Exploring Snacking Habits of College Students

by

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(ABSTRACT)

Previous research has revealed that adolescents have the highest prevalence of unsatisfactory nutritional status and unstructured eating patterns. They also recognized the importance of snacks in the eating habits of this population group. The purpose of this study was to investigate the snacking habits of undergraduate college students, and their correlations with the population's general eating practices and response to nutrition education. Two hundred eighty four students taking a nutrition course undertook a term project in which they provided information on the percentage calories provided by protein, fat, carbohydrate and alcohol; their nutrient consumption in meals and snacks; and their vitamin/mineral supplement(s) usage toward the beginning of the class. Toward the end of the class, they answered questions on the effect of nutrition education on their eating habits for the overall diet and on vitamin/mineral supplement usage. They also reported their frequencies of meals and snacks, their snacks' food preferences, and responded to snacking perceptions. Correlational statistics were used to identify any significant relationships between all the variables. The data analysis revealed that the unstructured eating patterns of college students do not automatically mean unsatisfactory nutritional status and a fondness for just low nutrient dense foods. However, no specific trend could be detected between the snacking perceptions and the consumption practices of college students.

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Introduction

The role of nutrition in achieving optimal growth and development of children, in maintenance of optimal health in adults, and in prevention of disease has received increasing attention in recent years (Walser et al., 1984). Most people concern themselves with food several times daily, and there is undoubtedly no practice or habit that can influence the health of an individual as much as the decisions that are made with regard to the kinds and amount of foods consumed. Therefore, it is important that daily decision-making on this important aspect of health be properly guided and not conditioned by pseudoscientific or faddist influences (Krause and Mahan, 1984, p.2).

It has been detected by the Ten-State Nutrition Survey of 1968-1970 that adolescents had the highest prevalence of unsatisfactory nutritional status (Highlights, 1972). Furthermore, in a study of adolescents in Europe, North America and Australia, Truswell and Darnton-Hill reported that eating habits were characterized by missed meals, snacking, a fondness for fast and take away foods, the eating of unconventional meals, the questioning of parents' nutritional values, and the consumption of alcohol and soft drinks. They also found that adolescents display strong likes and dislikes and prefer high energy foods with some deficiencies of some minerals and macronutrients (Court, 1988). This high incidence of meal skipping, snack consumption, and snack-like meals suggest unstructured eating patterns among most adolescents. These unstructured patterns may contribute to inadequate intakes of certain nutrients. Thus, the challenge for nutrition educators

becomes how to educate adolescents to select nutrient-dense foods wherever and whenever they eat (Skinner et al., 1985). Furthermore; it has been obvious that because of the frequency of snacking, efforts toward recognizing the potential contribution of snacks to the total nutrient intake and improving the nutrient quality of common snacks should prevail (Bigler-Doughten et al., 1987).

Following are the definitions of some of the terms used in this study. Snacks were defined as what is eaten between meals or between time meals were normally consumed. Perceptions are impressions in the mind of the students perceived by their senses.

The purpose of this study was to investigate the snacking habits of undergraduate college students, and their correlations with the population's general eating practices and responses to nutrition education. The eating practices covered: percentages of calories provided by protein, fat, carbohydrate and alcohol; nutrient's intakes; and supplement's consumption. The researchers wanted and succeeded in developing instrument which could be used to investigate snacking perceptions. Such a questionnaire would be useful to detect the nature of eating habits and the predisposing attitudes which influence food consumption. This could help the nutrition educators to develop preventive programs which would address these specific attitudes and provide tips on the factors to focus on in their role of changing eating habits.

Review of Literature

This literature review will cover the following four topic areas:

1. Nutrient intakes of different groups and measurement standards.
    - The Recommended Dietary Allowances.
    - Validation of food records.
    - Food habits.
    - Nutrient intakes.
2. Eating habits of different groups.
    - Meals.
    - Skipping meals.
    - Snacking.
    - Alcohol consumption.
    - Dietary supplements.
3. Nutrition education.
4. Snacking attitudes.

Nutrient Intakes of Different Groups and Measurement Standards

Recommended Dietary Allowances

In 1980, the Committee on Dietary Allowances of the Food and Nutrition Board defined the Recommended Dietary Allowances (RDA's) as the levels of intake of essential nutrients considered, in their judgment on the basis of available scientific knowledge, to be adequate to meet the known nutritional needs of practically all healthy persons (Recommended Dietary Allowances, 1986). The primary purpose for developing these dietary allowances was to determine the amount of food that people required, so that it could be supplied in emergency situations, particularly warfare and for populations whose normal food supplies had been cut off. The first RDA's were published in May 1941 by the Food and Nutrition Board which came into existence this same year. Subsequently, the RDA's have undergone a number of revisions, with a new edition coming out approximately every five years (Caan and Margen, 1986).

The RDA's were calculated for population requirements on a mean intake plus two standard deviations above and below the mean which covered 97% of the population. Clearly, the RDA's were not meant to be the minimum requirements for health but safe levels for virtually all the population (Court, 1988). In 1985, Hegsted noted that several of the RDA's were so high that it was not possible to meet them by food. Similarly, Emery et al. in 1988, found the U.S. allowances more generous than the ones established by the United Kingdom. He stated that several nutrients, such as vitamin E and zinc, could not be attained without supplementation. On this ground, the analysis of a diet in terms of the RDA's could be misleading.

Two main reasons, referred to above, would be the cause of this misinterpretation. First, the daily allowances were intended as statements about populations rather than individuals. Second, the information could only be understood by appreciating the underlying philosophy: the U.S. RDA's included safety margins to provide for individual variations.

Thus consumption levels lower than the RDA's would not necessarily mean deficiency. To conclude that a deficiency exists, it would be necessary to demonstrate a nutritionally associated abnormality (Benton and Robert, 1988). However, the risk of a deficiency would increase with one-fourth of the population consuming 50% of of the RDA's or less (Kurinij et al., 1986).

Taking into account this safety margin, most of the researchers did not base their nutritional evaluations on an intake meeting 100% of the RDA's. Their criteria varied between 66% and 70% of the RDA's. Jakobovits et al. in 1977, considered an intake equal to or greater than two-thirds of the RDA for a nutrient to be adequate. Young and Lafortune, in 1957, considered an intake of below 70% of the allowances as being undesirably low. For Warwick and Williams, in 1987, the indicator of a risk of nutritional deficiency was 67% of the RDA's. Finally, in the nationwide food consumption surveys of the Department of Agriculture, a diet was labeled poor when it supplied less than two-thirds of the allowance for one or more nutrients. It seemed probable that such a level could be nutritionally inadequate over an extended period (Leverton, 1986).

However, as Leverton stated in 1985, these chosen criteria are open to criticism because the margin of safety that was included in the RDA's differed for different nutrients. Furthermore, these margins of safety for the various nutrients have never been stated in quantitative terms. Therefore, the following questions need to be asked: What percent of the RDA's should be met by what percent of the individuals in a survey before one can assume that most people are adequately nourished? When any given individual calculates his or her dietary intake, what percent of how many nutrients can fall below the RDA's without suggesting that that individual is at risk? The answers to these questions are left to the judgment of the researchers who should look at the RDA's with clear and careful thoughts (Gussow and Thomas, 1986).

Nevertheless, in spite of these weaknesses, it is clear that the RDA's are the only standard the researchers have for planning meals for institutions, for assessing nutritional status in dietary surveys, and even for deciding whether individual diets may be lacking something essential (Gussow and Thomas, 1986). Furthermore, The American Dietetic Association stated that the RDA's represent the best currently available assessment of safe and adequate intakes (ADA statement, 1987).

Validation of Food Records

As subjects may change their eating behavior or misreport food intake when participating in dietary studies, the necessity to validate records of food intakes was recognized (Warwick and Williams, 1987). However, validation, the demonstration that a method measured what it was intended to measure, requires that the truth be known; and for dietary intake that is the difficulty. Nevertheless, an accurate method, meaning that patient A's dietary assessment accurately reflects patient A's intake, would not be essential in order to produce valid and useful epidemiological research on diet and disease (Block, 1982).

No validation trial for a three-day diet record has been found in the literature, but quite a few investigations have been reported concerning the validity of a seven-day food record (Block, 1982). This common dietary assessment method, which appeared to rest on firmer ground than other methods, was the seven-day record of actual intake, with either weighing, measuring or estimating portion sizes. Several studies, by showing agreement between records obtained on two different occasions lent credence to a belief that diet records were accurate reflection of consumed diet (Block, 1982).

Two of these studies, one by Heady (1961) and the other by Morris et al. (1963), compared the records of bank employees repeated after an interval of one to nine months (Block, 1982). They found that for most nutrients the records agreed quite well. This validation was more likely to be

true because the method used in these studies involved a detailed record of all food consumed and measurement of portion size. A consistency, unrelated to intake, would have required the respondent to invent a detailed diet and measurements consistent over two twenty one-meals record. A suggestion that this was not what was occurring may be derived from the fact that certain nutrients were reported to be consumed in different amounts at different seasons (Block, 1982).

Furthermore, Gersovitz et al.(1978) found agreement between the mean values obtained by seven-day records and by actual weighing of intake (Block, 1982). Finally, in the same study, Gersovitz et al.(1978) attempted to validate the seven-day food record against actual intake. Using the regression analysis, they reported that a significant association of actual and recorded values, for individual data, was revealed in the first two days; but that accuracy of recording deteriorated in the last two days (Block, 1982). All these findings, and especially the last one, give an indirect validation to the three-day diet record, which is the method used in this study.

Food Habits

Food habits have been defined as the way in which individuals consume and utilize portions of the available food supply (Cosper and Wakefield, 1975). What people eat and the way in which they eat was another definition stated in the cover letter of the Journal of Human Nutrition (February 1977). According to Clark (1970) food habits are a result of education, sociological background and present situations.

In 1986, Marrale, et al., stated eleven factors affecting the dietary patterns of adolescents: (1) lack of time due to involvement in many activities; (2) priority of peer activities over eating; (3) lack of guidance in selection of meals away from home; (4) eating of most foods outside the home; (5) concern that certain foods cause or aggravate acne; (6) fear of obesity; (7) fear of underweight or

lack of muscle; (8) desire to excel in athletics; (9) exclusion of certain foods from the diet on a regular basis; (10) skipping of meals; and (11) lack of knowledge regarding nutritional needs.

Nutrient Intake of Various College Student Groups.

Several studies have looked at the nutrient intakes of various population groups. Except for iron and calcium, little consistency has been found in the results obtained by these different investigations. In most of the studies, the intake levels of these two nutrients were found to be below the adequate levels.

Driskell (1979) evaluated the nutritional status of 150 students attending Virginia Polytechnic Institute and State University during the spring quarter of 1977. She found that the mean intakes of kilocalories, protein, thiamin, riboflavin, niacin and ascorbic acid approximated the Recommended Dietary Allowances for these nutrients. However, most of the women did not consume sufficient iron. Thirty-seven percent of the women reported consuming less than 10 mg. dietary iron daily, the allowance for iron for this group being 18 mg. Jakobovits et al. (1977) reported the nutrient intakes of college women over a thirty-year period. The group characteristics of the diet included high intakes of protein and vitamin A, very high intakes of ascorbic acid, and low iron intakes. Mean intakes of riboflavin, niacin and calcium were slightly in excess of the RDA, with thiamin intakes falling just below the allowances.

The examination of the intake of young adult volonteers interested in eating a healthy diet revealed that none of the male subjects consumed less than 67% of the RDA for protein or any of the micronutrients. In females, intakes less than 67% of the RDA's were found for protein, thiamin and ascorbic acid (Warwick and Williams, 1987).

The following results were obtained from the analysis of adolescents' 24-hour food records in a southern Appalachian state. The mean nutrient intakes of boys met 100% of the RDA for all

nutrients except iron (80% of the RDA). The mean nutrient intake of girls met 100% and more of the RDA for protein, thiamin, riboflavin, niacin and vitamin C. The problem nutrients, for which the girls mean intakes were low at all eating occasions throughout the day, were calcium, iron and vitamin A. However, when daily intakes were analysed per 1000 Kcal., differences between the intakes of boys and girls were significant only for riboflavin (Skinner et al., 1985). The findings of this study support the common assumption also stressed by Schorr et al. (1972) that males' nutrient intakes are more adequate than those of females because males consume larger quantities of food. Schorr et al. (1972) in his study on teen-age food habits, reported that, as a group (combining both males and females), the percent of subjects consuming less than two-thirds of their ascorbic acid, calcium, vitamin A and iron allowances were 21, 44, 51 and 69 respectively.

As referred to previously, iron and calcium have been the two nutrients found deficient by most of the researchers studying the diets of different teenagers and college student groups. The following reports will give more support to this statement. A study of iron status in the U.S. population indicated a relatively high prevalence of impaired iron status in young adolescent boys and in older adolescent girls (Court, 1988). A 1980 U.S. review that reported a ten-state nutritional survey, and the Health and Nutrition Survey also found a substantial number of teenagers with iron deficiency (Court, 1988). Hertzler et al. (1976) collected information from 257 teenage girls in the tenth and eleventh grades. They found that nearly 75% of the girls consumed less than two-thirds of the iron allowance and 45% consumed less than one-half. According to Young and Lafortune (1957), the nutrients where college freshmen girls were least likely to meet allowances or where intakes were below desirable levels were calcium, iron and thiamin. Failure to use milk, either for its constipating or nauseating effects resulted in calcium intakes below 50% of the allowance. Finally, Stasch et al. (1970) described the frequency of drinking milk by freshman college students. One-third reported that they drank milk with every meal. An additional one-third drank milk at least once a day. Nine percent of females and three percent of males never drank milk. These observations reflected that approximately two-thirds of all students drank less milk at meals than the recommended four cups per day.

Few studies evaluated food consumption through rating of the diets consumed. The 1965 Food Consumption Survey found that about half of the U.S. households had food supplies described as good; that is, they met the RDA of the Food and Nutrition Board for seven nutrients. About one-fifth had food supplies called poor because they furnished less then two-thirds of the RDA in one or more of these seven nutrients. The remainder were fair, somewhere between good and poor (Clark, 1970). The groups with average diets low in more than one mineral or vitamin were all age groups of females nine years and over, boys twelve to seventeen and older men (seventy five and over) (Preliminary Report, 1969). Marrale et al. (1986) investigated the eating habits of undergraduate college students. Less then 25% of the subjects achieved a rating of good on their diary of food intake over a twenty-four hour period. More than 75% were rated as fair or poor. The standards of the rating were not given.

Only one study has reported the mean percentage of energy derived from protein, fat and carbohydrate. Skinner et al. (1985) analyzed the diets of adolescents in a southern Appalachian state,and found that an average of 39% of the energy was coming from fat, 13 to 14% from protein and 47 to 48% from carbohydrate.

Eating Habits of Different Groups

Meals.

The usual current sense of meal which has existed since the 13th century is the food eaten at one setting. However, it was actually an extension of the Old English sense, fixed time for eating (Webster dictionary, 1984). From the nutrition point of view, a meal should contain a complete

protein or two or more complementary proteins, sufficient calories for energy needs and a good percentage of the vitamin and mineral requirements (Krause and Mahan, 1984).

The results obtained by most of the researchers agreed with the fact that meals are characterized by a greater nutrient density than snacks (Ezell, 1985; Skinner et al., 1985; Bigler- Doughten and Jenkins, 1987). One exception has been reported by McCoy et al. (1986) who studied the nutrient content of snacks consumed by southern girls. He also found that the meals were more nutrient dense than the snacks, except for carbohydrate, riboflavin, thiamin and iodine.

Skipping Meals.

High school and college students are the group of the population with the highest possible incidence of skipped meals. This may be due mainly to their life-styles and to their flexible schedules.

A study of Appalachian adolescents found that 34% of the respondents skipped breakfast and 27% either skipped lunch or ate a snack type lunch, while only 6% skipped the evening meal (Skinner et al., 1985). Jacobovits et al. (1977) also found that the dinner was the least often missed meal with only 3% of the college women missing it more than twice a week. Fifty-three percent missed breakfast at least once a week and an even higher percentage 76% missed lunch, 69% for one to five times per week and 7% for six or seven times. Khan and Lipke (1982) obtained results similar to Skinner et al. (1985) with college women; however, with lower percentages. In their population, approximately one-fourth of the students (23%) skipped breakfast, 12% missed lunch and only 4% skipped the evening meal.

Snacking

Snack is defined by the Webster dictionary (1984) as a hurried or light meal as well as food eaten between meals. Snacking has long been one of the most difficult components of food intake to determine. Indeed, diet surveys had rather frequently omitted consideration of this part of daily consumption, for means of learning if non-meal intakes were inadequate, unreliable or both, being based primarily on what was recalled by the individual (Nutrition Reviews, 1984). However, several researchers have attempted to investigate this component of food intake.

Most frequently, a snack was defined as any food and/or beverage consumed at times other than the traditional meal time (Cosper and Wakefield, 1975; Khan, 1980). A slightly different definition was given by Khan and Lipke (1982). For them a snack was a food or beverage consumed between regular meals.

There are widespread misconceptions about snack foods, and they have often been described as junk foods or empty calories (Khan, 1980). As Thomas and Call (1973) indicated, many writers considered that eating between meals spoils the adolescent's appetite for regular meals and that food eaten between meals provides the teenager with a substantial proportion of his daily calorie requirements, but little else in the way of nutrients.

Nevertheless, findings from several studies indicated the contrary. McCoy et al. (1986) reported that snacks contributed more than empty calories to the dietary intakes of teenagers. However, it has been noticed by several studies (Skinner et al, 1985; Ezell,1985; McCoy et al, 1986) that snacks were of lesser nutrient densities than meals.

Skinner et al. (1985) investigated the snack patterns of adolescents in a southern Appalachian state. It appeared,on the basis of mean daily energy intakes, that snacks provided approximately one-third of the day's energy intake for both boys and girls. Although snacks were expected to

provide the same portion of the RDA for the other nutrients, this was not the case. Mean intakes of iron and vitamin A from snacks were less than 21% of the RDA. For girls the mean intakes of calcium and vitamin A were respectively 16% and 25% of the RDA. Another investigation of Appalachian adolescents' snack patterns revealed that snacks provided about one-third of the adolescents' daily caloric intakes, but that they had a low nutrient density, especially for calcium, iron and vitamin A (Ezell, 1985).

Khan and Lipke (1982) gave a more positive image about snacks. They found that without snacks, the desired energy level for all their college student subjects, the iron and calcium levels for women, and the vitamin A and thiamin levels for male nutrition majors would have been below the RDA's levels.

Finally, McCoy et al. (1986) looked at the nutrient contribution of snacks among southern girls. According to their findings, the snacks provided the following percentages of daily nutrient intake: 23% of energy, 14% of protein, 27% of carbohydrate, 22% of fat, 15% of the cholesterol (40 mg.), 15 to 20% of the minerals and 13 to 17% of the vitamins. The snacks contributed especially to the intakes of riboflavin, vitamin C and thiamin.

In summary, it has been estimated that snacks provide from one-fourth to one-third of the adolescent's total calories (Marrale et al., 1986) but were less dense than meals for the other nutrients.

Stressing the fact that snacks should be taken into consideration when studying the food intakes of people, high percentages of snacking have been reported in different studies. The lowest recorded was 66% (Driskell et al., 1979), and the highest was 99% (Jakobovits et al., 1977) of the samples studied.

Slightly over two-thirds of a group of 150 white college students reported snacking once or twice daily (Driskell et al., 1979). A higher percentage has been obtained in the Ten State Survey where 78% of the teenagers reported eating between meals (Thomas and Call, 1973). Bigler-Doughten

and Jenkins (1987) looked at the U.S. Department of Agriculture's 1977-1978 Nationwide Food Consumption Survey computer available data. Their sample consisted of all individuals aged 11 to 18 years who had completed a three-day food record. The percentage of boy and girl snacking was 80% and 79% respectively. Hertzler and Frary (1988) surveyed 212 undergraduate college students. Of these students, 85% reported themselves as being snackers. In a sample of 225 adolescents selected from four metropolitan and three rural schools, 89% ate at least one snack on the day of the survey (Ezell, 1985). Finally, Jakobovits et al. (1977) obtained a snacking percentage as high as 99% in a sample of sixty-six college women. Beyer and Morris (1974) studied the dietary habits of a group of children during the pre-school years and again during the early elementary school grades. They noticed that there was a tendency for the children to consume less food as snacks as they became older.

The frequency of snacks consumed varied from one to eight per day. Skinner et al. (1985) surveyed 225 Appalachian adolescents about their eating patterns. Fifty-two percent recorded consuming one or two snacks on the day of the survey, 32% ate three or four snacks, and 5% consumed from five to eight snacks. In another study (Hertzler and Frary, 1988), undergraduate college students were asked to report the frequency of their snacking. Although 14% checked that they hardly ever snacked, 81% checked snacking one to three times per day. It can be concluded that the majority of young people consume one to two snacks per day; however, further investigation would be appropriate.

Several researchers investigated the nature of the snacks consumed by young people. The food items each one reported as being consumed for snacks were quite similar. However, quite a few differences could be noticed in the ranking of these food items in terms of consumption importance. In their study on Appalachian adolescents' eating patterns, Skinner et al. (1985) concluded that although typical snack foods, such as carbonated beverages, candies, desserts and salty snacks were popular choices, many adolescents also chose bread and cereal products, meats, milk and milk products and that relatively few adolescents selected fruits and vegetables. Stasch et al. (1970) indicated that soft drinks were the most commonly chosen snacks among college students.

The following results were obtained from a questionnaire given to 170 college women who were attending classes in which some phase of food and nutrition was being studied (Lamb et al., 1954). Many often ate between meals. At least once a day 20% to 30% drank milk, carbonated drinks, coffee or milk drinks or ate fruits; 10 to 20% drank tea and ate candy bars; and the remaining 10% ate an assortment of such foods as crunchy tidbits, cheese and crackers , sweet rolls and doughnuts, sandwiches, olives, pickles, nuts, pies, ice cream, cake, hot dogs and so on. Khan (1980) reported that the common snacks selected by more than 10% of 250 college students were carbonated beverages (65%), hot beverages (37.5%), raw fruits and vegetables (28.8%), chewing-gum (25.4%), candies cookies (22.1%), alcoholic beverages (20.4%), pretzels (18.3%), chips (16.7%), milk (16.3%), fruit juices (13.3%), and cakes and crackers (10.8%). Skinner et al. (1985) reported that the types of food selected for snacks varied with the time of day the snack was eaten.

A scoring of fifth and sixth grade children's snacks resulted in the following observations. The mean snack score for foods taken at home (7.25 ± 1.64) was significantly higher than scores for snacks eaten away from home (6.42 ± 1.7). This suggested that the family or home has influenced snacks chosen there. Gillespie points out, however, using the same system of calculation, that the highest score a snack could have would be 30. Thus, as she noted, there was considerable room for improvement in the snacking patterns of these New York pupils (Nutrition Reviews, 1984). In conclusion, as McCoy et al. (1986) noted, efforts to improve nutritional habits of teenagers might well concentrate on educating them to choose their snack foods for nutrient density.

Alcohol Consumption.

Igra and Moos (1979) noted that drinking was part of a pattern of college social life which has been labeled a collegiate subculture. Engs (1977) commented that educators, administrators, and even students felt that there has been a dramatic increase in drinking and drinking-related problems on the college campus. However, his study found that the percentage of students who were

drinking in 1977 was similar to the drinkers' percentage 5 and 25 years ago. The proportions of students who were heavy drinkers or abstainers appeared to be about the same as the proportions in samples studied in the past. Furthermore, series of data accumulated in three other studies reflected little change in drinking pattern between 1971 and 1981. The per capita consumption of absolute alcohol from all beverages combined was approximately 2.37 gallons in 1967 and 2.65 gallons in 1985: an 11.8% increase (Hilton and Clark, 1987).

It has been reported in the May 22, 1985 issue of the Chronicle of Higher Education, that efforts to reduce the amount of drinking were widespread and intense. Yet, the Chronicle article itself provided reason to believe that collegiate drinking (like drinking in general) was still a very common behavior and was considered problematic by the larger society (Nasatir, 1986).

Social factors play an important role in alcohol consumption including places where humans gather to drink and the role of social imitation and social stress. One of the principal sources of human stress involves social interactions, either as the source or as the chief index of the degree of stress (Ellison, 1987). College drinking may be primarily a function of the situational stresses inherent in the college situation, as well as the environmental press of the college drinking ethic which is reinforced by fraternity and dormitory parties that focus on alcohol (Brennan et al., 1986). Students drink because they are exposed to and want to emulate peers who drink. However, it has been noticed that students who spend much of their time in conventional activities were less likely to engage in alcohol use. The peer context, the degree of involvement in informal college social life, and the lack of commitment to conventional social values appeared to play the most important role in influencing drinking behavior (Igra and Moos, 1979).

Motives for drinking have traditionally been classified as one of two types: social drinking and escape/relief drinking. Another motive found to be related to frequency of intoxication was drinking to get high and drunk (Brennan et al., 1986).

Three studies have reported that male students tend to drink more than females (Hilton and Clark, 1987; Igra and Moos, 1979; Brennan et al., 1986). However, Igra and Moose (1987) stated that this effect seemed to be disappearing.

Hilton and Clark (1987) investigated changes in American drinking problems between 1967 and 1984. They found that skipping meals was one of the most frequently reported drinking problem and that an increase in the proportion who reported experiencing this problem was observed between 1967 and 1984. The incidence of this problem was further supported by an experiment conducted on rats. Results indicated that high-alcohol consumers ate less food than low-alcohol consumers (Ellison, 1987). The greatest deficiency of the research in this area was the failure to establish an appropriate and uniform definition of what constitutes abuse of alcohol. Several studies left this to the respondents who were asked to rate themself (Brennan et al., 1986). Furthermore, no information has been found in the literature on the percentage of the diet's energy coming from alcohol.

Dietary Supplements

Nutritional supplements include vitamins, minerals and less conventional additives such as lecithin, brewer's yeast and protein powders that people take in addition to their usual food (Pally et al., 1984). More specifically, Stewart et al. (1885) defined a vitamin/mineral supplement as any product containing one or more of thirty three specific vitamins, minerals or miscellaneous dietary components.

Koplan et al. (1986) considered vitamin and/or mineral supplement users as those reporting taking vitamins or minerals regularly (daily) or irregularly (at least once a week). Kurinij et al. (1986) was more strict in his criteria of supplement users. For him the user was the person taking supplement only on a regular basis, that is daily or almost daily.

On April 8, 1987, The American Dietetic Association made public a task force statement regarding vitamin and mineral supplement usage. It stated that healthy children and adults should meet their nutrient needs by choosing a variety of foods in moderation, rather than by supplementation, except for iron and folic acid during pregnancy. This would reduce the potential risk for both nutrient deficiencies and nutrient excesses. However, if individual supplements were needed, for example in some cases of metabolic or malabsorption problems, these should come from physicians and registered dietitians.

Nevertheless, the use of vitamin and mineral supplements is common in the United States, with the rapidly growing vitamin industry currently doing over $ 2 billion of business per year (Pally et al., 1984). Furthermore, a study conducted by Benton and Roberts (1988) concluded that vitamin and mineral supplementation increased non-verbal intelligence in a sample of school children. However, this study has been criticized concerning the nature of the supplement used, the way the results were analyzed and the way the author responded to vitamin/mineral deficiencies in school children (Letter to the Editor, 1988).

Existing studies of nutritional supplement usage report considerable variation in the prevalence of utilization (Pally et al., 1984) which vary from 16% (Thomsen et al., 1987) to 55% (DeMicco and Karam, 1986) of the population group studied. Through a questionnaire presented to 163 girls and boys in the ninth through twelveth grades, 16% consumed vitamin/mineral supplements almost daily; 7%, several times per week; and 13%, several times per month (Thomsen et al., 1987). Government studies found that 47% to 54% of households included members who used nutritional supplements, and that although 52% of individuals had used them at some point in their lives, only 22% currently used them (Pally et al., 1984). Kurinij et al. (1986) examined the data obtained from 3227 nonpregnant women, aged 15 to 41 years, in the first National Health and Nutrition Examination Survey (NHANES I), and found that 25% of the women used dietary supplements regularly. Thirty-one percent of 128 patients in an urban family health center reported using supplements (Pally et al., 1984). The percentage was similar (34%) in a group of college women (Jakobovits et al., 1977), and in the data obtained from the second U.S. National Health and

Nutrition Examination Survey (NHANES II), which suggested that approximately 35% of the U.S. population, 18 to 74 years of age, took vitamin/mineral supplements regularly (Koplan et al., 1986). A higher percentage was determined through a national telephone interview survey of an age stratified random sample of 2991 adults. In the U.S. population, 39% of 16 years and older was found to consume one or more vitamin mineral supplement daily (Stewart et al., 1985).

Levy and Shucker (1987) also reported the conclusions obtained from this same telephone survey, but in much more detail. Dietary supplement users were divided into four groups, on the basis of the type and amount of nutrient intake from supplements: (1) the group of light consumers (with an average daily intake of 70% of an RDA per nutrient) constituted 14% of total users, (2) the moderate group (average daily intake of 168% per nutrient) formed 28% of total users, (3) the heavy group (average daily intake of 400% per nutrient) comprised 16% of total users, (4) the very heavy group (average daily intake of 777% of an RDA per nutrient) composed 42% of total users. Young supplement users (aged 16 to 25) had the highest rate of light users but the lowest rate of very heavy users, suggesting perhaps that vitamin and mineral supplement use becomes more intensive with increasing age. Koplan et al. (1986) stressed this point by reporting higher nutrient intake and use of vitamin supplementation with older age, higher income, higher education and white race.

Kurinij et al. (1986) stated that 40% of the adult population was found to use vitamin and mineral supplements in a national telephone survey conducted in 1980 by the Food and Drug Administration. In a sample of 154 college students, 45% reported using dietary supplements (DeMicco and Karam), whereas in another sample of two hundred twelve college students the percentage of vitamin/ mineral supplement users was 51% (Hertzler and Frary, 1988). It was 53% in a third sample of college students (Stash et al., 1970). A survey of 75 families living in the University of Minnesota, Como family housing, revealed that 51% of these families had a family member taking vitamins, either regularly or as needed, for acute problems without a physician's prescription (Bootman and Wertheimer, 1980). Furthermore, the Food and Drug Administration surveys of 1973 to 1974 and 1975 indicated that 55% of the population sampled used supplements

(DeMicco and Karam, 1986). Finally, a questionnaire given to 87 women attending Extension Services Programs indicated that 87% of the women reported taking vitamins and/or mineral supplements during the previous two years (Raab, 1987).

Most of the studies agreed that multivitamins were the most popular type of vitamin mineral supplements consumed. According to Pally et al. (1984), multivitamins users were the most frequent (53% of supplement users) followed by users of vitamin C (48% of users), iron (43% of users), vitamin E (33%), vitamin B (28%), calcium (15%) and other vitamins and minerals.

Stewart et al. (1985) reported a prevalence of supplement usage by product type. Single vitamin/miscellaneous dietary component supplements were the most widely consumed type (17.3% among whole population and 45.2% among users). Vitamin / mineral combinations were the second most widely consumed form of supplement (16% of whole population, 40.9% among users). Multivitamins, multivitamins / multiminerals, and multivitamins plus iron constituted the third most widely consumed form of supplement (12.4% of the whole population, 32.1% of users). The fourth most widely consumed supplementation form was vitamin combinations (9% of the whole population, 22.9% of users). The remaining categories were single minerals, mineral combinations, and multiminerals.

Jacobovits et al. (1977) indicated that the most widely used supplement was a multivitamin with iron, which 68% of the college women stated they took regularly. Ascorbic acid supplements were also popular with 41% of the students using them regularly. Kurinij et al. (1986) concluded that the most frequently used dietary supplements were multivitamins plus iron (35%), vitamins A, D and E (25%) multivitamins plus minerals (15%), and multivitamins (14%).

Studying the nutrient intake of college women, Jakobovits et al. (1977) found from the dietary adequacy score, that 39.5% of the college women had diets in which all nine nutrients considered met at least two-thirds of the current recommended allowances. Only 8.2% had five or fewer nutrients for which two-thirds of the allowances were met. When nutrient supplements were included,

46.7% of the women had diets in which all nutrients met at least two-thirds of the present allowances, and only 3.6% had five or fewer nutrients which did not meet two-thirds of the allowances. In other words, dietary supplements improved the dietary intake of the sample of students studied.

On the other hand, some studies revealed that the persons with higher nutrient intake were the most likely to supplement their diet (Koplan et al., 1986). This may indicate that the individuals taking dietary supplements may be the ones who need them the least. According to Kurinij et al. (1986), independently of the supplement, the diet of supplement users contained significantly more dietary protein, phosphorus, iron, thiamin and niacin than the diets of non-users. He concluded that supplement users generally consume a more nutrient dense diet.

Finally, Looker et al. (1987) compared the iron status of supplement users and non-users among children and adolescents, using the NHANES II data. Supplement users in all five age-sex groups ate more of all types of fruits and vegetables per week than non-users, consuming fruits and vegetables on the average of 14.5 - 19.2 times per week (or 2 - 2.7 times per day) compared with 12.6 - 15 times per week (i.e. 1.8 - 2 times per day). However, the iron status of supplements users as a group did not differ from that of non-users, among 1 to 19 year old children and adolescents. He suggested the following explanation: the majority of both users and non-users were already iron replete. In this case the users might not have been expected to show any improvement over non users with additional iron intake.

Raab (1987) suggested that the belief in the effectiveness of supplements was correlated with the usage of more kinds of specific vitamins and minerals. The perception of having control over one's health was associated with more frequent usage of supplements.

Pally et al. (1984) investigated the reasons for taking dietary supplements. A desire for more energy dominated the reasons (48%) given by the 128 patient of an urban family practice center. The other usage reasons were: to ensure good nutrition(42%), to combat fatigue (34%), to feel good (25%), to prevent illness (25%), to gain strength (23%), to deal with stress (21%) and to treat

illness (15%). The therapeutic reasons for consuming supplements obtained by Bootman and Wertheimer (1980) from their sample of university students were the following: diet supplement, cold and flu, self-determinant, stress, and epilepsy .

Nutrition Education

The general objective of nutrition education programs is to educate the public about appropriate nutrition for optimal growth and development, physical activity, reproduction, lactation, recovery from illness and injury and maintenance of health throughout the life cycle (Owen et al., 1986). The people who plan nutrition education programs use tools to educate the participant about how to plan a healthy, nutritious and balanced diet. However, a question frequently asked is: does nutrition education actually modify dietary behavior? (Bell and Lamb, 1973).

Until the early 1950's, programs for people's health related behavior were placing heavy emphasis on creating a better informed public, with the expectation that people informed about health and disease, would act more intelligently to promote the improved food behaviors (Hochbaum, 1981). However, about the beginning of the middle of the 1950's , educators realized that this was not what was happening and that different factors influenced the changing of people's eating behavior. One of these factors with high-school students has been found to be the characteristics of the communicator. Feldman (1984) indicated that by emphasizing their similarities with their students rather than expertise, school health educators were likely to increase their effectiveness.

Many studies have found that nutrition education caused definitive improvement in cognitive learning (Baker, 1972; Bell and Lamb, 1973; Byrd-Bredbenner et al., 1984; Perkin, 1983). However, the results were not similar when changes in eating behavior were evaluated. A study involving

Maryland's Expanded Food and Nutrition Education Program reported, that during the program, participants made positive dietary changes in terms of food groups, and that after graduation (follow-up twenty months later) they maintained 75% of these changes (Amstutz and Dixon, 1986). Cosper and Wakefield (1975) found that homemakers with higher education tend to use all basic food groups in preparing meals and concluded that educational attainment and nutritional knowledge correlate positively.

Only one study (Hertzler and Frary, 1988) on undergraduate college students reported changes in food habits in terms of food grouping following recommendations of the Dietary Guidelines. Toward the end of a nutrition class, a survey undertaken gave the following information about the changes in the students eating behavior. Fifty percent of the students increased their use of milk products and 40% increased their use of vegetables. Twenty-five percentage increased their consumption of fruits and 23% their consumption of bread/cereals. The least amount of increase occurred for legumes (14%), for meat/ fish/ poultry (12%), and for eggs (11%). Approximately 50% checked that they had decreased fat and sugar; one third, salt and calories; and 20%, alcohol.

A Heart Healthy program (Coates et al., 1981), including twelve class lessons, was provided to fourth and fifth grade students. Significant increases in the average number of target food items in students' lunches were found following the beginning of the classes. These levels increased even further following the end of the program and, moreover, maintained at follow-up after summer vacation (Coates et al. 1981). Other studies found that intense nutrition counseling resulted in a superior outcome of pregnancy in a group of low income women (Orstead et al., 1985), and that even three hours of a nutrition education program, held in a public health clinic setting, resulted in significant improvements in the dietary intake of low-income pregnant women (Hunt et al., 1976).

Yet, different results have been obtained by other researchers. Perking (1983) reported that actual dietary improvements after a nutrition education program for pregnant teenagers were slight and were within the range of normal intake variations. Three other studies, using students of fifth to ninth grades, did not find significant changes in dietary eating patterns after the program (Baker,

1972; Bell and Lamb, 1973; and Byrd-Bredbenner et al., 1984). Furthermore, Coates et al. (1985) reported that the positive changes which occurred during the school year, in the food consumption patterns of inner city high-school students, through a nutrition education project, were not maintained across summer vacation. Finally, Richter-Strydom et al. (1985) revealed that six home-based nutrition education sessions, over a period of few months, had no discernable effects on the growth or psychological performance of malnourished black children after a period of three years.

Such findings may be due to the difficulty in changing attitudes and behaviors, formed over a lifetime, through short-term nutrition education programs (Byrd-Bredbenner et al., 1984). Besides, as Hall et al. (1939) stated, man is not an entirely rational animal. When his prejudices and preferences are opposed by scientific findings, too often the former guide his conduct. Hence, the problem of building better nutritional habits cannot be solved merely by supplying man with knowledge of what is best for him. His attitudes toward food, their origin and development, must be recognized as potential barriers to his acceptance of nutritional advice. This is further stressed by Mazzeo-Caputo et al. (1985), who noted that providing information alone was not sufficient to achieve behavior change. Strategies should be developed by health professionals to assist individuals in complying with the U.S. Dietary Goal and Guidelines.

Finally, a group of adults interested in eating healthy diets encountered the following problems while trying to follow dietary recommendations: extra time needed for meal preparation (30% of the whole group), less taste experienced in the modified diet (30%), lack of control felt over food preparation (24%), normal life-style contravened by diet modifications (24%),and dietary guidelines not properly followed on social occasions (22%). Few subjects complained about extra cost, craving for specific foods, eating when under stress or increased volume of food (Warwick and Williams, 1987).

Snacking Attitudes

Social scientists defined attitude as a disposition (positive, negative or somewhere in between) toward objects, situations, actions, ideas or other stimuli. Five definitional categories presenting examples of attitudinal measures used in food habits research are: (1) attitudes as preferences, (2) as overt food behavior, (3) as willingness or ability to change, (4) as agreement among family members and (5) as complexity of meanings (Foley et al., 1979). Few studies have attempted to investigate attitudinal factors affecting snacking.

Lamb et al. (1954) investigated the food preferences of 170 college women: 101 living in residence halls and 69 living in non- residence halls. The two groups differed in their between meals practices. Of the residents, 26% drank carbonated drinks every day, 19% drank coffee, 17% had a milk drink, 17% had tea, and 16% ate a candy bar. Of the non-residence hall women, 65% drank milk daily between meals, 55% ate fruit and 48% had a carbonated drink. This choice of between meals snack may have been due to availability. The non-residence hall students had, in many cases, access to the family refrigerator, whereas the residence hall group had access to dispensers of candy bars and carbonated beverages located on each floor of the building.

Ezell (1985) stressed this fact that the type of snacks chosen by adolescents may be determined more by availability than by preference. He noticed, through studying the snack patterns of Appalachian adolescents, that in the afternoon and evening hours, with an increased variety of foods available in the home and / or community setting, foods from the four food groups were more popular and candies and salty snacks were less popular.

Khan (1980) noted that vending machines, which are commonly accessible to college students, may have a profound impact on food snacking habits. This issue was also stressed by Hruban (1977) who found that from the 985 high school students, 723 regularly used the vending machines either two or three times per week or everyday representing 73.4% of the students.

Hruban (1977) added an extra factor to the availability in the choice of the kind of snack. He studied the selection of snack foods from vending machines by high school students. When students were provided a wide variety of snack foods from which a greater percentage were nutritious, students tended to select nutritious snacks. But when there was an equal percentage of excellent, fair and poor snacks, they tended not to select the snack foods which were considered nutritious.

Stasch et al. (1970) investigated food practices and preferences of college students. The students were asked to list the snacks they ate most often at college (during the study) and those they had eaten most frequently when living at home. Greater use by college students was reported for coffee, candy and hamburger and less use for milk, iced tea, fruit, cake and cheese. This change appears to be due to the ready availability of certain kinds of foods at home that were not so easily kept in a dormitory room without kitchen facilities. They hypothesized that when these more nutritious foods were no longer close at hand, or when the student was completely free from parental direction for the first time, peer group influences exerted a greater effect on choice.

Two studies investigated the reasons for snacking. The first one was conducted by Lamb et al.(1954) on college women. The reasons the students gave for eating between meals were: to satisfy hunger, to be sociable, to substitute for missed meals, to relieve boredom, at the urging of friends, no resistance to food, and from habit. The second study was conducted on southern girls who gave the following reasons: hungry, looks good, to have something to do, to be social and to gain weight (McCoy et al., 1986). In spite of the differences in the years each one of these studies has been conducted and in the target group, high levels of similarities can be observed between the reasons given by each one of the two groups.

Summary and Objectives.

Throughout this review of literature, allusions have been made concerning the reasons for conducting further research in the field of eating habits of college students. Nevertheless, they are being summarized in these nine points:

1. No agreement concerning the nutrients in excess or in lack in college students' diets.
2. Only one study reporting the average percentage of energy obtained from fat, carbohydrate, and protein in college students' diets.
3. No study reporting the average percentage of energy provided by alcohol in college students' diets.
4. No agreement concerning frequency of snacking among college students.
5. Only one study reporting specific consumption changes in the different food groups after provision of nutrition education.
6. No agreement on the effect of nutrition on eating habits of college students.
7. No agreement on percentage of supplement users among college students.
8. Few studies dealing with the snacking attitudes of college students.
9. No study investigating the existence of correlation(s) between the following different factors:
    - age-sex group,
    - daily caloric intake and energy expenditure,
    - percent total energy supplied by protein, carbohydrate, fat and alcohol,
    - percent of the different nutrients RDA consumed at meals and at snacks,
    - percent RDA provided per day by dietary supplements,
    - changes in food habits after nutrition education,
    - consumption of dietary supplements before and after nutrition education,
    - number of skipped meals,

- number of snacks consumed on a typical day,
- kind of foods more likely to be consumed for snacks,
- specific perceptions toward snacking.

Methodology

Sample

This study took place at Virginia Polytechnic Institute and State University, during the winter quarter of the year 1988. It was conducted with undergraduate students enrolled in two sections of an introductory nutrition course.

The survey investigating food habits (Appendix A) consisted of three major parts. The first part was the term project of the class and it will be referred to as term project. It provided information on the eating habits, including nutrient consumption in meals and snacks and vitamin/mineral supplement(s) usage of college students toward the beginning of the nutrition class. The second part investigated the effect of nutrition education on eating habits for the overall diet and for vitamin/mineral supplement(s) usage. It will be referred to as effect of nutrition education on eating habits. Finally, the third part examined the frequency of meals and snacks, the snack food preferences and snacking perceptions. It will be referred to as snacking habits.

The original number of students taking the class was 345. Thirty did not turn in the opscan sheet on which they were asked to report their answers. From the 315 opscan sheets obtained, 31 were eliminated, the information or the analysis being inappropriate. Thus, the final population of this study consisted of 284 (82% of original population) undergraduate students.

The Term Project

The purpose of the term project was for college students to evaluate daily intake of calories and nutrients from meals, snacks, and vitamin(s)-mineral(s) supplements. Each student had a project handbook (Appendix B) with detailed instructions on how to record, compute and analyze food intake and how to report the appropriate information on included worksheets. The directions of the term project were developed, refined and standardized with sections of the course in previous years classes.

During the second week of the course, the procedure in the project handbook for recording the food intake was reviewed with the students during class time. The students were directed to record for three days (including one week-end day) foods consumed as meals or as snacks in appropriately marked areas on the food record sheets as the first step of the term project. Snacks were defined as what is eaten between meals or between time meals were normally consumed. The following directions were given to make the diet record and analysis as accurate as possible:

1. Estimate the quantity in household measuring units as accurately as possible. Two dimensional figures in a Food for Fitness pamphlet, and three dimensional food models were available for the students to visualize serving sizes of different food items.

2. Break down food mixtures and combination foods by listing every food item. This was important in order for items such as spaghetti to be differentiated as a single pasta item or as a mixed dish including sauces and/or additional ingredients for completeness of information.
3. Try to eat what you would normally eat. The students were told that they were not being graded on their food habits, but on their adequacy of recording, analysis and interpretation of their three-day food intake. Furthermore, the importance of the term project in providing them reliable information on their nutrient intakes was stressed. So the more accurate their recording and analysis, the more valuable the results were for them.

The three-day record was turned in one week later and checked by the teaching assistants for completeness and accuracy concerning type of food (e.g. whole wheat or white bread, skim or whole milk); quantity (e.g. exact size of the bowl, spoon, glass); and mode of preparation of the foods consumed (e.g. fried, boiled, roasted).

The next step was the nutritional analysis of the three day dietary record. Explanation of the specific written directions included in the project handbook was given in class, after the checked three day dietary records had been returned to the students. Students were directed how to calculate the nutritional value of each food for each day from dietary record for meals and snacks, and of the vitamin/mineral supplements; how to total each day on the final worksheet; and how to total the three days and calculate the average intakes from foods and supplements separately. Details were then given on how to:

1. Compute the percent of total calories supplied by protein, fat, carbohydrate and alcohol. The student calculated the number of calories received from carbohydrate, protein, fat and alcohol by multiplying the three-day average for total meal/snack intake of each one of these nutrients by 4, 4, 9, and 7 values for calories/gram respectively. To obtain the

percent of total calories supplied by each energy source, each of the above caloric values was divided by the three day average calorie intake.

2. Approximate the total energy expenditure through three steps. The first step was to estimate the energy spent on basal metabolism by using the figure 1.0 calorie per kilogram of desirable weight per hour (for men) or 0.9 calorie (for women) and then multiply by 24 hours. The second step was to estimate the energy spent on physical activities by using the following guidelines. For sedentary (mostly sitting) activity (a professor) take 20% of the energy spent on basal metabolism. For light activity (a student) take 30%. For moderate activity (a nurse) take 40%. Or for heavy work use 50% or more. The third step was to estimate the energy spent on metabolizing food as 10% of the three day average caloric intake. Total energy expenditure was obtained by adding the three figures calculated through the above three steps.
3. Figure the average consumed percentage of their Recommended Dietary Allowances (RDA's) from foods for protein and the following minerals and vitamins: calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C for the whole day as well as for meals and snacks separately. For protein the RDA was calculated by using 0.8g. of protein for each kilogram of desirable body weight. For the vitamins and minerals the RDA's were taken from the 1980 RDA table for the appropriate age-sex group (Committee on Dietary Allowances of the Food and Nutrition Board, 1985).

The teaching assistants were available during regular office hours for further help in looking up nutrient content of foods, identifying substitutions, and/or answering project questions. To calculate the nutrient content of the foods consumed, the students used the class textbook: "Nutrition for Living" (Christian and Greger, 1985) and three food composition textbooks available in the Human Nutrition and Food department: (1) Agriculture Handbook 456 (Adams, 1975), (2) Agriculture Handbook 8 series (U.S. Department of Agriculture, 1986), and (3) Bowes and Church (1985). The completed term projects, turned in two weeks later, were checked and graded by the

teaching assistants. They looked at the precision of the analyzed food, at the accuracy of the foods' nutrient analysis and the accuracy of the calculations.

Each student recorded on an opscan sheet, socio-demographic data (weight, ideal body weight, gender and academic major) and three day average information for nutrients: average total caloric intake; average total energy expenditure; percentage of total calories supplied by proteins, fats, carbohydrates and alcohol; and percent RDA's from protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C consumed in meals and snacks. Additionally, where applicable, the percent RDA's provided per day by the supplement(s) consumed for calcium, iron, vitamin A, riboflavin, niacin and vitamin C. The calculations of the final data sheet of the term projects were verified and checked with the opscan sheets for correctness. In order to maintain the confidentiality of each student, no names or identification number were listed on the opscan sheets.

Effect of Nutrition Education on Eating Habits

This questionnaire investigated the following topics: (1) Changes in food group consumption toward the end of the class term and, (2) the use of vitamin and/or mineral supplement(s) before and toward the end of the class term. The participants answered these questions along with the following part of the survey after completing the term project and after the major portion of the course focusing on nutrients has been presented, but before receiving the section on application of nutrient information to the life cycle.

Changes in Food Group Consumption

The students had to respond to changes in their consumption of specific food items in terms of increasing, staying the same, or decreasing. The sixteen food items were: milk foods, fruits, vegetables, bread/cereals, legumes (dried beans), fish and poultry, meat, eggs, fat, saturated fat, cholesterol, sugar, alcohol, salt, calories and snacks. These food items were based on the food group categories relating to the Recommended Dietary Allowances (Committee on Dietary Allowances of the Food and Nutrition Board, 1985) and to the Dietary Guidelines (USDHHS, 1985). More specifically, the first six items correlated with the Dietary Guidelines Recommendations of eating a variety of foods in order to meet the RDA's and increasing consumption of complex carbohydrate and fiber. The other ten items related to the Recommendations of reducing fat, saturated fat, cholesterol, sugar, sodium and alcohol consumptions. The response was assigned a score of one if the answer was increased, two if it was stayed the same, and three for decreased.

Changes in Vitamin/Mineral Supplement Consumption

The respondent also reported change, if any, in the vitamin and/or mineral supplement(s) consumption before and toward the end of the class. The first question asked the subject if he (she) used to take a multivitamin or a multivitamin/mineral supplement. A score of one was given for a no answer and a score of two was given for a yes answer. The second question asked the replier if he (she) used to take a specific vitamin or mineral supplement. If the answer was yes, he (she) was asked to specify if it was in moderate amounts or in megadoses. The scoring was one for a no answer, two for yes in moderate amounts, and three for yes in megadoses. The same two questions with the same scoring system for the answers were repeated concerning present and/or anticipated future use.

Snacking Habits

Pilot Study

The last section of the questionnaire was about snacking habits. For this segment a preliminary questionnaire (Appendix C) was assembled based on the researchers experiences and perceptions, and inspired from questionnaires used in previous research. It covered the frequency of meals and snacks, the snack food preferences, and snacking perceptions. These questions were reviewed by a statistical expert for scope of content, clarity, and appropriateness for computer analysis. This preliminary questionnaire was presented to ninety-one Virginia Tech undergraduate students in a nutrition class and in a production and operations management class. The respondents answered the questionnaire on computerized answer sheets and reported any comments or suggestions concerning the clarity and/or content of the questions. The opscan sheets were entered into the computer and the responses were analyzed using intercorrelations and relationships. Based on the statistical results and the comments of the students participating in the pilot study, the preliminary questionnaire was modified. Only the questions with high degree of correlation were selected. Of these questions, some were rewritten for further clarity based on student comments and suggestions.

Frequency of Meals and Snacks

The first question was about the number of meals skipped during the three day food intake record (Appendix A). The score given was the actual number of meals skipped during the three days. The next question concerned the number of snacks consumed on a typical day. Five possible answers were available none, one, two, three, and four or more. They were given respectively the scores of zero, one, two, three and four.

Snack Food Preferences

The following group of questions were concerned with the food preferences for snacks. The respondent was presented with nine different food items: soft drink, candy bar, piece of cake, potato chips, salted nuts, fresh fruit, yogurt, milk and a small sandwich. (Appendix A). The student had to determine how much he (she) would like each one as a snack item: a lot, neutral or not much. The scores appropriated were one for a lot, two for neutral, and three for not much. These items were chosen specifically to reveal the kind of snacks popular among college students. A greater preference for the last four food items in comparison to the first four would indicate a tendency for high nutrient dense snacks. A more favorable reaction toward the first four food items would suggest the use of less nutrient dense snacks.

The cumulative means and frequencies of the less nutrient dense snack items and the high nutrient dense snack items were computed in order to investigate any correlation with the other variables. Soft drink, candy bar, piece of cake, and potato chips were considered the less nutrient dense snacks; while fresh fruit, yogurt, milk, and small sandwich were considered the high nutrient dense snacks. Salted nuts, being able to fit in both of the two groups were not included in either nutrient dense category.

Snacking Perceptions

The remaining questions examined snacking perceptions. Based on the pilot study, 14 items were studied. For each statement the respondent was asked to answer one of four choices: agree, tend to agree, tend to disagree or disagree (Appendix A) The responses were scored one for agree, two for tend to agree, three for tend to disagree and four for disagree. The first statement wanted to know if the respondent gives any importance to the nature of the snack consumed. The next three statements investigated the influence of the time of the day and of specific situations on the

tendency to snack. The three succeeding statements were about the concept of snacks as an award or punishment. After that were statements about the frequency, the objective, the reason, and the size of snacking. The next statement was about snacks and children. Finally, the last statement wanted to study the kind of snack the respondent would choose if he had available two kinds of vending machines: one providing fruit, yogurt and milk; and the other one offering soda and different sweet items.

The matrix of intercorrelations among the 14 snacking variables was computed. Then the linkage analysis on this matrix (McQuitty, 1957) was performed. The means of the responses to the meaningfully related snacking perception statements were calculated to form the snacking efficacy score. This snacking efficacy score meant the likelihood to snack.

The final food habits questionnaire (Appendix A) along with the opscan sheets were given to the students in class on an exam day, two weeks before the due date of the project. This day was specifically chosen in order to be sure to reach all the students taking the class. The questionnaire contained detailed information on how to report the answers on the opscan sheet. Furthermore, the purpose of the research and the way to mark the answers on the opscan sheet were explained to the students. Students were reminded that their answers were anonymous, that their responses would not affect their grade in any way, and the importance of accuracy and sincerity in reporting their answers.

Statistical Analysis

The raw data, marked on the computerized opscan sheets by the students, were statistically analyzed. Frequencies and percentages along with the mean, standard deviation and range were

calculated for each answer. Pearson Product Moment Correlation Coefficients were used to study the relationship between the different responses of the questionnaire. The sections of the last part of the questionnaire (the snacking habits) were cluster analyzed using average linkage on squared Euclidian distances to establish correlation subgroups. In the interpretation of the results, correlation coefficients lower than -0.2 or higher than + 0.2 with a significant level of at least 0.001 were considered meaningful.

This statistical analysis was performed twice. The researchers checked the unusual values obtained in the first statistical analysis on the final data sheets and corrected the ones which needed correction on the respective opscan sheet. Then the statistical analysis was performed a second time.

Results and Discussion

Descriptive Findings

Sample Characteristics

The 284 college students, who completed the survey, constituted the population of this study. Six age-sex groups were represented in this population (Table 1). In summary, 60% of the population was female and 40% was male, with the majority being between 19 and 22 years old. A wide variety of different majors were represented making a comprehensive sample of college students, with less than 2% majoring in nutrition.

Table 1. Age-Sex and Academic Majors of the Student Population (N = 284)

	Frequency	Percentage
1. Age-sex group:		
Women between 15-18 yrs old	13	4.6
Women between 19-22 yrs old	149	52.6
Women between 23-50 yrs old	8	2.8
Pregnant women	1	0.4
Men between 15-18 yrs old	0	0.0
Men between 19-22 yrs old	108	38.2
Men between 23-50 yrs old	4	1.4
2. Academic major:		
Engineering, Physical Sciences	13	4.6
Social Sciences, Arts,Architecture	62	22.1
Math, Statistics, Computer Science	23	8.2
Human Nutrition and Food (HNF)	6	2.1
Human Resources other than HNF	50	17.9
Agriculture, Life Sciences (Biol.,Biochem.)	29	10.4
Business, Urban Affairs and Planning	94	33.6
Other majors	3	1.1

Term Project

Caloric Intake and Total Energy Expenditure

The mean of the recorded three day average total calorie intakes was 1900 calories $\pm$ 774 with the different values varying between 500 calories and 4800 calories. Twenty-eight students (10% of the whole population) had an average calorie intake between 500 and 1000 calories. Twenty-two students (8% of the population) had an average calorie intake higher than 3000 calories, with 4 of them consuming an average 4000 calories or more. A significant positive correlation (0.5524) was noted between total caloric intake and gender. This implies that the higher the total caloric intake, the greater the probability of a student being male.

The mean of the reported average total energy expenditure per day was 2100 calories $\pm$ 444 with one of the values being as low as 800 calories and one as high as 3300 calories. Total energy expenditure had a highly significant correlation with ideal body weight (0.9163) and gender (0.8307) of the student. This indicates that the higher the total energy expenditure of a student, the more likely for him (her) to be close to his (her) ideal body weight and to be a male.

Therefore, the average tendency in this population group was to have, on a daily basis, a caloric intake very close to the total energy expenditure. More specifically, the average caloric difference between total energy expenditure and caloric intake was equal to 237 calories (range = -2753 and 2195 calories). This would indicate, that on the average, the students had a slightly higher total energy expenditure than caloric intake with a wide variation in the caloric difference of college students ranging from under active to over active. A significant positive correlation (0.6160) occured between total caloric intake and total energy expenditure. This denotes that the higher the caloric intake of a student the greater his tendency to be more active.

Daily Percentage Energy from Protein, Fat, Carbohydrate and Alcohol

The average percentages of energy derived from protein, fat, carbohydrate and alcohol of the study's population are reported in Table 2. The frequency distribution of these percentages indicated the following. Twenty-five students (9% of the population) reported a percentage energy from protein equal to or lower than 10%. Fifty-five students (19% of the population) had a percentage energy from protein equal to or greater than 20% with five students having a percentage greater than 30%.

Concerning fat, 20 students (7% of the population) reported a percentage energy from fat equal or lower than 20%. Sixty students (21% of the population) had a percentage equal or greater than 40%.

For carbohydrate, 68 students (24% of the population) had a percentage energy equal to or lower than 40% and only one student had a percentage greater than 70%. In other words, extremes predominated in high percentages of energy from fat (21% of the population) and protein (19% of the population), and low percentages of energy from carbohydrates (24% of the population).

Regarding alcohol, 181 students (64% of the population) did not report any alcohol consumption in their three day food record. The average percentage of energy intake from alcohol for the other 103 students (36% of the population) varied from 1% to 37%. The majority of the students consuming alcohol (80 students: 28% of the population) had a percentage intake between 1% and 12%. Twenty three students had a percentage intake between 14% and 37%. No study reporting the percentage alcohol consumption among college students was found with which to compare with this data. A slight positive correlation (0.1838) was detected between alcohol consumption and the sex of the students, indicating a slight higher alcohol consumption among males than females. This follows the report by Igra and Moos (1979) that the higher incidence of drinking among males than females seems to be disappearing. A negative correlation (-0.2496) between al-

Table 2. Average Daily Percentage of Energy Derived from Protein, Fat, Carbohydrate and Alcohol (N = 284)

	Mean Percentage (± sd)	Range
Protein	16 ± 5	8-43
Fat	33 ± 8	7-61
Carbohydrate	47 ± 9	27-71
Alcohol	4 ± 7	0-37

cohol consumption and caloric differences indicates that consumption of alcohol parallels having total energy expenditure lower than the total caloric intake.

Dietary guidelines for the dietary sources of energy are as follows: 12% of the energy from protein, 30% from fat and 58% from carbohydrate (Anonymous, 1988). There is no recommended percentage of energy from alcohol, except if used, to do so in moderation. The estimated average percentages of energy derived from protein, fat and carbohydrate for the whole U.S. population are: 12% of the energy from protein, 42% of the energy from fat and 46% of the energy from carbohydrate (Anonymous, 1988). Although, the percent energy from protein is 4% higher in this study's population, the average percent energy from carbohydrate is almost similar to the average U.S. population. The main difference is in the percent of energy from fat which is 9% lower in the population of this study. Even if the 4% of energy provided from alcohol is added to the percentage of energy provided from fat, the cumulative percentage of energy from fat and alcohol would be 5% lower in the population of this study than the estimated percentage of energy from fat of the U.S. population. The comparison of the percentages obtained in this study with the ones obtained by Skinner et al. (1985) in their study on the nutrient intakes of Appalachian's adolescents, provides similar conclusions. It is then clear that the percentages obtained in this study as in the other reports are not close to the recommended percentages.

Total Nutrients Intake

Table 3 reports that the mean total intakes of all the nutrients studied were found to be above 100% of the RDA's. However the ranges show an extremely wide variation in total intakes.

The frequency distributions of the recorded nutrients are summarized in Table 4. The adequate consumption level for the different nutrients was considered to be 67% of the RDA's. Although average intakes were all above 100%, intakes less than 67% of the RDA were found for all the nutrients studied. Iron and vitamin A had the highest frequencies of percentages below 67% of the RDA's, followed by calcium, vitamin C and thiamin. These findings, except for thiamin, were in agreement with Schorr et al. (1972) findings in their study on teen-age food habits. Similarly, Lafortune in his 1957 study on freshman college girls found similar results for calcium, iron and thiamin. Other studies of college students by Court (1988) and Hertzler et al. (1976) supported the above findings concerning iron.

On the other hand, vitamin C had the highest frequency of students consuming more than 200% of their respective RDA. This may be due to the widespread beliefs concerning vitamin C in the prevention of colds.

Positive correlations occured between the total caloric intake and the gender of a student, with total iron intake (0.3501 and 0.3947 respectively), total calcium intake (0.5477 and 0.3113 respectively), and total vitamin C intake (0.2960 and 0.2537 respectively). In other words, total iron, calcium and vitamin C intakes are higher among male subjects and among the students consuming greater caloric intakes. Therefore, these students have less tendency of getting, through their diets, intakes of iron, calcium and vitamin C below 67% of their RDA's. This was not the case for vitamin A which did not have any significant correlation with caloric intake nor the gender of the student.

Table 3. The Daily Total Nutrient's Percentage RDA's Means and Ranges (N = 284)

Nutrient	% RDA's Mean	% RDA's Range
Protein	143	26-351
Calcium	106	2-373
Iron	128	11-731
Vitamin A	110	3-567
Thiamin	162	21-1166
Riboflavin	176	16-1149
Niacin	142	13-996
Vitamin C	228	3-1849

Nutrients Distribution Between Meals and Snacks

The percent of the population having 0% of nutrients from snacks varied between 17% and 20% for protein, calcium, iron, thiamin, riboflavin, and niacin; 37% for vitamin A; and 41% for vitamin C. This would mean that at least 17% of the population had no snacks or nutrient empty snacks (foods providing only calories).

The mean of the percent RDA's consumed in meals and in snacks for protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C are reported in Table 5. A greater amount of nutrients were consumed in meals in comparison to snacks. This observation is in agreement with what has been reported by Ezell (1985), Skinner et al. (1985), and Bigler-Doughten and Jenkins (1987). The average percentage contribution of snacks to the daily nutrient intake was 7% for protein, 10% for calcium, 9% for iron, 7% for vitamin A, 9% for thiamin, 13% for riboflavin, 10% for niacin and 15% for vitamin C. Thus it can be estimated that the snacks provided from 7% to 15% of the recorded consumed nutrients. This is in concordance with the findings of

Table 4. Distribution of Total Dietary Nutrient Intakes Relative to the RDA's (N = 284)

Nutrient	Below 67% of RDA Frequency (%)	Below 100% of RDA Frequency (%)	Above 200% of RDA Frequency (%)
Protein	12 (4)	37 (13)	39 (14)
Calcium	79 (28)	71 (25)	22 (8)
Iron	100 (35)	46 (16)	45 (16)
Vitamin A	96 (34)	54 (19)	31 (11)
Thiamin	56 (20)	56 (20)	54 (19)
Riboflavin	38 (13)	40 (14)	74 (26)
Niacin	29 (10)	67 (24)	49 (17)
Vitamin C	58 (20)	39 (14)	106 (37)

McCoy et al. (1986) that snacks are not just empty calories. On the average the most common nutrient in snacks was vitamin C followed by riboflavin then calcium, iron, and niacin, succeeded by thiamin and finally vitamin A and protein.

The ranges, shown in Table 5, denote a wide variety in the reported percentages of the RDA's consumed in meals and snacks. The highest frequencies of the percentage RDA consumed in meals were as follow for the recorded nutrients: (1) 47% ranged between 100% to 150% of the RDA for protein, (2) 45% and 25% ranged between 50% to 100% of the RDA for calcium and vitamin C respectively, (3) 47%, 44%, and 42% ranged between 25% to 75% of the RDA's for iron, vitamin A and thiamin respectively, (4) 54% ranged between 50% to 125% of the RDA for riboflavin, and (5) 28% ranged between 75% to 100% of the RDA for niacin.

Seventeen students (6% of the population) consumed an amount of vitamin C varying between 400% and 800% of the RDA in their meals, and three students had higher percentages. Only eight students had an intake of vitamin C in snacks above 150% of the RDA. One student had an intake

Table 5. Percent U.S. RDA's from Meals and Snacks (N = 284)

	% U.S. RDA's from meals		% U.S. RDA's from snacks	
	Mean(sd)	Range	Mean(sd)	Range
Protein	134(52)	23-251	10(11)	0-60
Calcium	93(58)	0-372	10(14)	0-94
Iron	100(78)	7-518	10(24)	0-334
Vitamin A	92(65)	3-444	7(15)	0-136
Thiamin	130(152)	19-999	13(33)	0-286
Riboflavin	136(128)	7-999	20(44)	0-376
Niacin	116(79)	13-971	13(20)	0-113
Vitamin C	162(159)	3-999	28(86)	0-999

of iron in snacks above 100% of the RDA (334% of the RDA). However, the majority of the population (78%) had an iron intake from snacks equal or below 10% of the RDA. No significant correlation was found between nutrient consumption in snacks and in meals except for vitamin C. The percentage RDA of vitamin C consumed in meals correlated positively (0.2261) with the percentage RDA of vitamin C consumed in snacks. This denotes that the students consuming high levels of vitamin C in meals had also the tendency of getting high levels of vitamin C in snacks.

Positive correlations were detected between: percentage RDA of calcium, iron, vitamin A and protein in snacks (Figure 1). These correlations reflect the following relationships. A student consuming a low percentage RDA of protein in snacks would have tendency to receive a lower percentage RDA's of iron, calcium and vitamin A. Low percentage RDA's of calcium in snacks would mean a tendency for low percent RDA of iron in snacks. The same correlation was prevalent between percent RDA of calcium and vitamin A in snacks. No correlations have been found between these variables and the level of calories consumed.

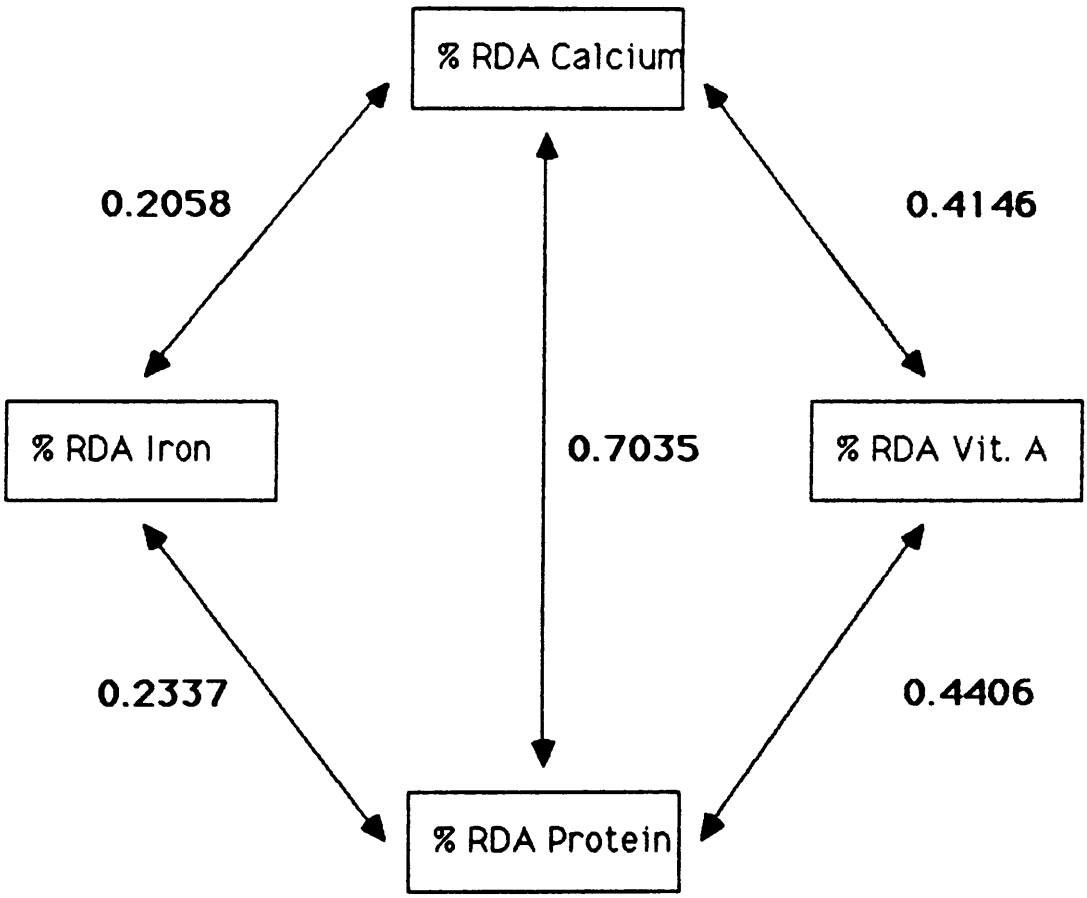


Figure 1. Correlations Between Percentage RDA of Calcium, Iron, Vitamin A, and Protein in Snacks

Intakes from Vitamin/Mineral Supplements

The mean percent RDA for calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C provided by vitamin/mineral supplements are reported in Table 6, along with the percentage of users. Only 13% of the students stated consuming vitamin and/or mineral supplements, with very few consuming megadoses except for vitamin C. For this vitamin, 10 students (27% of vitamin C users) had an average intake higher than 400% of their RDA with 5 of them taking more than 999% of their RDA.

This reported use of vitamin/mineral supplements is lower than the use found by Thomsen et al. in 1987. They reported that 16% of 163 girls and boys in the ninth through twelveth grades consumed vitamin/mineral supplements almost daily. The highest percentage of vitamin/mineral supplements' consumption by college students (55% of a U.S. population sample) was reported by DeMicco and Karam in 1986. A significant negative correlation, varying between -0.6 and -0.7, was detected between the level of nutrients' intake from supplements and the percentage RDA obtained for the relative nutrient from meals. This indicates that the students who consumed supplements had a tendency of getting lower percentages of this supplement's nutrients in meals. This is in contradiction with what has been reported by Koplan et al. (1986). They found that supplement users generally consumed a more nutrient dense diet than non users.

Table 6. Nutrient Intake from Supplements (N = 284)

Nutrients	Mean % RDA Intake	Range	% of Users
Calcium	3	0-122	11
Iron	18	0-611	11
Vitamin A	11	0-500	10
Thiamin	18	0-999	10
Riboflavin	18	0-999	10
Niacin	13	0-395	10
Vitamin C	38	0-999	13

Effect of Nutrition Education on Eating Habits

Changes in Food Group Consumption

Percentage changes in food groups' consumption toward the end of the class are reported in Table 7. The calculation of the responses' means for each one of the food groups indicated: (1) a slight tendency toward increasing the consumption of milk foods, breads/cereals, fish and poultry, legumes (dried beans) and especially fruits and vegetables, (2) no change in eggs' and meats' consumption, and (3) a tendency toward decreasing the consumption of sugar, alcohol, salt, calories,snacks and especially fat, saturated fat, and cholesterol. These findings are in correlation with the ones reported by Hertzler and Frary (1988) in their study of undergraduate college students' at the same time period.

The change in milk consumption correlated positively with total calcium intake (0.3556), %RDA of calcium consumed in meals (0.3052), the total protein intake (0.2512) and the gender

Table 7. Percentage Changes in Food Groups Consumption after Nutrition Education (N = 284)

Food Groups	% Increased	% Stayed the same	% Decreased
Milk foods	38	57	5
Fruits	52	47	1
Vegetables	46	53	1
Breads/Cereals	27	68	5
Meat	10	68	22
Fish and poultry	23	73	4
Eggs	12	72	16
Legumes (dried beans)	14	81	5
Fat	6	34	60
Saturated fat	3	39	58
Cholesterol	4	47	49
Sugar	3	61	36
Alcohol	4	78	18
Salt	4	67	29
Calories	18	49	33
Snacks	10	58	32

of the student. This indicates that the increase in the milk consumption was more predominant among females than males. It was also more prevalent among the students who reported a low total calcium and protein intake in meals.

The change in fat consumption correlated positively with the percentage of total calories supplied by fat (0.2073). This means that there was a greater tendency toward decreasing fat consumption among the students who discovered high percentages of calories provided by fat in their nutrient analysis.

The change in alcohol consumption correlated positively with the percentage of total calories supplied by alcohol (0.2490). This reflects a greater trend toward decreasing alcohol consumption among the students who reported higher percentages of calories provided by alcohol in their nutrient analysis.

The change in calories consumption correlated negatively with the difference between total energy expenditure and caloric intake (-0.2028). This denotes a greater tendency toward decreasing caloric intake among the students who discovered in their analysis a caloric intake greater than their total energy expenditure.

Changes in Vitamin/Mineral Supplement Consumption

Table 8 reports supplement consumption before and toward the end of the class. The percentage of supplement users, before taking the class, was similar to the percentage obtained by Thomsen et al. (1987) in his study on 163 girls and boys in ninth through twelveth grades. This is the lowest percentage of vitamin/mineral supplement usage reported in previous studies on different population groups. Among the users of specific vitamins or minerals 18 (3% of the whole population) were taking megadoses.

Toward the end of the class the following could be noticed: a 7% increase in multivitamin/mineral supplements consumption, a 9% increase in specific vitamin or mineral supplements consumption, and a 2% decrease of megadose consumption of specific vitamin or mineral. The consumption of multivitamin/mineral toward the end of the class correlated negatively with the percentage RDA's of thiamin (-0.3515), riboflavin (-0.3193), iron (-0.2534), niacin (-0.2479), and vitamin A (-0.2414) obtained in meals. This means that the tendency to consume multivitamin/ mineral toward the end of the class was more predominant among the students whose nutrient analysis had low percent RDA's of thiamin, riboflavin, iron, niacin, and vitamin A in their meals. Therefore, the detection of low nutrient intakes through the dietary analysis could

Table 8. Supplement Consumption Before and Toward the End of the Class (N = 284)

	Frequency	Percentage
Before the class:		
1.Multivitamin and/or mineral		
a.No	237	84
b.Yes	46	16
c.Undetermined	1	-
2.Specific vitamin or mineral		
a.No	239	84
b.Yes in moderate amts.	36	13
c.Yes in megadoses	8	3
d.Undetermined	1	-
After the class:		
1.Multivitamin and/or mineral		
a.No	215	77
b.Yes	65	23
c.Undetermined	4	-
2.Specific vitamin or mineral		
a.No	211	75
b.Yes in moderate amts.	68	24
c.Yes in megadoses	4	1
d.Undetermined	1	-

have been the reason behind the increase in supplement consumption between "before" and "toward" the end of the nutrition class.

Snacking Habits

Frequency of Meals and Snacks

The eating patterns of this population of college students are reported in Table 9. Only 30% of the population did not skip any meal during the three days of the study. The other 70% skipped

between one to five meals during the three days. These results are in agreement with previous studies, which reported high (34% and higher) incidence of skipping meals among college students (Skinner et al., 1985; Jacobovits et al., 1977; and Khan and Lipke, 1982).

Eighty-eight percent of the students indicated snacking one to four times per day. However, the majority of the students reported having one to two snacks. This correlates with what has been reported by Skinner et al. (1985) in their study on eating patterns of Appalachian adolescents. The percentage of snackers found in this study is higher than all the percentages determined in previous research except for one by Jakobovits et al. (1977) reporting 99% of snackers among a sample of 66 college women.

Snacks' Food Preferences

The frequencies and percentages of snacks food preferences are reported in Table 10. No predominant food preferences toward high nutrient dense or less nutrient dense snacks could be detected by looking at the percentages and frequencies of the three possible responses for each one of the nine food items. The calculation of the responses' means for each one of the items showed a prevaling neutral reaction to candy bar, cake, potato chips, salted nuts and yogurt as snack items; and a slight favorable predisposition for small sandwich, milk, soft drink and especially fresh fruit as snack items.

Although, this population of college students has a slight tendency to prefer high nutrient dense snacks, in reality this may not be the case since, as noted by Skinner et al. (1985), Lamb et al. (1954) and Ezell (1985), the type of snack chosen may be determined more by the the time of the day and the availability than by preference. No significant correlation was detected between the snack food preferences and the eating practices.

Table 9. Frequency of Meals and Snacks (N = 284).

Number of meals skipped per 3 days	Frequency	Percentage
Zero	86	30
One	64	23
Two	57	20
Three	56	20
Four	13	5
Five	5	2
Undetermined	3	-
Number of snacks on a typical day		
Zero	34	12
One	107	38
Two	98	35
Three	34	12
Four	8	3
Undetermined	3	-

Snacking Perceptions

The percentages of the responses to snacking perceptions are reported in Table 11. The calculation of the mean responses for each one of the snacking perceptions gave the following results:

1. The mean of the population was half-way between agree and tend to agree for the following snacking perception: a snack should be a small amount of food compared to a meal.

Table 10. Frequency and Percentages of Snacks' Food Preferences (N = 284)

Snack items	A lot	Neutral	Not much	Undetermined
Fresh fruit	167(60%)	92(33%)	20(7%)	5
Soft drink	141(50%)	79(28%)	60(22%)	4
Small sandwich	120(43%)	102(37%)	56(20%)	6
Milk	107(38%)	99(35%)	75(27%)	3
Candy bar	97(34%)	98(35%)	86(31%)	3
Potato chips	93(33%)	102(36%)	86(31%)	3
Yogurt	88(31%)	95(34%)	97(35%)	4
Piece of cake	83(30%)	91(32%)	107(38%)	3
Salted nuts	83(30%)	104(37%)	93(33%)	4

2. The mean of the population tended to agree with the following perceptions: (a) snacking is independent from circumstances, (b) snacking is independent from mood, (c) occasional snacking is not bad, but habitual snacking is probably undesirable, (d) snacking is adequate when hungry between meals, (e) snacks are desirable for children, and (f) snack preference for fruit, yogurt and milk vs. soda or candy for snacks.
3. The mean of the population was neutral for the following perception: snacking is independent from time of the day.
4. The mean of the population tended to disagree with the following snacking perceptions: (a) the nature of snack is not important, (b) witholding a snack could be a good way for punishing a child, (c) snacks allowed when meals are nutritionally adequate (d) snacks are good ways to make up for skipped meals, and (e) snacking prevents being too hungry and eating too much at meal time.
5. The mean of the population was half-way between tend to disagree and disagree for the following perception: a snack can be considered a justified reward after a hard task.

So in general, there was a wide acceptance of snacks in the students' meal patterns. The average attitude, however, supports healthy snacks and the fact that snacks are independent from circumstances; and disagrees with using snacks for reward or punishment or as a replacement or supplement for meals.

Significant Correlations and Relationships with the Snacking Habits Questionnaire

Frequency of Meals and Snacks

The correlations with the frequency of meals and snacks are reported in Table 12. From these correlations the following can be described. The greater the tendency to skip meals, the lower the calcium, vitamin A, iron and total calories consumptions. On the other hand, the college student who has a greater tendency to snack would not need a specific time and situation to snack, would consider a snack an appropriate reward after a hard task, would appreciate a piece of cake for snack, and would get higher percentages of protein and iron from his (her) snacks than the students who do not snack frequently.

Table 11. Percentages of Responses to Snacking Perceptions (N = 284)

Statements	Agree	Tend to agree	Tend to disagree	Disagree
1.Snack smaller than meal (136)*	53	40	5	2
2.Snacking independent from circumstances (127)	44	40	11	5
3.Habitual snacking undesirable (132)	42	39	14	5
4.Prefer fruit, yogurt and milk vs. soda or candy for snacks (138)	35	24	27	14
5.Snacking independent from mood (128)	32	28	25	15
6.Snacking independent from time (126)	26	29	27	18
7.Snack desirable for children (137)	19	41	32	8
8.Snack good reward after hard task (129)	18	31	33	18
9.Snacking adequate when hungry between meals (135)	16	56	23	5
10.Snacks allowed when ate adequate meal (131)	12	23	40	25
11.Snacking prevents being too hungry at meals (134)	7	33	39	21
12.Nature of snack not important (125)	6	16	44	34
13.Witholding snack: a good punishment (130)	6	19	33	42
14.Snack good way to make up for skipped meals (133)	4	18	34	44

* Corresponding perception in the survey instrument.

Table 12. Correlations of Frequency of Meals and Snacks with Eating Practices and Snacking Habits

Eating Practices and Snacking Habits	Number of meals skipped per days	Number of snacks on a typical day
Total calcium intake	-0.2621	-
Percentage RDA of calcim in meals	-0.2445	-
Total vitamin A consumption	-0.2367	-
Percentage RDA of iron in meals	-0.2109	-
Total caloric intake	-0.2013	-
Snacking independent from time	-	-0.4710
Snacking independent from circumstances	-	-0.2292
Snacking good reward after a hard task	-	-0.2167
Dislike cake for snack	-	-0.2352
Percentage total protein in snacks	-	0.2681
Percentage total iron in snacks	-	0.2355

Snack Food Preferences

Significant Correlations with Snack Food Preferences

The correlations with the snack food preferences are reported in Table 13. These correlations reflect the following relationships. The college students who are prone to like soft drinks, candy bars and potato chips as snack items, would tend to choose snacks from a vending machine pro-

viding soda and different sweet items than from a vending machine offering fruit, yogurt and milk. Also, the college students who like candy bars, cake and potato chips as snack items, are prone to not give any importance to the nature of a snack. In other words, a student who has tendency to like one of the low nutrient dense snack items would be apt to not giving any importance to the kind of snack consumed, and to choosing snack items from a vending machine offering soda and different sweet items than from a vending machine providing fruit, yogurt and milk.

A college student who would like fresh fruit and/or yogurt (two nutrient dense snacks) as snack items, would have a tendency to choose snacks from a vending machine offering fresh fruit, yogurt and milk than from a machine providing soda and different sweet items. Furthermore, a college student who would like milk for snack would tend to consume higher total caloric intakes than a student who would not like milk for snack. Finally, a college student who would like cake (a low nutrient dense snack item) and/or small sandwich (a nutrient dense snack item) would be apt to snack at any time of the day.

Linkage Analysis of Snack Food Preferences

The Linkage analysis of snack food preferences are reported in Figure 2. It can be noticed that there are strong intercorrelations within the low nutrient dense snack items (soft drink, candy bar, potato chips and cake). There are also some correlations within the high nutrient dense snack items (small sandwich, milk, yogurt and fresh fruit). Finally, the snack food item, "nuts", had correlation with both snack categories: low nutrient dense snacks (potato chips and cake) and high nutrient dense snacks (small sandwich and yogurt).

The correlations of the above snack items with low nutrient dense snacks and high nutrient dense snack preferences are reported in Table 14. These correlations reflect the following relationships. College students who have a tendency to like one of the snack items in the low nutrient dense category are prone to prefer low nutrient dense snacks, while college students who have a

Table 13. Correlations of Snack Food Preferences with Snacking Perceptions and Eating Practices

Snack food Preferences	Prefer fruit, yogurt and milk vs. soda or candy for snack	Nature of snack not important	Snacking independent from time	Total calories
Soft drink	-0.3588	-	-	-
Candy bar	-0.2608	0.2722	-	-
Piece of cake	-	0.2003	0.2006	-
Potato chips	-0.3289	0.1940	-	-
Salted nuts	-	-	-	-
Fresh fruit	0.2866	-	-	-
Yogurt	0.2944	-	-	-
Milk	-	-	-	-0.2448
Small sandwich	-	-	0.2096	-

tendency to like a snack item from the high nutrient dense category are apt to prefer high nutrient dense snacks.

Snacking Perceptions

Significant Correlations with Snacking Perceptions

The correlations with snacking perceptions are reported in Tables 15 and 16. Based on these correlations, the following relationships can be inferred:

1. A college student who agrees that the nature of a snack is not important would tend to like low nutrient dense snacks.

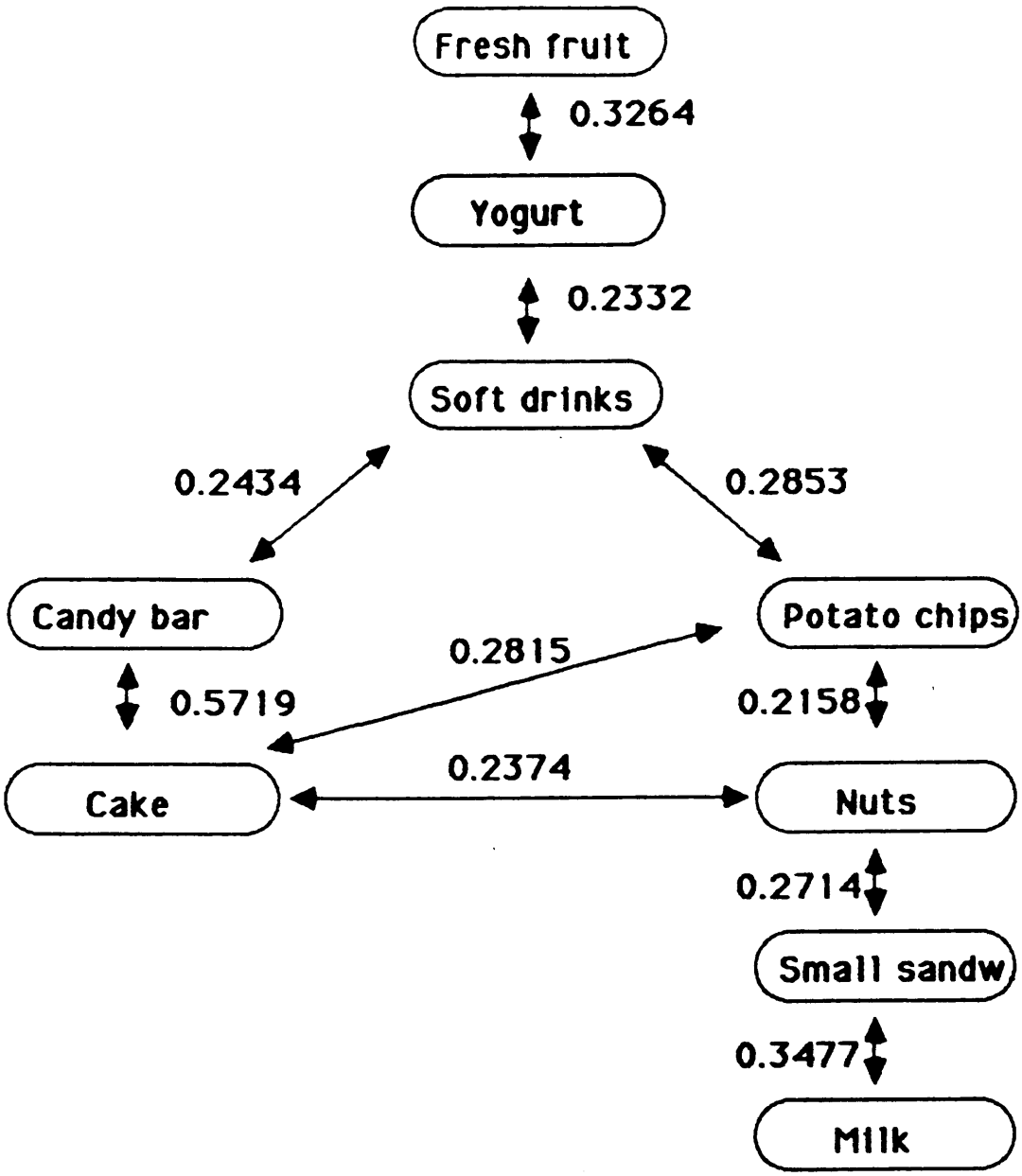


Figure 2. Linkage Analysis of Snack Food Preferences

Table 14. Correlations Between Snack Food Preferences and Nutrient Density of Snacks

Snack item	Consumption of Low nutrient dense snacks	Consumption of High Nutrient dense snacks
Soft drink	0.5952	-0.1620
Candy bar	0.7772	-
Piece of cake	0.7211	-
Potato chips	0.6932	-
Salted nuts	0.2166	0.2090
Fresh fruit	-	0.5343
Yogurt	-0.1868	0.6389
Milk	-	0.6577
Small sandwich	-	0.6123

2. A college student who would agree with the undesirability of habitual snacking will be prone to receive a lower percentage iron's RDA from meals than a student who do not agree with this perception.
3. A college student who would buy snacks from a vending machine offering fruit, yogurt and milk rather than from a machine providing soda or candy will have a tendency to consume nutrient dense snacks, to obtain higher percentages of vitamin A's RDA from meals and to have a greater total vitamin A consumption than a student who tends to disagree with this snacking perception and who would be prone to consume low nutrient dense snacks.
4. A college student who has a tendency to snack at any time of the day would consume a higher number of snacks per day, would obtain lower percentages of protein from meals, and higher percentages of protein, calories and vitamin A from snacks than a student who does not agree with this snacking perception.

Table 15. Correlations of Snacking Perceptions with Eating Practices and Snacking Habits (1)

Eating practices and snacking habits	Snacking Perceptions		
	Nature of snack not important	Habitual snacking undesirable	Prefer fruit, yogurt and milk vs. soda or candy for snacks
Low nutrient dense snacks	0.2770	-	-0.3898
Nutrient dense snacks	-	-	0.2804
Percent RDA of iron from meals	-	0.2178	-
Percent RDA of vitamin A from meals	-	-	-0.2315
Total vitamin A intake	-	-	-0.2160

5. A college student who does not need a specific situation to snack would consume a higher number of snacks per day and would obtain a higher percentage of the vitamin A's RDA from snacks than a student who does not agree with this snacking perception.
6. A college student who considers a snack as a justified reward after a hard task would have a tendency to consume a greater number of snacks on a typical day than the college student who does not agree with this perception.

No general trend can be inferred from these correlations except that the students who have a tendency to agree with some of the positive perceptions toward snacks, have a tendency to obtain higher levels of certain nutrients from snacks and lower levels of other nutrients from meals. The opposite applies to the students who have a tendency to disagree with these perceptions. The non-reported snacking perceptions did not have significant correlation with any of the study's variables.

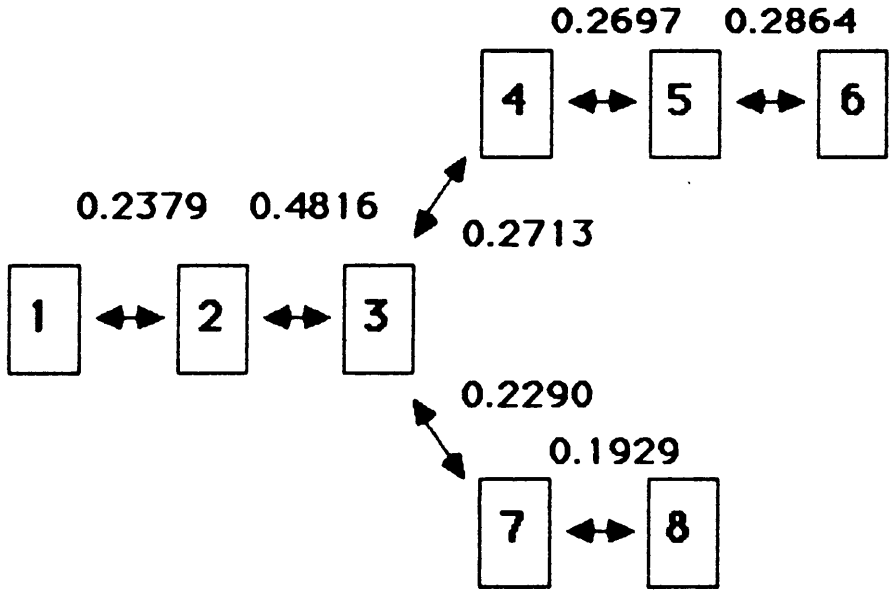
Table 16. Correlations of Snacking Perceptions with Eating Practices and Snacking Habits (2)

Eating practices and snacking habits	Snacking Perceptions		
	Snacking independent from time	Snacking independent from circumstances	Snack good reward after hard task
Number of snacks on a typical day	-0.4710	-0.2292	-0.2167
Percentage protein from meals	0.2123	-	-
Percentage protein from snacks	-0.2123	-	-
Percentage calories from snacks	-0.2080	-	-
Percentage vitamin A from snacks	-0.2029	-	-
Percentage RDA of vitamin A from snacks	-	-0.2111	-

Linkage Analysis of Snacking Perceptions

Only one cluster of more than two variables arose from the linkage analysis of snacking perceptions. These six variables are shown in Figure 3. All of these correlating perceptions indicate a favorable attitude toward snacks and the habits of snacking. A college student who would agree with one of these perceptions will be apt to agree with all the other ones. Similarly, if he(she) disagrees with one of the perceptions he will be prone to disagree with all the other ones. Therefore, the mean score, referred to as snacking efficacy, obtained on these perceptions will indicate the extent to which a student has a positive or negative attitude toward snacking. The closer a student's mean score approaches one, the more favorable his attitude toward snacking and the stronger his snacking efficacy, while the closer the mean score to four, the more unfavorable the student's attitude toward snacking and the weaker his snacking efficacy.

Even though the remaining snacking perceptions did not have any correlation with the above correlating ones, they had some degree of intercorrelation. The snacking perception "snacks are a



1. I am as likely to snack when I am happy as when I am sad.
2. I do not need a specific situation to snack (i.e., party, gathering, celebration).
3. I have tendency to snack at any time of the day.
4. A snack can be considered a justified reward after a hard task.
5. Witholding a snack can be a good way for punishing a child.
6. People should not snack when they did not eat all what they were supposed to eat at meal time.
7. Snacking is a good idea when you feel hungry between meals.
8. Snacks are desirable for children.

Figure 3. Linkage Analysis of Snacking Perceptions.

good way to make up for skipped meals" correlated positively (0.2322) with the perception "snacking prevents being too hungry and eating too much at meal time." The snacking perception "if a vending machine with fruit, yogurt and milk was available, I would rather buy food items from it instead of from a soda or candy vending machine" correlated negatively (-0.2264) with the perception "when I eat a snack it does not matter what it is." This correlation indicates that the college student who would choose snacking food items from a vending machine offering fruit, yogurt and milk instead of from a machine offering soda and candy, would have a tendency to disagree with the fact that the nature of a snack is not important. While the student who would prefer to snack from a soda and candy vending machine would not give any importance to the nature of the snack he is consuming. Finally, the snacking perception "an occasional snack is not bad, but habitual snacking is probably undesirable" correlated positively (0.3023) with the perception "a snack should be a small amount of food compared to a meal." No specific general trend can be inferred from these three correlations.

Significant Correlations with Snacking Efficacy

The snacking efficacy score correlated negatively with the number of snacks consumed on a typical day (-0.3414). It also had a positive correlation with low nutrient dense snack consumption (0.2486) and a very low positive correlation with high nutrient dense snack intake (0.1367). From these correlations the following can be deduced. A student who has a tendency to agree with most of the correlated snacking perceptions and therefore scores low on snacking efficacy, will be more prone to consume a high number of snacks on a typical day. The contrary also applies. This further reinforces the previous finding that a low score on the snacking efficacy indicates a favorable attitude toward snacking while a high score would express an unfavorable attitude toward snacking.

It can also be concluded that a student who tends to disagree with the correlated snacking perceptions would be predisposed to dislike low nutrient dense snacks.

More precisely, the percentages of the snacking efficacy and the low nutrient dense snacking scores are reported in Table 17. It can be concluded that 44% of the students either disagreed with the snacking efficacy perceptions and disliked low nutrient dense snacks, or agreed with the snacking efficacy perceptions and liked low nutrient dense snacks. Twenty-seven percent of the students agreed with the snacking efficacy perceptions, but disliked low nutrient dense snacks. This means that 27% of the students who have a likelihood to snack, do not like low nutrient dense snacks. Finally, 17% of the students disagreed with the snacking efficacy perceptions (low tendency to snack) and liked low nutrient dense snacks. It can be concluded that there is not one single trend concerning snacking frequencies and snack food preferences among college students.

Limitations

The use of self-report instruments inherently imposes certain limitations on this study. The students had to measure their own food intakes and do their own nutrient analysis. Even though their work was closely monitored and checked by the researchers and the teaching assistants, errors in the recording and in the calculations cannot be completely ruled out. However, due to the big sample size and the close supervision, these errors would likely be insignificant.

The fact that the students had to record and then analyze their own food consumption, may have caused a change in their normal eating patterns. However, the normal curiosity of the students for obtaining an idea of their nutrient intakes should have kept the degree of change to a minimum.

Table 17. Percentage Distribution of Snacking Efficacy and Low Nutrient Dense Snacks Scores (N = 284)

	Low Nutrient Dense Snacks	
	Do not like low nutrient dense snacks	Like low nutrient dense snacks
Tend to disagree with the snacking efficacy perceptions	29%	17%
Tend to agree with the snacking efficacy perceptions	27%	27%

Although it has been stressed to the respondents that their answers were going to be anonymous, some could have chosen not to be very honest and thus selected what appeared to be the most positive answer rather than the one that described them best.

Some of the students could have misinterpreted the snacking perceptions, and thus given an inadequate answer. However, the researchers used a pretesting procedure to make these statements as clear as possible in order to prevent a significant number of misunderstandings.

Summary, Conclusion and Implications for Future Studies

This study has reinforced previous findings that college students' eating habits are characterized by missed meals, snacking and unstructured eating patterns. However, it revealed that this does not automatically mean unsatisfactory nutritional status and a fondness for just low nutrient dense foods.

The total nutrient intakes indicated that the average intakes were all above 100% of the RDA's, even though intakes less than 67% of the RDA's were found for all the recorded nutrients. In addition, only small groups in the population reported these low nutrient intakes except for iron, vitamin A and calcium. The percentage of vitamin/mineral supplement users was very low (only 13% of the population) compared to the findings of previous studies with very few students taking megadoses.

The proclaimed snack food preferences demonstrated that this population of college students had a slight tendency to prefer nutrient dense snacks. In fact the average response was a prevaling neutral reaction to candy bar, cake, potato chips, salted nuts, and yogurt as snack items and a slight favorable predisposition for small sandwich, milk, soft drink, and especially fresh fruit. But, further

research is needed to determine if food preferences are related to actual food consumptions or if the latter is influenced by food availability. However, consistency was detected in the college students food preferences through the correlations between snack food items and low nutrient and nutrient dense scores. These correlations indicated that the college students who have a tendency to like one of the snack items in the low nutrient dense category are prone to prefer low nutrient dense snacks, while the college students who have a tendency to like a snack item from the nutrient dense category are apt to prefer nutrient dense snacks.

The correlating snacking perceptions (snacking efficacy) constituted a good instrument for the investigation of the frequency of snacking among college students. However, it did not have any correlation with the eating habits of college students. This indicates that no specific trend could be detected between the snacking attitudes and the consumption practices of college students. This is further reinforced by the lack of a specific correlation between the snacking efficacy and the tendency to like or dislike low nutrient dense snacks. The fact that the tendency to snack at any time of the day correlated positively with the aptitude to like both cake (a low nutrient dense food item) and sandwich (a nutrient dense food item) for snacks reinforces the above conclusion. So even though the food habits of college students are far from being optimal, their snacks are not exclusively low nutrient dense snacks.

As found by this study the nutrition education classes can be effective. Therefore, nutrition educators should try to improve the college students' eating habits based on their actual food patterns. Asking for a complete change in eating practices would not be effective. Based on the findings of this study, nutrition classes should focus on the following topics: (1) the Dietary Guidelines for Americans concentrating on increasing complex carbohydrate consumption and decreasing saturated fat and cholesterol intakes, (2) the importance of healthy snacks, and (3) the dangers of relying on vitamin/mineral supplements for the provision of the nutrients needed and the toxic effects of megadoses intakes.

This study was able to provide an instrument for the detection of snacking frequency (the snacking efficacy score) and the preferred kinds of snacks (the snack food preferences). However, further research is needed to build an instrument which will provide more specific information on the food and nutrient intakes of college students. Furthermore, it can investigate the importance of exercise and fast food consumption in the life style of college students. It would be also interesting to know wether any changes happened in the eating practices of these students after moving out of their home to come to college.

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Appendix A.

HNF 1000 - CODING DIRECTION FOR OBSCAN SHEET

DIET RECORD - TERM PROJECT

PLEASE FOLLOW THE FOLLOWING INSTRUCTIONS TO RECORD THE INFORMATION REQUIRED.

NUMBERS 1 to 3: record your weight to the nearest pound.
Right justify your numbers:
Line 1 for hundreds,
Line 2 for tens,
Line 3 for units.

If you weigh 142 pounds, mark 142 starting in the first line.
1- Ⓐ Ⓑ ⓪ ❶ ② ③ ④ ⑤ ⑥ ⑦ Ⓑ ⑨ (Mark 1 on #1)
2- Ⓐ Ⓑ ⓪ ① ② ③ ❹ ⑤ ⑥ ⑦ Ⓑ ⑨ (Mark 4 on #2)
3- Ⓐ Ⓑ ⓪ ① ❷ ③ ④ ⑤ ⑥ ⑦ Ⓑ ⑨ (Mark 2 on #3)

If you weigh 85 pounds, mark 0 in the first line followed by 85.
1- Ⓐ Ⓑ ❶ ① ② ③ ④ ⑤ ⑥ ⑦ Ⓑ ⑨ (Mark 0 on #1)
2- Ⓐ Ⓑ ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ❽ ⑨ (Mark 8 on #2)
3- Ⓐ Ⓑ ⓪ ① ② ③ ④ ❺ ⑥ ⑦ Ⓑ ⑨ (Mark 5 on #3)

Numbers 4 - 6: record your ideal body weight to the nearest pound.
Right justify your numbers the same way as above.

Numbers 7: record your age-sex group:
1. woman between 15-18 years old
2. woman between 19-22 years old
3. woman between 23-50 years old
4. pregnant woman
5. man between 15-18 years old
6. man between 19-22 years old
7. man between 23-50 years old

Number 8: record your major:
1. Engineering; Physical Sciences
2. Social Sciences; Arts; Architecture
3. Math; Statistics; Computer Science
4. Human Resources other than HNF
5. HNF
6. Agriculture, Life Sciences (Biol., Biochem.)
7. Business, Urban Affairs and Planning

NUMBERS 9 to 138 on the obscan form:

9 - 12: Record your 3-day average total caloric intake:
Right justify your numbers:
Line 9 for thousands
Line 10 for hundreds
Line 11 for tens
Line 12 for units
Examples: If your average kcal. consumption is 759 kcal., mark 0 on #9, 7 on #10, 5 on #11 and 9 on #12.
If your average kcal consumption is 4968 kcal., mark 4 on # 9, 9 on #10, 6 on #11 and 8 on #12.

13 - 16: Mark your average total energy expenditure (TEE) per day.
Right justify your numbers the same way as above.

On the following lines mark the % total Kcalories supplied by: (taken from p.16 on the bottom right hand corner):

17-18: Proteins
Right justify your numbers:
Line 17 for tens
Line 18 for units

19-20: Fats — Right justify your numbers as above.

21-22: Carbohydrates — Right justify your numbers as above.

23-24: Alcohol — Right justify your numbers as above.

On the following lines mark the % RDA consumed by: (taken from the 13th and 14th bottom lines of the table p.16); (if you have greater then 1000% record 999)

25-27: Proteins in meals
Right justify your numbers:
Line 25 for hundreds
Line 26 for tens
Line 27 for units
Examples: if you have 78% => mark 0 on #33, 7 on #34 and 8 on #35.
if you have 9% => mark 0 on #33, 0 on #34 and 9 on #35.

28-30: Proteins in snacks — Right justify your numbers as above.

31-33: Calcium in meals	Right justify your numbers as above.
34-36: Calcium in snacks	Right justify your numbers as above.
37-39: Iron in meals	Right justify your numbers as above.
40-42: Iron in snacks	Right justify your numbers as above.
43-45: Vit A in meals	Right justify your numbers as above.
46-48: Vit A in snacks	Right justify your numbers as above.
49-51: Thiamin in meals	Right justify your numbers as above
52-54: Thiamin in snacks	Right justify your numbers as above.
55-57: Riboflavin in meals	Right justify your numbers as above.
58-60: Riboflavin in snacks	Right justify your numbers as above.
61-63: Niacin in meals	Right justify your numbers as above.
64-66: Niacin in snacks	Right justify your numbers as above.
67-69: Vit C in meals	Right justify your numbers as above.
70-72: Vit C in snacks	Right justify your numbers as above.

Vitamins-Minerals supplementation (if you don't consume any supplement leave blank the numbers from 73 to 93 and skip to #94).

On the following lines mark the % RDA provided per day by the supplement(s) for:

73-75: Calcium	Right justify your numbers as above.
76-78: Iron	Right justify your numbers as above.
79-81: Vit A	Right justify your numbers as above.
82-84: Thiamin	Right justify your numbers as above.
85-87: Riboflavin	Right justify your numbers as above.
88-90: Niacin	Right justify your numbers as above.
91-93: Vit C	Right justify your numbers as above.

For each one of the following food items mark the appropriate answer:

To what extend have you changed your food habits as a result of this class?
1- Increased. 2- Stayed the same. 3- Decreased.

94- Milk foods
95- Fruits
96- Vegetables
97- Breads/Cereals
98- Meat
99- Fish and poultry
100- Eggs
101- Legumes (dried beans)
102- Fat
103- Saturated fat
104- Cholesterol
105- Sugar
106- Alcohol
107- Salt
108- Calories
109- Snacks

For each one of the following questions mark the appropriate answer:

110- Before this class, were you taking a multivitamin or a multivitamin/mineral supplement?
1- No
2- Yes

111- Before this class, were you taking a specific vitamin or mineral supplement? (mark only one answer)
1- No
2- Yes, in moderate amounts
3- Yes, in megadoses

112- At present or for the anticipated future, are you going to take a multivitamin or a multivitamin/mineral supplement?
1- No
2- Yes

113- At present or for the anticipated future, are you going to take a vitamin or mineral supplement? (mark only one answer)
1- No
2- Yes, in moderate amounts
3- yes, in megadoses

114- How many meals did you skip during your three days study?

115- About how many snacks do you eat on a typical day?
0- None
1- One
2- Two
3- Three
4- Four or more

NUMBERS 116 to 124: How well would you like each one of the following as a snack item?
1- A lot. 2- Neutral. 3- Not much.

116- Soft drink
117- Candy bar
118- Piece of cake
119- Potato chips
120- Salted nuts
121- Fresh fruit
122- Yoghurt
123- Milk
124- Small sandwich

NUMBERS 125 to 136: For each one of the following statements choose one of the answers:
1- Agree. 2- Tend to agree. 3- Tend to disagree. 4- Disagree.

125- When I eat a snack, it doesn't matter what it is.

126- I have tendency to snack at any time of the day.

127- I don't need a specific situation to snack (i.e. party, gathering, celebration).

128- I am as likely to snack when I am happy as when I am sad.

129- A snack can be considered a justified reward after a hard task.

130- Withholding a snack can be a good way for punishing a child.

131- People shouldn't snack when they didn't eat all what they were supposed to eat at meal time.

132- An occasional snack isn't bad, but habitual snacking is probably undesirable.

133- Snacks are good way to make up for skipped meals.

134- Snacking prevents being too hungry and eating too much at meal time.

135- Snacking is a good idea when you feel hungry between meals.

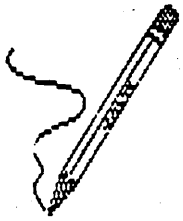
136- A snack should be a small amout of food compared to a meal.

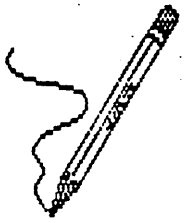
137- Snacks are desirable for children.

138- If a vending machine with fruit, yoghurt and milk was available, I would rather buy food items from it instead of from a soda or candy vending machine.

Appendix B.

TERM PROJECT





HNF 1000
FOOD AND PEOPLE
WINTER 1988

STUDENT NAME: _____

SOCIAL SECURITY NO.: _____

SECTION (MARK ONE): 9:00 A.M. ____
1:00 P.M. ____

NOTE: DUE DATE - 3 DAY FOOD RECORD, DECEMBER 9, 1987
DUE DATE - TOTAL PROJECT, JANUARY 29, 1988

TABLE OF CONTENTS

HNF 1000
FOOD AND PEOPLE

DIRECTIONS FOR THREE DAY FOOD INTAKE RECORD (DIET RECALL)

1) Record everything you eat or drink (except water) for 3 consecutive days including one weekend day (Saturday or Sunday). Include gum, candies, snacks, etc., from getting up to going to bed (6 a.m. to 6 a.m.). Use the provided sheet for each day. Record Foods in spaces to show whether food was eaten as a meal or snack. Snacks are what you eat between meals.

   If you consume processed foods (e.g. cake mix, canned beef stew, pop tarts), keep the package so you can use the label for your analysis.

2) In the amounts column, indicate the total quantity of each food eaten. Estimate as accurately as possible in cups, teaspoons, tablespoons, grams, ounces, slices (bread), cheese 1-1/2" cube, etc. for recording purposes. If the dish includes more than one ingredient, break it down. Example: spaghetti sauce, noodles, meat, cheese.

3) Try to eat what you would ordinarily eat. Knowing you have to record the food will undoubtedly make some difference in your choices. Try to keep this effect to a minimum. Remember, you will NEVER be graded on what or how much you eat.

4) It is easier to record the food you eat as you eat it or immediately after. This is so you don't forget the little things like margarine, salad dressing, sugar, beverages, etc.

5) This food record is to give you an idea of your usual daily intake. It will be the basis for your term project, which will be explained next week.

6) If you take any vitamin or mineral supplements, record the brand name, the nutrients included, and amount (e.g. dosage such as mg., I.U.) of each nutrient at the bottom of each daily diet record sheet.

7) Your three day food intake record is due December 9, 1987. Make certain you have completed the information at the top of each page (name, class time, and date) and staple the three sheets together before turning them in. Your three day record will be checked and returned to you at a later date for your use in the term project. Remember, points will be taken off for each day it is late, including weekends.

DIET RECORD SHEET EXAMPLE

NAME_____
CLASS TIME_____
DATE OF RECALL_____

Please record all food/drink and amounts for one 24-hour period (6 a.m. on day 1, 2 or 3 to 6 a.m. on day 2, 3, or 4).

FOOD/DRINK		AMOUNT
MEAL	SNACK	
Some Examples:		
Whole Wheat Bread		1 slice
2% Milk		1 cup
Hamburger Patty		4 oz.
Hamburger Bun		1 bun
Ketchup		2 tbsp
	Pepsi	12 oz. can

	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alcohol (g)
Vitamin/Mineral Supplement								XXXXXXXX XXXXXXXX

DAY 1

DIET RECORD SHEET

NAME _____
CLASS TIME _____
DATE OF RECALL _____

Please record all food/drink and amounts for the 24-hour period (6 a.m. on day 1 to 6 a.m. on day 2).

FOOD/DRINK		AMOUNT
MEAL	SNACK	

	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alcohol (g)
Vitamin/Mineral Supplement								XXXXXXXX XXXXXXXX

DAY 2

DIET RECORD SHEET

NAME_____
CLASS TIME_____
DATE OF RECALL_____

Please record all food/drink and amounts for the 24-hour period (6 a.m. on day 2 to 6 a.m. on day 3).

FOOD/DRINK		AMOUNT
MEAL	SNACK	

	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alcohol (g)
Vitamin/Mineral Supplement								XXXXXXXX XXXXXXXX

DAY 3

DIET RECORD SHEET

NAME_____
CLASS TIME_____
DATE OF RECALL_____

Please record all food/drink and amounts for the 24-hour period (6 a.m. on day 3 to 6 a.m. on day 4).

FOOD/DRINK		AMOUNT
MEAL	SNACK	

	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alcohol (g)
Vitamin/Mineral Supplement								XXXXXXXX XXXXXXXX

HNF 1000
FOOD AND PEOPLE
TERM PROJECT INSTRUCTIONS

1. Use the three day dietary record. The stamped 3 day record (Diet Recall) must be included in your project report.

2. CALCULATE THE NUTRITIONAL VALUE OF YOUR DIET FOR EACH DAY: FOR MEALS; FOR SNACKS; AND FOR THE TOTAL DAY ON THE GREEN ORIGINAL DIET WORKSHEET.

   A. Under the column labeled Approx. Measure or Weight list the food item and the portion size for each day taken from your 3 day record. Group foods under meals or under snacks. NOTE: Do not record any vitamin or mineral supplement you took except as described under 5-D-3. Also, note that there is a white worksheet for each day (pages 23-26). This is for your rough draft prior to completing the final copy to turn in. If you need more space, divide spaces in half or use another sheet.

   B. Calculate the energy value and the amount of fat, carbohydrate, protein, calcium, iron, vitamin A, vitamin C (ascorbic acid), niacin, thiamin, riboflavin and alcohol for each food/beverage by using the sources listed below. Appropriate units of measure are listed in the column headings on the work sheet (kilocalories, grams, milligrams, or international units). Be certain that the units of measure correspond to the RDA Recommendations, especially note vitamin A, thiamin and riboflavin. Indicate in the column labeled source, which table you used for each food item. NOTE:

INFORMATION ON NUTRIENT CONTENT OF FOOD IS FOUND IN:

1) TEXT: NUTRITION FOR LIVING
   (a) APPENDIX E - TABLE OF FOOD COMPOSITION, PP. 521-548.
   (b) APPENDIX F - FAST FOOD, PP. 549-553.

2) WALLACE 313 DURING OFFICE HOURS
   (a) AGRICULTURAL HANDBOOK 456
   (b) BOWES AND CHURCH
   (c) AGRICULTURE HANDBOOK 8

4) FOOD LABELS - If you use the package or container label, be certain you convert Percentage of USRDA to nutrient amounts (e.g., mg, IU). On page 13 of your text, use column 3 to estimate the amount of nutrient present.

3) ADDITIONAL REFERENCE
   Since the above sources do not indicate the alcoholic content of beverages, use the following table to list grams of alcohol.

Alcoholic Beverages	Amount	Alcohol(g)
Beer	12 oz.	13
Beer (lite)	12 oz.	12
Rum, Gin, Whiskey, etc.	1 1/2 oz.	15
Wine	3 1/2 oz.	10
Grain Alcohol	1 1/2 oz.	35

3. For each daily record, subtotal the column values for meals and for snacks. Total the day.

4. On the fourth GREEN page (page 16) original diet worksheet

   A. Transfer the subtotals for meals and for snacks for each day into the appropriate column.
   B. Total the three days.
   C. Calculate your average intake for the three days.

5. COMPARE YOUR AVERAGE INTAKE WITH RDA RECOMMENDATIONS.

   A. Kilocalories (kcal)

   Using 4, 4, 9, 7 values for kcalories/gram of carbohydrate, protein, fat, and alcohol, respectively, calculate the number of kcalories you received from each of these energy sources for your 3 day average for total meal/snack intake. Show your calculations on the worksheet using 3 day average values.

   STEP 1

   _____g Protein X 4 kcal/g = _____kcal

   _____g Fat X 9 kcal/g = _____kcal

   _____g CHO X 4 kcal/g = _____kcal

   _____g Alcohol X 7 kcal/g = _____kcal

   STEP 2: To obtain the percent of total kcalories supplied by each energy source divide each of the above kcal values by the 3 day average kcal from the energy column on the summary page (last GREEN page) and then multiple by 100.

   Example: $\frac{\text{800 kcal from CHO}}{\text{1800 kcal from 3 day ave.}}$ X 100 = 44.4% kcal from CHO

   (Show your calculations for STEP 2 on the last GREEN sheet - page 16.)

   Enter your results on the summary page (last GREEN sheet - page 16) in the space titled percent of total kcalories supplied by. Total the percentages.

   NOTE: Because the values (kcal/g) used in Step 1 have been rounded and are approximations, totals may not agree with the total energy value you use in Step 2. Thus your total of percentages may not necessarily be 100.

B. Total Energy Expenditure (TEE). Show the calculations for each step below.

   1) ESTIMATING TOTAL ENERGY EXPENDITURE

   (a) Estimate the energy you spend on basal metabolism by using the figure 1.0 kcal per kilogram per hour (for men) or 0.9 kcal (for women) and then multiply by 24 hours. Estimate your basal metabolism using your desirable weight not your actual weight.

   Basal Metabolism _____kcal

(b) Estimate the energy you spend on physical activities by using the following guidelines. For sedentary (mostly sitting) activity (a professor), take 20 percent of the energy spent on basal metabolism (a). For light activity (a student), take 30 percent. For moderate activity (a nurse), take 40 percent. Or for heavy work (a roofer), use 50 percent or more.

Activity _____kcal

(c) Estimate the energy spent on metabolizing food as 10 percent of your 3 day average caloric intake.

Specific Dynamic Effect _____kcal

2) Now add these three figures together.

a + b + c = (TEE) Total Energy Expenditure _____kcal

EXAMPLE: Energy needs of a woman who is 5'6" in height and has a large frame. From Table 10.1, page 238 of your text, her desirable weight would be halfway between 140 and 160 lbs or 150 lbs.

(a) First, change pounds to kilograms (2.2 lb in 1 kg): $\frac{150 \text{ lb}}{2.2 \text{ lb}} \times 1 \text{ kg} = 68 \text{ kg}$

Then multiply weight in kilograms by the factor for women:

$$68 \text{ kg} \times \frac{0.9 \text{ kcal}}{\text{kg per hour}} = 61 \text{ kcal per hour}$$

Then multiply the kcal used in one hour by the hours in a day:

$$61 \text{ kcal per hour} \times \frac{24 \text{ hours}}{1 \text{ day}} = 1464 \text{ kcal per day}$$

Energy used for basal metabolism (a) is 1464 kcal per day.

(b) Now, suppose the woman is engaged in sedentary activity. Multiplying the metabolic energy by 20 percent gives:

1464 kcal per day x 0.20 = 293 kcal per day

Energy used for muscular activities (b) is 293 kcal per day.

(c) If we know that this woman normally eats about 1900 kcal per day, we can estimate the metabolic need generated by eating this much at 10 percent of that, or 190 kcal, Specific Dynamic Effect.

(d) Answer: Her Total Energy Expenditure (TEE) for a day is (a) + (b) + (c), or 1464 + 293 + 190 kcal. The total is 1947 kcal. The exact figure is based on several estimates, so it's probably best to express her needs as falling within a 50-calorie range: say, 1925 to 1975 kcal per day.

3) Enter your TEE in the designated space on the summary GREEN sheet - page 16.

4) Subtract your TEE from the number of kcal in your 3 day dietary recall average and enter your answer in the appropriate space.

C. RDA for Protein

Calculate your RDA for protein using 0.8 g protein for each kilogram of desirable body weight. Show your calculations here

$$\frac{\text{\_\_\_\_\_ pounds}}{2.2\ \text{kg/lb}} = \text{\_\_\_\_\_ kg body wt}$$

_____ kg X 0.8 g protein/kg = _____ g protein

Enter this figure on the GREEN summary sheet in (page 16) the space for protein RDA.

D. Calculate the percentage of your RDAs for vitamins and minerals coming from meals and from snacks.

1) Refer to the table of RDAs in the back inside cover of your textbook for the correct values based on your sex and age. List in the appropriate spaces on the GREEN summary sheet - page 16.

2) Using your 3 day average intakes for the listed vitamins and minerals, calculate the % of the RDA that your diet contained. Enter this % in the appropriate space.

EXAMPLE:

The RDA for Vitamin C for a 20 year old female is 60 mg. If the Vitamin C content of the diet is 68 mg,

$$\frac{\text{mg nutrient in diet}}{\text{RDA}} \times 100 = \frac{68\text{mg}}{60\text{mg}} \times 100 = 113\% \text{ of RDA for vitamin C}$$

3) On the appropriate line of the GREEN summation sheet (page 16) record the vitamin/mineral content of any supplements you took. Note that this should be a value based on a three day average.

6. REVISE YOUR 3 DAY DIET RECORD ON THE REVISED DIET FORM (PINK) SO THAT:

A. Your 3 day average energy (kcalories) value is neither greater than 10% above or less than 10% below your calculated TEE.

B. The distribution of your 3 day average energy approaches the dietary guidelines within 5 percentage points.

Energy Source	Guideline	+ or - 5% pts
protein	12%	7-17%
fat	30%	25-35%
carbohydrate	58%	53-63%
alcohol	0%	0- 5%

C. You meet at least 66% (i.e., 2/3s) of the RDA for each nutrient listed. You may go over 100% of the RDA if necessary.

If your diet already meets all three of the above criteria, then assume you are pregnant and revise your diet to meet the RDA for a pregnant woman (see inside back cover of your textbook for RDA). (Sorry boys - we will just have to assume a miracle has taken place for you!!)

A. Make adjustments to your diet by adding reasonable amounts of any food you like to eat. (Anyone who adds 4 lbs of raw kale or 1 pound of chicken livers risks losing his/her credibility!) Keep in mind the four food groups as you revise your diet. You can also reduce the amount of any food or delete a food altogether from your original diet.

In the extreme right hand column of each of your daily original and revised diet forms place a ( ) by any food you have adjusted by reducing or increasing it and an (X) by any food deleted (original diet forms) or added (revised diet forms).

B. Total each column on the Revised Diet Form for each day.

C. Enter the total of each day on the PINK summary sheet (page 20).

D. Calculate the 3 day average.

E. Calculate the percentages of total kilocalories supplied by protein, fat, carbohydrate, and alcohol using your 3 day average. Report in the designated space.

F. Show all your calculations on the last PINK sheet (page 20) - Revised Summary Sheet - for Item 5-A, Step 1 and 2.

7. Evaluate your original 3 day dietary recall by answering the questions on the PINK sheet titled - Evaluation (pages 21-22).

8. Complete the survey form. Code responses on the mark sense sheet provided by your instructor.

8. ORGANIZE YOUR PROJECT

In order to facilitate grading of your project it is necessary that you submit your project in the order shown below. Failure to do so will result in a loss of points.

		PAGES
A.	COVER PAGE - NAME/ID NUMBER/CLASS TIME	—
B.	ORIGINAL DIET RECORD (Diet Recall)	4-6
C.	TERM PROJECT INSTRUCTIONS (Including calculations) (GREEN)	7-12
D.	ORIGINAL DIET FORMS (GREEN pages) FOR DAY 1, 2, & 3 AND SUMMATION	13-16
E.	REVISED DIET FORM (PINK pages) FOR DAY 1, 2 & 3 AND SUMMATION	17-20
F.	EVALUATION (WHITE)	21-22
G.	WORKSHEETS FOR ORIGINAL DIET: DAYS 1, 2, 3, AND SUMMATION	23-26
H.	WORKSHEETS FOR REVIESED DIET FORMS: DAYS 1, 2, 3 AND SUMMATION	27-30

STAPLE A - F TOGETHER BEFORE TURNING IN YOUR PROJECT. Remember, 5 pts. will be taken off for each day late including weekends. Even if the project is so late as to give you 0 pts., you must still turn one in and get a minimum grade equivalent to 25 points or you fail the course.

I. SURVEY FORM - A survey form and opscan sheet will be handed out in class for you to complete. Attach with a paper clip to your report. Do not staple to this form.

ORIGINAL DIET FORM

FINAL COPY TO BE TURNED IN

DAY 1

NAME _____ ID NUMBER _____ CLASS MEETING TIME _____

HEIGHT _____ in WEIGHT _____ lb _____ kg DESIRABLE WEIGHT* _____ lb _____ kg AGE _____ yr

Food	Approx. Measure or Weight	Energy (kcal)	Protein (g)	Fat (g)	Carbo-hydrate (g)	Cal-cium (mg)	Iron (mg)	Vitamin A (IU)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alco-hol (g)	Source (Abbr)
MEALS														
SUBTOTAL MEALS														
SNACKS														
SUBTOTAL SNACKS														
TOTAL	XXXXXXXXXX													
	XXXXXXXXXX													

*Determine your desirable weight from the Tables on page 238 and 239 of your Text. For example, if you are a 5'10" female and estimate your frame size as medium, the table gives 130–144 lbs. Select your desirable weight at halfway between 130 and 144 or 137.

ORIGINAL DIET FORM

FINAL COPY TO BE TURNED IN

DAY 2

NAME _____ ID NUMBER _____ CLASS MEETING TIME _____

Food	Approx. Measure or Weight	Energy (kcal)	Protein (g)	Fat (g)	Carbo-hydrate (g)	Cal-cium (mg)	Iron (mg)	Vitamin A (IU)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alco-hol (g)	Source (Abbr)
MEALS														
SUBTOTAL MEALS														
SNACKS														
SUBTOTAL SNACKS														
TOTAL	XXXXXXXXXX XXXXXXXXXX													

ORIGINAL DIET FORM FINAL COPY TO BE TURNED IN DAY 3

NAME _____ ID NUMBER _____ CLASS MEETING TIME _____

Food	Approx. Measure or Weight	Energy (kcal)	Protein (g)	Fat (g)	Carbo-hydrate (g)	Cal-cium (mg)	Iron (mg)	Vitamin A (IU)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alco-hol (g)	Source (Abbr)
MEALS														
SUBTOTAL MEALS														
SNACKS														
SUBTOTAL SNACKS														
TOTAL	XXXXXXXXXX XXXXXXXXXX													

ORIGINAL DIET FORM

FINAL COPY TO BE TURNED IN

SUMMATION OF DAYS 1, 2, & 3

NAME _____ ID NUMBER _____ CLASS MEETING TIME _____

Food	Energy (kcal)	Protein (g)	Fat (g)	Carbo-hydrate (g)	Cal-cium (mg)	Iron (mg)	Vitamin A (IU)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Alcohol (g)
MEALS												
Day 1 Total												
Day 2 Total												
Day 3 Total												
SUBTOTAL MEALS												
SNACKS												
Day 1 Total												
Day 2 Total												
Day 3 Total												
SUBTOTAL SNACKS												
Total of Days 1, 2 & 3												
3 Day Average												
RDA	XXXXXX		XXXX	XXXXXXX								XXXXXXX
% RDA (TOTAL AVERAGE)	XXXXXX		XXXX	XXXXXXX								XXXXXXX
% RDA (MEALS)	XXXXXX		XXXX	XXXXXXX								XXXXXXX
% RDA (SNACKS)	XXXXXX		XXXX	XXXXXXX								XXXXXXX
TEE												
Difference = TEE minus 3 day average			Vitamin/Mineral Supplement									XXXXXXX XXXXXXX

SHOW CALCULATIONS FOR ORIGINAL DIET FOR ITEM 5-A STEP 2 OF THE INSTRUCTIONS.

_____g Protein X 4 Kcal/g = _____Kcal

_____g fat X 9 kcal/g = _____Kcal

_____g CHO X 4 kcal/g = _____Kcal

_____g alcohol X 7 kcal/g = _____Kcal

Percent of total kcalories supplied by:

protein _____%

fat _____%

carbohydrate _____%

alcohol _____%

TOTAL _____%

Appendix C.

VIRGINIA TECH — LEARNING RESOURCES CENTER

NAME	COURSE	DATE

INCORRECT MARKS	CORRECT MARKS	USE NO. 2 PENCIL
◒ ◯ ⊗ ✓	① ② ● ④	

ID NUMBER | FORM | SEAT NO. | GROUP

1- What is the average number of snacks you consume per day?

2- What do you think a snack would be?
   1- A soft drink or a candy bar.
   2- A salty food item.
   3- A fruit, a cup of milk or yoghurt.
   4- A cheese or meat sandwich.
   5- Both 1 and 2.
   6- Both 3 and 4.
   7- All of the above.

3- How many meals do you usually skip per three days?

4- When would you most probably eat a snack?
   1- In the morning.
   2- In the afternoon.
   3- In the evening.
   4- Both 1 and 2.
   5- Both 1 and 3.
   6- Both 2 and 3.
   7- All of the above.

5- Under which situation would you more probably have a snack?
   1- When don't have anything special to do.
   2- Being under pressure.
   3- Feeling happy.
   4- Feeling sad.
   5- Both 1 and 2.
   6- Both 2 and 4.
   7- Both 1 and 3.
   8- All 1, 2 and 4.
   9- All 2, 3 and 4.
   10- All of the above.

FOR EACH ONE OF THE FOLLOWING STATEMENTS CHOOSE ONE OF THE ANSWERS:
1- DISAGREE 2- AGREE 3- NO OPINION 4- NEUTRAL

6- A snack can be considered a justified reward after a hard task.

7- Witholding a snack can be a good way for punishing a child.

8- People shouldn't snack when they didn't eat all what they were supposed to eat at meal time.

9- An occasional snack isn't bad, but habitual snacking is probably undesirable.

10- Snacking is justified when there is a big time lapse between meals.

11- Snacks are good way to make up for skipped meals.

12- Snacking prevents being too hungry and eating too much at meal time.

13- Snacking is a good idea when you feel hungry between meals.

14- Calories in snacks are usually too small to be consideres in dietary computation.

15- A snack should be a small amount of food compared to a meal.

16- Snacks are desirable for children.

17- If a vending machine providing fruits, yoghurt and milk was available, I would rather buy food items from it instead then from a soda or candies vending machines.

18- I feel the same way about snacks as my mother.

19- I feel the same way about snacks as my father.

20- My peers have influenced my opinion about snacks.

1 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
2 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
3 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
4 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
5 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
6 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
7 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
8 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
9 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
10 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
11 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
12 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
13 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
14 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
15 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
16 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
17 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
18 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
19 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
20 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
21 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
22 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
23 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
24 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

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