire for independence, peer pressure, and social needs for acceptance may contribute to poor dietary habits of adolescence. Considerable gaps exist in our knowledge of the nutrient requirements of adolescents and the specific factors which contribute to nutritional status.

The purpose of this descriptive cross-sectional study was to examine snacking patterns and nutritional status for vitamin A and ascorbic acid in adolescent girls. A brief discussion of the bases for vitamin A and ascorbic acid requirements is followed by a review of nutritional status of adolescents, including dietary intake, biochemical analysis, and tissue storage. Snacking and meal patterns of adolescents are described. A discussion of other factors affecting nutritional status includes sexual maturity, race, socioeconomic factors, use of oral contraceptives, alcohol and drugs, and other factors. The last part of the review includes background information important to the methodology of nutritional assessment. Biochemical measurement of vitamin A and ascorbic acid is described. Additionally, dietary survey methods are reviewed.

Nutritional Status of Vitamin A and Ascorbic Acid in Adolescents

Requirements

Total nutrient needs during adolescence are higher than almost any other period in the life cycle. Failure to consume an adequate diet during this period can potentially retard growth and delay sexual maturity. Few data for adolescents are available to support recommendations for nutrient needs. Estimates of requirements and recommendations for vitamin A are largely interpolated from studies of infants and male adults (National Research Council, 1980). Evidence from chemical and biochemical measurements, intakes which are associated with good health and growth, body composition studies, and work on experimental animals providc further support for the nutrient recommendations. The human requirement for ascorbic acid has been estimated from the amount of ascorbic acid necessary to prevent scurvy, the amount metabolized from the body daily, and the amount necessary to maintain adequate reserves (Irwin & Hutchins, 1976). The Recommended Dietary Allowance (RDA) for adolescent girls for vitamin A is 800 retinol equivalents or 4000 international units (IU). The ascorbic acid allowance for girls 11 to 14 years of age is 50 mg and for girls 15 to 18 years of age, 60 mg (National Research Council, 1980).

Dietary Intake

Contradictory findings have been reported in research studies regarding vitamin A and ascorbic acid nutritional status. Population surveys of nutritional status in North America have indicated that vitamin A is one of the three essential nutrients most likely to be supplied in marginal amounts (Sauberlich, Dowdy, & Skala, 1974). Other dietary studies have shown that intakes of vitamin A and ascorbic acid are often below the recommended levels for adolescents (Baker, Frank, Feingold, Christakis, & Ziffer, 1967; Daniel, 1976; Everson, 1960; Hampton, Hunneman, Shapiro, & Mitchell, 1967; Hinton, Eppright, Chadderon, & Wollins, 1963; Kirksey, Keaton, Abernathy, & Greger, 1978; Morse, Merrow, & Clarke, 1965; Schorr, Sanjur, & Erickson, 1972; Wharton, 1963).

In the Ten-State Nutrition Survey (U.S. Department HEW, 1972), it was reported that adolescents between the ages of 10 and 16 years had the highest evidence of unsatisfactory nutritional status of any age group surveyed. Although significant numbers of 10 to 16-year-olds consumed energy levels below the standards, mean intakes of ascorbic acid were above the standard for all groups in that age range. A low prevalence of vitamin A dietary deficiency was found in both blacks and whites of low and high-income populations. A high prevalence of dietary vitamin A deficiency was found among Spanish Americans.

Findings from the Hanes study (Abraham, Lowenstein, & Johnson, 1974) relative to adolescent nutritional status indicated ascorbic acid intake was adequate for all groups, and vitamin A intake was above the standard for all groups with the exception of 12 to 17-year-old blacks. A study of adolescents in Indiana (Greger, Higgins, Abernathy, Kirksey, de Corso, & Baligar, 1978) revealed that less than two-thirds of the Recommended Dietary Allowances were consumed of vitamin A by 42 percent of the subjects and of ascorbic acid by 26 percent. Other researchers have reported adequate intakes of ascorbic acid (Brown, Bergan, & Murgo, 1979; Etnyre, 1977; Prothro, Mickles, & Tolbert, 1976; Truswell & Darnton-Hill, 1981), and inadequate intakes of vitamin A (Brown, Bergan, & Murgo, 1979; Donald, Esselbaugh, & Hard, 1958; King, Cohenour, Calloway, & Jacobson, 1972; Lee, 1978; Rodriguez & Irwin, 1972). In an extensive review of vitamin A research, Rodriguez and Irwin (1972) cited results of seven dietary studies involving 1,836 subjects 13 to 19 years of age. In these studies, the mean daily vitamin A intake from mixed diets ranged from 5,170 to 8,000 IU.

Approximately every ten years, the United States Department of Agriculture conducts a nationwide survey of household food consumption. It was interesting to note the trend in mean consumption of vitamin A and ascorbic acid over a 20-year period as reported by USDA (Adelson & Peterkin, 1968; Pao, 1980). Vitamin A, ascorbic acid, and calcium intake were the nutrients most often reported below recommended allowances in both 1955 and 1965, but more often in 1965. Seventy-three and 74 percent of the population failed to meet the allowances for ascorbic acid and vitamin A, respectively, in 1965 (Adelson & Peterkin, 1968). A 35 percent average increase in the levels of ascorbic acid intake was reported in the 1977 survey. Ascorbic acid intake increased approximately 40 percent for adolescent girls. The average intake of vitamin A increased seven percent for the total population in the 1977 food consumption survey. Examination of the data for subgroups within the sample, however, showed that vitamin A intake increased only for older men and women. Intake of vitamin A decreased 14 to 18 percent for adolescent girls in the 1977 survey (Pao, 1980). The reported decrease raised concern about vitamin A nutrition in all of the population, especially adolescent girls.

The type and number of foods available to American consumers are constantly changing. In recent years, the popular fruit drinks, punches, and ades, many ready-to-eat cereals, and other foods have been fortified with ascorbic acid. Increased consumption of fruit drinks, punches, and drink mixes, some of which are fortified with ascorbic acid, has become an important source of ascorbic acid for children and adolescents (Pao, 1980). As the food supply continues to change, more information will be needed to determine how food consumption actually affects the nutritional health of adolescents. "There is not enough information on the range and variation of food intakes of adolescents, especially those living in permissive affluent societies" (Davidson, Passmore, & Brock, 1979, p. 530).

Dietary intake of vitamin A and ascorbic acid-rich foods is clearly related to preference for these foods. Vegetables are generally not well liked by adolescents (Carlisle, Bass, & Owsley, 1980; Greenwood & Richardson, 1979; Schorr, Sanjur, & Erickson, 1972). A study of a one-day food record for 324 sixth-grade boys and girls in North Carolina (Clawson, 1979) reported 91 percent of the subjects had no servings from the fruit and vegetable category, both of which contain excellent sources of both vitamin A and ascorbic acod. Ninety-three percent of the adolescents had no servings from a second category of fruits and vegetables known to be excellent sources of vitamin A alone. More students ate fruits and vegetables high in ascorbic acid. Another North Carolina study (Edwards, Hogan, & Spahr, 1964) also reported low intake of green leafy and yellow vegetables. Only 17 percent of the 6,200 adolescents surveyed ate a vitamin A-rich vegetable on the test day, and only 41 percent ate an ascorbic acid-rich food.

A nationwide food consumption survey (USDA, 1980) observed that vegetables and fruits contributed the largest share of vitamin A value (36 percent) of any major food group for adolescent girls 12 to 18 years old. Also important as sources of vitamin A were the milk group (26 percent) and the grain group (19 percent). Ascorbic acid was supplied by fruits and vegetables (41 percent), and citrus fruits and white potatoes were consumed more often than other fruits or vegetables. Other worthwhile amounts of ascorbic acid came almost equally (10 percent) from grain products, nonalcoholic beverages, and milk.

Greger, Divilbiss, and Aschenbeck (1979) observed that the average adolescent consumed less than the recommended number of servings of fruits and vegetables in the four food groups. Twenty percent of the girls in the fall and 15 percent in the spring consumed less than two servings of fruits and vegetables. Other investigators have also observed that adolescents' diets, as compared to the basic four food plan, are often poor in fruit and vegetable intake (Duyff, Sanjur, & Nelson, 1975).

Serum Levels of Vitamin A and Ascorbic Acid

Low serum or plasma values for vitamin A and ascorbic acid have been observed in adolescents. Baker et al. (1967) reported that more than 50 percent of 10-to-13-year-old children from diverse population and socioeconomic backgrounds had vitamin A, beta-carotene, and ascorbic acid levels below the mean of the sample population. Low vitamin A biochemical values were observed for 20 to 40 percent of the 10-to-16-year-olds in a 1968 Texas Nu-rition Survey (McGainty, 1977). One in five of the students was assessed as being at risk with respect to vitamin A. Low ascorbic acid values were observed for approximately 13 percent of the subjects.

Later studies in Texas revealed improved ascorbic acid status, but the continuation of poor nutritional status for vitamin A (McGainty, 1977). Low serum values for ascorbic acid and vitamin A were also found in Kentucky adolescents (Lee, 1978). Higher percentages of blacks of both sexes than whites had below acceptable values of serum ascorbic acid. There were higher proportions of whites of both sexes than blacks with serum levels of vitamin A and carotene below the acceptable value. Serum vitamin A values of Kentucky adolescents ranged from 41 to 47 mcg/100 ml. Rodriguez and Irwin (1972) cited mean plasma vitamin A levels of 29 to 35 mcg/100 ml from several studies of adolescents 14-to-16 years of age. Prothro et al. (1976) reported a value of 22 ± 8 mcg/100 ml for retinol and 109 ± 43 mcg/100 ml for beta-carotene in adolescent girls. Serum beta-carotene was significantly higher in blacks, and higher in black males than in black females. These results supported an earlier finding (Leitner, 1960) of higher vitamin A levels in males than in females. No correlation has been reported between serum levels of vitamin A and serum levels of beta-carotene (Krishnaswamy, 1978; Pearson, 1962).

Seasonal variations have been observed in biochemical values for plasma vitamin A, beta-carotene, and ascorbic acid for adolescents (McGainty, 1977). A highly positive correlation has been observed between plasma vitamin A and plasma proteins, particularly albumin (Ismadi & Olsen, 1975; Kothari, Lal, Srivastava, & Rameshwar, 1971). Strong experimental evidence exists that vitamin A utilization (absorption, transport, and storage) is closely related to both the quality and quantity of dietary protein (Rodriguez & Irwin, 1972).

Tissue Reserves of Vitamin A

Autopsy results have indicated that liver vitamin A values in 20 to 30 percent of the United States population may be at risk with respect to vitamin A nutriture (Mitchell, Young, & Seward, 1972; Raica, Scott, Lowry, & Sauberlich, 1972). Liver stores of vitamin A appeared to be much lower in the 11-to-20-year-old group. The physiological significance of this observation is unknown. A normal range of 100 to 300 mcg/gm of liver tissue has been reported. Mitchell et al. (1973) observed some possible racial differences in vitamin A levels in liver tissue.

Snack and Meal Patterns of Adolescents

Snacking is definitely a part of adolescent food behavior. Work and school schedules, the desire to be independent and to exhibit freedom of expression, extracurricular activities, and socializing with peers are factors which often result in irregular eating patterns and frequent snacking. The standard meal is sometimes omitted and snacks are substituted. A survey of adolescent females in Indiana reported that 90 percent of the girls snacked at least once during the day (Gregar et al., 1979). Other studies reported snacking or eating between meals for 78 percent (U.S. Department of HEW, 1972), and 70 percent (Pao & Mickle, 1980) of the adolescents surveyed. Three to six snacks were consumed per day, and younger girls snacked more than older girls. Lee (1978) found that the number of snacks per day averaged 2.5 daily for white girls and 3.8 daily for black girls.

Estimates are that from one fourth to one third of the adolescent's total calories came from snacks, which indicates that a significant amount of other nutrients may also come from this source. Research studies vary considerably in regard to the amount of vitamin A or ascorbic acid consumed in snacks. Past research (Steele, Clayton, & Tucker, 1952) reported snacks contributed about 10 percent of the RDA of nutrients for adolescents. Recent research has indicated this percentage may now be as high as 10 to 17 percent (Brown, Bergan, & Murgo, 1979) or higher (Cala, Morgan, & Zabik, 1981). Pao and Mickle (1980) found that snacks provided approximately 16 percent of adolescent girls' vitamin A intake and 19 percent of their ascorbic acid intake. Girls consumed more ascorbic acid from snacks than adolescent males. Between-meal snacks contributed nine percent of the RDA for vitamin A and 24 percent of the RDA for ascorbic acid in the diets of adolescent girls in Rhode Island (Brown et al., 1979). One in four of the girls in this study had vitamin A intakes below the 50-percent level of the RDA.

Analysis of 24-hour intake records of adolescents in the Ten-State Nutrition Survey (U.S. Department of HEW, 1972), revealed that up to 55 percent of vitamin A and ascorbic acid intake was supplied by between-meal snacks for some adolescents. Wharton (1963) stated that if snacks contribute more than 20 percent of the day's caloric intake, the diet may supply more of all nutrients except vitamin A and ascorbic acid than a daily diet of three traditional meals. Several researchers (Hampton et al., 1967; Hunnemann et al., 1968; Pao, 1980; Thomas & Call, 1973) have concluded that between-meal eating does seem to make a significant contribution to nutritional health.

The great variability of the nutritive value and frequency of consumption of snacks in an individual's diet makes it necessary to analyze how often specific foods are consumed or to analyze intake over a period of time before appropriate recommendations can be made. More information is needed to specifically describe the contribution of snacks to vitamin A and ascorbic acid intake. Many people label snacking as bad, and the misconception has created confusion and uncertainty about what to teach about this food behavior. Emphasis on the positive aspects of snacking may have been limited because of a lack of knowledge or scientific evidence about the nutritional contribution snacks can make toward adequate intakes of certain nutrients.

Other Factors Affecting Nutritional Status of Adolescents

Sexual Maturity

The transition from childhood to adulthood is accomplished by a series of physical, physiological, psychological, and social changes. Dorlund (1965) defined adolescence as "the period of life beginning with the appearance of secondary sex characteristics and terminating with the cessation of somatic growth" (p. 21). Even though this period is usually called adolescence, it has two phases--pubescence and adolescence. Pubescence begins with the increase in hormone secretions and the appearance of secondary sex characteristics, and ends when sexual reproduction becomes possible. Adolescence follows pubescence, and ends with the completion of physical growth at maturity (McKigney & Munroe, 1976; Roche, 1976). This critical period of human development has no specific beginning or end. It is often defined as the teen-age years between 12 and 19. The precise chronologic timing of onset, progression, and completion of adolescence varies from individual to individual and between the sexes. The changes, however, do usually occur in an orderly sequence. Thus, in a group of adolescents of the same age group, a few will be children unaffected by hormonal changes, some will appear to be adults, but most will be growing rapidly.

Almost all research with adolescents has been age-related; yet chronologic measurement comprises a poor reference point for studying pubertal changes. A measure for developmental age, or physiological maturity, which represents more accurately than chronological age how far one has progressed to maturity, has been proposed (Tanner, 1962). Sex maturity ratings (Roche, 1976) are frequently used as a measure of maturation during adolescence, because they provide a more useful gauge of developmental achievement. Many nutrient and biochemical measurements correlate better with sexual maturity ratings than they do with chronological age. This precise determination of maturation can assist greatly in defining the appropriate nutritional needs of adolescents, and also can be used as a practical tool for nutritional planning and counseling (Beal, 1980; Daniel, 1976).

Race

Various population groups have distinctive patterns of vitamin nutriture (Baker et al., 1976). Certain eating patterns and food preferences seem to be associated with ethnic and socioeconomic factors (Hunemann, Shapiro, Hampton, & Mitchell, 1978; Lee, 1978; Pipes, 1977). This tendency makes certain groups of adolescents at risk for suboptimal nutrition more than others. Food preferences and eating patterns of blacks, as compared to whites, may be related to differences in nutritional status of the two groups. Nutritive intake of vitamin A may be higher for blacks than for whites (Lee, 1978; Prothro et al., 1976; Wharton, 1963).

Income

The availability of nutrients has been closely and directly related to family income (Bowers, 1955; Hampton et al., 1967; Hinton et al., 1963; Inana & Pringle, 1975; Pao, 1980; Wilhemy, 1950).

Financial security does not guarantee an adequate diet. Data from the 1977 Nationwide Food Consumption Survey (1980) showed that of four income groups, the lowest income group had the highest intake as a percentage of the RDA for vitamin A. The highest income group had the highest percentage of the RDA for ascorbic acid intake. Among the income groups, mean intake for all sex-age groups met the RDA for ascorbic acid, and mean intake for all but the 19-to-22-year-old females met the RDA for vitamin A. Families in the United States who have higher incomes consume more fruits and vegetables (Pao, 1980; Steibling, 1950). Consequently, adolescents from higher-income families have greater opportunity to select foods high in vitamin A and ascorbic acid.

Oral Contraceptives

Sexual permissiveness and efforts to control teen-age pregnancies have resulted in the use of oral contraceptives by a growing number of adolescents. Oral contraceptives cause many different metabolic alterations, including changes in vitamin metabolism. Gal et al. (1971) reported a significant increase in vitamin A levels in the serum of patients using oral contraceptives, as compared to their controls. Serum carotene levels, on the other hand, showed a decrease in groups taking oral contraceptives. The increased serum level of vitamin A is thought to represent a shift from tissue stores (Prasad, Maghissi, Lei, Oberleas, & Stryker, 1977). The question may be asked as to whether such a shift results in tissue depletion in females whose vitamin A intake is marginal or deficient. Lowered levels of plasma carotene among oral contraceptive users remains essentially unexplained. Decreased ascorbic acid levels in platelets, leukocytes (Briggs & Briggs, 1972) and plasma (Rivers, 1975) have been reported, as well as no effect (Young, 1976). Although oral contraceptive agents seem to alter the metabolism of nutrients, there is little evidence to suggest that increased intakes of these nutrients are needed to prevent nutritional deficiencies. Therefore, the adolescent who uses oral contraceptives can meet nutritional requirements for vitamin A and ascorbic acid by an adequate diet.

Alcohol and Drug Use

An increase in alcohol and drug consumption by adolescents and its consequent problems has been reported (Marino & King, 1980). Alcohol can contribute a significant amount of energy and displace food and nutrient intake in the diet. Reduced appetite and drastic alteration in the absorption, utilization, and metabolism of some nutrients may occur. Liver damage caused by long-term alcohol abuse can lead to a reduction in vitamin A stores. The adolescent who has increased nutrient needs for growth and development may be susceptible to nutritional deficiencies as a result of alcohol abuse. The effects of drug use on nutritional status of adolescents was not reported in the literature.

Other Factors

The food habits of adolescence reflect the weakening influence of the parental family and the importance of peer-group pressures. Social changes affect food habits and therefore food intake. The young person's concern about appearance is clearly related to the establishment of identity and self-image. Psychological factors are often related to experimentation with "fad diets," vegetarianism, weight reduction, and "muscle building." Although nutrition knowledge has been positively related to food practices (Hinton et al., 1963), knowledge may not be a determining factor in the selection of an adequate diet (Hampton et al., 1967).

Various influences and changes in the adolescent's eating habits raise questions concerning the nutritional contributions of at-home and away-from-home foods. Approximately 44 percent of the total population ate meals and snacks away from home. Slightly more than one third of both vitamin A and ascorbic acid intake was consumed in food eaten away from home (USDA, 1980). This proportion increased progressively with age, and peaked among females at 55 percent for the 12-to-14-year olds. Fast-food restaurants provided 18 percent of adolescent boys' and 24 percent of adolescent girls' meals and snacks outside the home, and another 17 to 18 percent was food eaten at someone else's home. Foods eaten away from home make important contributions to nutrient intakes. Greecher and Shannon (1977) examined nutrient intakes of college-age patrons of fast-food outlets, and reported very low intakes of vitamin A from fast-food meals. The limited range of menu items in most fast-food restaurants raises particular concern for intake of vitamin A, especially among adolescents who regularly choose fast-food fare.

Consumption of new foods from the marketplace, particularly those fortified with vitamin A and ascorbic acid, may contribute to improved dietary intake. The effect of this factor on dietary intake and nutritional status of adolescents has not been delineated. Adolescents are important consumers, and as the implications of diet for health become more obvious, the need for sound nutrition education is evident, especially for adolescents.

Biochemical Measurement of Vitamin A and Ascorbic Acid

Inadequate intakes of vitamin A, either as preformed retinol or as active carotenoids, result in decreased tissue levels of the vitamin. Serum measurements of vitamin A are the most practical biochemical means of assessing the nutritive status of this nutrient. Serum levels of vitamin A and carotene are related to the dietary intakes of these nutrients. Serum levels less than 20 mcg/100 ml probably indicate both a prolonged low intake of vitamin A and a low tissue reserve of this vitamin (Sauberlich et al., 1974). Higher serum vitamin A levels (above 30 mcg/100 ml) are generally associated with an appreciable tissue reserve of the vitamin. Mean plasma vitamin A values for normal adults range from approximately 45 to 65 mcg/100 ml, with higher values noted in older age groups (Sauberlich et al., 1974). On a weight basis, the vitamin A requirement of the rapidly growing child is considered to be higher than that of the adult, and this may relate to the lower mean plasma vitamin A values observed (U.S. Department of HEW, 1972). Whenever feasible, clinical cases of suspected hypovitaminosis A should be submitted to visual functional tests.

Serum beta-carotene measurements provide limited information concerning vitamin A nutriture, but do reflect recent dietary intakes of the nutrient. A relationship between retinol and carotenoid levels in serum has been observed in population surveys (Sauberlich et al., 1974). When both low serum beta-carotene and vitamin A levels are found together, strong evidence exists for inadequate vitamin A nutriture. Serum beta-carotene values average about 113 to 126 mcg/100 ml (Sauberlich et al., 1974), and a range of 24 to 216 mcg/100 ml has been observed in the United States (Davis, Gershoff, & Gamble, 1969).

Although vitamin C nutritional status in many may be determined on the basis of dietary intake findings and on clinical signs of a dietary deprivation, biochemical measurement represents the most objective approach. Without the availability of a functional biochemical procedure that relates to ascorbic acid status, information concerning inequacies of this nutrient has been derived mainly from measuring levels of ascorbic acid in serum, blood, leucocytes, and urine (National Institutes of Health, 1963; Sauberlich, 1975; Sauberlich et al., 1974). The measurement of serum levels of ascorbic acid is the most commonly used and practical procedure for determining ascorbic acid nutritional status in individuals or population groups. Serum levels of ascorbic acid show a linear relationship with the intake of ascorbic acid. The maximum serum ascorbic acid level is 1.4 mg/100 ml (Sauberlich et al., 1974). Clinical deficiency symptoms are associated with levels below 0.30 mg/100 ml, and the body pool of the vitamin is severely depleted. In general, serum ascorbate levels tend to reflect recent dietary intakes of ascorbic. Fidanza and Baldesserini (1975) concluded a higher intake of ascorbic acid is necessary in children than in adults to achieve a certain plasma ascorbic acid concentration. White blood cell levels of ascorbic acid better reflect tissue stores than serum levels, but the measurement is technically difficult to perform and not practical (Sauberlich et al., 1974). Urinary levels can provide supportive information regarding status even though excretion rates are highly variable. Ascorbic acid in biological specimens is unstable and samples require careful handling to prevent losses prior to analysis.

Dietary Survey Methods

Dietary studies are used to determine food and nutrient intake, and are usually an integral part of most nutritional assessment surveys. Actual food intakes are measured during a specified period. Dietary studies cannot be taken as absolute indicators of adequate nutrition, but they are widely used to provide presumptive evidence of dietary inadequacies and excesses of individuals and groups. When used in conjunction with other methods of nutritional assessment, dietary studies may help explain possible reasons for clinical and laboratory findings (Christakis, 1973).

Usual dietary intake measured over longer periods of time is a reliable method to assess factors related to health (Burk & Pao, 1976). Costs, management, and other problems in obtaining this type of information, however, usually prohibit measurement of intake over extended periods in large-scale surveys. The 24-hour recall or two- or three-day recall-record combination is most frequently used in large surveys of nutritional status (Abraham et al., 1974; Chassy, Van Veen, & Young, 1967).

The procedures and problems of design, collection, analysis, and interpretation of data of various survey methods have been discussed in several reviews (Bazzarre & Myers, 1979; Bowers, 1955; Burk & Pao, 1976; Christakis, 1973; Young & Trulson, 1960). No one method is consistently superior to all other methods (Burk & Pao, 1976). The principal survey methods for measuring food intake of individuals are (1) record of current food intake, including weighed or estimated methods; (2) recall of past food intake, including the 24-hour recall, the dietary history, and frequency methods; or (3) some combination of the two principal methods (Burk & Pao, 1976). Each method has limitations. Selection of one appropriate method is based on the intended purposes of the dietary study of individuals or groups. In a comparison of a seven-day record, a dietary history, and a 24-hour recall, no one method has been found to be more reliable than another (Young, Hagen, Tucker, & Foster, 1952). Gersovitz, Madden, and Wright (1978) concluded in a comparison of two methods, however, that the 24-hour recall tended to slightly overstate the actual intake, and the seven-day record tended to understate it. Accuracy in the food record declined by the fifth, sixth, and seventh days.

A weighed record is a listing of foods and their weights consumed during a specific period. The food may be weighed by the subject or the interviewer. This method is usually limited to controlled metabolic studies. The reliability and validity of this method are variable when the subject weighs the food because of various factors which contribute to systematic bias (Burk & Pao, 1976).

Estimates of current food intake are made in one-, three-, or seven-day diary records. These records are best used for group means (Burk & Pao, 1976), and are subject to error in estimating portions consumed and food pattern changes. Young et al. (1952) recommended that the 24-hour recall be substituted for the one-, three-, or seven-day record to avoid risk of respondents changing their customary food patterns. Several researchers have reported good agreement between actual consumption and the 24-hour recall method (Emmons & Hayes, 1973; Samuelson, 1970). The dietary history provides a check on the completeness of the 24-hour recall and additional information about dietary practices. The 24-hour recall is subject to problems of memory of the individual interviewed, and may result in underestimation of nutrient intake (Campbell & Dodds, 1967; Christakis, 1973). Because of higher response rates, more representativeness and predictive validity exist for the 24-hour recall than for other methods (Burk & Pao, 1976).

The food-frequency rating is a tool used to evaluate food patterns by describing how often specified foods are eaten in a given time period. Abramson, Stone, and Kosovosky (1963) found that amounts of food consumed by subjects correlated well with the frequency with which these foods were eaten as well as with certain biochemical analyses. The frequency method is simple to administer, economical, and provides useful descriptive data. It is not appropriate for collecting detailed food-intake data for measuring nutritional status (Burke & Pao, 1976).

The importance of food preferences must not be underestimated for it is these preferences that influence food choices and consumption.

Sanjur (1979) commented that in order to improve the nutritional status of adolescents, nutrition educators must recognize adolescents' food preferences. Einstein and Hornstein (1970) studied food preferences of 50,000 college students in the United States and found that of all food classes, bread was the most popular, followed by beverages, desserts, and sandwiches. Salads, vegetables, and soups were least popular. The ten least liked foods were all vegetables, with the exception of liver. In an attempt to determine the relationship between food preferences and nutritional value of foods, Einstein and Hornstein (1970) concluded that if food preferences were the sole determinant of food intake, then dietary intake would be low in vitamin A. Some of the best sources of vitamin A were among the most disliked foods identified by participants in the survey.

Summary

Based on this review of literature, it can be concluded that adolescents are very vulnerable to nutritional problems. There is a wealth of information regarding dietary intake, but few existing studies assess nutritional status in terms of clinical, biochemical, anthropometric, and dietary analysis. Describing and interpreting the results of studies on nutritional status on any population group is a complex task. There are considerable gaps in knowledge of the nutrient requirements for adolescents. Available information is related primarily to chronological age, whereas nutrition and growth need to be related to developmental age. Research needs to focus directly on this group rather than extrapolating from previous child and adult studies.

Food habits of adolescents were examined extensively more than 20 years ago. Social and economic changes in the United States have altered lifestyles, food intake, and concerns about nutrition and health. The effects of these changes have not been fully examined and described for the adolescent population. The contradictory reports presented in this review from national surveys on nutritional status and vitamin A and ascorbic acid intake lead one to conclude that vitamin A status in adolescents and, to a lesser extent, ascorbic acid status may be a problem in the United States. Guthrie (1976) included both vitamin A and ascorbic acid as two of the seven nutrients to measure as predictors of nutritional risk in population assessments. Research findings support the need for assessing more carefully the nutritional status of the adolescent, and for examining related factors which may affect dietary intake and individual nutriture. Rapid, economical, and more reliable methods are needed for measuring the nutritional status and dietary intakes of individuals and populations.

CHAPTER III

METHODS OF PROCEDURE

The purposes of this study were to assess vitamin A and ascorbic acid nutritional status of adolescent girls and to describe snacking patterns and related factors which may affect nutritional health. This cross-sectional study included measurement of serum levels of vitamin A and beta-carotene; dietary analysis of meals and snacks from two 24-hour dietary recalls; and frequency intake, snacking patterns, and preferences for foods high in vitamin A and ascorbic acid. Measurement of plasma ascorbic acid levels were not completed for reasons explained later in this section.

The data for this study were collected as part of a regional project assessing nutritional health of adolescent females in eight states. Much of the procedure and design were standardized for use in the interstate study. Additional instruments were designed by the author and other graduate students for use only in the North Carolina study. The author participated in the North Carolina study as research assistant in planning and coordinating project implementation procedures, field interviewer, assistant in data collection and coding, and laboratory technician.

Information was gathered at two different times during January through May, 1981. Some data were collected during a home interview of the subject and parent or guardian. Girls were then invited to the university campus where blood and urine samples and other data were collected. Recruitment procedures, the consent form, and the guidelines for the participation of subjects were approved by the departmental and university Human Subjects Review Committee.

Sample and Selection of Subjects

A sample of approximately 200 adolescent girls, ages 12 to 16 years, who were willing to cooperate and who gave consent, was selected. Numbers of subjects in each race-age category were as follows.

Table 1

Race and Age of Subjects

	Age (Years)			
	12	14	16	Total
Blacks	32	36	19	87
Whites	52	40	19	111
				198

Students whose birthdates fell six months before or after March 1, in 1969, 1967, and 1965, met the age criterion for participation.

Subjects were obtained from the population to assure a spectrum of income categories. However, to ensure that income could be related to nutritional health, 10 percent to 15 percent of the sample for each race was included from the following groups: (1) low income or those with income of $2,000 or less per capita; (2) high income or those with $4,000 or above per capita. All other subjects were selected without regard to income.

Recruitment of Subjects

Participants were selected from the 12, 14, and 16-year-old population in the Greensboro City and Guilford County Public Schools. An incentive of ten dollars was paid and a free breakfast was provided to all girls who completed the entire assessment procedure. Transportation to the university for the Saturday interview and testing procedures was provided to those subjects who needed it. When possible, requests to schedule the university visit with a friend were honored.

Publicity flyers and a letter (see Appendix A) were distributed in all four senior high schools and all seven junior high schools in the Greensboro City Schools, and selected senior high schools and junior high schools in the Guilford County system. This procedure allowed all eligible female students the opportunity to be informed about the project. A member of the project staff met with the principals and health and physical education teachers in junior high schools. The staff member solicited their cooperation in announcing the project to their classes and in encouraging participation. All students enrolled in junior high schools were required to take the health and physical education class; therefore, all eligible students had an equal chance to hear about and to enroll in the project. A project staff member met with the principals and homeroom teachers in the senior high schools, and solicited their cooperation in announcing the adolescent nutrition project. All high school students met in a homeroom daily. In addition, an article describing the study and procedures for enrollment was printed in the local newspaper.

Interview Procedures

Data were collected at two different times for all subjects. Trained interviewers visited the home and collected the following: (1) medical history; (2) socio-demographic information; (3) 24-hour food recall and dietary history; (4) food frequency for snacks; and (5) self-esteem rating. Approximately two weeks after the home interview, 15 to 20 subjects per Saturday visited the university campus and the following data were collected: (1) blood sample; (2) anthropometric measurements; (3) sexual maturity rating; (4) 24-hour food recall; (5) food frequency for meals; (6) food preferences; (7) nutrition knowledge, attitudes, and behavior test; and (8) physical fitness inventory. Only a description of the instruments and data important to the objectives of this study are included here.

Interview Training

Graduate research students assigned to the regional project and volunteer senior undergraduate students were trained for the home interviews and 24-hour recalls. All students were trained in interviewing procedures and skills. A Project Procedural Guidelines and Manual for Interviewers (1981) was given each interviewer and used in training sessions. Three training sessions were conducted prior to the beginning of the project. Instructions, explanations of procedures, and practice sessions were included.

Five interested and motivated graduate students committed to the project were trained for the 24-hour dietary recalls. A faculty member certified by the National Heart, Lung, and Blood Institute and skilled in dietary recalls was responsible for the 24-hour food recall training. Guidelines and procedures recommended in the regional project for training and certifying interviewers collecting dietary information were used. After practice sessions, all dietary interviewers were required to code three standard and three community recalls with less than five errors each in food description and coding. Interviewers qualified for certification upon completion of this phase of training.

Enrollment of Subjects

Students volunteered to enroll in the project by returning a signed consent form or by calling one of two telephone numbers assigned to the project for enrollment of subjects. Calls for enrollment were accepted in both day and evening hours. Birthdate, age, and address were secured from students who enrolled by telephone (see Appendix A). Students who returned the form by mail were called to confirm their enrollment. All students were provided verbal information about the study, the home visit, and other procedures, and the anticipated time schedule for the subject's participation.

A running tabulation was kept on number, age, and race of subjects enrolled to assure the selection of a balanced sample. Additional subjects were solicited in specific age and race categories as needed. Solicitation of subjects continued as long as necessary to complete the sample. Actual data collection began before enrollment of all subjects.

Consent Form and Medical History

A short time before the home visit, an appointment was scheduled at a time convenient for both the mother and daughter to be home. The home visit was made approximately two weeks prior to the subject's visit to the university campus. Trained staff members interviewed both the subject and her mother and administered various questionnaires. Before asking the mother or daughter any questions, the interviewer reviewed the consent form (see Appendix A), secured signatures, and explained the procedures followed to provide confidentiality for each subject. Arrangements and schedules for the university visit were made at the end of the home visit.

A medical history was secured for each subject. During the home visit, the interviewer read the questions to the mother, and recorded her responses. If the subject had any serious illnesses or conditions which interferred with normal nutrition or was identified to have sickle cell trait, the interview was terminated, and the subject was not included in the study. The subject also completed a medical history during the university visit. This questionnaire included information regarding smoking and use of alcohol, drugs, and oral contraceptives.

Research Instruments

Questionnaire Development

Three questionnaires were developed for the specific objectives of this study. Two food frequency questionnaires--one for meals, and the other for snacks--(see Appendix A) listed 56 food items considered either excellent, good, or fair sources of vitamin A and ascorbic acid. Food items were selected for the frequency and preference listing by reviewing USDA Agricultural Handbook No. 456 (1975) and USDA Home and Garden Bulletin 72 (1978), and selecting any foods where one serving could be classified as an excellent, good, or fair source of vitamin A and/or ascorbic acid. A food was classified as an excellent source of vitamin A if it contains 2900 IU; good, if one serving contains 1500 to 2899 IU; and fair, if one serving contains 450 to 1499 IU of vitamin A (see Appendix B). According to this classification, one serving of an excellent source of vitamin A contains almost three-fourths of the Recommended Dietary Allowance for female adolescents. A food was classified as an excellent source of ascorbic acid if it contains 35 or more mg; good, if it contains 20 to 34 mg; and fair, if it contains seven to 19 mg of ascorbic acid (see Appendix B). One serving of an excellent source of ascorbic acid contains approximately one-half of the Recommended Dietary Allowance for female adolescents. The classifications of food sources used in the development of these questionnaires were in general agreement with other published lists in basic nutrition textbooks. Only 15 foods on the list of 56 were excellent, good, or fair sources of both vitamin A and ascorbic acid. All other foods were excellent, good, or fair sources of either vitamin A or ascorbic acid. A food-preference questionnaire (see Appendix A) contained the same 56 food items as were included on the food frequency listing.

The food frequency and food preference questionnaires were pretested with approximately 50 adolescents who were enrolled in an eighth grade class in Caswell County and not participating in the project. The questionnaires were pretested to determine clarity of instructions, whether they elicited the information desired, and length of time required for completion.

Nutrient Intake and Snacking Patterns

Adolescent girls were asked to recall all foods and beverages consumed in a 24-hour period (see Appendix A), both in the home visit and the university visit to ascertain nutrient intake and snacking patterns. Additional questions were asked in the home interview to obtain a dietary history and other related information. The dietary history questionnaire included questions regarding usual meal and snacking patterns, vitamin supplementation, concerns about weight, regularity of eating a family meal, and reasons for snacking. Research assistants trained in the method of dietary recall interviewed each subject. To help students estimate quantities for the 24-hour recalls, measuring cups, spoons, drinking cups in a variety of sizes, ruler, and other appropriate props were used (see Appendix A). Mean nutrient intake for vitamin A and ascorbic acid and other nutrients were averaged for the two days.

Two food frequency questionnaires (see Appendix A) were used to determine how often the subject usually ate food items high in vitamin A and ascorbic acid. Using the self-administered frequency form, the subject was asked to indicate an appropriate response for the foods listed. A snack frequency form was administered after the dietary recall during the home visit. The meal frequency form was given following the 24-hour recall at the university. Relative frequencies of foods high in vitamin A and ascorbic acid for meals and snacks were determined.

A self-administered food preference questionnaire (see Appendix A) was given during the university visit. Food preferences were measured by the frequency a subject chose the food when available. The preference questionnaire reordered the same 56 foods rich in vitamin A and ascorbic acid listed on the frequency questionnaires for snacks and meals.

Socio-Demographic Questionnaire

Socio-demographic background information (see Appendix A) was secured for each subject. The interviewer read the questions to the mother and recorded her responses. Information regarding income was included in this questionnaire.

Self-Esteem Rating

Subjects were asked to rate their self-esteem, using Rosenberg's (1965) Self-Esteem Scale (see Appendix A). The scale is a ten-item Guttman scale with items answered on a four-point scale from "strongly agree" to "strongly disagree."

The scale has been tested for 93 percent reproducibility, 73 percent scalability for items, and 72 percent scalability for individuals. The test has a test-retest reliability of 85 percent.

Anthropometric Measurements

Weight, height, and triceps skinfold were measured by a trained research assistant during the university visit. A single beam balance which had been calibrated for accuracy was used for weight. Subjects were asked to remove shoes, outer, and excess clothing prior to measurement. The weight of remaining clothing was estimated, using a table of weights for usual clothing items (Project Procedural Guidelines and Manual, 1981). Height was measured by a nonwoven tape and board against the wall. The board was constructed with a right angle so a flat surface could rest against the wall and head of the subject.

Triceps circumference and triceps skinfold were taken at the same site on the right side of the body, according to guidelines established by Lipid Research Clinics Program (1973). These guidelines were included in the Project Procedural Guidelines and Manual for Interviewers (1981). Lange skinfold calipers[1] were used for taking skinfold measurements. These measurements were utilized to compute a weight/height index, sometimes called the Quetelet Index (Beal, 1980). The Quetelet Index (W/H^2) is one measure of adiposity.

Biochemical Nutrient Analysis

A sample of approximately 15 ml of venous blood was drawn by a qualified medical technologist from the subject in a fasting state during the university visit. Blood samples were centrifuged to separate cellular elements. Aliquots of serum were stored in small plastic vials which were labeled and frozen at -10°C. Serum samples for vitamin A and beta-carotene determinations were stored seven to 14 days before biochemical analyses were completed. Determinations were made for the 157 subjects for whom there was an adequate blood sample.

The objectives of this study included determination of plasma ascorbic acid levels of the subjects. Although plasma samples were collected and frozen for analysis, ascorbic acid levels could not be measured because of the degradation of ascorbic acid during storage. The samples were frozen for approximately three months before the first experimental trials were conducted.

Vitamin A and Beta-Carotene

A variety of methods for the determination of vitamin A in serum have been proposed, but the reaction between vitamin A and trifluoroacetic acid (Neeld & Pearson, 1963) is most commonly used in clinical laboratories. Trifluoroacetic acid (TFA) reacts with the π-electrons in the conjugated double bonds of vitamin A to form a chemical compound with a blue color. Carotene is the precurser of vitamin A and is usually determined along with the vitamin.

Preliminary laboratory trials using 1.5 ml serum instead of the 1.0 ml used by Neeld and Pearson (1963) resulted in higher and more consistent optical density readings. Consequently, 1.5 ml of serum was used in this experiment to ensure more accurate results with the procedures of the method employed. Duplicate serum samples were used in most determinations. Only in rare exceptions was there too little serum to run a duplicate.

Using the method of Neeld and Pearson (see Appendix C), the proteins in the serum were precipitated with ethanol, and the carotene and vitamin A were extracted with petroleum ether. The carotene concentration was determined directly by measuring its absorption at 450 nm against a petroleum ether blank. The sample was dried, dissolved in chloroform, and then trifluoroacetic acid was added forcefully with an Eppendorf pipet directly to the sample in the microcuvette. Vitamin A was determined by reading at 620 nm the intensity of the blue color produced by the addition of the trifluoroacetic acid chromagen against a TFA/chloroform blank. All readings were made in 30 seconds or less to ensure readings at the inflection point after the initial surging peak caused by the introduction of the trifluoroacetic acid reagent. All optical density readings were made in percent transmittance on a Bausch and Lomb digital, double-beam spectrophotometer.[2] The digital recording of transmittance facilitated the quick reading of values. Since carotenes also produce some color with the trifluoroacetic acid, a correction for the absorbance contributed by carotenes was made as described in the method. The vitamin A reading was then corrected by means of a factor calculated from the standard curve (see Appendix C). Vitamin A and beta-carotene content of each subject's serum were calculated in micrograms per 100 ml from the standard curve.

Vitamin A working standards[3] of three concentrations, 4, 8, and 12 mcg/ml, were made each week, and stored in brown, stoppered bottles in the refrigerator. Sample aliquots from the working standards were prepared fresh each day in duplicate, and treated the same as the serum samples of the subjects for the purpose of quality control. Prior to the analyses of any experimental samples, standard carotene and vitamin A curves (see Appendix C) were prepared according to the Neeld-Pearson procedure using appropriate aliquots of standards.

Analysis of Data

Nutrient Analysis

Nutrient intake was determined by analyzing the 24-hour dietary recall data. An average was computed for the two 24-hour recalls. Food recall information was coded by interviewers who were also trained in coding food data. The Nutritional Analysis System (NAS) of Louisiana State University[4] was used for coding and calculating by computer the nutrient intake of subjects. Total daily nutrient intake was divided into meals and snacks. Values for vitamin A and ascorbic acid consumed in all foods during a 24-hour period and for snacks during that same period were calculated. Means and standard deviations were computed for the total intake of vitamin A and ascorbic acid from meals and snacks for each age group, race, and for the group as a whole. The percentage of subjects whose total diets furnished $\geq$ 100, 67-99, 34-66, or $\leq$ 30 percent of the 1980 Recommended Dietary Allowances were computed as well as a ratio of vitamin A and ascorbic acid intake per 1,000 kilocalories.

Food Frequency

Food frequency responses for meals and snacks were recorded as eaten two or more times daily, one time daily, three to four times per week, at least one time per week, less than one time a week, never eaten, and eaten in season only (see Appendix A). If the subject recorded eaten in season only, she was asked to record also how often she ate the food when the food was in season. In other words, she was asked to mark two responses for that particular food. Frequency counts for each of the 56 foods were made separately for snacks and for meals.

Relative frequencies for the response categories were combined into three groups in order to make the data more meaningful and to describe the frequency of consumption of foods. The response categories, eaten two or more times daily and one time daily, were combined to designate high-frequency intake. Three to four times per week and at least one time per week were combined to designate medium-frequency intake. Low-frequency intake was defined as eaten less than one time per week. Foods which were never eaten were grouped separately. High, medium, and low-frequency intake for vitamin A and ascorbic acid-rich foods for snacks and meals were used to study the variations in the three age groups and black and white girls.

A number of subjects recorded only one response for foods eaten in season only. Either the subject did not understand the directions or the interviewer did not adequately instruct the subject and check the form at the time of the dietary interview. Frequency responses for each food were recorded only for those subjects who completely understood and followed directions. If a subject had marked at least one food as eaten in season only and did not respond how often she ate the food, her entire response was omitted in the analysis of frequency of intake of foods at meals and snacks. Consequently, the sample size for the inferential statistics regarding frequency of intake for foods high in vitamin A and ascorbic acid consisted of approximately 131 subjects.

Food Preferences

In response to the question, "if you could choose your food, how often would you choose this food when it is available," food preference response categories were every time, most of the time, some of the time, seldom, and never (see Appendix A). A percentage frequency for each response was calculated for all 56 foods listed. Relative frequencies were used to determine most and least preferred foods. The relative percentage responses every time and most of the time were combined and ranked to determine the most preferred foods. Seldom and never eaten responses were combined and ranked to determine least preferred foods. A food was identified as most preferred if 50 percent or more of the subjects reported a high preference for the food. A food was identified as least preferred if 50 percent or more of the subjects reported a low preference for the food.

Statistical Analysis

A statistician[5] was consulted for the statistical analysis of the data. Data from the standardized instruments for the regional project, including subjects' dietary intake from two 24-hour recalls, were sent to Louisiana[3] to be processed. A computer data tape of all data from the North Carolina study was returned to the University of North Carolina at Greensboro to be utilized in data analysis of ancillary studies.

Items on the food frequency and food preference questionnaires and biochemical and dietary values for vitamin A and beta-carotene were analyzed using the statistical package SAS - The Statistical Analysis System (Barr, Goodnight, Sall, Blair, & Chilko, 1976).

Descriptive and inferential statistics, including *t* tests, analysis of variance, Pearson's correlation coefficient, Kendall's tau correlation, chi-square tests of independence, and the Kruskal-Wallis Test were used to analyze the data to determine the relationship between nutritional status and snacking patterns for selected independent variables. The independent variables in this study were age, race, income, food preferences, use of nutritional supplements, body fat, frequency of intake of vitamin A and ascorbic acid foods, concerns about weight, regularity of eating a family evening meal, and self-esteem rating. A .05 level of significance was used throughout the study.

REFERENCE NOTES

[1]Cambridge Scientific Instruments, Box 265, Moose Lodge Road, Cambridge, MD, 21613.

[2]Shimadzu, Bausch and Lomb Spectrophotometer, Model UV210A. Fisher Scientific Company, 2775 Pacific Drive, Box 829, Norcross, GA, 30091.

[3]All-trans-retinyl acetate, Sigma Chemical Company, P.O. Box 14508, St. Louis, MO, 63178.

[4]Department of Experimental Statistics, Louisiana State University, Baton Rouge, LA, 70803.

[5]Statistical Consulting Center, Academic Computer Center, University of North Carolina at Greensboro, Greensboro, NC, 27412.

CHAPTER IV

RESULTS AND DISCUSSION

The purposes of this field and laboratory experiment were (1) to assess the nutritional status of adolescent girls for vitamin A and ascorbic acid, and (2) to describe snacking patterns for young girls as they relate to nutritional health. A total of 198 girls were interviewed, and dietary information was secured using two 24-hour dietary recalls. Laboratory analyses of blood serum for 157 subjects were made to determine vitamin A (retinol) and beta-carotene levels. Plasma samples were not analyzed for ascorbic acid. Dietary recall information for ascorbic acid is included, however, in these findings. Information from a diet history, a food preference check sheet, and two food frequency forms provided data to describe snacking patterns of adolescent girls.

The results of this nutritional assessment and description of snacking patterns will be presented in the following sequence: (1) description of the participants, (2) description of nutritional status, (3) tests of hypotheses for nutritional status, (4) food frequency intake, (5) food preferences, (6) snacking patterns, (7) tests of hypotheses for snacking patterns, and (8) discussion.

Description of the Participants

The demographic data from this study described participants according to age, race, and family income. Each of these characteristics was examined. The sample was primarily urban since most of the subjects lived in Greensboro or the immediate surrounding area.

Age and Race

The design for this study limited participation to adolescent girls who were 12, 14, and 16 years old. Forty-three percent of the girls were 12 years old (n = 84); 38 percent, 14 years old (n = 76); and 19 percent, 16 years old (n = 38). Approximately 44 percent (n = 87) of the subjects were black, and 56 percent (n = 111) were white. An almost equal number of black and white girls were included in each age category except for the 12-year-old group which consisted of 38 percent and 62 percent of black and white girls, respectively. Unless otherwise reported, data on all subjects were used for analysis.

Income

The per-capita median family income of white and black participants averaged $2,834. Approximately 17 percent of the participants were from families with a per-capita income of less than $2,000 and were classified as low income. Fifty-nine percent of the subjects were from high-income families whose income was more than $4,000 per person. One-fourth of the subjects were classified at a moderate-income level. The per-capita income for the volunteers in this study ranged from $800 to $20,000. The median annual family income of all families represented in this study was $12,000 with a range from $3,500 to $80,000.

Description of Nutritional Status

Nutritional status for the purposes of this study was defined as dietary intake and serum levels of vitamin A, beta-carotene, and ascorbic acid. Descriptive statistics for the sample in this study are presented in the following discussion. Test of hypotheses are presented in the next section.

Nutrient Intake

Dietary intake for the total group expressed as means, percentage of the Recommended Dietary Allowance (RDA), and intake/1000 kcals for vitamin A and ascorbic acid is shown in Table 2. Girls exceeded the RDA for both vitamin A and ascorbic acid by two or three times the allowance, respectively. The mean intake of ascorbic acid was 68 mg/ 1000 kcals. The range of intake for ascorbic acid was from 7.0 to 3,195 mg with a wide variation in standard deviation. Mean intake for 16-year-olds was 101 mg and the lowest of any age group (Appendix D, Table D). Blacks consumed an average of 111 mg of ascorbic acid, compared to an average of 188 mg for white girls (Appendix D, Table E). Two comparisons of intake are presented for vitamin A, retinol equivalents (R.E.), and vitamin A in international units. Vitamin A activity in foods was expressed as international units (IU), one IU being equivalent to 0.3 mcg of retinol and 0.6 mcg of beta-carotene. Retinol equivalent (RE) was recently adopted as the measure of vitamin A activity because of the physiological inefficiency of dietary pro-vitamins (National Research Council, 1980). By either comparison, girls consumed more than an adequate intake of vitamin A. The intake

Table 2

Mean Dietary Intake Based on 24-Hour Recall[a]

Nutrient	Intake Mean	Intake SD	Intake/1000 kcals Mean	Intake/1000 kcals SD	RDA	Percentage RDA Mean	Percentage RDA SD
Ascorbic Acid (mg)	155	307	68	138	50-60	304	613
Vitamin A (IU)	5995	5321	2573	1928	4000	-	
Retinol Equivalents (mcg)	1665	1412	722	537	800	208	177
Retinol (mcg)	1.4	7.2	0.52	2.1	-	-	
Beta-Carotene (mcg)	1.3	1.5	0.58	0.63	-	-	

[a]Includes vitamin and mineral supplements.

for vitamin A ranged from 457 to 34,475 IU. White girls consumed an average of 6,073 IU per day as compared to 5,878 IU for blacks (Appendix D, Table E). Sixteen-year-olds had the lowest mean intake, 5,005 IU, of any of the three groups (Appendix D, Table D).

Presented in Table 3 is the percentage of girls whose ascorbic acid and retinol equivalent intakes were 67 percent or less than the RDA. Twenty-one percent of the subjects had marginal dietary intakes of ascorbic acid and 12 percent had marginal intakes of vitamin A (RE). Generally, blacks were more likely to have marginal intakes than were white girls. Twelve-year-old girls had better nutritional status for vitamin A than did older girls since only two percent consumed less than two thirds of the RDA. Twenty-nine percent of the 16-year-old girls had a marginal intake of ascorbic acid.

The mean nutrient intake for other essential nutrients was not computed for the purposes of this study. Energy intake, however, was observed. All three age groups consumed an average of 2,284 kcals per day. Mean caloric intake was 2,266, 2,313, and 2,263 for 12, 14, and 16-year-old girls, respectively (Appendix D, Table D). Black girls consumed an average of 200 kcals less than white girls and barely met the RDA energy allowances with a mean intake of 2,150 kcals (Appendix D, Table E).

Use of Supplements

Fifteen percent (n = 30) of the girls in this study reported they took vitamin and mineral supplements. Eighteen 12-year-olds, nine 14-year-olds, and three 16-year-olds reported they used supplements.

Table 3

Percentage of Girls Whose Intakes Were

67 Percent or Less of RDA

	Race		Age (Years)			
Intakes	White (%)	Black (%)	12 (%)	14 (%)	16 (%)	Total (%)
Retinol Equivalents	9	17	2	19	18	12
Ascorbic Acid	19	24	19	19	29	21

Presented in Table 4 is the percentage of mean vitamin A and ascorbic acid intake from supplements by race and age of all girls in this study. Slightly more than 10 percent of the ascorbic acid intake of white girls came from supplements. This was three times more than the amount of ascorbic acid black girls consumed in a supplement. This difference was statistically significant (t = 2.057, p = .0416). The mean ascorbic acid intake from supplements was 89 mg for white girls and 14 mg for blacks. Mean intake of ascorbic acid from supplements by white girls exceeded the RDA by approximately one-third. Even though 16-year-olds appeared to consume less ascorbic acid from supplements than any age group, results of an analysis of variance did not indicate any statistically significant differences between age and intake of ascorbic acid from supplements.

Further analysis of the data was made to investigate mean nutrient intake of the 30 girls who used supplements in this study. The mean intake of vitamin A received from supplements ranged from 1,333 IU for 16-year-old girls to 5,000 IU for 14-year-old girls. Mean vitamin A intake from supplements for 12-year-old girls was 2,242 IU. Ascorbic acid intake ranged from 112 mg for 16-year-olds to 616 mg for 14-year-olds. Twelve-year-olds received 302 mg ascorbic acid from supplements. Presented in Table 5 is the mean percentage of the total intake of ascorbic acid and vitamin A from supplements for the girls who used supplements in this study. Higher intakes of vitamin A from supplements were observed among 12-year-old girls and among blacks. Fourteen year-old girls received the highest mean intake (69 mg) of ascorbic acid from supplements. White girls received slightly more ascorbic

Table 4

Percentage of Total Mean Intake From Supplements[a]

	Race				Age (Years)					
	White (23)		Black (6)		12 (18)		14 (9)		16 (3)	
	Percentage		Percentage		Percentage		Percentage		Percentage	
Nutrient	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Vitamin A	4	15	2	12	5	16	2	13	1	9
Ascorbic Acid	11	26	3	14	9	23	8	24	3	15

[a]n = 198.

Table 5

Percentage of Total Mean Intake From Supplements

For Users of Supplements[a]

	Race				Age (Years)					
	White (23)[b]		Black (6)[b]		12 (18)[b]		14 (9)[b]		16 (3)[b]	
	Percentage		Percentage		Percentage		Percentage		Percentage	
Nutrient	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Vitamin A	19	29	30	34	23	29	17	35	16	28
Ascorbic Acid	54	33	47	31	43	33	69	28	43	42

[a]n = 30.

[b]Number of subjects.

acid from supplements than black girls. Comparision of Table 4 and Table 5 shows wide variation in intake of nutrients between all subjects and the 30 girls who used supplements in this study.

Serum Levels of Vitamin A and Beta-Carotene

Serum levels for vitamin A, as determined by the Neeld-Pearson procedure, are presented in Table 6. The mean vitamin A serum level for the total group was 48.8 $\pm$ 11.1 mcg/100 ml blood. Values ranged from 16.5 to 95.1 mcg/100 ml of blood. Only one of the subject's serum levels fell below 20 mcg/100 ml, a low level which is associated with medium to high risk of deficiency for vitamin A. Twenty percent of the subjects had serum levels between 20 and 30 mcg/100 ml, which is acceptable but identified as low risk for deficiency for vitamin A. A majority of the subjects had acceptable serum vitamin A levels when compared to a normal range of 20 and 65 mcg/100 ml.

Serum levels of beta-carotene ranged from 2.2 to 273.0 mcg/100 ml of blooc (Table 7). Percentile ranks for the total group are shown in Appendix D, Table F. Serum values fell below normal for only 15 percent (n = 23) of the subjects. Of the 15 percent considered below normal, 11 subjects' serum values fell below 40 mcg/100 ml and were identified at medium risk for deficiency in vitamin A. One in five of the subjects exceeded the normal range of beta-carotene intake. High serum beta-carotene concentrations reflect recent dietary intake of the nutrient and are not indicative of vitamin A nutritional status per se.

Table 6

Serum Vitamin A Levels for Adolescent Girls

Vitamin A mcg/100 ml	n	Percentage
< 20	1	0.5
20-39	32	20.4
40-49	54	34.4
50-59	42	26.8
60-65	17	10.8
> 65	11	7.0
Total	157	100.0

Note. Overall mean $\pm$ SD = 48.8 $\pm$ 11.1 mcg/100 ml,
Range = 16.5-95.1 mcg/100 ml
Normal Range = 20-65 mcg/100 ml

Table 7

Serum Beta-Carotene Levels for Adolescent Girls

Beta-Carotene mcg/100 ml	n	Percentage
< 60	23	15.0
60-200	103	65.0
> 200	31	20.0
Total	157	100.0

Note. Mean = 130.9 ± 70.6 mcg/100 ml
Range = 2.2 - 273.3 mcg/100 ml
Normal Range = 60 - 200 mcg/100 ml

Tests of Hypotheses for Nutritional Status

The results of the analyses for the nutritional status hypotheses are presented in this section. Several different statistical tests were used to analyze the relationships among dietary intake, serum levels, and 10 selected dependent variables. The t-test procedure was utilized to determine differences for race, use of supplements, and weight concerns in hypotheses one and two, while correlation techniques were used to examine income, frequency of snacking, body fat, self-esteem, and regularity of eating a family evening meal. The third technique, one-way analysis of variance (ANOVA), was employed to examine differences in age and dietary intake of vitamin A and ascorbic acid or age and serum levels of vitamin A and beta-carotene. A summary of the findings related to nutritional status is presented at the end of the section.

Hypothesis One

There is no relationship between adolescents' dietary intakes of vitamin A and ascorbic acid and selected variables, including (1) age, (2) race, (3) family income, (4) frequency of snacking, (5) preference for vitamin A and ascorbic acid-rich foods, (6) weight concern, (7) use of nutritional supplements, (8) body fat, (9) self-esteem rating, and (10) regularity of eating a family evening meal.

(1) Age. Table 8 presents the results of the ANOVA for intake of vitamin A, retinol equivalents/1,000 kcals from the 24-hour recall and age of adolescent girls. Significant differences were found in the three age groups ($p = .05$) and the null hypothesis was rejected. Scheffé's test for critical differences was computed to determine which age groups consumed a higher mean intake of retinol equivalents/ 1,000 kcals. Differences were found between the 12- and 14-year-old girls, and younger girls had a higher mean intake of retinol equivalents/1,000 kcals. No differences were found between 12- and 16-year-old girls or 14- and 16-year-old girls. The results from the ANOVA showed no significant relationship between age and intake of ascorbic acid or for vitamin A when total intake and percentage of RDA were used for comparison (Appendix D, Table G).

(2) Race. The null hypothesis that no difference exists between dietary intake of vitamin A and ascorbic acid and race was rejected for ascorbic acid intake, but could not be rejected for vitamin A

Table 8

ANOVA for Vitamin A, Retinol Equivalents/

1000 kcalories and Age of Girls

Source of Variance	df	SS	MS	f	p
Age	2	1709860	854930	3.03	.05
Error	196	55388750	282596		
Total	198	57098609			

intake (Appendix D, Table H). The t-test values, mean dietary intake for ascorbic acid, and levels of significance for black and white girls are shown in Table 9. A significant difference between black and white girls' intakes of ascorbic acid existed whether ascorbic acid status was compared by dietary intake (p = .05) or percentage of the RDA (p = .05). After examining the means, it was determined that white girls consistently consumed significantly greater amounts of ascorbic acid than black girls. In spite of this difference, both groups greatly exceeded by two or three times the RDA for ascorbic acid.

(3) Family Income. The hypothesis that there is no relationship between dietary intake of vitamin A and ascorbic acid and income was tested utilizing Pearson's product-moment correlation. The null hypothesis was rejected for all comparisons of ascorbic acid and for total dietary intake of vitamin A (Table 10). A moderately weak and positive relationship was found between vitamin A and income (r =

Table 9

t-Test Values, Means, and Levels of Significance

for Ascorbic Acid Intake and Race

Variables	Blacks $\bar{X}$	Whites $\bar{X}$	t	p
Dietary Intake, mg	111	188	1.97	.05
Percentage RDA	216	370	1.97	.05
Intake, mg/1000 kcals	51	81	1.70	.09
Supplement Intake, mg	14	89	2.06	.04

.143) at the $p = .044$ level of significance. Even though a significant ($p = .013$) but moderately weak relationship ($r = .1768$) also existed for ascorbic acid and income, the relationship was stronger for ascorbic acid than for vitamin A. Regardless of how ascorbic acid was examined and compared--dietary intake, percentage of the RDA, ratio/1000 kcals, or intake consumed in supplements--there was a positive relationship with income. The association between vitamin A and income existed for only one comparison, dietary intake. Girls from families of higher per capita income had higher intakes of ascorbic acid and vitamin A. Thus, the null hypothesis that there is no relationship between dietary intake of vitamin A and ascorbic acid is fully rejected.

Table 10

Pearson's Correlation Coefficients of Vitamin A

and Ascorbic Acid Intake with Income

Variable	n	p
Ascorbic Acid	.1768	.013*
Vitamin A	.1431	.044*
Retinol Equivalents	.1277	.073
Retinol	.0304	.671
Beta-Carotene	.0988	.166
Percentage RDA		
Ascorbic Acid	.1768	.013*
Retinol Equivalents	.1277	.073
Ratio/1000 kcals		
Ascorbic Acid	.1705	.016*
Vitamin A	.1109	.120
Retinol Equivalents	.0861	.228
Beta-Carotene	.0521	.466
Supplements		
Retinol Equivalents	.0843	.295
Ascorbic Acid	.1474	.038*

(4) Frequency of snacking. The null hypothesis that there is no relationship in dietary intake of vitamin A and ascorbic acid and frequency of snacking was tested in two ways. First, Kendall's tau-B correlation statistic was used to examine the relationship between dietary intake from two 24-hour recalls and the number of snacks actually consumed on the day of the recall during four periods--before

breakfast, before lunch, before dinner, and after dinner. Significant findings from the two recalls are shown in Table 11. Particularly noteworthy is the highly significant positive relationships between calories consumed and frequency of snacking before and after dinner. Girls who snack with greater frequency before and after dinner also consumed more calories daily. Only two other significant relationships were found during the before- and after-dinner snacking periods. One was a weak positive relationship (r = .122) between beta-carotene/1000 kcals and frequency of snacking before dinner ($\underline{p}$ = .028). The other significant association was a weak positive relationship (r = .118) between retinol intake and frequency of snacking before dinner ($\underline{p}$ = .034). Three positive relationships were found during the period before lunch. Although the relationships were weak, vitamin A, retinol equivalents, and retinol/1000 kcals were all significantly ($\underline{p}$ = .006, $\underline{p}$ = .009, and $\underline{p}$ = .049, respectively) related to frequency of snacking before lunch. As the frequency of snacking increased, the ratio/1000 kcals of vitamin A increased. No relationships were found for ascorbic acid. The hypothesis for dietary intake and frequency of snacking cannot fully be rejected.

Utilizing Kendall's tau-B correlation statistic, a second relationship, usual frequency of snacking and dietary intake, was examined. Responses from the question, "how many days do you usually eat a snack?" during the four identified time periods and dietary intake from the 24-hour recalls were used in this analysis. No relationships were found, and the hypothesis cannot be rejected for relationship of usual frequency of snacking and dietary intake.

Table 11

Kendall's Tau-B Correlation Coefficients of

Vitamin A Intake and Actual Frequency

of Snacking

Dependent Variables (n = 198)	Frequency of Snacking			
	BB[a]	BL	BD	AD
Energy, kcals				
Recall 1			0.1501[b] .007*	0.170 .003*
Recall 2			0.108 .05*	0.137 .014*
Retinol, mcg				
Recall 1			0.118 .034*	
Recall 2			0.108 .05*	
Vitamin A/1000 kcals				
Recall 2		0.160 .006*		
Retinol Equivalents/1000 kcals		0.153 .009*		
Retinol/1000 kcals		0.115 .049*		
Beta-Carotene/1000 kcals				
Recall 1	0.121 .038*		0.122 .028*	

[a]BB: Before Breakfast; BL: Before Lunch; BD: Before Dinner; AD: After Dinner

[b]*r*-value and *p*-value

(5) Preference for vitamin A and ascorbic acid-rich foods. The relationship between ascorbic acid and vitamin A intake and girls' preferences for foods high in these nutrients was examined using Kendall's tau-B statistics. The hypothesis was not fully rejected as a number of positive associations were observed. Presented in Table 12 is a summary of observed relationships and their p-values. Most of the relationships were weak, but a trend was evident that high preference for certain foods resulted in higher mean intakes of vitamin A or ascorbic acid.

(6) Weight concerns. The null hypothesis that there is no relationship between adolescents' dietary intakes of vitamin A and ascorbic acid and concerns about their weight was not rejected. Utilizing the t-test procedure, no differences were found between girls who expressed concerns about their weight and responded "yes" they had been on a diet, and those girls who had no concerns about their weight.

(7) Use of nutritional supplements. The null hypothesis that there is no relationship between adolescents' dietary intakes of vitamin A and ascorbic acid and use of nutritional supplements was rejected. Presented in Table 13 are t-test values and levels of significance for comparisons of dietary intakes and use of supplements. Highly significant differences were found for both vitamin A (p = .003) and ascorbic acid (p = .005). Girls who used nutritional supplements consumed a significantly greater amount or an average of twice as much vitamin A as girls who did not use supplements. Ascorbic acid intake was approximately five times greater among girls who used supplements. These girls were likely to consume almost ten times the RDA for ascorbic acid.

Table 12

Summary of Relationships Between Total Dietary Intake and Preference for Selected Vitamin A and Ascorbic Acid-Rich Foods

Food	Vitamin A	Ascorbic Acid
Greens		-.1021[a] .056*
Broccoli	.1258 .0201*	.1075 .0475*
Cantaloupe		.1039 .0473*
Baked Potato		.1289 .0152*
Tomato Juice	.1456 .0083*	
Green Peas		.1541 .0035*
Carrots	.1558 .0029*	.1331 .0111*
Vegetable Soup	.1112 .0348*	
Mixed Vegetables	.16225 .0024*	
Milk	.1698 .0021*	
Butter/Margarine		.1073 .0449*
Brussels Sprouts	.1208 .0311*	.1254 .0255*

Table 12 (Continued)

Food	Vitamin A	Ascorbic Acid
Cauliflower	.1330 .0166*	.1503 .0063*
Avocado	.1197 .0359*	
Liver Púdding		.1109 .0465*
Bean Sprouts	.1708 .0026*	-.1327 .0190*
Black-Eye Peas	.1146 .0312*	

[a]Kendall's correlation coefficient and p-value.

Table 13

t-Test Values, Means, and Levels of Significance for Vitamin A and Ascorbic Acid Intake and Use of Supplements

Variable	No $\overline{X}$	Yes $\overline{X}$	*t*	*p*
Ascorbic Acid, mg	97.8	480	-3.0272	.0051
Vitamin A, IU	5314	9836	-3.2457	.0027
Retinol Equivalents, mcg	1565	2223	-2.3770	.0184
Percentage RDA				
Ascorbic Acid	189	952	-3.0155	.0053
Retinol Equivalents	196	278	-2.3770	.0184
Ratio/1000 kcals				
Ascorbic Acid, mg	43.9	205.8	-2.8011	.009
Vitamin A, IU	2350	3832	-3.1677	.0032
Retinol Equivalents	694	882	-1.7747	.0775

(8) Body fat. The null hypothesis that there is no relationship between adolescent's dietary intake of vitamin A and ascorbic acid and body fat was not rejected. Utilizing Kendall's tau-B correlation technique, no associations were found between Quetelet index values, a measure of adiposity, and dietary intake of the tested nutrients.

(9) Self-esteem rating. The null hypothesis that there is no relationship between adolescent's dietary intake of vitamin A and ascorbic acid and self-esteem rating was not rejected. Kendall's tau-B correlation statistic was used to determine the relationship between dietary intake and girls' self-esteem ratings on a ten-item scale. No relationships were found.

(10) Regularity of eating a family evening meal. The null hypothesis that there is no relationship between adolescents' dietary intakes of vitamin A and ascorbic acid and regularity of eating an evening meal with the family was not rejected. Kendall's tau-B correlation statistic was used to determine the relationship between dietary intake and number of days girls responded they ate an evening meal with the family. No relationships were found, and it was concluded dietary intake of vitamin A and ascorbic acid is not related to eating an evening meal at home.

Hypothesis Two

There is no relationship between serum vitamin A, beta-carotene, and ascorbic acid levels among adolescent girls and selected variables including (1) age, (2) race, (3) family income, (4) frequency of snacking, (5) weight concerns, (6) use of nutritional supplements, (7) body fat, (8) self-esteem rating, and (9) regularity of eating a family meal.

Only the independent variables, vitamin A and beta-carotene, were tested in this hypothesis. Degradation of ascorbic acid in serum samples during storage made it necessary to eliminate the laboratory analysis of ascorbic acid from this study.

(1) Age. Tables 14 and 15 present the results of the ANOVA for serum levels of vitamin A and beta-carotene and age of adolescent girls. Significant differences were found among the three age groups for both vitamin A (p = .0001) and beta-carotene (p = .014). The null hypothesis was rejected. The results of a Scheffé test for critical differences revealed significant differences between serum beta-carotene levels of the 12- and 14-year-old groups. Upon examining the means, it can be concluded that serum beta-carotene levels of 14-year-old girls exceeded those of 12-year-old girls. There were no differences between the other age groups. A Scheffe test of critical differences among age groups for serum vitamin A levels was also computed. A significant difference was found between the 12- and 16-year-old groups and the 14- and 16-year-old groups. Sixteen-year-old girls had the highest serum levels of vitamin A of the three groups, and the difference was statistically different from both 12- and 14-year-old girls.

(2) Race. The null hypothesis that no difference exists between serum levels of vitamin A and beta-carotene and race was not rejected. Based on the values computed in the t test, there were no significant relationships between serum levels of vitamin A and age.

Table 14

ANOVA for Serum Vitamin A Levels and Ages of Girls

Source of Variance	df	SS	MS	f	p
Age	2	2618.09	1309.05	12.20	.0001
Error	155	16629.82	107.29		
Total	157	19247.91			

Table 15

ANOVA for Serum Beta-Carotene Levels

and Ages of Girls

Source of Variance	df	SS	MS	f	p
Age	2	39452.98	19726.49	4.36	.0144
Error	155	701015.2	4522.68		
Total	157	740468.2			

(3) Family income. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene and income was not rejected. Based on Pearson's product-moment correlation, r = .064 was computed for beta-carotene and r = .005 for vitamin A, it was concluded family income was not a related factor for serum levels of vitamin A or beta-carotene.

(4) Frequency of snacking. The hypothesis that there is no relationship between serum vitamin A and beta-carotene was tested uitlizing Kendall's tau-B correlation technique and was not rejected. Neither usual snacking nor actual snacking of the day of the 24-hour recall was found to be a related factor to serum levels of vitamin A and beta-carotene.

(5) Weight concerns. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene and adolescent girls' concerns about their weight was not rejected. Based on *t*-test values, it was concluded no differences existed between serum levels of vitamin A and beta-carotene and weight concerns of girls.

(6) Use of nutritional supplements. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene among girls and use of nutritional supplements was not rejected. Based on *t*-test values, it was concluded use of nutritional supplements does not significantly effect serum levels of vitamin A and beta-carotene in adolescent girls.

(7) Body fat. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene among adolescent girls and body fat was not rejected. Utilizing Kendall's tau-B

correlation test statistic, no associations were found between Quetelet index values, a measure of adiposity, and serum levels of the vitamin A and ascorbic acid.

(8) Self-esteem rating. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene and self-esteem rating was not rejected. Kendall's tau-B correlation test statistic was used to examine the relationships, and none were found.

(9) Regularity of eating a family evening meal. The null hypothesis that there is no relationship between serum levels of vitamin A and beta-carotene and regularity of eating an evening meal with the family was not rejected. Kendall's tau-B correlation statistic was used to examine the relationship between nutrient serum levels and number of days girls responded they ate an evening meal with the family. No relationships were found.

A summary of findings for tests of hypotheses for nutritional status is presented in Table 16.

Hypothesis Three

There is no relationship between total daily nutrient intake and blood serum levels for vitamin A and beta-carotene.

Pearson's product-moment correlation technique was employed to test this hypothesis utilizing nutrient intake data from two 24-hour dietary recalls and serum levels from laboratory analyses of vitamin A and beta-carotene. No relationships were found between dietary intake and serum levels of vitamin A and beta-carotene, and hypothesis three was not rejected.

Table 16

Summary of Hypotheses Tests for Nutritional Status

Variable	Hypothesis 1: Dietary Intake		Hypothesis 2: Serum Levels	
	Vitamin A	Ascorbic Acid	Vitamin A	Beta-Carotene
Age	*[a]	0[b]	*	*
Race	0	*	0	0
Income	*	*	0	0
Frequency of Snacking	*	0	0	0
Preferences	*	*	-[c]	-
Weight Concerns	0	0	0	0
Supplements	*	*	0	0
Body Fat	0	0	0	0
Self-Esteem	0	0	0	0
Regularity of Family Evening Meal	**[d]	0	0	0

[a]* = Relationship, hypothesis rejected.

[b]0 = No relationship, hypothesis not rejected.

[c]- = Not tested.

[d]**= Relationship for certain factors.

Hypothesis Four

There is no relationship between total vitamin A and ascorbic acid intake from snacks and blood serum levels for vitamin A and beta-carotene.

This hypothesis was tested using Pearson's product-moment correlation and rejected. Vitamin A and ascorbic acid intake from snacks was not a related factor to girls' serum levels of vitamin A and beta-carotene. Pearson's r was also computed for associations between nutrient intake from each snacking period during the day and serum levels of vitamin A and beta-carotene. Intake of ascorbic acid from the before breakfast snack was strongly related (r = .7653) and significant (p = .0099) to serum levels of beta-carotene. This strong positive relationship may be related to the frequent intake of a food or beverage at breakfast which has an appreciable amount of both ascorbic acid and beta-carotene such as orange juice.

Hypothesis Five

There is no relationship between frequency of intake and preference for foods high in vitamin A and ascorbic acid.

The association between intake and preference for vitamin-A and ascorbic-acid-rich foods was tested by food rankings based on frequency of intake and preference for individual foods. The 56 foods used in this study were ranked by cumulative frequency from most to least preferred. The same 56 foods were ranked by cumulative frequency from high intake to low intake. Kendall's tau-test statistic was computed to determine if frequency of intake and preference were directly related. Based on the way the foods were ranked, a very strong linear relationship was observed at meals (tau = .768) and the relationship was highly significant at $p = .005$. This strong relationship between intake and preference was also observed at snacks (tau = .7805, $p = .005$). The null hypothesis was rejected. The conclusion was drawn that the more girls liked a food, the more often they ate it.

Food Frequency Intake for Meals and Snacks

Girls' frequency of intake of vitamin A and ascorbic acid-rich foods at meals and at snacks was investigated utilizing a food frequency check sheet. Food frequency responses were classified into three groups--high, medium, and low frequency--based on how often the foods were eaten. High-frequency foods were eaten one or more times daily; medium-frequency foods, one or more times per week; and low-frequency foods, less than one time per week. Frequency responses for intake of excellent, good, and fair sources of vitamin A-rich foods at meals are presented in Table 17. Generally, less than 35 percent of the girls reported either high, medium, or low intake for all food items. Of the 25 vitamin-A-rich foods included on the frequency form, milk was consumed most frequently with 72 percent of the girls consuming milk one or more times per day. Other vitamin-A-rich foods which were identified with a high frequency of intake by subjects were butter or margarine, 50.4 percent; cereals, 35.4 percent; watermelon, 25.8 percent; carrots, cantaloupe, and peaches, approximately 20 percent each. Only one of these high-frequency foods was classified as an excellent source of vitamin A. Most of the high-frequency foods

Table 17

Frequency of Intake of Foods High in Vitamin A at Meals

	Frequency of Intake[a]				
Foods	High %	Medium %	Low %	Never Eaten %	In Season %
Excellent Sources					
Liver	3.9	18.6	19.4	58.1	-
Sweet Potato	8.5	18.5	48.4	24.6	8.4
Carrots	20.3	28.1	35.2	16.4	3.1
Spinach	4.6	18.5	25.4	51.5	0.8
Mixed Vegetables	4.7	39.4	34.7	21.3	2.4
Winter Squash	3.8	13.9	23.9	58.5	17.7
Greens	7.8	36.7	31.2	24.2	7.8
Pumpkin Pie	8.6	17.1	35.7	38.8	20.2
Vegetable Soup	6.2	34.2	40.3	19.4	1.6
Good Sources					
Watermelon	25.8	33.6	36.7	3.9	78.2
Broccoli	3.1	27.3	21.1	48.4	-
Cantaloupe	19.4	27.9	32.6	20.2	55.9
Apricots	2.4	10.9	21.9	64.8	7.0
Braunschweiger	1.6	3.9	7.0	87.6	0.8

Table 17 (Continued)

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Fair Sources					
Cereals	35.4	43.8	16.2	4.6	-
Tomato	7.0	38.8	26.4	27.9	10.9
Tomato Soup	2.3	22.3	33.1	42.3	-
Tomato Juice	2.3	2.4	24.2	70.3	1.6
Cherries	10.9	11.7	33.3	44.2	14.0
Asparagus	1.6	5.5	15.8	77.2	5.6
Green Peas	5.4	52.3	26.9	15.4	-
Peaches	19.9	39.5	33.3	7.8	26.3
Milk	71.9	18.0	5.5	4.7	0.8
Butter or Margarine	50.4	42.6	3.9	3.1	-

[a]N = 130, and includes subjects who responded they ate food only in season.

were only fair sources of vitamin A (one serving contains from 450 to 1,500 IU of vitamin A). Depending on specific choices, two to six servings of these foods are needed to meet the RDA. About half of the vitamin-A-rich foods were consumed at medium frequency with a range of intake from 27.3 percent for broccoli to 52.3 percent for green peas. Greens, mixed vegetables, and vegetable soup, classified as excellent sources of vitamin A, were eaten by more than one-third of the girls at least once per week. Foods which were eaten less than once per week by adolescent girls included almost all of the excellent sources of vitamin A foods. Excellent sources of vitamin A and the percentage of girls who never ate those foods were liver (58 percent), spinach (52 percent), and winter squash (59 percent). Broccoli, a readily available and good source of vitamin A, was never eaten by 48 percent of the girls. Braunschweiger, or liver pudding, was apparently the least liked food on the list followed by asparagus as 88 and 77 percent of the girls, respectively, reported never eating these foods. As expected, watermelon and cantaloupe were eaten more often when in season.

Frequency of intake of vitamin-A-rich foods at snacks was generally lower than intake for meals in all three frequency categories (Table 18). No one vitamin-A food was observed to be a favorite snack food based on frequency of intake. Milk was again consumed more frequently every day than any other food on the list. Fruits, including peaches, cantaloupe, and watermelon, were consumed by approximately one-third of the girls at least one time per week. Many vitamin A foods were never eaten for snacks by more than three-fourths of the

Table 18

Frequency of Intake of Foods High in

Vitamin A at Snacks

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Excellent Sources					
Liver	1.3	5.8	11.7	81.2	-
Sweet Potato	6.5	11.6	18.1	63.6	7.7
Carrots	8.6	30.9	30.3	30.3	2.7
Spinach	2.6	6.4	12.3	78.6	2.5
Mixed Vegetables	3.9	16.7	17.4	61.9	0.6
Winter Squash	1.9	4.5	9.7	83.9	5.8
Greens	5.8	9.6	11.6	72.9	1.8
Pumpkin Pie	10.0	12.6	26.5	51.0	17.9
Vegetable Soup	4.0	22.2	24.2	49.7	2.0
Good Sources					
Watermelon	22.7	35.0	35.1	7.1	72.1
Broccoli	3.8	9.7	11.6	74.8	1.9
Cantaloupe	16.2	33.1	22.7	27.9	53.9
Apricots	3.8	4.5	16.8	74.7	5.1
Liver Pudding	3.2	7.8	9.7	79.2	-
Braunschweiger	-	1.9	3.2	94.8	0.6

Table 18 (Continued)

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Fair Sources					
Cereals	26.5	31.0	27.7	14.8	-
Tomato	8.4	17.5	20.7	53.2	11.0
Tomato Soup	0.6	9.0	24.7	65.6	1.2
Tomato Juice	4.0	3.9	10.6	81.6	1.4
Cherries	8.4	18.0	23.9	49.7	12.9
Asparagus	-	2.0	5.9	92.1	1.3
Green Peas	1.9	15.4	14.8	67.7	0.6
Peaches	17.5	40.3	33.1	9.1	27.9
Milk	57.1	22.7	9.1	11.0	-
Butter or Margarine	31.2	26.0	10.4	32.5	-

[a]N = 155, and includes subjects who responded they ate food only in season.

girls. Included in the foods never eaten for snacks were vegetables such as spinach, sweet potato, winter squash, greens, broccoli, tomato juice, asparagus, and green peas. These vegetables were not popular choices at meals or snacks based on frequency of intake, but they were eaten more frequently at meals.

Of the 40 ascorbic-acid-rich food items listed on the food frequency form for meals, orange juice was consumed at meals every day by 39 percent of the girls, and at least once per week by 47 percent of the girls (Table 19). One serving of orange juice provides 66 mg of ascorbic acid, and more than adequately meets the Recommended Dietary Allowance. Strawberries, another excellent source of ascorbic acid, were eaten when in season by approximately one-fourth of the girls every day, and by one-half of the girls at least one time per week. Fair sources of ascorbic acid such as cereals, banana, french fries, and lemonade were consumed at least once each day by one-fourth of the girls. Almost three-fourths of the foods classified as fair sources of ascorbic acid were eaten one time per week or more by 30 to 50 percent of the girls. Several other good or excellent sources of ascorbic acid such as broccoli, cantaloupe, baked potato, tomato, tangerine, cabbage, greens, and watermelon were eaten one or more times per week by approximately one third of the subjects. Ascorbic acid-rich foods which were never eaten by a majority of the girls included brussels sprouts, cauliflower, cranberry juice, honeydew melon, spinach, green pepper, avocado, liver, asparagus, tomato juice, turnips, sauerkraut, V-8 juice, winter squash, yellow squash, okra, bean sprouts, and blueberries.

Table 19

Frequency of Intake of Foods High in

Ascorbic Acid at Meals

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Excellent Sources					
Orange	38.8	46.5	14.0	0.8	1.6
Brussels Sprouts	6.2	3.1	20.0	70.8	1.5
Tang	16.2	13.1	36.2	34.6	-
Broccoli	3.1	27.3	21.1	48.4	-
Cantaloupe	19.4	27.9	32.6	20.2	55.9
Grapefruit	13.1	18.5	30.7	37.7	12.3
Strawberries	23.9	47.0	21.6	7.7	57.8
Cranberry Juice	3.9	3.9	21.7	70.5	1.6
Cauliflower	3.9	11.0	19.5	65.6	1.6
Good Sources					
Greens	7.8	36.7	31.2	24.2	7.8
Honeydew Melon	4.6	14.6	23.1	57.7	27.7
Baked Potato	8.5	37.7	47.7	6.2	2.3
Watermelon	25.8	33.6	36.7	3.9	78.2
Tomato	7.0	38.8	26.4	27.9	10.9
Tangerine	19.2	29.2	31.5	20.0	26.1
Sweet Potato	8.5	18.5	48.4	24.6	8.4
Spinach	4.6	18.5	25.4	51.5	0.8

Table 19 (Continued)

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Green Pepper	2.3	10.7	29.2	57.7	1.5
Liver	3.9	18.6	19.4	58.1	-
Avocado	1.6	3.9	7.9	86.7	4.0
Cabbage	7.0	31.8	38.8	22.5	4.8
Asparagus	1.6	5.5	15.8	77.2	5.6
Tomato Juice	2.3	2.4	24.2	70.3	1.6
Fair Sources					
Turnips	4.7	17.8	25.6	51.9	4.7
Sauerkraut	3.1	6.2	28.5	62.3	1.6
Cereals	35.4	43.8	16.2	4.6	-
Blackberries	11.7	21.0	27.1	40.3	26.5
Black-Eyed Peas	8.6	30.3	28.7	32.6	3.2
V-8 Juice	2.3	3.1	17.0	77.7	1.6
Winter Squash	3.8	13.9	23.9	58.5	17.7
Spaghetti with Meat Sauce	10.0	42.3	44.6	3.1	-
Tomato Soup	2.3	22.3	33.1	42.3	-
Banana	20.0	38.5	30.0	11.5	7.7
Yellow Squash	5.4	16.7	25.3	51.5	12.3
Lima Beans	2.3	30.3	32.6	34.9	3.2
French Fries	24.2	58.1	16.1	1.6	2.4
White Potatoes	10.0	32.3	43.8	13.8	2.3
Okra	4.7	15.6	24.2	55.5	10.2
Bean Sprouts	3.1	6.2	13.8	76.9	0.8
Blueberries	6.2	17.0	27.1	49.6	20.1

Table 19 (Continued)

Foods	High %	Medium %	Low %	Never Eaten %	In Season %
	Frequency of Intake[a]				
Pineapple	12.3	13.0	42.3	32.3	6.1
Lemonade	24.6	33.1	34.6	7.7	10.0
Green Beans	13.1	52.3	22.3	12.3	3.8
Green Peas	5.4	52.3	26.9	15.4	-
Hi-C	17.9	29.5	34.1	18.6	0.8

[a]N = 130, and includes subjects who responded they ate food only in season.

Food choices for snacks were not very different from choices at meals for ascorbic-acid-rich foods (Table 20). Based on frequency of intake, orange or orange juice, strawberry, cantaloupe, watermelon, tangerine, cereals, blackberries, banana, french fries, lemonade, Hi-C fruit drink, and pineapple were favorite choices for snacks.

Food Preferences

Fifty-six foods considered to be excellent, good, or fair sources of vitamin A and ascorbic acid were ranked by adolescents from the most to the least preferred (Appendix D, Table I and Table J). The most preferred and least preferred foods are shown in Tables 21 and 22, respectively. In general, fruits were definitely more preferred than vegetables.

Only 13 foods were identified as most preferred. Fifty percent or more of the girls reported they chose most preferred foods every time or most of the time when the food was available. Milk, french fries, and oranges or orange juice were preferred by at least 75 percent of the girls. Orange or orange juice, strawberry, watermelon, banana, peach, and tangerine were the most preferred fruits. Only one vegetable, potato, prepared as french fries or baked was included in the most preferred listing.

According to vitamin A and ascorbic acid nutrient content rating (Table 21), no excellent sources of vitamin A and only two excellent sources of ascorbic acid, orange or orange juice and strawberry, were included among the most preferred foods. Watermelon, a good source of vitamin A and ascorbic acid, and cereal, a fair source of both

Table 20

Frequency of Intake of Foods High in

Ascorbic Acid at Snacks

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Excellent Sources					
Orange	37.0	37.0	18.1	7.8	2.5
Brussels Sprouts	-	0.6	6.4	92.9	0.6
Tang	14.2	17.4	22.6	45.8	-
Broccoli	3.8	9.7	11.6	74.8	1.9
Cantaloupe	16.2	33.1	22.7	27.9	53.9
Grapefruit	12.3	20.8	23.3	43.5	9.0
Strawberry	24.4	36.2	25.7	13.8	50.7
Cranberry Juice	3.2	6.4	12.3	77.9	1.2
Cauliflower	0.7	5.2	11.2	83.0	3.3
Good Sources					
Greens	5.8	9.6	11.6	72.9	1.8
Honeydew Melon	7.8	9.7	16.8	65.6	19.4
Baked Potato	7.1	19.3	20.6	52.9	1.9
Watermelon	22.7	35.0	35.1	7.1	72.1
Tomato	8.4	17.5	20.7	53.2	11.0
Tangerine	17.9	32.4	31.1	18.5	27.1
Sweet Potato	6.5	11.6	18.1	63.6	7.7
Spinach	2.6	6.4	12.3	78.6	2.5

Table 20 (Continued)

Foods	High %	Medium %	Low %	Never Eaten %	In Season %
	Frequency of Intake[a]				
Green Pepper	2.6	10.3	12.9	74.0	1.2
Liver	1.3	5.8	11.7	81.2	-
Avocado	-	0.6	4.5	94.8	1.2
Cabbage	4.5	16.7	22.5	56.1	1.2
Asparagus	-	2.0	5.9	92.1	1.3
Tomato Juice	4.0	3.9	10.6	81.6	1.4
Fair Sources					
Turnips	2.6	9.0	7.7	80.6	0.6
Sauerkraut	2.0	3.9	15.1	79.1	0.7
Cereals	26.5	31.0	27.7	14.8	-
Blackberries	13.8	19.6	26.1	40.5	35.3
Black-Eyed Peas	4.5	16.8	16.1	62.6	1.3
V-8 Juice	1.2	5.2	11.6	81.9	0.6
Winter Squash	1.9	4.5	9.7	83.9	5.8
Spaghetti with Meat Sauce	6.6	30.5	24.5	38.4	-
Tomato Soup	0.6	9.0	24.7	65.6	1.2
Banana	15.5	39.0	31.2	14.3	5.8
Yellow Squash	3.9	8.4	8.4	79.2	9.7
Lima Beans	2.5	9.0	16.1	72.3	2.5
French Fries	20.7	41.6	21.4	16.2	1.9
White Potatoes	5.2	24.5	19.3	51.0	1.9
Okra	5.2	6.8	14.4	70.6	7.2
Bean Sprouts	0.6	1.3	9.1	89.0	0.6
Blueberries	6.5	18.8	25.3	49.4	23.4

Table 20 (Continued)

Foods	Frequency of Intake[a]				
	High %	Medium %	Low %	Never Eaten %	In Season %
Pineapple	14.9	24.7	24.0	36.4	9.0
Lemonade	16.9	32.4	37.0	13.6	1.9
Green Beans	5.9	21.0	17.0	56.2	1.4
Green Peas	1.9	15.4	14.8	67.7	0.6
Hi-C	18.2	27.9	27.9	26.0	0.6

[a]N = 155, and includes subjects who responded they ate food only in season.

Table 21

Most Preferred Foods of Adolescent Girls and

Vitamin A and Ascorbic Acid Nutrient Rating

	Nutrient Rating					
	Vitamin A			Ascorbic Acid		
Food	Excellent	Good	Fair	Excellent	Good	Fair
Milk			X			X
French Fries						X
Orange or Orange Juice				X		
Spaghetti with Meat Sauce						X
Strawberry				X		
Watermelon		X			X	
Cereal			X			X
Lemonade						X
Banana						X
Peach			X			
Tangerine					X	
Hi-C						X
Baked Potato					X	

Table 22

Least Preferred Foods of Adolescent Girls and

Vitamin A and Ascorbic Acid Nutrient Rating

	Nutrient Rating					
	Vitamin A			Ascorbic Acid		
Food	Excellent	Good	Fair	Excellent	Good	Fair
Braunschweiger		X				
Avocado					X	
Asparagus			X		X	
Bean Sprouts						X
V-8 Juice						X
Brussels Sprouts				X		
Tomato Juice			X		X	
Sauerkraut						X
Cauliflower				X		
Cranberry Juice				X		
Liver Pudding		X				
Liver	X				X	
Turnips						X
Green Pepper					X	
Winter Squash	X					X
Spinach	X				X	
Yellow Squash						X
Okra						X
Honeydew Melon					X	
Lima Beans						X

Table 22 (Continued)

	Nutrient Rating					
	Vitamin A			Ascorbic Acid		
Food	Excellent	Good	Fair	Excellent	Good	Fair
Apricot		X				
Tomato Soup			X			X
Mixed Vegetables	X					
Broccoli		X		X		
Black-Eyed Peas						X
Cabbage					X	
Cherries					X	
Greens	X				X	
Blueberry						X

nutrients, were also among the 13 most preferred foods. Other foods identified as most preferred were only fair sources of either vitamin A or ascorbic acid.

A larger number of foods, a total of 29, was ranked least preferred by adolescent girls (Table 22). Fifty percent or more of the girls reported they chose these foods seldom or never when the food was available. Nineteen of the 29 least preferred foods were vegetables including asparagus, bean sprouts, V-8 juice, brussels sprouts, tomato juice and soup, sauerkraut, cauliflower, turnips, green pepper, winter and yellow summer squash, spinach, ckra, lima beans, mixed vegetables, broccoli, black eyed peas, cabbage, and greens. Braunschweiger, liver pudding, and liver, all excellent or good sources of vitamin A, were ranked low in preference by adolescent girls. Avocado, cranberry juice, honeydew melon, apricot, cherries, and blueberries were also least preferred foods. Several of the least preferred foods are excellent sources of either vitamin A or ascorbic acid; many are categorized as good or fair sources.

A rank order listing of foods never eaten by adolescent girls is shown in Table 23. Approximately three-fourths of the girls never ate braunschweiger, avocado, asparagus, and bean sprouts. Two-thirds of the subjects never ate cauliflower, liver pudding, V-8 juice, sauerkraut, and tomato juice. Fifty to 62 percent of the girls reported they never ate liver, turnips, winter squash, yellow squash, spinach, apricot, cranberry juice, okra, and green pepper.

Table 23

Foods Never Eaten by Adolescent Girls

Foods	Percentage of Subjects
Braunschweiger	83.2
Avocado	78.4
Asparagus	76.3
Bean Sprouts	74.6
Brussels Sprouts	72.8
Cauliflower	68.7
Liver Pudding	68.0
V-8 Juice	67.5
Sauerkraut	66.1
Tomato Juice	65.7
Liver	62.1
Cranberry Juice	61.0
Turnips	59.1
Winter Squash	53.8
Okra	53.1
Green Pepper	52.8
Yellow Squash	52.8
Spinach	52.8
Apricot	52.6
Broccoli	49.5
Honeydew Melon	48.4
Tomato Soup	39.1
Lima Beans	38.5
Black-Eyed Peas	35.6
Mixed Vegetables	35.1
Cabbage	34.7
Blackberries	32.5
Cherries	31.3
Blueberry	31.1
Greens	29.4
Tomato	27.6
Pumpkin Pie	26.9
Grapefruit	26.3
Green Peas	24.4
Vegetable Soup	21.9
Sweet Potato	21.8
Cantaloupe	20.3
Green Beans	17.9
White Potato	16.1
Pineapple	16.0
Tang	14.1

Table 23 (Continued)

Foods	Percentage of Subjects
Banana	11.3
Carrots	11.1
Tangerine	10.8
Hi-C	8.8
Baked Potato	7.1
Lemonade	6.7
Peach	6.1
Strawberry	5.7
Butter or Margarine	5.1
Milk	4.6
Spaghetti with Meat Sauce	3.6
French Fries	2.6
Orange	2.1
Watermelon	1.5
Cereal	1.5

Description of Snacking Patterns

Snacking pattern for the purposes of the study was defined as the frequency of snacking, the mean nutrient intake from snacks, the reasons for snacking, and the place snacks were eaten. Each of these factors was used to test the dependent variables in the hypothesis related to snacking. The following discussion presents descriptive data for each factor related to snacking pattern and the subjects.

Frequency of Snacking

Ninety-eight percent of the girls in this study actually snacked; an average of two snacks per day was reported. Actual frequency and time of snacking on the day of the 24-hour recalls are presented in Table 24. The number of snacks eaten in one day ranged from none to five snacks. The time of day girls snacked varied, but between lunch and dinner and after dinner were the most popular snacking times. Only five percent of the girls snacked before breakfast. Almost one in five girls snacked before lunch. Approximately three fourths of the girls reported snacking in the afternoon before dinner, and slightly more than one-half of the girls snacked after dinner. Almost one in ten girls consumed at least two snacks before dinner each day. A few girls even reported eating three snacks either before dinner or after dinner.

Responses to the question, "how many days do you usually snack before breakfast, before lunch, before dinner, and after dinner," were summarized from a diet history interview. For the purposes of

Table 24

Frequency of Daily Snacking of Adolescent Girls

	Number of Snacks/Day			
Time of Snack	Zero %	One %	Two %	Three or More %
Before Breakfast	94.9	4.9	.25	-
Before Lunch	80.5	18.5	1.0	-
Before Evening Meal	24.6	63.1	9.7	2.8
After Evening Meal	48.4	40.8	8.4	2.5

Note. n = 194; range = none to five; average/day = two.

this study, these responses were defined as usual snacking frequency. On the average, girls reported they usually snacked four times per week. Snacks were reported an average of two days per week before lunch, 5.5 days before dinner, and 3.7 days after dinner. Comparison of actual and usual frequency of snacking revealed girls probably under reported usual snacking in the diet history interview. The period before dinner was the most popular snack time for adolescent girls.

Nutrient Intake

Presented in Table 25 is the mean vitamin A and ascorbic acid intake from snacks for the day and for four separate time periods during the day. A total of 965 IU comprised 16 percent of the day's total intake of vitamin A. A total intake of 35 mg of ascorbic acid

Table 25

Mean Nutrient Intake From Snacks

		Vitamin A (IU)		Ascorbic Acid (mg)		kcals	
Snack Period	*n*	Mean	SD	Mean	SD	Mean	SD
Before Breakfast	15	104	147	8	20	106	85
Before Lunch	64	216	653	2	6	105	232
Before Dinner	184	456	899	12	27	298	239
After Dinner	144	611	1466	30	26	277	237
Day's Total	194	965	1698	35	22	546	396
Percentage RDA	194	24%		57%		24%	
Percentage of Actual Mean Intake	194	16%		22%		24%	

comprised 22 percent of the day's total intake for that nutrient. More vitamin A and ascorbic acid were consumed in snacks during the after dinner period than at any other time during the day. Approximately one-fourth of the RDA for vitamin A and one-half of the RDA for ascorbic acid were consumed from the day's total snack intake.

Mean intake of vitamin A from snacks before dinner was 456 IU compared to 611 IU consumed in after dinner snacks. Mean intake of ascorbic acid was 11.9 mg in snacks before dinner compared to a 29.6 mg mean intake from after dinner snacks. Approximately one-fourth of the day's total intake or a mean intake of 546 kcals was consumed in snacks. Caloric contribution of snacks before and after dinner was almost equal, but before-dinner snacking contributed a slightly greater number of calories.

Reasons for Snacking

Information about reasons for snacking was obtained in the diet history interview. Girls were asked to respond never, sometimes, or often to five reasons listed for snacking. A percentage distribution of the reasons for snacking is presented in Table 26. The reasons "hungry" and "food looks good" were given most often to explain the reasons for between-meal eating. "To gain weight" was never a reason for snacking for a majority of the girls. The other reasons--"hungry," "to be social," "something to do," and "food looks good"--were observed to be reasons for approximately 50 percent of the girls some of the time. Examination of the cross-tabulations provided a description of reasons why girls snacked according to age and race.

Table 26

Reasons Adolescent Girls Snack

Reasons	Never %	Sometimes %	Often %
Hungry	1	54	45
To Be Social	34	56	11
Something To Do	47	41	13
Food Looks Good	12	50	38
To Gain Weight	83	9	8

Note. n = 198.

Approximately two-thirds of the 16-year-old girls and one-half of the 12- and 14-year-olds reported they sometimes snacked because they were "hungry." The other half of the 12- and 14-year-old girls snacked often for the reason of being "hungry." The age groups of white girls were equally divided in the incidence of snacking sometimes or often for the reason being "hungry." Sixty percent of the black girls said they snacked sometimes because they were "hungry" and 40 percent snacked often for that reason.

There were few differences in the age groups and the incidence of snacking for the reason "to be social." Approximately one-third of the girls in each age group said they never snacked for the reason "to be social," and slightly more than 50 percent in each group said they snacked sometimes for this reason. White girls were more likely to snack "to be social" than were black girls.

The reason "to have something to do" was never reported as a reason for snacking by 55 percent of the 12-year-olds, 39 percent of the 14-year-olds, and 43 percent of the 16-year-old girls. Many girls did snack, however, for this reason. Fifty-three percent of the 14-year-old girls said they sometimes snacked to have something to do, and 20 percent of the 16-year-olds reported they often snacked for this reason.

There was little variation in the age groups and incidence of snacking for the reason "the food looked good." Approximately half the girls said they snacked for this reason sometimes, and little more than a third reported they snacked often because the "food looked good." Sixteen-year-old girls were more likely to snack often rather than sometimes because the "food looked good." Fifteen percent of the 12-year-olds and 12 percent of the 14-year-olds said they never snacked for this reason. Approximately 33 percent of the white girls and 46 percent of the black girls reported snacking often because the "food looked good."

The reason "to gain weight" was not a popular reason for snacking. Eighty-three percent of the girls reported they never snacked for this reason. There was little variation among the three age groups or between black and white girls for this reason of snacking.

Place Snacks Were Eaten

During the diet history interview, girls were asked each time they reported eating a snack where that snack was eaten. Response categories for places snacks were eaten included home, school cafeteria, fast-food restaurant or grocery, restaurant other than fast-food type, vending machine or school snack bar, friend's or relative's home, and other. Responses from subjects were variable, and small numbers were reported in some categories for places snacks were eaten. To simplify the analysis of data, responses were grouped into two categories: (1) snacks eaten at home, and (2) snacks eaten away from home, which included the five remaining response categories. Findings are presented using the at-home and away-from-home categories for three snacking periods during the day (Table 27). Few, if any, snacks were consumed before breakfast, and this snacking period was eliminated from the analysis.

An overwhelming majority, 89 and 91 percent of the girls who consumed snacks before and after dinner, respectively, ate them at home. Forty-one percent of the snacks eaten between breakfast and lunch, however, were eaten away from home. Since all of these girls were enrolled in school, this finding was expected. The 12-year-old group consistently ate more snacks at home during all three reported snack periods. Little variation was observed in where snacks were eaten among 14- and 16-year-old girls. Few differences were observed among black and white girls, except twice as many blacks (57 percent) than white girls (26 percent) ate snacks away from home before lunch. Although the percentage of girls who ate snacks away from home was small, blacks consistently ate more away from home than white girls. Other factors such as girls' concerns about weight and use of vitamin and mineral supplements were also examined in relation to where snacks were eaten. Concerns about weight and use of supplements were not

Table 27

Percentage of Snacks Eaten at Home and

Away by Adolescent Girls

	Age			Race		
Time and Place	12 Years %	14 Years %	16 Years %	White %	Black %	Total %
Before Lunch (n=131)						
Away	23	56	52	26	57	41
Home	77	44	48	74	43	59
Before Dinner (n=188)						
Away	7	14	12	5	18	11
Home	93	86	88	95	82	89
After Dinner (n=165)						
Away	4	13	12	4	16	9
Home	96	87	88	96	84	91

related to where girls ate snacks. A majority of the girls always ate snacks at home, espcially during the periods between lunch and dinner and after dinner.

Tests of Hypotheses for Snacking Patterns

The results of the analyses for snacking patterns are presented in this section. Four components of snacking patterns were examined and analyzed, including frequency of snacking, nutrient intake consumed in snacks, reasons for snacking, and place snacks were eaten. The discussion in this section is organized by components of snacking rather than the dependent variables. Several statistical tests were employed to determine the relationship between snacking patterns of adolescent girls and ten selected dependent variables used in the nutritional status analysis. Included among the statistical tests were the nonparametric Kruskal-Wallis and Kendall's tau-B test statistic and the parametric tests of analysis of variance, chi-square, and *t* test. A summary of findings related to snacking patterns is presented at the end of this section.

Hypothesis Six

There is no relationship between adolescent snacking patterns (frequency, nutrient intake, reasons, and place) and selected variables including (1) age, (2) race, (3) family income, (4) preference for vitamin A and ascorbic acid-rich foods, (5) weight concerns, (6) use of nutritional supplements, (7) body fat, (8) self-esteem rating, and (9) regularity of eating a family meal.

Frequency of snacking. Frequency of snacking was investigated based on the time of day and number of days per week girls usually ate snacks. The category before breakfast was eliminated in the analysis for lack of responses.

The Kruskal-Wallis test (Daniel, 1978) was used to determine the relationship between usual frequency of snacking at different times during the day and the variables age, race, concerns about weight, and use of supplements. Using the chi-square approximation, a significant difference (p = .009) was found among the three age groups and frequency of snacking before the evening meal. A nonparametric multiple comparison (Daniel, 1978) procedure was used to test which age groups snacked more frequently before the evening meal. Results of the multiple comparison showed 14- and 16-year-old girls snacked significantly less frequently before the evening meal than did 12-year-olds. There was no difference in 14- and 16-year-old girls regarding how many times they usually snacked during the week before the evening meal. Based on the analysis of data, no differences were found among the age groups for frequency of snacking at other times during the day. Twelve-, 14-, and 16-year-old girls snacked with approximately the same degree of frequency before lunch and after the evening meal. The hypothesis related to frequency of snacking and age was rejected for the time period before the evening meal.

Highly significant (p = .0001) differences were observed between race and frequency of snacking before lunch. Black girls snacked more frequently than did white girls at this time during the day. Results of the Kruskal-Wallis test showed significant (p = .05) differences in race and frequency of snacking before the evening meal. White girls snacked more frequently than did black girls at this time during the day. There were no differences among black and white girls and the number of snacks they consumed after the evening meal during the week. The hypothesis that there is no relationship between frequency of snacking and race was rejected for the time periods before lunch and before the evening meal.

The relationship between frequency of snacking and girls' concerns about weight was tested using the Kruskal-Wallis technique, and the hypothesis was rejected for the time period before lunch. The chi-square approximation was computed, and a p value of .011 indicated a significant difference in frequency of usual snacking before lunch among girls who were concerned and those not concerned about their weight. No differences were observed among girls who snacked before or after the evening meal. Fewer snacks were usually consumed during the week before lunch. Findings in this study indicate girls who were concerned about their weight actually snacked less frequently before lunch.

Kendall's tau-test statistic was utilized to examine the relationship between frequency of snacking and income, use of supplements, body fat, self-esteem, and regularity of eating an evening meal with the family. A positive but weak relationship ($r = .1581$) was observed between income and frequency of snacking before dinner, which was significant ($p = .0033$). As income increased, girls consumed more snacks before dinner. Vitamin A intake from supplements was also weakly related to frequency of snacking before dinner ($r = .1409$, $p = .0296$).

Girls who snacked before dinner were more likely to have higher intakes of vitamin A from supplements. No relationships were found for the other snacking periods. The hypothesis for frequency of snacking and income and frequency of snacking and use of supplements could not be fully rejected. No relationships were found between frequency of snacking and self-esteem, body fat, or regularity of eating an evening meal with the family, and the hypotheses were not rejected.

In summary, frequency of snacking was directly related to race. How many snacks girls consumed at different periods during the day was partially related to girls' age, income, concerns about weight, and use of supplements. Body fat, self-esteem rating, and eating an evening meal regularly with the family were not related to snacking frequency.

Nutrient intake from snacks. Nutrient intake, a second component of snacking patterns, was based on the daily mean intake of ascorbic acid and vitamin A from snacks eaten at three periods during the day. An analysis of variance test was used to test the hypothesis test that there is no relationship in age and nutrient intake from snacks. The hypothesis was not rejected as no differences were evident in the amount of ascorbic acid and vitamin A consumed in total snacks or at any of the snack periods during the day. An interesting finding which was statistically significant (p = .0257), however, was that kilocalories consumed each day in snacks did vary with age. Results of this analysis of variance are presented in Table 28.

Utilizing Scheffé's test for critical differences, it was determined that 16-year-old girls consumed an average of 200 more calories

Table 28

ANOVA for Calories from Snacks and Age of Girls

Source of Variance	df	SS	MS	f	p
Age	2	1137777	568888	3.37	.0257
Error	191	29098830	152349		
Total	193	30236607			

per day than 12-year-olds, and this difference was statistically significant. Significant differences were not observed between 12- and 14-year-old girls.

The t-test statistic was used to test the hypotheses that there is no relationship between race, weight concerns, or use of supplements and snack nutrient intake. There were no statistically significant differences between weight concerns or use of supplements and ascorbic acid and vitamin A intake for any of the snack periods or for the day as a whole. The hypotheses were not rejected.

The hypothesis that there is no relationship between nutrient intake from snacks and income or body fat were tested using Pearson's product-moment correlation. Neither income nor body fat was a related factor to intake of ascorbic acid and vitamin A from snacks, and the hypotheses were not rejected.

The relationships between nutrient intake from snacks and self-esteem and regularity of eating an evening meal with the family were tested using Kendall's tau-B correlation. The hypothesis was not rejected for regularity of eating an evening meal with the family. A weak positive relationship was observed between self-esteem rating and vitamin A intake before dinner (r = .1457, p = .0127), and between self-esteem rating and ascorbic acid intake after dinner (r = .1551, p = .0258). Self-esteem rating and nutrient intake at other snacking periods were not related, and the hypothesis was rejected.

The relationship between ascorbic acid and vitamin A intake and girls' preferences for foods high in these nutrients was examined using Kendall's tau-B statistic. The hypothesis was rejected for a number of associations between preference for a food item and intake of ascorbic acid and vitamin A in snacks. Table 29 presents a summary of the observed relationships and their p-values at different snack periods. Many of the relationships were weak and positive. A positive correlation between preference for a particular food and snack nutrient intake of either vitamin A or ascorbic acid meant the more preferred the food item, the higher the nutrient intake. Positive relationships were observed for green peas, V-8 juice, avocado, winter squash, spinach, broccoli, tomato soup, carrots, vegetable soup, mixed vegetables, cranberry juice, okra, cauliflower, and pineapple at different snack periods. Strong negative correlations were observed for greens,(r = -.5723, p = .0104), tomato juice (r = -.4976, p = .0224), and pineapple (r = -.5934, p = .0077) before breakfast. Girls who exhibited a low preference for these foods also had a low intake of vitamin A in snacks before breakfast. Only a few food

Table 29

Summary of Relationships Between Snack Dietary Intake and Preference for Selected Vitamin A and Ascorbic Acid-Rich Foods

Food	Snack Period[a]	Vitamin A	Ascorbic Acid
Winter Squash	TD	-.1167[b] .0348*	
	BL	.2237 .0298	.2462 .0242*
Green Peas	TD	.1266 .0356*	
	BD	.1152 .0491*	
V-8 Juice	TD	.1364 .0168*	
	BL	.2745 .0085*	
	AD	.1335 .0444	
Avocado	TD	.1156 .0459*	
	BL	.2401 .0252	
Greens	BB	-.5723 .0104*	
Spinach	BL	.2572 .0109	
Broccoli	BL	-	.2221 .0386*

Table 29 (Continued)

Food	Snack Period	Vitamin A	Ascorbic Acid
Tomato Juice	BB	-.4976 .0224*	
	BL	.3050 .0032*	
Tomato Soup	BL	.2684 .0068*	
Carrots	BL	.2099 .0314*	
Vegetable Soup	BL	.2299 .0201*	
Mixed Vegetables	BL	.3049 .0020*	
Cranberry Juice	BL	.3350 .0012*	
Pineapple	BB	-.5934 .0077*	
	BL	.2698 .0072*	
	AD	.1350 .0424*	
Okra	BL	.2351 .0224*	.2917 .0077*
Sweet Potatoes	BD	-.1419 .0106*	
Brussels Sprouts	AD		-.1582 .0251*
Cauliflower	BD	.1684 .0062*	

Table 29 (Continued)

Food	Snack Period	Vitamin A	Ascorbic Acid
French Fries	BD	-.1185 .0423*	
	AD		.1491 .0320*
Banana	AD	.1461 .0291*	

[a]BB: Before Breakfast; BL: Before Lunch; BD: Before Dinner; AD: After Dinner.

[b]Kendall's correlation coefficient and p value.

items were related to ascorbic acid intake at snacks, and these relationships were primarily positive and weak.

In summary, nutrient intake of foods rich in ascorbic acid and vitamin A from snacks was related to some food preferences and to self-esteem rating during some snack periods. All other variables examined, including race, age, income, weight concerns, use of supplements, body fat, and regularity of eating an evening meal with the family, were not related to ascorbic acid and vitamin A from snacks.

Reasons for snacking. Five reasons for snacking were investigated for the purpose of describing snacking patterns of adolescent girls. The relationship between income and reasons for snacking was analyzed using the Kruskal-Wallis test statistic. A significant relationship ($p = .0073$) was detected between income and snacking for the reason "hungry." Girls from low-income families sometimes snacked because they were "hungry," whereas girls from high-income families snacked often for this reason. No significant differences were observed between income and other reasons for snacking. The hypothesis that there is no relationship between income and reasons for snacking could not be fully rejected.

An analysis of variance was used to test the hypothesis that there is no relationship between body fat and various reasons for snacking. No differences were observed, and the hypothesis was not rejected. As noted earlier, 17 percent of the 198 girls in this sample reported they snacked sometimes or often for the reason "to gain weight," and 83 percent never snacked for this reason.

The hypotheses that no relationships exist between reasons for snacking and the variables of interest in this study were rejected for the variables race and certain ages and reasons for snacking. Chi-square analysis of the data for race revealed a relationship (p = .0306) for the reason "to be social" and for the reason "food looks good" (p = .0496) (Appendix D, Tables L and M). Whites were more likely than expected to snack sometimes to be social, and blacks were more likely than expected to never snack to be social. Further comparisons of race and the reason "food looks good" provided evidence that more whites than expected snacked sometimes for this reason, and more blacks than expected snacked often because the "food looked good" (Appendix D, Table M). Chi-square analysis for age and the reason "something to do" revealed more 12-year-olds than expected never snacked to have "something to do," and more 14-year-olds than expected snacked sometimes because they wanted "something to do" (Appendix D, Table N).

Utilizing the chi-square analysis, no significant differences were found in reasons for snacking according to the variables weight concerns, use of supplements, and regularity of eating an evening meal with the family. The hypothesis was not rejected for these variables.

Place snacks were eaten. The hypothesis that no relationship exists between the place snacks are eaten and the variables of interest in this study was rejected for the variables race, age, and income. Chi-square analysis of the data revealed a significant relationship between race and where snacks were eaten before lunch (p = .0004), before dinner (p = .0062), and after dinner (p = .0111) (Appendix D, Table O). Fewer whites and more blacks than were expected ate snacks away from home before lunch. More whites than were expected ate snacks at home in the afternoon before dinner. Blacks were more likely than expected to eat afternoon snacks away from home. White girls ate more snacks at home after dinner than was expected. In summary, blacks ate more snacks away from home at all times during the day than did whites.

A comparison of girls' ages and where snacks were eaten is presented in Appendix D, Table P . The relationship between age was significant at the .0014 level. The chi-square analysis does not identify which groups are statistically different, but upon examination of the data, it was apparent 12-year-old girls snacked more at home than was expected.

The relationship of income and where snacks were eaten was examined utilizing the Kruskal-Wallis test statistic. A significant relationship was observed between income and where snacks were eaten before lunch (p = .001). Girls from families of lower income snacked away from home more than at home. This pattern of snacking was also observed during the period before dinner, and the finding was significant (p = .008). Income was not a factor related to where girls chose to eat snacks after dinner. Relationships did not exist between income and other variables of interest in this study, including self-esteem, weight concerns, body fat, use of supplements, and the regularity of eating the evening meal with the family. The hypotheses for these variables were not rejected. In summary, age, race, and income were significant factors related to whether girls chose to eat snacks at home or away from home throughout the day.

Hypothesis Seven

There is no relationship between adolescent snacking patterns and total daily nutrient intake of vitamin A and ascorbic acid-rich foods.

The relationships between total vitamin A and ascorbic acid intake and snack intake of these same nutrients for the day is presented in Table 30. Positive relationships were observed for both vitamin A and ascorbic acid, and the hypothesis was rejected. The positive association between daily ascorbic acid intake and vitamin A intake from snacks was moderately strong (r = .4372) and significant (p = .0001). The positive relationship between total day and snack intake of ascorbic acid was even stronger (r = .7194) and significant (p = .0001). High intakes of both ascorbic acid and vitamin A, but more so for ascorbic acid, contributed significant amounts to the total daily intake of these two nutrients (Table 25). Another

Table 30

Relationships Between Snack and Total Daily Intake of Vitamin A and Ascorbic Acid

	Total Intake/Day	
Snack Intake	Vitamin A	Ascorbic Acid
Vitamin A	.3991[a]	.1491
	.0001*	.0380*
Ascorbic Acid	.4372	.7194
	.0001*	.0001*
Calories	.1563	-
	.0296*	

[a]Pearson's correlation coefficient and *p* value.

interesting relationship not tested in the hypothesis was observed. A weak positive relationship existed between kilocalorie intake for the day and intake of vitamin A from snacks. In other words, the more kilocalories girls consumed during the day, the higher the intake of vitamin A from snacks. Positive correlations between snacks and total intake of ascorbic acid and vitamin A at the three snack periods investigated are shown in Appendix D, Table Q.

The choice to eat snacks at home or away from home make a difference in vitamin A and ascorbic acid intake from snacks. Results of the *t*-test statistic used to test the hypothesis are presented in

Table 31. Significant differences in nutrient intake were observed for all three snack periods, and the hypothesis was rejected. Nutrient intake of ascorbic acid and vitamin A from snacks was always higher when girls snacked at home.

Table 31

t Tests for Intake of Vitamin A and Ascorbic Acid and Place Snacks Eaten

Nutrient	Away $\bar{X}$	Home $\bar{X}$	t	*p*
Before Lunch (n=131)				
Vitamin A, mcg Retinol Equivalents	1361	1863	-2.0388	.0435
Before Dinner (n=188)				
Ascorbic Acid, mg	76	169	-3.3667	.0009
Vitamin A, IU	4122	6227	-3.0159	.0041
Vitamin A, mcg Retinol Equivalents	1195	1715	-2.6406	.0115
Beta-Carotene, mcg	.696	1.351	-4.2653	.0001
After Dinner (n=165)				
Ascorbic Acid, mg	100	174	-2.0669	.0421
Vitamin A, IU	3973	6496	-2.9806	.0057

A one-way analysis of variance test was used to test the relationship between vitamin A and ascorbic acid intake and reasons for snacking. The hypothesis could not be fully rejected as only one significant relationship was observed (Table 32). Differences existed in whether girls snacked "to be social," sometimes, never, or often.

Table 32

Relationship Between Vitamin A and

Snacking to be Social

Source of Variance	df	SS	MS	f	p
Social Snacking	2	221235024	110617512	4.01	.0197
Error	195	5384474332	27612688		
Total	197	5605709356			

Paired comparisons were made using Scheffé's test for critical differences. Girls who snacked sometimes "to be social" had higher vitamin A intakes than did girls who never snacked or snacked often "to be social."

There were no significant differences in frequency of snacking and total intake of vitamin A and ascorbic acid. In summary, the daily nutrient intake of ascorbic acid and vitamin A is significantly affected by the amount of vitamin A and ascorbic acid consumed in snacks, by whether snacks are eaten at home or away and by the reason "to be social." The number of days girls snacked each week had no effect on total nutrient intake of vitamin A and ascorbic acid.

Summarized in Table 33 are the relationships found between snacking patterns and the variables of interest in this study. After reviewing the two hypotheses related to snacking patterns which were formulated for this study, it was concluded that 18 of the 42 components tested were rejected.

Table 33

Summary of Hypotheses Tested for Snacking Patterns

Variable	Frequency	Nutrient Intake	Reasons	Place
<u>Hypothesis Six</u>				
Age	*[a]	0[b]	*	*
Race	*[c]	0	*	*
Income	*	0	*	*
Preference	*	*	-[d]	-
Weight Concerns	*	0	0	D[e]
Supplements	*	0	0	0
Body Fat	0	0	0	0
Self-Esteem	0	*	0	0
Regularity of family evening meal	0	0	0	D
<u>Hypothesis Seven</u>				
Vitamin A	0	*	*	*
Ascorbic Acid	0	*	0	*

[a]* = Relationship and hypothesis rejected for certain factors.

[b]0 = No relationship, hypothesis not rejected.

[c]X = Relationship, hypothesis rejected.

[d]D = Descriptive statistics only.

[e]- = Not tested.

Discussion

The findings and results of this study were based on 24-hour dietary recalls, diet history interviews, laboratory analysis of blood serum, and a food preference and food frequency check sheet. Summaries of the findings related to nutritional status and snacking patterns are shown in Tables 15 and 30. Nutritional status for vitamin A and ascorbic acid of adolescent girls was found to be more than adequate for the majority, but marginal for 20 percent of the subjects.

Mean dietary intakes for vitamin A (5995 IU) and ascorbic acid (155 mg) exceeded the Recommended Dietary Allowances, and were well above the averages reported by others (Abraham et al., 1977; Brown et al., 1979; Hampton et al., 1976; Lee, 1978; Prothro et al., 1976; Schorr et al., 1972). One possible reason for the higher intakes reported in this study is that the average intakes reflect the contributions of vitamin supplements used by some of the girls; other studies reported intakes from food only. Use of supplements also contributed to the wide variation observed for vitamin A (457 to 34,475 IU) and ascorbic acid (7 to 3195 mg) intake among the girls. Approximately 20 percent of the total group consumed a marginal amount (less than 67 percent of the RDA) of ascorbic acid with blacks and 16-year-old girls having the lowest intakes.

A significantly higher intake of vitamin A ($p = .05$) was consumed by 12-year-old girls than by 14- and 16-year-old girls. The reason for this higher intake is not entirely clear, but it is noteworthy that 12-year-olds also snacked more frequently than did the other age groups (p = .009). Although no significant differences were found between age and vitamin A intake at four snacking periods, examination of the data revealed 12-year-old girls on the average did consume more vitamin A at all snacking periods than did the other groups. Income was also related to the intake of vitamin A. Twelve-year-old girls in this sample had significantly higher (p = .0156) income levels than did any other age group. Ages of girls, use of supplements, frequency of snacking, and incomes appear to be interrelated factors which may contribute to intake of vitamin A.

Differences in race and vitamin A intake were not found in this study, but several studies (Lee, 1978; Prothro et al., 1976; Wharton, 1963) have reported higher intakes of vitamin A for blacks. Black girls consumed much lower intakes of ascorbic acid than did white girls in this study (p = .05), but the group as a whole consumed an adequate amount of ascorbic acid compared to the RDA. One factor which must be considered is that four times as many whites used supplements as did black girls, and the intake of ascorbic acid was strongly related to use of supplements (p = .005). Another factor worth mentioning is the moderately weak but positive relationship observed between income and ascorbic acid (p = .013), including intake of ascorbic acid in supplements (p = .038). A highly significant difference (p = .0001) was observed between race and income of the sample in this study. Per capita income for white girls was almost twice that of black girls. Higher income and increased use of supplements by white girls are possible reasons for their higher intakes of ascorbic acid.

Mean serum vitamin A (44 mcg/100 ml) and beta-carotene levels (129 mcg/100 ml) of girls in this study were similar to levels reported by several researchers (David, 1969; Hodges & Krehl, 1965; Lee, 1978; Leitner, 1960; Morse et al., 1965) and higher than the values reported by Prothro (1976). One in five of the girls had serum levels which were acceptable but associated with a low risk for deficiency of vitamin A according to ICNND standards (Sauberlich, 1974). Low values have been reported in other studies (Baker et al., 1967; Lee, 1978; McGainty, 1977; Prothro et al., 1976).

Previous studies (Lee, 1978; Prothro et al., 1976) showed that blacks have higher serum levels of both vitamin A and beta-carotene, but the results of this study did not show any differences between blacks and whites for this parameter. Age differences were observed in both vitamin A and beta-carotene serum levels. Sixteen-year-old girls had the highest serum levels of vitamin A ($\underline{p}$ = .0001). Although this finding cannot be fully explained based on the results of this study, it would be interesting to compare a measure of physiological maturity rather than chronological age to serum levels of vitamin A. Since the growth "spurt" of adolescent females is almost completed by age 16, the body's need for vitamin A may be less than estimated. The relationship of serum vitamin A to plasma proteins may be another factor. Sixteen-year-old girls in this study may have better nutritional status for protein which is a positive factor in vitamin A utilization and transport (Rodriguez & Irwin, 1972). Further investigation of protein status of girls, particularly of those at risk for vitamin A deficiency, would clarify this observation.

A relationship between intake and serum levels of vitamin A and beta-carotene was not observed in this study. This finding is not unusual for vitamin A since a majority of the subjects had serum vitamin A levels above 30 mcg/100 ml. Higher serum levels such as those observed in the subjects in this study are generally associated with an appreciable tissue reserve of the vitamin (Sauberlich, 1974). The results were surprising in that intake of beta-carotene was not significantly related to serum levels of beta-carotene; serum levels reflect recent dietary intake of that nutrient. Serum levels of vitamin A and beta-carotene were not related to each other (Krishnaswamy, 1978; Pearson, 1962).

The favorite foods of adolescent girls were primarily fruits, baked potato or french fries, milk, and the fortified cereals, and fruit punch beverages. Most of these favorite foods were classified as fair sources of ascorbic acid with the exception of strawberries which are seasonal and orange juice. Low preference for vegetables was consistent with the findings of earlier studies (Carlisle et al., 1980; Duyff et al., 1975; Einstein & Hornstein, 1970; Gregar et al., 1979). The very strong association observed between foods of high preference and high intakes of vitamin A and ascorbic acid confirms the observation that food preferences do affect food consumption and ultimately nutritional status. In fact, if preferences were the sole determinant of food intake, dietary intake of vitamin A would be low. Apparently, the acceptable nutritional status for vitamin A and ascorbic acid for girls in the present study was influenced by moderate and low frequency of intake of moderately or less-preferred foods. Most all foods included in this investigation were consumed less than once per week by three-fourths or more of the subjects. With this observation in mind, it becomes even more important in nutrition education to emphasize the selection of a variety of foods. Since people will most likely eat what they like, it seems useless to promote nutritious foods that people never eat in a given population. An alternative is to increase food preferences by establishing better food habits earlier in life. This seems particularly important for vegetables as a food group based on the number of vegetables never eaten by girls in the present study.

Generally, frequency of intake reflected preference for a particular food. Further investigation is needed to confirm the associations between vitamin A and ascorbic acid intake of different age, race, and income groups, and preference and frequency of intake of foods high in these nutrients.

Ninety-eight percent of the girls snacked, and reported an average of two or more snacks each day. Snacking was fairly uncommon during school hours, except significant differences were observed for black girls during the period before lunch. The question, "did black girls eat breakfast?" is immediately raised; meal patterns were not examined in this study. Most snacks were eaten in the afternoon before dinner (75 percent) and after dinner (50 percent). Younger girls snacked more frequently in the afternoon than did other age groups (p = .009). Snacks contributed approximately one-fourth of the day's energy intake. Other studies (Gregar et al., 1978; Hunneman et al., 1967; Lee, 1978) reported similar incidence, frequency, and energy intake from snacks; Lai, Shimabukuro, Wenkam, and Raman (1982) reported a higher energy intake from snacks. Based on a comparison of frequency of snacking from the diet history interview and the 24-hour recalls, snacking was under reported by more than three times in the diet history interview. The conclusion is drawn that dietary recall is a more objective and accurate method for examining frequency of snacking. Dietary history is an accurate and approximate method for examining specific foods eaten as snacks.

Sixteen percent (965 IU) and 22 percent (35 mg) of the total intake of vitamin A and ascorbic acid, respectively, were from snacks. These values are almost identical to those reported by Murgo et al. (1979) and Pao and Mickle (1980). The increased intake of vitamin A and ascorbic acid from snacks differs from an earlier study (Steele et al., 1952), most likely because of fortification of cereals and fruit punch beverages consumed by adolescents in the present study. A practical explanation is not apparent from the data for the higher intakes of vitamin A and ascorbic acid observed in after-dinner snacks.

Race ($\underline{p}$ = .003) and income ($\underline{p}$ = .05) were related factors for frequency of snacking. Further investigation of the interaction of the two would provide a more descriptive analysis of snacking patterns. It was anticipated that girls who were concerned about their weight would snack less frequently at the popular snacking periods before and after dinner, but the results in the present study did not support that hypothesis.

The reasons most often cited by girls for snacking were "hungry" and "food looks good." Girls from high-income families snacked often because they were "hungry." The actual reason may be food availability in high-income families rather than the reason given by the girls. Food availability and appearance (i.e., "food looks good") are antecedents to snacking. Based on the extracurricular activities of adolescents and the influence of the peer group, it was surprising that more girls did not snack often for the reason "to be social." A trend was observed, however, among older girls to snack often for the reason "something to do."

A majority (90 percent) of the girls consumed snacks at home; blacks as a group ate snacks away from home more often than did white girls for all snacking periods observed (before lunch, $p = .0004$; before dinner, $p = .0062$; after dinner, $p = .011$). No particular place was observed to be popular for snacking away from home other than the fast-food restaurant. As expected, 12-year-old girls ate snacks at home more often than did older girls ($p = .0014$). The relationship between low income and eating snacks away from home may possible be explained by the higher percentage of black girls who ate snacks away from home. Based on results of the study, this finding is not completely understood, but related factors may include meal skipping and cultural-social activities of black girls.

The .05 level of significance was accepted for the present study's investigative type of research where detecting possibilities that differences exist was a primary purpose. Based on the large number of hypotheses tested, the experiment-wise alpha was high, or there was a high probability of making Type I errors in rejecting the hypotheses. Results from the present study should be viewed as the basis for proceeding with further investigation and not as the final word. In addition, caution must be used in generalizing the findings in this research, because the sample consisted of selected volunteers. Income and race of the subjects in the present sample may not be representative of the adolescent population at large.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purposes of this study were to assess vitamin A and ascorbic acid nutritional status of adolescent girls and to investigate and describe snacking patterns and related factors which may affect nutritional health. This cross-sectional, investigative study included measurement of serum levels of vitamin A and beta-carotene, dietary analysis of meals and snacks from two 24-hour dietary recalls, and frequency of intake, preferences, and snacking patterns for foods high in vitamin A and ascorbic acid.

The sample consisted of 198 adolescent girls, black and white, who were selected from the 12-, 14-, and 16-year-old population in the local public schools. Trained interviewers visited the girls at home to gather demographic, personal, and dietary data. Subjects were asked questions about usual meal and snacking patterns, use of vitamin and mineral supplements, concerns about weight, regularity of eating a family meal, and reasons for snacking. Trained interviewers with backgrounds in foods and nutrition probed girls to recall food intake over the previous 24-hour period on each of two occasions--the home interview and university visit. Participants visited the university where clinical and laboratory assessments were made, and other tests were given. Self-administered questionnaires for assessing food preferences and frequency of intake included 56 food items classified as excellent, good, or fair sources of vitamin A and ascorbic acid.

Significant relationships were noted for five of the seven null hypotheses formulated and tested by this research. Summarized below are the results of the hypotheses tested.

1. The hypothesis tested for the relationship between dietary intake of vitamin A and ascorbic acid and 10 selected variables was rejected for vitamin A and age, income, frequency of snacking, food preferences, use of supplements, and regularity of eating a family evening meal. This hypothesis was also rejected for ascorbic acid and race, income, preferences, and use of supplements.
2. The hypothesis tested for the relationship between serum levels of vitamin A and beta-carotene and 10 selected variables was rejected for age for both nutrients.
3. The hypothesis tested for the relationship between vitamin A and ascorbic acid intake and serum levels was not rejected.
4. The hypothesis tested for the relationship between total vitamin A and ascorbic acid intake from snacks and serum levels was not rejected.
5. The hypothesis tested for the relationship between frequency of intake and preference for vitamin A and ascorbic acid-rich foods was rejected.
6. The hypothesis tested for the relationship between snacking patterns and 10 selected variables was partially rejected

for age, race, income, preferences, weight concerns, use of supplements, and self-esteem rating.

7. The hypothesis tested for the relationship between snacking patterns and total intake of vitamin A and ascorbic acid-rich foods was rejected for vitamin A and nutrient intake from snacks, reasons for snacking, and place snacks were eaten. This hypothesis was also rejected for ascorbic acid and nutrient intake from snacks.

Conclusions

The following conclusions were drawn:

1. The nutritional status for vitamin A and ascorbic acid of the adolescent girls in this research was generally adequate for a majority of the subjects, but marginal for 20 percent.
2. The use of vitamin and mineral supplements contributed significantly to the intake of vitamin A and ascorbic acid.
3. If food preferences were the sole determinant of food intake, dietary intake of vitamin A would be low. The most preferred foods of adolescent girls were very limited in vitamin A.
4. Variety in food choices and frequency of intake of certain foods are always important factors in consuming adequate intake of nutrients, but perhaps more important for vitamin A and ascorbic acid than for other nutrients.
5. Vegetables are an important food group in the diet, and for one in five girls, an important source of vitamin A or ascorbic acid. Vegetables should be emphasized in nutrition

education even though girls in this study had more than adequate intakes of vitamin A and ascorbic acid, and exhibited low preferences for the vegetables as a group. Vegetables contribute fiber, other minerals and vitamins, aesthetic appeal, and are generally low in calories.

6. Snacking is an important between-meal pattern for adequate nutritional status of adolescent girls.
7. A large proportion of girls snacked at home, and the availability of high nutrient-density foods could improve nutritional status.

Recommendations

Some differences attributed to race in this research maybe attributed to income or a combination of these two factors. If race and income are both significant as variables, the interaction of the two may be an important factor in explaining the results. Hypotheses formulated for the present study were aimed at a more simplistic examination of the variables investigated. Further investigation is recommended using more sensitive analyses to address the race and income issues identified in this study (McCoy, Kenney, Kirby, Clark, Disney, Ercanli, Glover, Korslund, Lewis, Liebman, Moak, Stallings, Wakefield, Schilling, & Ritchey, 1982).

After considering the overall findings, the writer offers these recommendations for development and study.

1. Analyze dietary intake from total snacks for the day in addition to that for each snacking period.

2. Examine meal patterns and determine the relationship between intake at meals and intake and frequency of snacking.
3. Compare the differences in chronological age and serum levels of vitamin A and beta-carotene to a measure of physiological maturity and serum levels of vitamin A and beta-carotene.
4. Analyze food preferences and frequency of intake for selected foods by age and race.
5. Revise the food frequency form to include fewer responses, i.e.; one or more times per day, two or more days per week, less than one time per week, never eaten. Omit the seasonal response.
6. Analyze further the interaction and associations of several variables combined.
7. Exclude supplements in the overall analysis of data to allow comparison with previous studies.
8. Investigate the protein status of girls and its relationship to serum vitamin A levels in girls identified at risk for vitamin A deficiency.
9. Develop nutrition-education programs for parents, school children, and adolescents on vegetable intake and snacking which incorporate the important factors identified in this study.

BIBLIOGRAPHY

Abraham, S., Lowenstein, F., & Johnson, C. Preliminary findings of the first health and nutrition examination survey, United States, 1971-72: Dietary intake and biochemical findings. (DHEW Pub. No. (HRA) 74-1219-1) U.S. Department of Health, Education, & Welfare, National Center for Health Statistics, Public Health Service, 1974.

Abramson, J. H., Stone, C., & Kosovosky, C. Food frequency interview as an epidemiological tool. American Journal of Public Health, 1963, 53, 1093.

Adams, C. F. Nutritive value of American foods in common units. (Agricultural Handbook No. 456) Washington, DC: Agricultural Research Service, United States Department of Agriculture, 1975.

Adelson, S. F., & Peterkin, B. B. Quality of diets in U.S. households in 1965. Family Economics Review. Washington, DC: Agricultural Research Service, U.S. Department of Agriculture, 1968.

Baker, H., Frank, O., Feingold, S., Christakis, G., & Ziffer, H. Vitamins, total cholesterol, and triglycerides in 642 New York City school children. American Journal of Clinical Nutrition, 1967, 20, 850.

Barr, A. J., Goodnight, J. H., Sall, J. P., Blair, W. H., & Chilko, D. M. SAS User's Guide (1979 ed.) Raleigh, NC: SAS Institute, 1979.

Bazzarre, T. L., & Myers, M. P. The collection of food intake data in cancer epidemiology studies. Nutrition and Cancer, 1979, 1, 23.

Beal, V. A. Nutrition in the life span. New York: Wiley, 1980.

Bowers, A. Nutrition of children in their school years. American Journal of Clinical Nutrition, 1955, 3, 254.

Briggs, M., & Briggs, M. Vitamin C requirements and oral contraceptives. Nature, 1972, 238, 277.

Brown, P. T., Bergan, J. G., & Murgo, C. F. Current trends in food habits and dietary intakes of home economics students in three junior high schools in Rhode Island. Home Economics Research Journal, 1979, 7, 324-333.

Burk, M. C., & Pao, E. M. Methodology for large-scale surveys of household and individual diets. (Home Economics Research Report No. 40) Washington, DC: Agricultural Research Service, U.S. Department of Agriculture, 1976.

Cala, R. F., Morgan, R. J., & Zabik, M. E. The condition of children's snacks to total dietary intakes. Home Economics Research Journal, 1981, 10, 150-159.

Campbell, V. A., & Dodds, M. L. Collecting dietary information from groups of older people. American Dietetic Association Journal, 1967, 51, 29.

Carlisle, J. C., Bass, M. A., & Owsby, D. W. Food preferences and connotative meanings of foods of Alabama teenagers. School Food Service Research Review, 1980, 4, 19-26.

Central Patient Registry and Coordination Center for Lipid Research Clinics. Training manual for measuring triceps skinfold thickness. Washington, DC: Lipid Research Clinics Program of the Lipid Metabolism Branch, National Heart, Lung, & Blood Institute, 1973.

Chassy, J. P., Van Veen, A. G., & Young, F. W. The application of social science research methods to the study of food habits and food consumption in an industrializing area. American Journal of Clinical Nutrition, 1967, 20, 56.

Christakis, G. Nutritional assessment in health programs. Washington, DC: American Public Health Assoc., 1973.

Clawson, B. First annual evaluation report for project teen. Greensboro: University of North Carolina at Greensboro, 1979.

Daniel, W., Jr. Nutrition and adolescence. Dietetic Currents, 1976, 3(4).

Daniel, W. A., Gaines, E. G., & Bennett, D. L. Dietary intakes and plasma concentrations of folate in healthy adolescents. American Journal of Clinical Nutrition, 1975, 28, 363.

Daniel, W. W. Applied nonparametic statistics. Boston: Houghton-Mifflin, 1978.

Davidson, S., Passmore, R., Brock, J. F., & Truswell, A. S. Human nutrition and dietetics (7th ed.) London: Churchill-Livingstone, 1979.

Davis, T. R. A., Gershoff, S. N., & Gamble, D. F. Review of studies of vitamin and mineral nutrition in United States. Journal of Nutrition Education, 1969, 1, 38.

Donald, E. A., Esselbaugh, N. C., & Hard, M. M. Nutritional status of selected adolescent children. II. Vitamin A nutrition assessed by dietary intake and serum levels: Biomicroscopic and gross observations. American Journal of Clinical Nutrition, 1958, 6, 126.

Dorland's medical dictionary (24th ed.). Philadelphia: W. B. Saunders, 1965.

Duyff, R. L., Sanjur, D., & Nelson, H. Y. Food behavior and related factors of Puerto Rican-American teenagers. Journal of Nutrition Education, 1975, 7, 99-103.

Edwards, C. H., Hogan, G., Spahr, S., & Guilford County Nutrition Committee. Nutrition survey of 6200 teen-age youth. American Dietetics Association Journal, 1964, 45, 543-546.

Einstein, M. A., & Hornstein, I. Food preferences of college students and nutritional implications. Journal of Food Science, 1970, 35, 429.

Emmons, L., & Hayes, M. Accuracy of 24-hour recalls of young children. American Dietetic Association Journal, 1973, 62, 409.

Etnyre, G. M. Nutritional assessment of female adolescents: Anthropometric measurements and validity check of the 24-hour dietary recall. Unpublished master's thesis, Purdue University, 1977.

Everson, G. J. Bases for concern about teenagers' diets. American Dietetic Association Journal, 1960, 36, 17.

Fidanza, F., & Baldesserini, V. L. Vitamin C intake and biochemical status in 24 children of a chool in Perugia. International Journal of Vitamin Nutrition Research, 1975, 45, 61.

Gal, I., Parkinson, C., & Craft, I. Effects of oral contraceptives on human plasma vitamin A levels. British Medical Journal, 1971, 2, 436.

Greecher, C. P., & Shannon, B. Impact of fast food meals on nutrient intakes of two groups. American Dietetics Association Journal, 1977, 70, 368.

Greenwood, C. T., & Richardson, D. P. Nutrition during adolescence in Bourne, GH. World Review of Nutrition and Dietetics, 1979, 33, 1-41.

Greger, J. L., Divilbiss, L., & Aschenbeck, S. K. Dietary habits of adolescent females. Ecology of Food and Nutrition, 1979, 7, 213-218.

Greger, J. L., Higgins, M. M., Abernathy, R. P., Kirksey, A., de Corso, M. B., & Baliyar, P. Nutritional status of adolescent girls in regard to zinc, copper and iron. American Journal of Clinical Nutrition, 1978, 31, 269-274.

Guthrie, H. A. Nutritional status measures as predictors of nutritional risk in preschool children. American Journal of Clinical Nutrition, 1976 , 29, 1048.

Hampton, M. C., Huenemann, R. L., Shapiro, L. R., & Mitchell, B. W. Caloric and nutrient intakes of teenagers. American Dietetic Association Journal, 1967, 50, 385.

Hinton, M. A., Eppright, E. S., Chadderon, H., & Wolins, L. Eating behavior and dietary intake of girls 12 to 14 years old. American Dietetic Association Journal, 1963, 43, 223.

Huenemann, R. L., Shapiro, L. R., Hampton, M. C., & Mitchell, B. W. Food and eating practices of teen-agers. American Dietetic Association Journal, 1968, 53, 17.

Inana, M., & Pringle, D. J. Dietary survey of low-income, rural families in Iowa and North Carolina, II. Family distribution of dietary adequacy. American Dietetic Association Journal, 1975, 66, 361.

Irwin, M. I., & Hutchins, B. K. A conspectus of research on vitamin C requirements of man. Journal of Nutrition, 1976, 106, 823-879.

Ismadi, S. D., & Olsen, J. A. Vitamin A transport in human blood. American Journal of Clinical Nutrition, 1975, 28, 967.

James, P., Sjolin, S., & White, P. Summary: Nutrition in adolescence symposium. Nutrition Reviews, 1981, 39, 115-116.

King, J. C., Cohenour, S. H., Calloway, D. H., & Jacobson, H. N. Assessment of nutritional status of teenage pregnant girls. I. Nutrient intake and pregnancy. American Journal of Clinical Nutrition, 1972, 25, 916-925.

Kirksey, A., Keaton, K., Abernathy, R. P., & Greger, J. Vitamin B_6 nutritional status of a group of female adolescents. American Journal of Clinical Nutrition, 1978, 31, 946.

Kothari, L. K., Lal, K. B., Srivastava, D. K., & Sharma, R. Correlation between plasma levels of vitamin A and proteins in children. American Journal of Clinical Nutrition, 1971, 24, 510-512.

Krishnaswamy, V. N. Dietary and serum vitamin A status of preschool children in two Mississippi counties. Unpublished master's thesis, Mississippi State University, 1978.

Lai, M. K., Shimabukuro, S. K., Wenkam, N. S., & Raman, S. P. A nutrient analysis of students' diets in the state of Hawaii. Journal of Nutrition Education, 1982, 14, 67-70.

Lee, C. J. Nutritional sta-us of selected teenagers in Kentucky. American Dietetic Association Journal, 1978, 31, 1453.

Leitner, E., Moore, T., & Sharman, I. M. Vitamin A and vitamin E in human blood. British Journal of Nutrition, 1960, 14, 157.

McCoy, H., Kenney, M. A., Kirby, A., Clark, A. J., Disney, G., Ercanli, R., Glover, E., Korslund, M., Lewis, H., Liebman, M., Moak, S., Stallings, S., Wakefield, T., Schilling, P., & Ritchey, S. J. Nutrient intakes of female adolescents from eight southern states. Unpublished manuscript, 1982.

McGainty, W. J. Nutrition in the adolescent. In K. S. Moghissi & T. N. Evans (Eds.), Nutritional impacts on women. New York: Harper & Row, 1977.

McKigney, J. I., & Munro, H. N. Nutrient requirements in adolescence. Cambridge, MA: MIT Press, 1976.

Manual for nutrition surveys (2nd ed.). Washington, DC: Interdepartmental Committee on Nutrition for National Defense, 1963.

Marino, D. D., & King, J. C. Nutritional concerns during adolescence. In I. F. Litt (Ed.), Pediatric clinics of North America. Philadelphia: W. B. Saunders, 1980.

Mitchell, G. V., Young, M., & Seward, C. R. Vitamin A and carotene levels of a selected population in metropolitan Washington, DC. American Journal of Clinical Nutrition, 1973, 26, 992-997.

Morris, N. M., & Udry, J. R. Validation of a self-administered instrument to assess stage of adolescent development. Journal of Youth and Adolescence, 1980, 9, 271.

Morse, E. H., Murrow, S. B., & Clarke, R. F. Some biochemical findings in Burlington (VT) junior high school children. American Journal of Clinical Nutrition, 1965, 17, 211.

National Center for Health Statistics. Dietary intake findings United States, 1971-74. (DHEW Pub. (HRA) 77-1647) Rockville, MD: Author, 1977.

National Research Council. Recommended dietary allowances (9th ed.). Washington, DC: National Academy of Sciences, 1980.

Neeld, J. B., Jr., & Pearson, W. N. Macro- and micro-methods for the determination of serum vitamin A using trifluoroacetic acid. Journal of Nutrition, 1963, 79, 454.

Pao, E. Nutrient consumption patterns of individuals, 1977 and 1965. Family Economics Review. Washington, DC: Science & Education Administration, USDA, 1980.

Pao, E. M., & Mickle, S. J. Nutrients from meals and snacks. Speech given at the 1981 Agricultural Outlook Conference, Washington, DC, November, 1980.

Pearson, W. N. Biochemical appraisal of nutritional status in man. American Journal of Clinical Nutrition, 1962, 11, 462.

Pipes, P. L. Nutrition in infancy and childhood. St. Louis, C.V. Mosby, 1977.

Prasad, A. S., Maghissi, K. S., Lei, K. Y., Oberleas, D., & Stryker, J. C. Effect of oral contraceptives on micronutrients and changes in trace elements due to pregnancy. In K. S. Moghissi & T. N. Evans (Eds.), Nutritional impacts on women. New York: Harper & Row, 1977.

Prothro, J., Mickles, M., & Tolbert, B. Nutritional status of a population sample in Macon County, Alabama. American Journal of Clinical Nutrition, 1976, 29, 94-104.

Raica, N., Jr., Scott, J., Lowry, L., & Sauberlich, H. E. Vitamin A concentration in human tissues collected from five areas in the United States. American Journal of Clinical Nutrition, 1972, 25, 291.

Rivers, J. M. Oral contraceptives and ascorbic acid. American Journal of Clinical Nutrition, 1975, 28, 550.

Roche, A. Some aspects of adolescent growth and maturation. In J. McKigney & H. Munro (Eds.), Nutrient requirements in adolescence. Cambridge, MA: MIT Press, 1976.

Rodriguez, M. S., & Irwin, M. L. A conspectus of research on vitamin A requirements in man. Journal of Nutrition, 1972, 102, 909-968.

Rosenberg, M. Society and the adolescent self-image. Princeton, NJ: Princeton University Press, 1965.

Samuelson, G. An epidemiological study of child health and nutrition in a northern Swedish county: II. Methodological study of the recall technique. Nutrition and Metabolism, 1970, 12, 321.

Sanjur, D. Teenagers and nutrition: Contemporary issues. Professional Nutritionist, Summer 1979.

Sauberlich, H. E. Human requirements and needs. Vitamin C status: Methods and findings. Annuals of New York Academy of Science, 1975, 258, 438.

Sauberlich, H. E., Dowdy, R. P., & Skala, J. H. Laboratory tests for the assessment of nutritional status. Cleveland: CRC Press, 1974.

Schorr, B. C., Sanjur, D., & Erickson, E. C. Teenage food habits. American Dietetic Association Journal, 1972, 61, 415.

Smith, J. L., Goldsmith, G. A., & Lawrence, J. D. Effects of oral contraceptive steroids on vitamin and lipid levels in the serum. American Journal of Clinical Nutrition, 1975, 28, 371.

Steele, B. F., Clayton, M. M., & Tucker, R. E. Role of breakfast and of between meal foods in adolescents' nutrient intakes. American Dietetic Association Journal, 1952, 28, 1054-1057.

Steibling, H. K. Trends in family food consumption. American Dietetic Association Journal, 1950, 26, 248.

Tanner, J. M. Growth and endocrinology of the adolescent. In L. J. Gardiner (Ed.), Endocrine and diseases in childhood (2nd ed.). Philadelphia: W. B. Saunders, 1975.

Thomas, J. A., & Call, D. L. Eating between meals: A nutrition problem among teenagers? Nutrition Reviews, 1973, 31, 137.

Tietz, N. W. Fundamentals of clinical chemistry. Philadelphia: W.B. Saunders, 1976.

Truswell, A. S., & Darnton-Hill, I. Food habits of adolescents. Nutrition Reviews, 1981, 39, 73-88.

U.S. Department of Agriculture. Nationwide food consumption survey 1977-78, food and nutrient intakes of individuals in one day in the U.S. USDA, Prelinary Report No. 2. Washington, DC U.S. Government Printing Office, 1978.

U.S. Department of Agriculture. Nutritive value of foods. (Home and Garden Bulletin No. 72) Washington, DC: U.S. Government Printing Office, 1978.

U.S. Department of HEW. Ten-state nutrition survey, 1968-1970. (DHEW Pub. No. (HSM) 72-8134) Washington, DC: U.S. Government Printing Office, 1972.

University of North Carolina at Greensboro. Project procedural guidelines and manual for interviewers. Greensboro: School of Home Economics, UNC-G, 1981.

Wharton, M. A. Nutritive intake of adolescents. American Dietetic Association Journal, 1963, 43, 306.

Wilhemy, O., Jr. Nutritional status survey, Groton Township, New York. American Dietetic Association Journal, 1950, 36, 868.

Yeung, D. L. Relationships between cigarette smoking, oral contraceptives, and plasma vitamins A, E, C, and plasma triglycerides and cholesterol. American Journal of Clinical Nutrition, 1976, 29, 1216.

Young, C. M., & Trulson, M. Methodology for dietary studies in epidemiological surveys: II. Strengths and weaknesses of existing methods. American Journal of Public Health, 1960, 50, 803.

Young, C. M., Hagan, G., Tucker, R., & Foster, W. A comparison of dietary study methods: II. Dietary history vs. seven-day record vs. 24-hour recall. American Dietetic Association Journal, 1952, 28, 218.

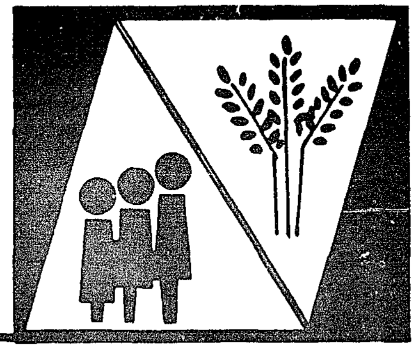
APPENDIX A

DATA COLLECTION

ATTENTION

JUNIOR HIGH & HIGH SCHOOL

GIRLS



WHAT ?????????? Food & Nutrition and Child Development & Family Relations Departments at UNC-G are researching the nutritional health of Junior High-High School age females. We need volunteers for this study. You'll be given a free breakfast and $10.

WHO ?????? Girls...ages 12, 14, and 16. You can be in the study if your birthdate was between:

September 1, 1968 & August 31, 1969...Age 12
September 1, 1966 & August 31, 1967...Age 14
September 1, 1964 & August 31, 1965...Age 16

First volunteers for each age will be first accepted

HOW DO I PARTICIPATE ?????? Spend a half day at UNC-G...Travel to and from UNC-G will be provided if needed...You will be asked to answer some questionnaires and donate a routine blood and urine sample. Height, weight, blood pressure and other measurements will be made by a qualified staff member.

WHEN ????? Between January & April, 1981...a non-school day convenient for you.

HOW TO SIGN UP ??????? Ask your parent(s) or guardian if you may be in the study. If you want to sign up, or would like more information:

Call ... Dr. Michael Liebman ... 379-5420 (UNC-G, daytime)
292-2971 (evenings, 6-10 pm)

OR

Fill out the form below and mail it to: Dr. Michael Liebman
School of Home Economics
UNC-G
Greensboro, NC 27412

We'll call or write after receiving it.

NUTRITIONAL HEALTH PROJECT

Name ____________________

Age ________ Birthdate ____________

Address ____________________

Phone Number ____________________

____
Signature, Parent or Guardian

THE UNIVERSITY OF NORTH CAROLINA
AT GREENSBORO

School of Home Economics

January 14, 1981

To: Teachers to Distribute Flyers
Junior High and High Schools in Greensboro, NC

From: Mike Liebman, Project Director
Nutritional Health of Adolescent Females

Please distribute flyers to those girls in your school who will be within six months of either their 12th, 14th, or 16th birthdays as of March 1, 1981. Included in the flyer are specific dates which constitute eligibility.

At the time you distribute the flyers, it would be helpful if you could briefly review each main point--what, who, how to participate, when. Also, point out that I will be available to answer any questions about the study; daytime and evening phone numbers are given on the flyer.

Specific objectives of this research are to (1) assess the nutritional health of adolescent females and to (2) relate nutritional health of adolescent females to several factors-socioeconomic, food habits, nutrition knowledge, and behavioral characteristics. UNC-G is participating with schools in seven other states to describe the nutritional status and characteristics of Southern adolescent females.

Any encouragement you might give students to participate in this study would certainly be helpful. Thank you for distributing these flyers. We are attempting to locate 200 eligible females in the Greensboro area; therefore, your cooperation is vital to the project's success. Your efforts are greatly appreciated.

Call Received:

Date______________

___Mother
___Child

Researcher________

PRELIMINARY INFORMATION

S-150 Nutritional Health of
Adolescent Females

Name____

School Attended____

Age__________________

Birthdate______________________

Race _____Black _____White _____Other

Address____

____

Phone Number___________________

Name of Parent or Guardian_______________________________________

Best time to call/visit mother in home or other location____________

Would transportation to UNC-G be needed? _____No _____ Yes

Notes From Conversation____

____

____

____

____

____

Consent for Participation

I have received an explanation of the nutrition study to be conducted at the University of North Carolina at Greensboro as part of the Southern Regional Nutrition Project: Nutritional Health of Adolescent Females (S-150). The project will be directed by Michael Liebman, faculty member in the Department of Food, Nutrition and Food Service Management in the School of Home Economics.

The study objectives are (1) to assess the nutritional health of adolescent females in the Southern region, and (2) to relate the nutritional health of adolescent females to socioeconomic factors, food habits, nutrition knowledge, behavioral characteristics, physiological development, and other appropriate factors.

I understand that I will be asked to answer questions about socioeconomic background (such as education, occupation of parents, etc.), food habits, overall health, and lifestyle. I understand that I will be asked to take tests which are designed to assess my personality and attitudes. I am also aware that I will be asked to donate a urine sample and a blood sample after a short period of fasting. The blood sample will be taken by a qualified blood drawer.

The potential risks of this study (such as fainting, bruising, or infection from the blood drawing; and stress during the interviews and tests) have been explained to me. I understand that I will receive $10.00 for being a subject in this study, payable at the end of my participation.

I understand that I am free to withdraw from the study at any time. I understand that all information will be considered private, will be treated confidentially, and will not be revealed so as to cause embarrassment. Dr. Liebman or one of the other members of the research staff will be free to answer any questions I may have regarding this study.

Understanding the above, I agree to participate.

____
Signature, Subject

Understanding the above, I agree to my daughter's participation.

____
Signature, Parent or Guardian

________________ ____________________________
Date Signature, # Interviewer

____
Social Security Number

S-150 Regional Project

Form S-1

Subject__________________________

Date____________________________

Subject______________

State________________

Station______________

Year 1 or 3__________

SOCIO-DEMOGRAPHIC BACKGROUND INFORMATION

Respondent's Relation to Subject____________________________________

***NOTE TO INTERVIEWER: If subject does not live with parent(s) and/or guardian(s), she may possibly be the respondent. Change wording of items appropriately.

1. Subject's race 1 = White 2 = Black ____

2. Location of Subject's Residence

   1 = Major urban--greater than or equal to 100,000
   2 = Minor urban--greater than or equal to 2500 and less than 100,000
   3 = Rural, nonfarm--less than 2500 and nonfarming
   4 = Rural, farm--less than 2500 and farming ____

3a Does subject attend school?

   1 = Yes 2 = No (If no, go to question 4) ____

3b What is subject's grade in school?__________

   (Record actual grade--example, Grade 8 = 08) ____ ____

4. If subject is not enrolled in school, ask:

   What was the last grade completed?__________ ____ ____
   (Record actual grade--example, Grade 8 = 08)

5a Is subject employed? 1 = Yes 2 = No ____

5b If employed, is subject employed 1 = full time 2 = part time __

5c If employed, what is subject's occupation?______________________

***NOTE: Refer to Table VII--Occupations: Levels and kinds--in coding the reply to this question.

1 = Professional	5 = Blue-Collar
2 = Proprietor	6 = Service
3 = Business	7 = Farm
4 = White-Collar	8 = Other ____

6. Is subject

1 = Married 2 = Widowed 3 = Divorced 4 = Separated
5 = Never Married ____

7. Where does subject stand in the birth order of her siblings?

1 = Only Child 2 = Oldest 3 = In the Middle 4 = Youngest___

***NOTE: In coding the reply to question 8, record actual number. If reply is none, record as 00. Example--record 3 as 03.

8. If the subject is not an only child, ask:

How many

a. Older brothers?
b. Older sisters?
c. Younger brothers?
d. Younger sisters?

9. Who lives in the household with subject?
(Check the appropriate category and record the actual number.)

_____Father	_____Grandmother(s)
_____Mother	_____Grandfather(s)
_____Brother(s)	_____Male Cousin(s)
_____Sister(s)	_____Female Cousin(s)
_____Uncle(s)	_____Niece(s)
_____Aunt(s)	_____Nephew(s)
_____Children of Subject	_____Mother-in-law
_____Husband of Subject	_____Father-in-law
_____Nonrelated Males	_____Guardian(s)
_____Nonrelated Females	_____None

***NOTE. From the information obtained in question 9, determine family type as follows:

If family consists of father and mother, and possibly brother(s) and/or sister(s),

Family Type = 1

If family consists of father and mother, possibly brothers and/or sisters, and in addition other related members,

Family Type = 2

If family consists of father and mother, possibly brothers and/or sisters, and in addition nonrelated members,

Family Type = 3

If family consists of father or mother and possibly brothers and/or sisters,

Family Type = 4

If family consists of father or mother, possibly brothers and/or sisters, and in addition other related members,

Family Type = 5

If family consists of father or mother, possibly brothers and/or sisters, and in addition nonrelated members,

Family Type = 6

***NOTE: Code the appropriate family type to the right. ____

10. What is the total number of persons living in subject's household? (Reply determined by interviewer.) ____

11a If father is not living in household, is the subject's father still living? 1 = Yes 2 = No ____

11b If mother is not living in household, is the subject's mother still living? 1 = Yes 2 = No ____

12. If subject's parents are living, but residing in separate households, are they
1 = Married 2 = Separated 3 = Divorced
4 = Never Married ____

***NOTE: If the father is living, ask questions 13a, b, c, d, e regardless of whether he lives in the household or not.

13a Is the subject's father employed? 1 = Yes 2 = No ____

13b (If employed), is the subject's father employed

1 = Full-time 2 = Part-time ____

13c (If employed), what is his occupation?____________________

***NOTE: Refer to Table VII in coding the reply to this question.

1 = Professional	5 = Blue-Collar
2 = Proprietor	6 = Service
3 = Business	7 = Farm
4 = White-Collar	8 = Other

____

13d (If not employed), is subject's father

1 = Unemployed 2 = Retired 3 = Student 4 = Homemaker ____

13e How many years of schooling has the subject's father completed? (Check the highest level of education completed.)

1 = 0 to 5	5 = Technical or Vocational School
2 = 6 to 8	6 = Some College
3 = 9 to 11	7 = Completed College
4 = Completed High School	8 = Graduate School

____

***NOTE: If the mother is living, ask questions 14a, b, c, d, and e, regardless of whether she lives in the household or not.

14a Is the subject's mother employed outside the home?

1 = Yes 2 = No ____

14b (If employed), is subject's mother employed

1 = Full-time 2 = Part-time ____

14c (If employed), what is her occupation?____________________

***NOTE: Refer to Table VII in coding the reply to this question.

1 = Professional
2 = Proprietor
3 = Business
4 = White-Collar
5 = Blue-Collar
6 = Service
7 = Farm
8 = Other

14d (If not employed), is subject's mother

1 = Unemployed 2 = Retired 3 = Student 4 = Homemaker ____

14e How many years of schooling have you (the mother) completed? (Check the highest level of education completed.)

1 = 0 to 5
2 = 6 to 8
3 = 9 to 11
4 = Completed High School
5 = Technical or Vocational School
6 = Some College
7 = Completed College
8 = Graduate School ____

***NOTE: Please indicate to the respondent that the period for reporting income is the past 12 months.

For all of the sources of income listed below, the following codes are to be used: 1 = Yes 2 = No

15. We need to relate information of food habits, meal practices, and health to your sources of income. To keep this completely confidential, I would like you to indicate which of the following ways your household received income last year.

a. Wages, salary, and/or bonus ____

b. Social Security, veteran's, pension (not welfare), or insurance payments ____

c. Farming ____

d. Rental property ____

e. Welfare payments ____

f. Child support (from divorced parent) or alimony ____

g. WIC ____

h. Food stamps ____

i. Gifts (friends, relatives) ____

j. Business ____

k. Odd jobs or any other source ____

16a Now that you have mentioned the source(s) of your family income, what is the total (add all sources) before taxes are deducted? You can do this by week, month, or year.

$__________Weekly

$__________Monthly

$__________Yearly

***NOTE: If listed weekly or monthly, ask 16b.

16b How many weeks or months of the year do you make this amount?

_____Weeks

_____Months

17. Given the above information in question 16, what is the subject's total gross family income? (Record actual amount.) ____ ____ ____ ____ ____ ____

18. How many people does this income support? (Record actual number.) ____ ____

____ ____ ____ ____

S-150 Regional Project

Subject______________

Form D1 FOOD RECALL 01

State______________

Subject Number____________

Station______________

Date____________________

Year 1 or 3__________

1. How many days each week do you usually eat something before breakfast? (Circle one.)
0 1 2 3 4 5 6 7 ____

2. Where do you usually eat if you eat something prior to breakfast? ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify___________________________

3. Where did you eat if you ate something prior to breakfast yesterday?____

4. What did you eat and/or drink prior to breakfast yesterday?

A. Food/Drinks	B. Amount in Household Units	C. PRBQ of Units	D. Has ID	E. Wt. in Grams

5. From the above question, record the frequency of each food group consumed. Record to half of a serving.

a. Meat equivalents ____ ____

b. Dairy products ____ ____

c. Vegetables ____ ____

d. Fruits ____ ____

e. Breads and cereals ____ ____

f. Fats ____ ____

g. Simple sugars ____ ____

h. Sodas ____ ____

i. Instant breakfast (includes Granola bars) ____ ____

j. Alcoholic beverages ____ ____

6. How many days each week do you usually eat something for breakfast? (Circle one.)
0 1 2 3 4 5 6 7 ____

7. Where do you usually eat if you eat something for breakfast? ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify____________________

8. Where did you eat if you ate breakfast yesterday?__________

9. What did you eat and/or drink for breakfast yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. FREQ of Units	D. Has ID	E. Wt. in Grams

10. From the above question, record the frequency of each food group consumed. Record to half of a serving.

a. Meat equivalents ____ ____

b. Dairy products ____ ____

c. Vegetables ____ ____

d. Fruits ____ ____

e. Breads and cereals ____ ____

f. Fats ____ ____

g. Simple sugars ____ ____

h. Sodas ____ ____

i. Instant breakfast (includes Granola bars) ____ ____

j. Alcoholic beverages ____ ____

11. How many days each week do you usually eat something between breakfast and lunch? (Select one.)
0 1 2 3 4 5 6 7 ____

12. Where do you usually obtain the items eaten? (Select one.) ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify____________________

13. Where did you eat if you ate something at this time yesterday?____________________

14. What did you eat and/or drink between breakfast and lunch yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. Freq of Units	D. Has ID	E. Wt. in Grams

15. From the above question, record the frequency of each food group consumed. Record to half of a serving.

   a. Meat equivalents ____ ____

   b. Dairy products ____ ____

   c. Vegetables ____ ____

   d. Fruits ____ ____

   e. Breads and cereals ____ ____

   f. Fats ____ ____

   g. Simple sugars ____ ____

   h. Sodas ____ ____

   i. Instant breakfast (includes Granola bars) ____ ____

   j. Alcoholic beverages ____ ____

16. How many days each week do you usually eat or drink something for lunch? (Circle one.)
0 1 2 3 4 5 6 7 ____

17. Where do you usually obtain what you eat for lunch? (Select one.) ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify________________________

18. Where did you eat if you ate lunch yesterday?________________

19. What did you eat and/or drink for lunch yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. Freq of Units	D. Was ID	E. Wt. in Grams

20. From the above question, record the frqeuency of each food group consumed. Record to half of a serving.

   a. Meat equivalents ____ ____

   b. Dairy products ____ ____

   c. Vegetables ____ ____

   d. Fruits ____ ____

   e. Breads and cereals ____ ____

   f. Fats ____ ____

   g. Simple sugars ____ ____

   h. Sodas ____ ____

   i. Instant breakfast (includes Granola bars) ____ ____

   j. Alcoholic beverages ____ ____

21. How many days each week do you usually eat something between noon and the evening meal? (Circle one.)
0 1 2 3 4 5 6 7 ____

22. Where do you usually obtain the items eaten? (Select one.) ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify________________________

23. Where did you eat if you ate something yesterday at this time?____

24. What did you eat and/or drink for an afternoon snack yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. Freq of Units	D. Has ID	E. Wt. in Grams

25. From the above question, record the frequency of each food group consumed. Record to half of a serving.

a. Meat equivalents ____ ____

b. Dairy products ____ ____

c. Vegetables ____ ____

d. Fruits ____ ____

e. Breads and cereals ____ ____

f. Fats ____ ____

g. Simple sugars ____ ____

h. Sodas ____ ____

i. Instant breakfast (includes Granola bars) ____ ____

j. Alcoholic beverages ____ ____

26. How many days each week do you usually eat an evening meal? (Circle one.) 0 1 2 3 4 5 6 7 ____

27. Where do you usually eat if you eat an evening meal? (Select one.) ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify____________________________

28. Where did you eat if you ate an evening meal yesterday?________

29. What did you eat/drink for an evening meal yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. Freq of Units	D. Has ID	E. Wt in Grams

30. From the above question, record the frequency of each food group consumed. Record to half of a serving.

a. Meat equivalents ____ ____

b. Dairy products ____ ____

c. Vegetables ____ ____

d. Fruits ____ ____

e. Breads and cereals ____ ____

f. Fats ____ ____

g. Simple sugars ____ ____

h. Sodas ____ ____

i. Instant breakfast (includes Granola bars) ____ ____

j. Alcoholic beverages ____ ____

31. How many days each week do you usually eat something between the evening meal and the time you go to bed? (Select one.)
0 1 2 3 4 5 6 7 ____

32. Where do you most frequently obtain what you eat? (Select one.) ____

1 = Home
2 = School cafeteria
3 = Fast-food restaurant or grocery
4 = Other restaurant (not fast-food type)
5 = Vending machine or school snack bar other than cafeteria
6 = A friend's or relative's home
7 = Other: Please specify____________________________

33. Where did you eat if you ate something yesterday at this time?____

34. What did you eat and/or drink for an evening snack yesterday?

A. Food/ Drinks	B. Amount in Household Units	C. Freq of Units	D. Has ID	E. Wt in Grams

35. From the above question, record the frequency of each food group consumed. Record to half of a serving.

a. Meat equivalents ____ ____

b. Dairy products ____ ____

c. Vegetables ____ ____

d. Fruits ____ ____

e. Breads and cereals ____ ____

f. Fats ____ ____

g. Simple sugars ____ ____

h. Instant breakfast (includes Granola bars) ____ ____

i. Alcoholic beverages ____ ____

36. How many times per week do you usually take nutritional supplements such as vitamins, minerals, or protein in addition to the foods to eat? 0 1 2 3 4 5 6 7 ____

37. If you take supplements, who recommended that you take the supplements? ____

1 = Physician
2 = Mother
3 = Father
4 = Self
5 = Girlfriend(s)
6 = Boyfriend(s)
7 = Media

38. What supplements did you take yesterday, how many capsules or tablets, and what time and where they were taken?

(Be sure if the supplements are a single nutrient that the concentration in each tablet is obtained. Under column below, record the meal code or snack code corresponding to the time period when the supplement was consumed.)

Vitamin/Mineral Supplement	Conc of Tablet	Freq.	Has ID	Time of Day

39. When you eat snacks, do you eat or drink them: (Answer each item by recording Often = 3 Never = 1 Sometimes = 2 in blanks 31-35)

    a. Because you are hungry? ____

    b. To be social or as part of a social activity? ____

    c. Just to have something to do? ____

    d. Because you see something that looks good? ____

    e. To gain weight? ____

    f. Any other reason volunteered______________________
    (Do not code.)

40. Are you presently on a vegetarian diet?
    Yes = 1 No = 2 ____

41. As a vegetarian, do you eat: Yes = 1 No = 2

    a. Eggs? ____

    b. Milk? ____

    c. Cheese? ____

    D. Fish? ____

42. Are you a vegetarian for (circle one)? ____

    1 = Religious reasons   4 = Economic reasons
    2 = Humanitarian reasons   5 = Health reasons
    3 = Dislike   6 = Lifestyle

43. How long have you been a vegetarian?__________ ____ ____ ____
    (Specify time in months.)

44. Have you ever been on a weight-reduction diet? ____
    Yes = 1 No = 2

If answer is "no," skip to #49.

---

45. If yes, was it recommended or decided on primarily by (select one): ____

1 = Physician
2 = Mother
3 = Father
4 = Self
5 = Girlfriend(s)
6 = Boyfriend(s)
7 = Media

46. Have you been on a weight-reduction diet within the past year? ____

Yes = 1 No = 2

47. How many times each year do you go on a weight-reduction diet? ____ ____ ____

48. How long does the diet usually last? (Select one.) ____

1 = Less than one month
2 = One to three months
3 = Four to six months
4 = More than six months

49. Have you ever been on a diet to try to gain weight? ____

Yes = 1 No = 2

If answer is "no," skip to #52.

---

50. Have you tried to gain weight within the past year? ____

Yes = 1 No = 2

51. If yes, was it recommended or decided on primarily by (select one): ____

1 = Physician
2 = Mother
3 = Father
4 = Self
5 = Girlfriend(s)
6 = Boyfriend(s)
7 = Media

52. Are you presently trying to ________ weight? ____

Gain = 1 Lose = 2 Niether = 3

53. Do you think your weight is how? (Circle one.) ____

Too heavy = 3 Too light = 1 About right = 2

54. Do you add salt to your food at the table? (Circle one.) ____

Almost always and before tasting = 4
Sometimes = 3
Almost always but only after tasing = 2
Almost never = 1

55. Do you like very salty foods such as salted nuts, potato chips? Yes = 1 No = 2 ____

56. Who prepares breakfast if your family (at least four times each week) has a prepared meal? (Select one.) ____

0 = Meal is not prepared at least four times each week.
1 = Mother
2 = Father
3 = Grandmother, aunt, or other female relative
4 = Yourself
5 = Other children in the family
6 = Mother prepares for the family, and the father prepares his own
7 = Each person prepares his/her own
8 = Varies from day to day
9 = Other: Specify________________________________

57. If breakfast is prepared at least four times each week, does your family usually eat breakfast: ____

0 = Breakfast is not prepared at least four times each week.
1 = Separately
2 = All together
3 = Children together and adults together (but not with children)
4 = Varies from day to day
5 = Separately Monday to Friday and all together on Saturday and Sunday
6 = Other: Specify________________________________

58. Is an evening meal regularly prepared at least four times a week in your home? 1 = Yes 2 = No ____

59. If so, who most frequently prepares the meal? (Select one.) ____

0 = Meal is not prepared at least four times each week.
1 = Mother
2 = Father
3 = Grandmother, aunt, or other female relative
4 = Yourself
5 = Other children in the family
6 = Mother prepares for the family, and the father prepares his own
7 = Each person prepared his/her own
8 = Varies from day to day
9 = Other: Specify______________________________

60. How many days each week do you usually eat your evening meal with most of your family? 0 1 2 3 4 5 6 7 ____

61. How many days each week do you usually eat your evening meal away from home? 0 1 2 3 4 5 6 7 ____

62. When you do not eat the evening meal at home, where do you eat most frequently? ____

1 = Always eat at home
2 = Fast-food restaurant or grocery
3 = Other restaurant (not fast-food type)
4 = Vending machine
5 = A friend's or relative's home
6 = Other: Specify______________________________

63. If your family has an evening meal provided at least four times a week, does it usually eat: (Select one.) ____

0 = Evening meal is not prepared at least four times a week
1 = Separately
2 = All together
3 = Children together and adults together (but not with children)
4 = Varies from day to day
5 = Separately Monday to Friday and all together on Saturday and Sunday
6 = Other: Specify______________________________

64. Who does most of the grocery shopping in your family? (Select one.) ____

1 = Male head of family
2 = Female head of family
3 = Male and female heads together
4 = Whole family
5 = The respondent
6 = One of the children other than the respondent
7 = Other: Specify ____________________

65. Who makes the majority of decisions about the groceries to buy? (Select one.) ____

1 = Male head of family
2 = Female head of family
3 = Male and female heads together
4 = Whole family
5 = Children
6 = Other: Specify ____________________

66. How often do you help to make decisions about what groceries your family buys? ____

1 = Never 2 = Sometimes 3 = Always

____ ____ ____ ____

* *

The following information needs to be answered by the interviewer:

A. Subject's age category (circle one): 12 14 16 years

B. Yesterday was (circle one): SU M TU W TH F SA

C. Is this recall being taken on the day blood is drawn? (Please circle.) Yes = 1 No = 2

This recall used Form D1.

Last Name, Initials: ____________ Date: ____________

Subject I.D. Number: _1_ _2_ _3_ State I.D. Number: _4_ Station #: _5_

Year: _6_ Blood Drawing: _7_ Race: _8_ _9_ RDA Classification: _10_ _11_ _12_

Recall Form Number: _13_ Key Puncher: leave 14 - 17 blank, punch 1 _18_

LINE NO.	RECORD NO.	TIME (A=am P=pm) Hour	Min		S-M	FOODS and BEVERAGES	AMOUNT	COMPLETE DESCRIPTION
010								
020								
030								
040								
050								
060								
070								
080								
090								
230								
240								
250								
260								
270								
280								
290								
300								
310								
320								
330								
340								
350								
360								
370		Enter "*" if there is a continuation sheet. →						

40 43 46 52

COMMENTS: *(Give question or line number when appropriate)*

Tools and Measures Used in 24-Hour Recall

6, 10, and 12 ounce styrofoam drinking cups

Set of measuring spoons (tablespoon, teaspoon, ½ teaspoon and ¼ teaspoon)

Nested measuring cups (1, 1/2, 1/3, 1/4 cup)

Paper for drawing sizes of food portions

Ruler

Foam packing pieces (½ inch x 1½ inches) for estimating food portions

Directions for food frequency and preference check sheets

These items were kept in tote bag and used in each dietary interview at home and at the university.

Interviewer Instructions

Directions for Food Frequency During Home Interview

1. After completing the dietary recall, ask the subject to complete Form S-7 Sumner, Food Frequency (at meals).
2. The questionnaire is self-administered by the subject, BUT please review the directions and frequency scale with the subject to be sure she understands. Emphasize she should answer thinking only of foods at meals and should not include foods eaten between meals.
3. If the subject does not know a food, never eaten is an appropriate answer.
4. If the subject checks "eaten only when in season," she should also check how often she eats the food when it is in season.
5. Be sure the subject completes both sides.

S-150 Regional Project
Form S-9 Summer
Subject No. _____
Date ___________

Subject_______________

FOOD PREFERENCES

If you could choose your food, how often would you choose this food when it is available?

FOOD ITEM	(Check Appropriate Box) Everytime	Most of the Time	Some of the Time	Seldom	Never
Greens (turnip, mustard, kale, collards, creases)					
Sweet potato					
Squash, winter (butternut, acorn)					
Spinach, cooked or raw					
Liver					
Broccoli					
Tomato, fresh or canned					
Cantalope					
Watermelon					
Baked potato					
Asparagus					
Tomato juice					
Tomato soup					
Green peas					
Ready-to-eat cereals such as Chex, Corn Flakes, Rice Krispies, Frosted Flakes, Raisin Bran, Cheerios, Apple Jacks, Sugar Pops					
Carrots					
Vegetable soup, canned					
Pumpkin pie					
Mixed vegetables					
Braunschweiger					
Apricots					
Peaches					
Cherries, red sour					
Milk					

TURN THE PAGE AND CONTINUE

FOOD ITEM	(Check Appropriate Box) Everytime	Most of the Time	Some of the Time	Seldom	Never
Margarine or butter					
Brussel sprouts					
Cauliflower, raw or cooked					
Cranberry juice cocktail					
Orange or orange juice					
Pineapple or pineapple juice					
Strawberries					
Grapefruit or grapefruit juice					
Honeydew melon					
Tang					
Hi-C or Hawaiian Punch fruit drink					
Green pepper					
Cabbage (cooked, raw, slaw)					
V-8 vegetable juice					
Turnips					
Avocado					
Sauerkraut					
Liver pudding					
Blackberries					
Tangerine					
French fries					
Squash, yellow summer					
Green beans					
Lima beans					
Bean sprouts					
Black eye or field peas					
Okra					
Spaghetti with tomato-meat sauce					
Banana					
Blueberries					
White potatoes (all except baked or fried)					
Lemonade (frozen or dry mix)					

S-150 Regional Project
Form S-8 Summer
Subject No. _____
Date ___________

Subject_______________

FOOD FREQUENCY

How often do you eat the following foods for snacks?

Frequency Scale:
1. Eaten two or more times daily
2. Eaten one time daily
3. Eaten three to four times per week
4. Eaten at least once per week
5. Eaten less than once per week
6. Never eaten
7. Eaten when in season only

FOOD ITEM	EATING FREQUENCY (Circle Appropriate Number)						
Greens (turnip, mustard, collards, kale, creases)	1	2	3	4	5	6	7
Sweet potato	1	2	3	4	5	6	7
Squash, winter (butternut, acorn)	1	2	3	4	5	6	7
Spinach, cooked or raw	1	2	3	4	5	6	7
Liver	1	2	3	4	5	6	7
Broccoli	1	2	3	4	5	6	7
Tomato, fresh or canned	1	2	3	4	5	6	7
Cantalope	1	2	3	4	5	6	7
Watermelon	1	2	3	4	5	6	7
Baked potato	1	2	3	4	5	6	7
Asparagus	1	2	3	4	5	6	7
Tomato juice	1	2	3	4	5	6	7
Tomato soup	1	2	3	4	5	6	7
Green peas	1	2	3	4	5	6	7
Ready-to-eat cereals such as Chex, Corn Flakes, Rice Krispies, Frosted Flakes, Raisin Bran, Cheerios, Apple Jacks, Sugar Pops	1	2	3	4	5	6	7
Carrots	1	2	3	4	5	6	7
Vegetable soup, canned	1	2	3	4	5	6	7
Pumpkin pie	1	2	3	4	5	6	7
Mixed vegetables	1	2	3	4	5	6	7
Braunschweiger	1	2	3	4	5	6	7
Apricots	1	2	3	4	5	6	7

TURN THE PAGE AND CONTINUE

FOOD ITEM	EATING FREQUENCY (Circle Appropriate Number)						
Peaches	1	2	3	4	5	6	7
Cherries, red sour	1	2	3	4	5	6	7
Milk	1	2	3	4	5	6	7
Margarine or butter	1	2	3	4	5	6	7
Brussel sprouts	1	2	3	4	5	6	7
Cauliflower, raw or cooked	1	2	3	4	5	6	7
Cranberry juice cocktail	1	2	3	4	5	6	7
Orange or orange juice	1	2	3	4	5	6	7
Pineapple or pineapple juice	1	2	3	4	5	6	7
Strawberries	1	2	3	4	5	6	7
Grapefruit or grapefruit juice	1	2	3	4	5	6	7
Honeydew melon	1	2	3	4	5	6	7
Tang	1	2	3	4	5	6	7
Hi-C or Hawaiian Punch fruit drink	1	2	3	4	5	6	7
Green pepper	1	2	3	4	5	6	7
Cabbage (cooked, raw, slaw)	1	2	3	4	5	6	7
V-8 vegetable juice	1	2	3	4	5	6	7
Turnips	1	2	3	4	5	6	7
Avocado	1	2	3	4	5	6	7
Sauerkraut	1	2	3	4	5	6	7
Blackberries	1	2	3	4	5	6	7
Tangerine	1	2	3	4	5	6	7
French fries	1	2	3	4	5	6	7
Squash, yellow summer	1	2	3	4	5	6	7
Green beans	1	2	3	4	5	6	7
Lima beans	1	2	3	4	5	6	7
Bean sprouts	1	2	3	4	5	6	7
Black eye or field peas	1	2	3	4	5	6	7
Okra	1	2	3	4	5	6	7
Spaghetti with tomato/meat sauce	1	2	3	4	5	6	7
Banana	1	2	3	4	5	6	7
Blueberries	1	2	3	4	5	6	7
White potatoes (all except baked or fried)	1	2	3	4	5	6	7
Lemonade (frozen or dry mix)	1	2	3	4	5	6	7
Liver pudding	1	2	3	4	5	6	7

S-150 Regional Project
Form S-7 Summer
Subject No. _____
Date ___________

Subject_______________

FOOD FREQUENCY

How often do you eat the following foods at meals?

Frequency Scale:

1. Eaten two or more times daily
2. Eaten one time daily
3. Eaten three to four times per week
4. Eaten at least once per week
5. Eaten less than once per week
6. Never eaten
7. Eaten when in season only

FOOD ITEM	EATING FREQUENCY (Circle Appropriate Number)						
Baked potato	1	2	3	4	5	6	7
Tomato juice	1	2	3	4	5	6	7
Green Peas	1	2	3	4	5	6	7
Cantalope	1	2	3	4	5	6	7
Broccoli	1	2	3	4	5	6	7
Spinach, cooked or raw	1	2	3	4	5	6	7
Sweet potato	1	2	3	4	5	6	7
Ready-to-eat cereals, such as Chex, Corn Flakes, Rice Krispies, Frosted Flakes, Raisin Bran, Cheerios, Sugar Pops	1	2	3	4	5	6	7
Tomato Soup	1	2	3	4	5	6	7
Asparagus	1	2	3	4	5	6	7
Watermelon	1	2	3	4	5	6	7
Liver	1	2	3	4	5	6	7
Squash, winter (butternut, acorn)	1	2	3	4	5	6	7
Greens (turnip, mustard, collards, kale, creases)	1	2	3	4	5	6	7
Tomato (fresh or canned)	1	2	3	4	5	6	7
Vegetable soup, canned	1	2	3	4	5	6	7
Mixed vegetables	1	2	3	4	5	6	7
Apricots	1	2	3	4	5	6	7
Cherries, red sour	1	2	3	4	5	6	7
Margarine or butter	1	2	3	4	5	6	7
Cauliflower, raw or cooked	1	2	3	4	5	6	7
Orange or orange juice	1	2	3	4	5	6	7
Strawberries	1	2	3	4	5	6	7

TURN THE PAGE AND CONTINUE

FOOD ITEM	EATING FREQUENCY (Circle Appropriate Number)						
Honeydew Melon	1	2	3	4	5	6	7
Hi-C and Hawaiian Punch fruit drinks	1	2	3	4	5	6	7
Cabbage (cooked, raw, slaw)	1	2	3	4	5	6	7
Turnips	1	2	3	4	5	6	7
Sauerkraut	1	2	3	4	5	6	7
Tangerine	1	2	3	4	5	6	7
Squash, yellow summer	1	2	3	4	5	6	7
Lima beans	1	2	3	4	5	6	7
Black eye or field peas	1	2	3	4	5	6	7
Banana	1	2	3	4	5	6	7
Blueberries	1	2	3	4	5	6	7
Lemonade (frozen or dry mix)	1	2	3	4	5	6	7
Carrots	1	2	3	4	5	6	7
Pumpkin pie	1	2	3	4	5	6	7
Braunschweiger	1	2	3	4	5	6	7
Peaches	1	2	3	4	5	6	7
Milk	1	2	3	4	5	6	7
Brussel sprouts	1	2	3	4	5	6	7
Cranberry juice cocktail	1	2	3	4	5	6	7
Pineapple or pineapple juice	1	2	3	4	5	6	7
Grapefruit or grapefruit juice	1	2	3	4	5	6	7
Tang	1	2	3	4	5	6	7
Green pepper	1	2	3	4	5	6	7
V-8 vegetable juice	1	2	3	4	5	6	7
Avocado	1	2	3	4	5	6	7
Blackberries	1	2	3	4	5	6	7
French fries	1	2	3	4	5	6	7
Green beans	1	2	3	4	5	6	7
Bean sprouts	1	2	3	4	5	6	7
Spaghetti with meat sauce	1	2	3	4	5	6	7
Okra	1	2	3	4	5	6	7
White potatoes (all except fried and baked)	1	2	3	4	5	6	7

S-150 Regional Project

Form S2-Child is Respondent

Subject____

State______________Station________________Year 1 or 3_______________

This is a study of some of your opinions. There is no right answer for any statement. The best answer is what you feel is true of yourself. Check ( ) one box after each question.

	A Strongly Agree	B Agree	C Disagree	D Strongly Disagree
1. On the whole, I am satisfied with myself. . .				
2. At times I think I am no good at all. . .				
3. I feel that I have a number of good qualities . . .				
4. I am able to do things as well as most people. . .				
5. I feel I do not have much to be proud of. . .				
6. I certainly feel useless at times . . .				
7. I feel I am a person of worth, at least on an equal plane with others . .				
8. I wish I could have more respect for myself . . .				
9. All in all, I am inclined to feel that I am a failure . . .				
10. I take a positive attitude toward myself . . .				

APPENDIX B

FOOD SOURCES

Table A

Food Sources of Vitamin A

Food	Serving Size	Vitamin A IU/Serving
Excellent Sources (> 2,900 IU/Serving)		
Liver	3 ounces	45,390
Sweet Potato	1 medium	9,230
Carrots	½ cup	8,140
Spinach	½ cup	8,100
Mixed Vegetables, Frozen	½ cup	4,505
Winter Squash	½ cup	4,305
Greens, Turnip, Kale, Mustard	½ cup	4,135
Pumpkin Pie	1 piece	3,210
Vegetable Soup, Canned	1 cup	2,940
Good Sources (2,899-1,500 IU/Serving)		
Watermelon	1 wedge, 4x8 inch	2,510
Broccoli	½ cup	2,405
Cantaloupe	¼ medium	2,310
Apricot	½ cup	2,245
Braunschweiger		1,850
Fair Sources (1,499-450 IU/Serving)		
Cereals	1 cup	~ 1,200
Tomato	1 medium	1,110

Table A (Continued)

Food	Serving Size	Vitamin A IU/Serving
Tomato Soup	1 cup	1,000
Tomato Juice	½ cup	970
Cherries, Red Sour	½ cup	830
Asparagus	½ cup	765
Green Peas	½ cup	585
Peaches	½ cup	550
Milk, Skim or Low-Fat, Fortified	1 cup	500
Margarine	1 tablespoon	470
Butter	1 tablespoon	430

Table B

Food Sources of Ascorbic Acid

Food	Serving Size	Ascorbic Acid mg/Serving
Excellent Sources (> 35 mg)		
Orange	1 medium or ½ cup juice	66.0
Brussels Sprouts	½ cup	63.0
Tang	½ cup	54.5
Broccoli	½ cup	52.5
Cantaloupe	¼ medium	45.0
Grapefruit	½ medium	44.0
Strawberries	½ cup	44.0
Cranberry Juice	½ cup	40.5
Pineapple Juice	½ cup	40.0
Cauliflower	½ cup	37.0
Good Sources (20-34 mg)		
Greens	½ cup	34.0
Honeydew Melon	1/10 medium	34.0
Baked Potato	1 medium	31.0
Watermelon	1 wedge	30.0
Tomato	1 medium	28.0
Tangerine	1 medium	27.0
Sweet Potato	1 medium	25.0
Spinach	½ cup	25.0
Green Pepper	¼ medium	23.5
Liver	3 ounces	23.0

Table B (Continued)

Food	Serving Size	Ascorbic Acid mg/Serving
Avocado	½ medium	22.0
Cabbage	½ cup	21.0
Asparagus	½ cup	20.5
Tomato Juice	½ cup	19.5
Fair Sources (7-19 mg)		
Turnips	½ cup	17.0
Sauerkraut	½ cup	16.5
Cereals	1 ounce	15.0
Blackberries	½ cup	15.0
Black-Eyed Peas	½ cup	14.0
V-8 Juice	3/4 cup	13.5
Hi-C	½ cup	13.5
Winter Squash	½ cup	13.5
Spaghetti with Meat Sauce	1 cup	13.5
Tomato Soup	1 cup	12.0
Banana	1 medium	12.0
Yellow and Summer Squash	½ cup	11.5
Lima Beans	½ cup	11.0
French Fries	10 strips	11.0
White Potatoes	½ cup	10.5
Okra	½ cup	10.5
Bean Sprouts	½ cup	10.0
Blueberry	½ cup	10.0
Pineapple	½ cup	9.0

Table B (Continued)

Food	Serving Size	Ascorbic Acid mg/Serving
Lemonade	½ cup	8.5
Green Beans	½ cup	7.5
Green Peas	½ cup	7.0

APPENDIX C

BIOCHEMICAL NUTRIENT ANALYSIS

Neeld-Pearson Method for Vitamin A and Beta-Carotene

Reagents

1. Ethanol, 95 percent (v/v), AR.

2. Petroleum ether, reagent (pesticide) grade.

3. Chloroform, anhydrous, AR.

4. Trifluoroacetic acid reagent. Mix 1 vol of trifluoroacetic acid (CF_3COOH), AR, with 2 vol of anhydrous chloroform just prior to use. This solution is stable for 4 hours at 25°C.

5. Vitamin A stock standard, 160 mcg/ml. Transfer 16.0 mg of all-*trans*-retinyl acetate (Sigma Chemical Company, St. Louis, MO) to a 100 ml volumetric flask and dilute to volume with anhydrous chloroform.

6. Vitamin A working standard. Pipet 2.5, 5.0, 7.5, and 10.0 ml of the stock standard (160 mcg/ml) into 100 ml volumetric flasks and dilute to volume with anhydrous chloroform to obtain working standards with vitamin A concentrations of 4.0, 8.0, 12.0, and 16.0 mcg/ml. These standards are stable for one week at 4 to 8°C if protected from light. Preparation of standards and all analytical operations must be performed in nonactinic or very low intensity light.

7. Beta-carotene stock standard, 200 mcg/ml. Transfer 20.0 mg of synthetic crystalline beta-carotene (Sigma Chemical Co., St. Louis, MO) to a 100 ml volumetric flask. Dissolve in approximately 4 ml of chloroform, and then dilute to volume with petroleum ether.

8. Beta-carotene working standard. Pipet 10.0 ml of the 200 mcg/ml standard into a 100 ml volumetric flask and dilute to volume with petroleum ether to obtain a concentration of 20.0 mcg/ml. Then transfer 2.5, 5.0, 10.0, 15.0, and 20.0 ml of the 20.0 g/ml standard to a 100 ml volumetric flask and dilute to volume with petroleum ether to obtain working standards with concentrations of 0.5, 1.0, 2.0, 3.0, and 4.0 mcg/ml. These standards are stable for only a few hours at 25°C and should be made up fresh each time an analysis is performed. All standard solutions <u>must</u> be protected from <u>direct</u> light.

Procedure

1. Pipet 1.0 ml[1] of serum into respective 15 ml glass-stoppered centrifuge tubes.

2. Pipet 2.0 ml of 95 percent (v/v) ethanol, stopper, and mix well with a vortex mixer.

3. Add 3.0 ml of petroleum ether and place tubes in a Kraft "Shaker in the Round" (Kraft Apparatus, Inc., Queens, NY) or some other suitable shaker to extract vitamin A and the carotenes into the petroleum ether phase.[2]

4. Centrifuge the stoppered tubes for 10 min. at 2500 rpm.

5. Carefully pipet off 2.0 ml of the petroleum ether phase (upper layer) and transfer into a dry cuvet[3] (e.g., 10 x 75 mm Coleman cuvet). Read the absorbance at 450 nm in a suitable spectrophotometer against a petroleum ether blank without delay to prevent evaporation of solvent and destruction of carotenoids by light. Mark this reading $\underline{A}_1$.

6. Evaporate the contents of the cuvets to dryness in a 50°C water bath with the aid of a fine stream of nitrogen. After removing the cuvets from the water bath, dry each one carefully with nonabrasive paper (to prevent scratching or marking them).

7. Add 0.1 ml of chloroform to each cuvet and mix briefly with a vortex mixer.

8. Add 1.0 ml of trifluoroacetic acid reagent to the cuvet serving as blank, mix, and set spectrophotometer to 0 absorbance at 620 nm.

9. Add forcefully[4] (to facilitate immediate mixing) 1.0 ml of trifluoroacetic acid reagent to all other cuvets, and the reading at 620 nm at exactly 2s after addition of the reagents. (Add the trifluoroacetic acid reagent only to one cuvet at a time so that readings may be taken as require required.) CAUTION: Trifluoroacetic acid is a strong acid and care should be exercised to prevent spilling or splattering it.

Best results are obtained if the trifluoroacetic acid reagent is added forcefully with an automated pipet. If a recorder is used, the absorbance value can be read at the peak of inflection point after the initial surging peak caused by the introduction of the trifluoroacetic acid reagent. This second peak or inflection point occurs about 2s after the introduction of the color reagent. Mark this reading $\underline{A}_2$.

Appendix C Reference Notes

[1] 1.5 ml of serum was utilized after preliminary trials resulted in improved values.

[2] Note. A Shaker in the Round was not available in the experimental laboratory. The researcher stoppered the tubes with a rubber stopper and vigorously inverted and shook for approximately one minute.

[3] Square, glass microcuvette.

[4] An Eppendorf pipet delivered the reagent directly into the microcuvette.

Calculations of Vitamin A and Beta-Carotene

Beta-Carotene. Determine the amount of beta-carotene per ml (see A, reading in step 5 of Procedure) from the carotene standard curve and carry out the following calculations:

mcg beta-carotene/100 ml serum = mcg beta-carotene/ml x 3.0 x 100

where

3.0 = vol petroleum ether containing the beta-carotene from 1.0 ml of serum after extraction
100 = conversion factor from mcg/ml to mcg/100 ml.

Vitamin A. For accurate calculation of the vitamin A content, it is necessary to correct for the absorbance contributed by carotenes at 620 nm:

$$A_3 = A_2 - (F \times A_1)$$

where

A_1 = absorbance of carotene at 450 nm (step 5).

A_2 = absorbance at 620 nm due to both carotene and vitamin A (step 9).

A_3 = absorbance at 620 nm of vitamin A (corrected for absorbance contributed by beta-carotene).

F = factor which converts the carotene absorbance at 450 nm (step 5) into the equivalent absorbance at 620 nm in the color reaction (step 9).

$$F = \frac{A_{620} \text{ of carotene using vitamin A procedure}}{A_{450} \text{ of petroleum ether solution of carotene}}$$

There have been reports indicating considerable variation in the value of this factor. The authors have also found a factor different from that given in the original Neeld-Pearson report. Therefore, each laboratory must determine its own factor.

After A_3 has been found, the actual concentration of vitamin A per 100 ml of serum is calculated as follows:

mcg vitamin A (free alcohol)/100 ml

$$= \frac{A_3 \text{ x mcg retinyl acetate standard/cuvet}}{A_{620} \text{ retinyl acetate standard}} \text{ x } \frac{3}{2} \text{ x } 100 \text{ x } 0.872$$

or

$$\text{g vitamin A/100 ml} = \frac{A_3 \text{ x mcg retinyl acetate standard/cuvet}}{A_{620} \text{ retinyl acetate standard}} \text{ x}$$

130.8

where

3 = volume of the petroleum ether extract of 1.0 ml serum.

2 = aliquot of the petroleum ether extract used for the assay.

100 = conversion of mcg retinyl acetate/ml to mcg retinyl acetate/100 ml.

0.872 = ratio of molecular mass of retinol to molecular mass of retinyl acetate. Thus, this factor corrects for the use of retinyl acetate instead of retinol as the standard.

Normal Values

Vitamin A - 20-65 mcg/100 ml serum.

Beta-carotene - 60-200 mcg/100 ml serum.

Calibration of the Standard Curves for Vitamin A and Beta-Carotene

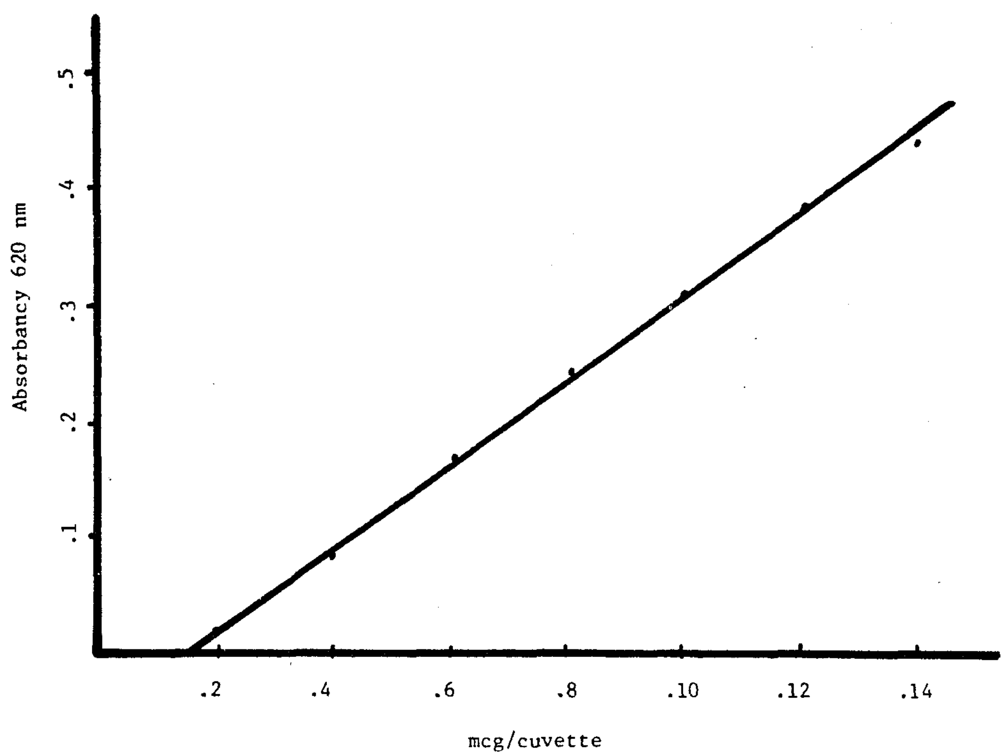
Beta-Carotene. Place beta-carotene working standards in concentrations of 0.5, 1.0, 2.0, 3.0, and 4.0 mcg/ml into appropriate cuvets (e.g., 10 x 75 mm Coleman cuvets), and read the absorbance at 450 nm against a petroleum ether blank. Plot beta-carotene concentration (mcg/ml) against absorbance.

For the purpose of calculating the carotene correction factor F for the vitamin A procedure, 2.0 ml of each of the beta-carotene standards is treated as a sample, beginning with step 6 of the vitamin A procedure. The average ratio of absorbance at 620 nm/concentration of beta-carotene (in mcg/ml) is then calculated and used in the computation of the beta-carotene correction factor F.

Vitamin A. Pipet 0.1 ml of each retinyl acetate working standard into cuvets and treat as in vitamin A procedure. Plot mcg retinyl acetate/cuvet against A_{620}.

Source: Tietz, N.W. Fundamentals of clinical chemistry. Philadelphia: W.B. Saunders, 1976.

Vitamin A Standard Curve



A standard factor (0.055) was computed from a regression equation, and vitamin A values were calculated from the standard curve.

Beta-Carotene Standard Curve

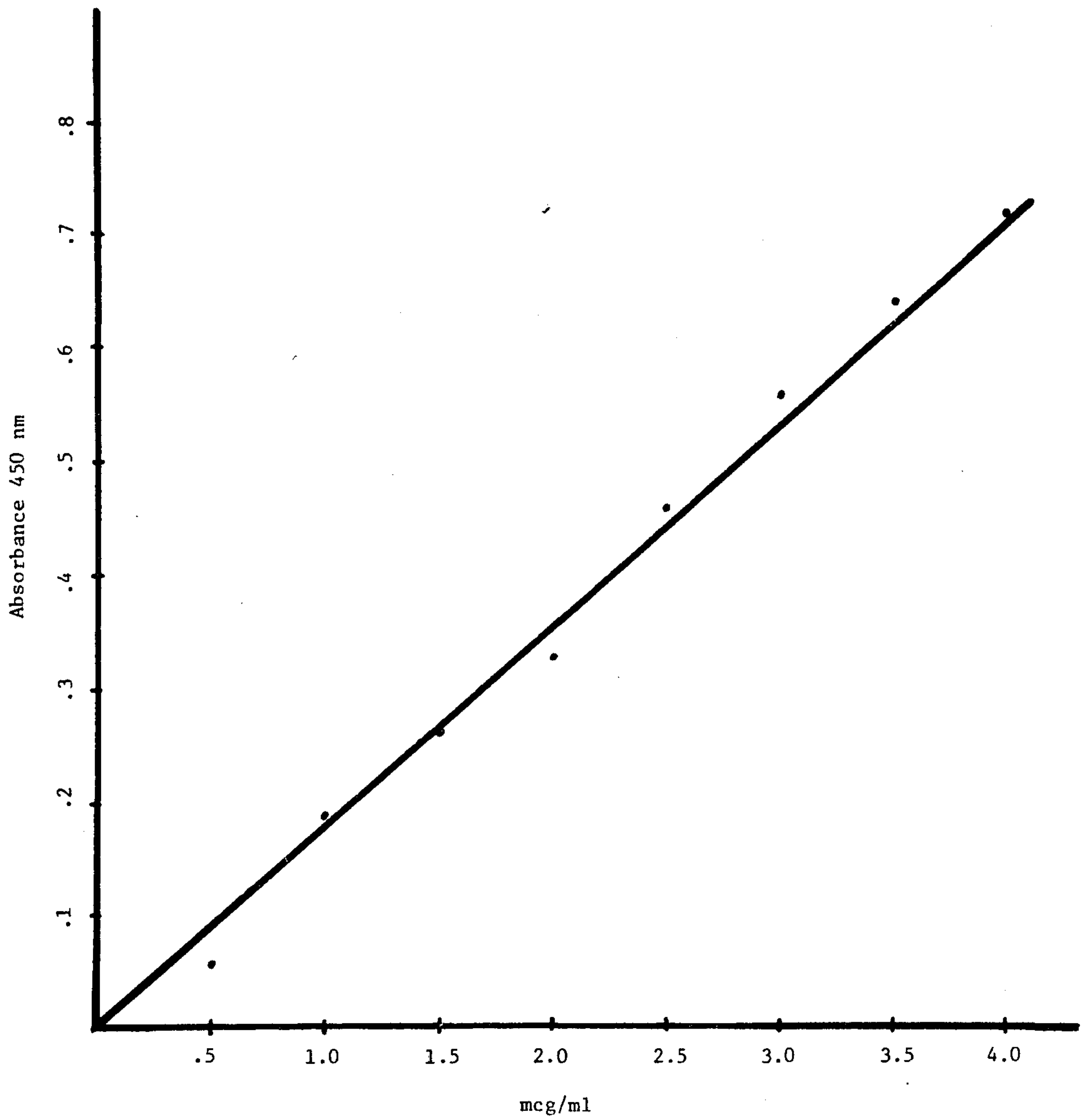


Table C

Individual Data for Vitamin A and Beta-Carotene

Subject	Beta-Carotene (mcg/100 ml)	Vitamin A (mcg/100 ml)
001	292.2[a]	39.3
002	200.8	41.5
004	125.0	40.5
007	121.7	47.9
009	137.8	49.4
011	232.2	32.9
012	149.1	52.1
013	15.56	30.8
014	81.95	42.4
015	125.6	49.6
016	167.8	31.5
017	132.0	47.6
018	84.4	36.8
020	37.8	-
025	51.1	49.9
026	245.1	59.7
027	48.9	54.7
029	8.9	43.9
030	165.6	40.9
031	63.3	35.4
035	66.7	53.6
037	41.1	36.1
038	100.0	52.0
039	99.2	51.5
041	83.9	45.1
042	70.0	43.7
043	27.8	64.5
044	168.9	63.9
046	140.0	51.6
048	126.7	65.8
049	33.3	34.0
050	137.8	41.3
051	104.4	41.1
052	80.0	36.2
053	151.1	31.4
054	5.1	54.0
055	134.4	33.5
056	148.9	65.2
058	198.9	51.7
059	160.6	41.5

Table C (Continued)

Subject	Beta-Carotene (mcg/100 ml)	Vitamin A (mcg/100 ml)
061	202.2	51.2
062	273.3	53.9
063	200.0	41.8
064	160.0	16.5
065	48.9	45.6
066	80.6	42.8
068	72.8	35.8
069	210.0	39.3
070	153.3	39.0
072	197.8	47.1
073	266.7	46.7
074	124.4	37.1
075	141.1	41.8
076	101.7	29.4
080	86.7	34.1
081	59.4	29.4
083	253.3	59.9
085	41.7	44.3
086	137.8	38.9
087	175.0	33.6
089	84.4	39.0
090	78.3	42.9
091	187.2	68.5
092	100.0	73.1
093	275.0	53.1
094	74.4	54.8
095	98.3	50.2
096	224.4	61.8
097	37.8	36.1
098	105.6	53.9
099	100.6	46.5
100	48.9	54.6
101	49.4	47.3
102	140.0	51.4
103	139.4	55.7
105	155.0	47.8
106	73.3	39.0
108	150.0	39.9
109	26.1	48.2
111	95.0	51.1
112	252.2	35.9
113	87.2	40.7

Table C (Continued)

Subject	Beta-Carotene (mcg/100 ml)	Vitamin A (mcg/100 ml)
114	231.1	58.5
115	86.7	52.8
116	105.6	44.6
117	4.4	54.8
118	114.4	37.3
119	76.1	31.8
120	78.3	57.0
122	27.2	48.3
123	127.8	66.6
124	97.9	38.0
126	58.9	39.4
127	125.0	40.3
129	96.7	49.4
130	145.0	67.3
131	266.7	69.7
133	97.8	42.9
134	93.3	45.0
135	61.1	40.1
137	83.4	41.1
138	102.2	43.7
139	184.4	61.2
140	122.2	51.9
141	117.6	45.6
142	123.3	37.2
143	65.6	59.5
146	96.7	48.5
147	98.9	65.3
148	232.8	62.4
150	93.3	50.4
151	152.2	50.9
152	43.4	73.3
153	71.1	46.4
154	82.2	47.2
155	83.3	48.4
156	202.8	47.9
157	2.02	60.5
158	43.9	44.9
159	83.3	42.5
160	17.8	53.4
161	43.4	45.5
162	203.3	56.6
163	69.5	57.7

Table C (Continued)

Subject	Beta-Carotene (mcg/100 ml)	Vitamin A (mcg/100 ml)
164	150.0	41.6
165	82.1	38.0
166	133.9	44.6
167	135.6	40.9
168	182.8	39.4
169	107.8	44.0
170	116.7	47.1
171	171.8	44.9
172	145.0	48.8
173	168.3	51.4
174	182.8	52.4
175	279.8	55.3
176	163.9	64.5
177	257.8	71.1
178	161.0	73.1
179	210.6	65.4
180	270.0	60.5
183	88.9	61.6
184	231.0	60.0
185	231.1	52.8
186	108.3	56.1
188	194.4	57.9
189	132.2	58.4
190	167.2	52.9
192	121.1	47.8
193	185.7	66.5
194	184.4	54.8
195	247.8	53.5
196	130.0	58.7
197	257.2	95.1
198	158.3	58.4
199	242.5	42.3
200	159.7	60.1

[a]Each value is a mean two samples.

APPENDIX D

SUPPLEMENTARY ANALYSIS TABLES

Table D

Descriptive Summary of Income and Dietary Intake

Based on 24-Hour Recall by Age of Girls

	Age (Years)					
	12 (n=84)		14 (n=77)		16 (n=37)	
Variable	Mean	SD	Mean	SD	Mean	SD
Income, per capita	\$6193	3521[a]	\$5591	3989	\$4162	2299
Vitamin A, IU	6816	5652	5589	5518	5005	3800
Vitamin A, mcg Retinol Equivalents	1918	1636	1476	1201	1487	1204
Ascorbic Acid, mg	163	363	173	308	101	86
Energy, kcals	2266	593	2313	726	2263	790

[a]Including vitamin and mineral supplements

Table E

Descriptive Summary of Income and Dietary Intake

Based on 24-Hour Recall by Race[a]

	White (n=114)		Black (n=84)	
Variable	Mean	SD	Mean	SD
Income, per capita	$6832	34.4	$3887	3080
Vitamin A, IU	6073	4571	5878	6251
Vitamin A, mcg Retinol Equivalents	1658	1131	1669	1735
Ascorbic Acid, mg	188	386	111	135
Energy, kcals	2361	657	2150	651

[a]Including vitamin and mineral supplements.

Table F

Percentile Ranks of Serum Beta-Carotene Levels

For Adolescent Girls

Percentile Ranks	n	Range (mcg/100 ml)
100-91	15	232.9 - 378.0
90-81	16	187.3 - 232.8
80-71	16	160.1 - 187.2
70-61	16	137.9 - 160.0
60-51	15	124.5 - 137.8
50-41	16	100.1 - 124.4
40-31	16	84.5 - 100.0
30-21	15	73.4 - 84.4
20-11	12	44.0 - 73.3
10- 0	16	2.2 - 43.9
	Total 157	

Note. Mean = 130.9 $\pm$ 70.6 mcg/100 ml.

Table G

ANOVA for Dietary Intake and Serum Levels

of Vitamin A and Ascorbic Acid

and Age of Girls

Variable	f	p
Intake		
Ascorbic Acid, mg	0.75	.474
Vitamin A, IU	1.90	.152
Vitamin A, mcg, Retinol Equivalents	2.37	.095
Retinol, mcg	0.46	.629
Beta-Carotene, mcg	1.89	.155
Percentage RDA		
Ascorbic Acid	1.16	.316
Retinol Equivalents	2.37	.096
Intake/1000 kcals		
Ascorbic Acid, mg	0.68	.507
Vitamin A, IU	2.62	.076
Retinol Equivalents, mcg	3.03	.050[a]
Retinol, mcg	0.59	.558
Beta-Carotene, mcg	2.40	.093
Serum Levels		
Beta-Carotene, mcg/100 ml	12.20	.0001[b]
Vitamin A, mcg/100 ml	4.36	.014

[a] df = 2,196

[b] df = 2,155

Table H

t Tests for Dietary Intake and Serum Levels for

Vitamin A and Ascorbic Acid and Race

Variable	Whites $\overline{X}$	Blacks $\overline{X}$	t	p
Intake				
Ascorbic Acid, mg	188.4	111.4	1.9742	.05
Vitamin A, IU	6073	5878	0.2415	.810
Vitamin A, mcg, Retinol Equivalents	1658	1669	-0.0550	.956
Retinol, mcg	0.82	2.20	-1.1415	.257
Beta-Carotene, mcg	1.24	1.41	-0.7640	.4461
Percentage RDA				
Ascorbic Acid	370	216	1.9652	.05
Retinol Equivalents	207	209	-0.0550	.956
Intake/1000 ,cals				
Ascorbic Acid, mg	81.2	51.4	1.7032	.091
Vitamin A, IU	2545	2624	-0.2745	.784
Vitamin A, mcg, Retinol Equivalents	707	747	-0.5039	.615
Retinol, mcg	0.361	0.744	-1.069	.288
Beta-Carotene, mcg	0.53	0.64	-1.1623	.247
Supplements				
Vitamin A, IU	572	298	0.7640	.446
Vitamin A, mcg, Retinol Equivalents	47.7	17.9	1.2251	.222

Table H (Continued)

Variable	Whites $\bar{X}$	Blacks $\bar{X}$	*t*	*p*
Supplements (Continued)				
Ascorbic Acid, mg	89.3	13.6	2.0565	.042
Energy, kcals	2361	2150	2.2384	.026
Serum Levels				
Vitamin A, mcg/100 ml	48.9	48.9	0.0491	.9609
Beta-Carotene, mcg/100 ml	123.0	139.6	-1.4877	.139

Table I

Rank Order of Vitamin A and Ascorbic Acid Foods

Most Preferred by Adolescent Girls

Food	Cumulative Percentage of Subjects[a]
Milk	78.4
French Fries	77.2
Orange	75.3
Spaghetti with Meat Sauce	70.1
Strawberry	68.4
Watermelon	67.2
Cereal	66.5
Lemonade	61.0
Banana	60.5
Peach	59.2
Tangerine	54.6
Hi-C	54.4
Baked Potato	50.5
Pineapple	46.9
Butter	46.9
Tang	44.8
Cantaloupe	44.7
Carrots	44.4
White Potato	40.6
Blueberry	39.4
Grapefruit	39.2
Pumpkin Pie	38.1
Green Beans	35.9
Blackberry	35.1
Cherries	31.3
Vegetable Soup	28.1
Tomato	28.1
Honeydew Melon	27.1
Cabbage	25.4
Green Peas	24.4
Sweet Potato	24.4
Black-Eyed Peas	23.2
Okra	22.2
Lima Beans	22.1
Yellow Squash	19.2
Mixed Vegetables	18.6
Broccoli	17.9
Tomato Soup	17.3

Table I (Continued)

Food	Cumulative Percentage of Subjects[a]
Greens	16.2
Spinach	15.2
Apricot	14.9
Cauliflower	14.9
Liver	12.6
Turnip	12.4
Liver Pudding	11.9
Green Pepper	10.9
Sauerkraut	9.4
Cranberry Juice	9.2
Winter Squash	9.1
Tomato Juice	8.1
Brussels Sprouts	7.7
V-8 Juice	7.7
Asparagus	6.7
Bean Sprouts	6.2
Braunschweiger	3.6
Avocado	2.6

[a]Preferred every time or most of the time when food is available.

Table J

Rank Order of Vitamin A and Ascorbic Acid Foods

Least Preferred by Adolescent Girls

Food	Cumulative Percentage of Subjects[a]
Braunschweiger	92.8
Avodado	91.3
Asparagus	88.2
Bean Sprouts	87.6
V-8 Vegetable Juice	87.1
Brussels Sprouts	85.6
Tomato Juice	83.4
Sauerkraut	81.2
Cauliflower	81.0
Cranberry Juice	80.5
Liver Pudding	80.4
Liver	76.2
Turnips	75.7
Green Pepper	74.0
Winter Squash	73.6
Spinach	70.6
Yellow Squash	68.9
Okra	65.5
Honeydew Melon	65.1
Lima Beans	59.5
Apricot	58.7
Tomato Soup	58.4
Mixed Vegetables	57.8
Broccoli	57.2
Black-Eyed Peas	56.7
Cabbage	53.9
Cherries	51.8
Greens	51.7
Blueberry	50.3
Blackberries	48.5
Tomato	46.5
Sweet Potato	45.7
Vegetable Soup	44.9
Grapefruit	43.3
Pumpkin Pie	43.1
Green Peas	42.2
Cantaloupe	37.1
White Potato	33.3

Table J (Continued)

Food	Cumulative Percentage of Subjects[a]
Carrots	32.8
Pineapple	32.0
Tang	31.3
Green Beans	29.2
Tangerine	21.6
Banana	20.5
Baked Potato	20.4
Hi-C	19.7
Butter or Margarine	18.4
Lemonade	15.4
Peach	14.3
Strawberry	12.4
Watermelon	12.3
Milk	10.3
Spathetti with Tomato Sauce	9.3
Orange	8.8
Cereal	8.2
French Fries	4.7

[a]Preferred seldom or never eaten when food is available.

Table K

Food-Preference Responses for Selected Foods

	Percentage of Subjects				
Foods	Every Time	Most	Some	Seldom	Never
Greens	4.6	11.6	32.0	22.3	29.4
Sweet Potatoes	10.7	13.7	29.9	23.9	21.8
Winter Squash	2.0	7.1	17.3	19.8	53.8
Spinach	6.6	8.6	14.2	17.8	52.8
Liver	7.1	5.6	11.1	14.1	62.1
Broccoli	8.2	9.7	25.0	7.7	49.5
Tomato	12.8	15.3	25.5	18.9	27.6
Cantaloupe	24.9	19.8	18.3	16.8	20.3
Watermelon	41.5	25.6	20.5	10.8	1.5
Baked Potato	24.5	26.0	29.1	13.3	7.1
Asparagus	2.6	4.1	5.2	11.9	76.3
Tomato Juice	3.0	5.1	8.6	17.7	65.7
Tomato Soup	7.1	10.2	24.4	19.3	39.1
Green Peas	8.6	15.7	33.5	17.8	24.4
Cereal	36.1	30.4	25.3	6.7	1.5
Carrots	19.2	25.3	22.7	21.7	11.1
Vegetable Soup	9.2	18.9	27.0	23.0	21.9
Pumpkin Pie	21.8	16.2	18.8	16.2	26.9
Mixed Vegetables	9.3	9.3	23.7	22.7	35.1
Braunschweiger	1.0	2.5	3.6	9.6	83.2
Apricot	9.3	5.7	12.4	20.1	52.6
Peach	34.2	25.0	26.5	8.2	6.1
Cherries	19.5	11.8	16.9	20.5	31.3
Milk	62.9	15.5	11.3	5.7	4.6

Table K (Continued)

Foods	Percentage of Subjects				
	Every Time	Most	Some	Seldom	Never
Butter	17.3	29.6	34.7	13.3	5.1
Brussels Sprouts	4.6	3.1	6.7	12.8	72.8
Cauliflower	7.7	7.2	4.1	12.3	68.7
Cranberry Juice	7.7	1.5	10.3	19.5	61.0
Orange	51.0	24.2	16.0	6.7	2.1
Pineapple	30.9	16.0	21.1	16.0	16.0
Strawberry	51.8	16.6	19.2	6.7	5.7
Grapefruit	25.8	13.4	17.5	17.0	26.3
Honeydew	18.2	8.9	7.8	16.7	48.4
Tang	26.0	18.8	24.0	17.2	14.1
Hi-C	32.1	22.3	25.9	10.9	8.8
Green Pepper	6.2	4.7	15.0	21.2	52.8
Cabbage	14.0	11.4	20.7	19.2	34.7
V-8 Juice	4.1	3.6	5.2	19.6	67.5
Turnip	8.3	4.1	11.9	16.6	59.1
Avacado	1.5	1.0	6.2	12.9	78.4
Sauerkraut	4.7	4.7	9.4	15.1	66.1
Liver Pudding	5.7	6.2	7.7	12.4	68.0
Blackberry	24.7	10.3	16.5	16.0	32.5
Tangerine	35.6	19.1	23.7	10.8	10.8
French Fries	51.8	25.4	18.1	2.1	2.6
Yellow Squash	11.9	7.3	11.9	16.1	52.8
Green Beans	19.5	16.4	34.9	11.3	17.9
Lima Beans	9.7	12.3	18.5	21.0	38.5
Bean Sprouts	2.6	3.6	6.2	13.0	74.6
Black-Eyed Peas	13.4	9.8	20.1	21.1	35.6

Table K (Continued)

Goods	Percentage of Subjects				
	Every Time	Most	Some	Seldom	Never
Okra	13.4	8.8	12.4	12.4	53.1
Spaghetti	41.2	28.9	20.6	5.7	3.6
Banana	33.3	27.2	19.0	9.2	11.3
Blueberry	22.8	16.6	10.4	19.2	31.1
White Potato	22.4	18.2	26.0	17.2	16.1
Lemonade	39.5	21.0	23.6	8.7	6.7

Table L

Chi-Square Analysis of "Social" Snacking

Responses	Whites (114)	Blacks (83)	Chi-Square	df	p
Never	33	34	6.977	2	.0306
Sometimes	72	37			
Often	9	12			

Table M

Chi-Square Analysis of Snacking for Reason

"Food Looks Good"

Responses	Whites	Blacks	Chi-Square	df	p
Never	13	11	6.006	2	.0496
Sometimes	65	33			
Often	36	39			

Table N

Chi-Square Analysis of Snacking for Reason

"Something To Do"

	Age (Years)					
Response	12 (84)	14 (76)	16 (37)	Chi-Square	df	p
Never	46	29	16	10.394	4	.0343
Sometimes	26	41	14			
Often	12	6	7			

Table O

Chi-Square Analysis of Race and

Place Snacks Were Eaten

Place Snacks Eaten	Whites	Blacks	Chi-Square	df	p
Before Lunch					
Away	18	36	12.698	1	.0004
Home	50	27			
Before Dinner					
Away	6	14	7.494	1	.0062
Home					
After Dinner					
Away	4	11	6.454	1	.0111
Home	91	59			

Table P

Chi-Square Analysis of Age and Snacks Eaten at

Home and Away Before Lunch

	Age (Years)					
Place Snacks Eaten	12	14	16	Chi-Square	df	*p*
Away	13	28	13	13.200	2	.0014
Home	43	22	12			

Table Q

Summary of Positive Correlations Between Snack and

Total Intake of Vitamin A and Ascorbic Acid

	Before Lunch		Before Dinner		After Dinner		Total	
Nutrient	Vitamin A	Ascorbic Acid	Vitamin A	Ascorbic Acid	Vitamin A	Ascorbic Acid	Vitamin A	Ascorbic Acid
Vitamin A		.2478[a] .048	.3812 .0001	.2565 .0004	.2447 .003		.3991 .0001	.1491 .0380
Ascorbic Acid	.4029 .001	.7016 .0001	.1621 .0279	.2014 .0061	.4967 .0001	.8374 .0001	.4372 .0001	.7194 .0001

[a]Kendall's correlation coefficients and p value.