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Snack foods, particularly empty calorie snacks, are increasingly used in place of more nutritious foods, especially by teenagers. In order to alleviate possible nutritional deficiencies that may result from excessive snacking, many researchers are trying to develop acceptable, nutritious snack foods. One of these products is sweet potato sticks, a nutritious snack food developed at the Department of Food Science at North Carolina State University. The purpose of this study was to determine if sweet potato sticks were an acceptable snack to teenagers.

A sample of 250 high school students randomly selected from three schools in different regions of piedmont North Carolina were used for the study. Each student evaluated two flavors of the sweet potato sticks, salted and cinnamon flavored, by completing a closed form questionnaire developed by the researcher. Snacking habits of these teenagers were also surveyed by means of the questionnaire.

After the taste-testing was completed in the three high schools, there were enough of both flavors of potato sticks remaining to test with one other class. A third grade, with twenty-eight students, was chosen in order to see the response of another age group to the sweet potato sticks.

} Both flavors of the sweet potato sticks were rated acceptable by the majority of the students. The salted flavor was rated higher in both age groups. Many of the adolescent females gave lower ratings than did the males.

Snacking was a way of life for these teenagers, with 95.6% of all students snacking at least once every day. Empty calorie snacks such as soft drinks and salty snack products were most frequently consumed. More nutritious snacks were consumed by only a small percentage of the students who participated.

FOR ADOLESCENTS

by  
Mertice Ann Hogan

A Thesis Submitted to  
the Faculty of the Graduate School at  
The University of North Carolina at Greensboro  
in Partial Fulfillment  
of the Requirements for the Degree  
Master of Science in Home Economics

Greensboro  
1974

Approved by

*Jean F. Cassilly*  
Thesis Advisor

This thesis has been approved by the Committee  
of the faculty of the University of  
North Carolina at Greensboro

SWEET POTATO STICKS: ACCEPTABILITY  
" AS A NUTRITIOUS SNACK FOOD  
FOR ADOLESCENTS

by

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in calcium, iron, vitamin A, and thiamine according to the Agricultural Research Service of the United States Department of Agriculture (U.S.D.A.) (1). The Ten-State Nutrition Survey of 1963-1970 also found adolescents' diets to be low or minimal in iron, protein, vitamin A, vitamin C, riboflavin, thiamine, and iodine (2).

The market is currently being flooded with new snack foods, many of which could be considered of the empty calorie variety. Such research and development expenditure goes toward the creation of these new snacks. Since 1963 snack food sales have surpassed both population growth and food sales in general (3). Thus, according to many nutritionists, an inadequate diet is easier to choose now than it was fifty years ago (4).



## INTRODUCTION

Today in the United States while there should be enough food to feed everyone adequately, empty calorie snack foods are increasingly used in place of more nutritious foods. Snacks do have a purpose in the diet; they furnish energy necessary for the body to do its work and provide psychological satisfaction for people who consume them. If appealing nutritious snacks could be developed, they would not only provide needed energy, but they would furnish vital nutrients. This is especially important to teenagers, who according to several recently published nutritional status surveys, have the most unsatisfactory nutritional status of all groups.

Teenagers consume less than the recommended dietary allowances in calcium, iron, vitamin A, and thiamine according to the Agricultural Research Service of the United States Department of Agriculture (U.S.D.A.) (1). The Ten-State Nutrition Survey of 1968-1970 also found adolescents' diets to be low or minimal in iron, protein, vitamin A, vitamin C, riboflavin, thiamine, and iodine (2).

The market is currently being flooded with new snack foods, many of which could be considered of the empty calorie variety. Much research and development expenditure goes toward the creation of these new snacks. Since 1945 snack food sales have surpassed both population growth and food sales in general (3). Thus, according to many nutritionists, an inadequate diet is easier to choose now than it was fifty years ago (4).

Empty-calorie snacks which furnish only energy and few nutrients usually contain much sugar. As a result, per capita consumption of sugar has increased from 96.6 pounds in 1965 to an estimated 102.0 pounds in 1972 (5).

White potato sticks and chips are already widely accepted snack foods, and the per capita consumption of these products increased constantly from 1950 to 1967. In 1950 the per capita consumption level of potato chips and dehydrated potato products (including French fries) was six pounds; whereas by 1967 the figure had increased to 25 pounds (6).

The sweet potato furnishes a plentiful supply of many nutrients, especially vitamins A and C. However, the consumption of sweet potatoes has decreased from 6.1 pounds per person in 1960 to 4.1 pounds per person in 1970 (7). Consumption of sweet potato sticks, a proposed new snack product that can be used similarly to the white potato sticks and chips already on the market, could improve the dietary levels of vitamins A and C.

To determine the acceptability of sweet potato sticks as a product, they were taste-tested by several age groups. In a preliminary study, the sticks were tested with groups of nursery school children and were found acceptable. Informal tests showed the salted flavor of this new product also appealed to adults. The major objective of this study was to determine if sweet potato sticks were an acceptable snack food to a representative sample of 250 high school students in North Carolina.

## REVIEW OF LITERATURE

Adolescents are susceptible to malnutrition for two reasons, one physiological and the other psychological. During their teens, youths grow at a faster rate than at any other time in their life except infancy. During this period the characteristic differences between male and female, such as height, weight, body conformation, basic metabolic rate, blood pressure, hemoglobin level, and nutritional requirements become established. A boy's nutritional needs during this time are higher than any other time in his life, whereas a girl's needs during adolescence are exceeded only during a period of pregnancy or lactation.

In addition to their physiological vulnerability to malnutrition due to increased nutritional requirements, teens may also experience nutritional problems due to psychological reasons. Teenagers become more independent, thus casting off many childhood habits while still trying to find their own identities. Acceptance by their peer group is of utmost importance, a fact which often leads to the spread of fad diets and strange eating habits. Many girls begin diets with the expectation of becoming slim and achieving a good figure, while boys eat extra servings of meat and eggs, hoping to build their muscles (8, 9, 10).

Another reason for malnutrition among many teenagers is the eating habits they develop. Many adolescents' daily activity schedules offer little time for regular meals. Breakfast is often skipped because they do not allow time for it, then at lunch the vending machines offer quicker

service than long cafeteria lines. The night meal may be a quick snack due to a ball game or meeting that must be attended.

Major nutritional problems of adolescents appear to be dental caries, obesity, iron deficiency anemia in girls and some boys, and less than desirable intakes of calcium, vitamin A, and vitamin C (8, 11). All of these problems can be either directly or indirectly related to snacking habits. Dental caries may result from frequent use of sweet snacks. Low levels of certain nutrients may develop with constant consumption of empty calorie snacks which leave little room for more nutritious foods. The overweight teenager may eat the same foods as his average friend, but too many of them, especially high calorie snack foods.

Thus, acceptable nutritious snacks could change the nutritional status of all people, especially teenagers who consume more snacks than other age groups. Experimentation with sweet potatoes has been in progress for over twenty years with one of the expectations being that of developing a highly acceptable and nutritious snack food.

Several attempts have been made to produce a high quality sweet potato chip. Sistrunk and Miller experimented with sweet potato chips in 1954. They found that proper curing, storing, and pre-heating of the potatoes prior to peeling, slicing, and frying were necessary conditions for a good product. Sweet potatoes were first cured 10 to 14 days at 85°F and then stored at 60°F for up to one year. When ready for processing, the sweet potatoes were preheated for 15 to 20 minutes at a temperature range of 170 to 190°F. This preheating gelatinized the starch of the potato and altered the cell structure so that the potato slices were limp, permeable, and fried well. One problem with these chips was that they lost their crispness rapidly when exposed to damp air (12).

In 1958, Kelley, Baum, and Woodward reported the results of their experiments with the sweet potato. Four pre-cooked, dehydrated sweet potato products had been produced by using the French-frying process previously used by Kelley and Baum in the production of vegetable chips made from beets, carrots, parsnips, peas, and lima beans. The products developed were sweet potato chips, dice, julienne strips, and frozen French fries. The chips, dice, and strips were made by first washing and paring cured sweet potatoes. The potatoes were then sliced to the desired degree of thickness, fried at 275°F for 3 to 5 minutes, drained, salted, and stored in tightly closed glass bottles in darkness to preserve their freshness and color. For French fries, the sweet potatoes were cut into the standard restaurant size used for white potatoes, fried, drained, and frozen at -22°F without being salted. When needed for use, these French fries were placed in an oven at 350°F for 10 to 15 minutes to complete the cooking and browning process (13, 14). These experiments produced some chips, strips, and cubes with higher moisture contents than those previously made. This was especially true of the larger cubes, which were slightly chewy and not crisp. Experimentation was also done with chips of varying thicknesses. The researchers found that 1/16 inch thick chips were sometimes tough and chewy even though they held up well structurally. Chips that were 1/32 inch thick were generally preferred, but wrinkled easily and would not have been easy to use with dips (14).

A total of seven different varieties of sweet potatoes was used in these experiments. Chips made from these varieties were evaluated by consumer taste panels for flavor, texture, and color. Each variety



tested had some drawback; the color was an undesirable pale yellow, the texture was tough and chewy, or the flavor was too sweet (14).

The major problem encountered in all the efforts to produce a quality sweet potato chip is discoloration. A gray or greenish-orange color develops when the cut surface of a sweet potato is exposed to air. Deep-fat frying further intensifies this discoloration. The color change varies with the variety of sweet potato, soil conditions, and pre and postharvest environmental conditions. Hoover found that the discoloration could be caused by a reaction of the bivalent iron in the sweet potato combining with o-dihydroxyphenol, forming a dark colored ferric compound when the cooked tissue was exposed to the air. In a study of color preservatives, Hoover found that sodium acid pyrophosphate (SAPP) was effective in maintaining the natural color of sweet potatoes (15, 16).

Another problem encountered in the production of sweet potato chips was their lack of crispness following deep-fat frying. Previously the chips became chewy and tough after deep-fat frying if exposed to air for a short period of time. Hoover and Miller believed that this effect might be due to the humectant properties found in sweet potatoes. They found that poor texture and discoloration were decreased when sweet potato chips were blanched in SAPP and partially dehydrated before frying (16).

The most recent process for producing high quality sweet potato chips was used by Hoover and Miller. For their experiments, sweet potatoes of the Jewel variety, which had been cured and stored for four months at 60°F, were used. The potatoes were lye-peeled, trimmed, and sliced into strips 1/2 inch wide and 3/32 inch thick. Next, the strips were blanched in water with a concentration of 0.50 to 0.75% SAPP. The strips were

dried in a continuous forced air dryer at 220°F for partial dehydration before cooking. The frying temperature used was 290°F for two minutes and fifteen seconds. After frying, the grease was shaken off and the strips were again placed in the dryer. In the final steps, maltrin was added to absorb the grease and salt was added for flavoring. The use of SAPP in the blanch water was judged as the major success factor in the prevention of discoloration. Sodium bisulfite also was found effective in preventing discoloration of raw sweet potatoes prior to blanching. However, the improvement in color of the raw sweet potatoes due to the use of this chemical did not carry through to the final product. Sodium bisulfite did prove beneficial when it was necessary to hold raw sweet potatoes for a period of time before blanching since SAPP did not exert its beneficial effect on the color of the potatoes until the elevated temperatures in the blanch water were reached (16).

#### METHODOLOGY

Preliminary tests showed that sweet potato sticks were an acceptable snack food to nursery school children and adults. Thus the purpose of this study was to determine if high school students, who use snacks frequently, consider the sticks an acceptable snack.

Early in the spring of 1973, permission was obtained from either the principal or the assistant principal in each of three high schools where the sweet potato sticks were to be taste-tested. The schools selected were Walter Hines Page High School in Greensboro; North Moore High School in Moore County; and Forest Hills High School in Union County, North Carolina. Students at North Moore and Forest Hills were either from small towns or from rural areas surrounding these towns; whereas, students at Page all lived in the city. The three schools were selected from different parts of the piedmont area of the state to eliminate some regional bias.

A random sample of students enrolled in required English classes were selected for the taste-testing. One English class from each grade level in each of the three schools was used for the sample. A total of 250 students was used, 107 males and 143 females. The ages of these students ranged from 14 to 21 years, with 16.5 as the mean age.

The sweet potato sticks were processed by the Department of Food Science at North Carolina State University according to the method of Hoover and Miller (12). Two flavors of the sticks, salt and cinnamon, were prepared so that the students could compare the sticks and determine



if one flavor were more acceptable than the other. For the purpose of differentiation, the two flavors were each assigned a three digit random number. The cinnamon flavor was labeled as Sample 373, and the salt flavor was labeled Sample 392. The sweet potato sticks were packaged in individual air tight plastic bags so that each student could receive a sample of each flavor. The salted sticks were packaged in slightly larger bags than the cinnamon sticks. Processing took place the last week in April, 1973 and taste-testing occurred during the first three weeks in May, 1973. According to the processors, the sticks remain fresh in their packages for approximately three months, so all of the sticks were fresh when they were tested.

A one-page, closed form questionnaire was developed by the researcher to evaluate whether the sweet potato sticks were acceptable to the students (Appendix A). First, some general information questions concerning sex, age, and opinions about sweet potatoes were asked. These variables were later evaluated to determine any influence they had on the acceptability of the product. Snacking habits were also surveyed. By determining how frequently students snacked and the types of snacks eaten most often, the researcher hoped to predict whether the sweet potato sticks could be used commercially if found acceptable. The students' smoking habits and possible nasal congestion were also surveyed to determine if there was a difference in acceptability of the potato sticks caused by smoking or nasal congestion. Either of these two factors could influence the ability to score foods accurately (17). An evaluation of the sweet potato sticks was also included. A rating scale, ranging from "very good" to "poor" and "undecided," was used to enable each participant to

decide how he would rate each flavor of the potato sticks. From this evaluation, the researcher hoped to determine whether the students would buy the sweet potato sticks, and if so, which flavor they would purchase. In order to determine why the students made their buying decisions, space was provided so an explanation of their previous answers could be given.

A basic administration procedure was followed in each class tested. First, the researcher introduced herself, briefly related the purpose of the study, and explained how the taste-testing would proceed. A copy of the questionnaire was distributed to each student, and the researcher read through the questionnaire with the students and allowed an opportunity for questions concerning the information desired on the questionnaire. Then the sweet potato sticks were presented for taste evaluation so that in half of the classes, the students received the cinnamon flavor first, while in the other half, the students received the salt flavor first. Time was allowed for each class to make its evaluation and complete the questionnaire. Students were asked to refrain from discussing the sweet potato sticks with their neighbors until all had completed their evaluations. After the questionnaires were collected, there was an opportunity for discussion, comments, and questions concerning the sweet potato sticks.

After the taste-testing was completed in the three high schools, there were enough of both flavors of potato sticks remaining to test with one other class. A third grade, with 28 students, was chosen in order to see the response of another age group to the sweet potato sticks. Acceptance or rejection of the sticks was determined by asking for a show of hands to the appropriate question.

Responses on the questionnaires administered to the high school students were coded and transferred onto punch cards for computer analysis. Analysis of variance and t-tests were applied to determine any significant differences in the responses of students from the three schools. Percentages of students in each school as well as total students responding in a certain way to each question were also calculated.

The majority of students, 77.6% said that they liked sweet potatoes; 22.4% indicated a dislike for sweet potatoes. The attitudes of the students toward sweet potatoes is given in Table I. A significantly higher percentage of students from Forest Hills liked sweet potatoes than did those tested in Page High School. The percentage of North Moore students tested who liked sweet potatoes, 79.7, was not significantly different from that at Page or Forest Hills. The attitude toward sweet potatoes might have been influenced by the fact that North Moore and Forest Hills had predominately rural students whereas Page had urban students. Although sweet potatoes can be purchased in the city, they are grown in rural areas, thus are more available to rural students.

TABLE I  
STUDENTS' ATTITUDES TOWARD SWEET POTATOES

School	Like		Dislike	
	Number	Percentage	Number	Percentage
Page	50	68.3	23	31.5
North Moore	71	79.7	18	20.3
Forest Hills	70	83.3	14	16.7

## RESULTS AND DISCUSSION

Two hundred and fifty students participated in the taste-testing of the sweet potato sticks: 74 from Walter Hines Page High School, 90 from North Moore High School, and 86 from Forest Hills High School. More females took part in the study than did males, with a total of 143 females and 107 males. The mean age of all the students was 16.5 years.

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Forest Hills	70	83.3	14	16.7

Although there was a difference in the acceptability of sweet potatoes between the participating students at Forest Hills and Page, this fact had no significant effect on the students' evaluations of the sweet potato sticks. The data also revealed that 69.9% of the participants at Forest Hills, 73.0% at Page, and 75.3% at North Moore said that they would buy either one or both of the samples of sweet potato sticks if they were on the market.

At least 95.6% of all students questioned snacked at least once every day and 71.4% of this number indicated they snacked several times a day. A small percentage of students surveyed ate snacks less than once per day, as illustrated in Table 2. These data support the belief that snacking is a way of life for most teenagers.

TABLE 2  
FREQUENCY OF SNACK CONSUMPTION  
FOR ALL STUDENT RESPONSES

Frequency	Number of Students	Percentage of Students
Several times daily	177	71.4
Once each day	60	24.2
Three times weekly	7	2.8
Once a week	3	1.2
Less than once a week	1	0.4
Total	248	100.0

Approximately 85% of the North Moore participants and 63% of the Forest Hills sample ate snacks several times daily, a difference significant at the 0.05 level (Table 3). Snacking several times a day was reported by 64.4% of the Page sample, a difference significant from the

North Moore sample at the 0.05 level. The difference between Forest Hills and Page was not significant.

TABLE 3  
FREQUENCY OF SNACK CONSUMPTION  
FOR INDIVIDUAL SCHOOLS

Frequency	Percentage of Students		
	Page	North Moore	Forest Hills
Several times daily	64.4	85.4	62.8
Once each day	28.8	11.2	33.7
Three times weekly	5.4	1.1	2.3
Once a week	1.4	2.3	0.0
Less than once a week	0.0	0.0	1.2

Potato chips or other salty snack foods and soft drinks were the two types of snacks eaten most often by a majority of the students. These two categories were used more than three times as often as the more nutritious snacks of fruits, raw vegetables, milk, and milk products. Other types of snacks frequently eaten included candy, fruits and vegetables, milk products, and cookies, in this order of frequency. Sandwiches, cake, toasted soybeans, and cereal were also listed.

TABLE 4  
SNACKS EATEN MOST OFTEN

Snack	Number	Percentage
Soft drinks	152	31.6
Potato chips and salty snack foods	136	28.3
Candy	60	12.5
Fruits or raw vegetables	41	8.5
Milk or milk products	41	8.5
Cookies	39	8.1
Other snacks	12	2.5



Nasal congestion or colds affected 22.9% of the students but did not appear to affect their abilities to judge the sweet potato sticks. There was no significant difference in the frequency of occurrence of these symptoms in the three schools. A significantly greater number of students had recently smoked a cigarette at Page than at North Moore or Forest Hills. Twenty six per cent at Page had smoked 30 minutes before the sweet potato sticks were sampled; 12.2% at North Moore and 12.9% at Forest Hills had smoked within the same time period. Neither smoking nor nasal congestion appeared to have any influence on the acceptability of the sweet potato sticks.

Students selected from all three schools rated the salted sweet potato sticks higher than the cinnamon flavored sticks. Fifty-one per cent of the students rated the salted sample "good" or "very good," 38.5% gave a "fair" rating, and 8.4% gave a "poor" rating; 2.1% were "undecided." Therefore, as shown in Table 5, most students considered the salted sticks to be "good" or "very good."

TABLE 5  
PERCENTAGE RATINGS OF SALTED AND CINNAMON FLAVORED  
STICKS FOR ALL STUDENTS TESTED

Rating Category	Cinnamon Sample	Salted Sample
Very good	7.4	18.3
Good	20.7	32.7
Fair	38.9	38.5
Poor	30.9	8.4
Undecided	2.1	2.1
Total	100.0	100.0

The majority of students considered the cinnamon flavor to be "fair" or "good," one step lower than the rating for the salted product. There were no significant differences in the ratings by the participants in the three schools.

There was a difference in the ratings by the males and females. In most cases, males rated the potato sticks higher than did the females. A much larger percentage of males rated the cinnamon flavored sample "very good" or "good," than did the females. However, females rated the salted sticks as "good" or "very good" more often than did the males. With both flavors, the females gave more "poor" ratings, as shown in Table 6.

A difference was also found in the number of males and females who said they would buy the sweet potato sticks if they were on the market. Nineteen and eight tenths per cent of all males who participated would buy both flavors, but only 5.7% of the females would buy both. Almost one third of the females responding would buy neither flavor; 19.8% of the males would buy neither flavor. Thus, of the students tested, more males liked the product than did the females.

TABLE 6  
RATINGS OF SWEET POTATO STICKS  
BY MALES AND FEMALES

Category	Cinnamon Sample				Salted Sample			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
Very good	12	11.2	6	4.3	17	16.3	28	20.3
Good	27	25.2	24	17.3	34	32.7	45	32.6
Fair	36	33.7	60	43.2	45	43.3	48	34.8
Poor	28	26.2	48	34.5	5	4.8	15	10.9
Undecided	4	3.7	1	0.7	3	2.9	2	1.4
Total	107	100.0	139	100.0	104	100.0	138	100.0



TABLE 7  
 TOTAL OF MALES AND FEMALES  
 WHO WOULD BUY THE SWEET POTATO STICKS

Flavor	Males		Females	
	Number	Percentage	Number	Percentage
Cinnamon	18	17.0	13	9.2
Salt	46	43.4	74	52.5
Both	21	19.8	8	5.7
Neither	21	19.8	46	32.6
Total	106	100.0	141	100.0

Over two thirds of all students responding replied that they would buy either one or both of the flavors of sweet potato sticks if they were on the market. Twelve and six tenths per cent said they would buy only the cinnamon flavor, 48.6% said they would buy only the salted flavor, 11.7% said they would buy both flavors, and 27.1% would buy neither. Of the three schools, more of the students at Page said they would buy neither sample. North Moore had the least number of sampled students who would buy neither product as illustrated in Table 8.

TABLE 8  
 PERCENTAGE OF STUDENTS WHO WOULD BUY  
 THE SWEET POTATO STICKS

Flavor	Page	North Moore	Forest Hills	Mean for all Students
Cinnamon	13.7	12.8	11.8	12.6
Salted	41.1	52.8	50.6	48.6
Both	15.1	10.1	10.6	11.7
Neither	30.1	24.7	27.0	27.1

Many of the students responded that they preferred the flavor of the salted potato sticks over the sweet flavor of the cinnamon sticks because they were more accustomed to salty snacks. Some said they preferred the salted sticks because they looked better. This flavor did have a more characteristic sweet potato color since the spice caused the cinnamon sticks to be slightly dark in color. Other reasons given for the dislike of the cinnamon product were that they did not like sweet potatoes, did not like cinnamon, and that the cinnamon flavor tasted "flat." One student suggested adding a little salt to the cinnamon flavored potato sticks. Reasons given for liking either flavor of the sweet potato sticks were good flavor, the product was so different from the conventional snack product, and the product was new.

The twenty-eight third graders who sampled the sweet potato sticks responded in the same way as the high school students concerning their acceptance of this new product. The majority liked the sweet potato sticks, but preferred the salted flavor to the cinnamon.

## SUMMARY AND CONCLUSIONS

Snacking was a frequent habit for the majority of teenagers who participated in this research. The types of snacks that were consumed most often were empty calorie snacks, especially soft drinks and salty snack foods. Frequent consumption of this type of snack may result in nutritional deficiencies. The sweet potato sticks were developed as a possible answer to the empty calorie snack dilemma.

The majority of the 250 high school students tested as well as the twenty-eight third graders, accepted both the salted and the cinnamon flavored sweet potato sticks. However, they preferred the salt flavor to the cinnamon. Eight and four tenths per cent rated the salted sample "poor," whereas 30.9% rated the cinnamon sample "poor."

There were no significant differences in the ratings given by students tested at the three high schools. There were also no significant differences found in the ratings of the students who had recently smoked a cigarette or had nasal congestion, as compared to the students who had not smoked and had no nasal congestion.

If these sweet potato sticks were on the market, 72.9% of the students tested indicated that they would buy one or both flavors of the sweet potato sticks. Therefore, this data suggests that sweet potato sticks would be a salable product if they were on the market.

Sweet potato sticks have now been formally taste tested with high school students and have been informally tested with nursery school students, elementary school children, and adults. In all tests the new product was found acceptable by the majority of people. Formal research

may need to be continued with adults as they are most frequently responsible for purchasing the family's food.

Additional research should be conducted on the cinnamon flavored sweet potato sticks since many students said these had a rather flat taste. Although considered acceptable, this flavor might have been more acceptable if it had had a small addition of salt.

Research should be continued with other flavors for the sweet potato sticks. There is an almost unlimited variety of flavoring agents that could be used with the sticks, such as hickory smoked, barbecued, or pizza flavor. One of these flavors may be more acceptable than the salt or cinnamon flavored potato sticks which were evaluated in this study.

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Directions: Please place a check (✓) in the blank beside the answer that best describes you.

1. Sex: Male \_\_\_\_\_ 2. Age \_\_\_\_\_  
 Female \_\_\_\_\_
3. Do you like sweet potatoes (yams)? yes \_\_\_\_\_  
 no \_\_\_\_\_
4. How often do you eat snacks?  
 Several times daily \_\_\_\_\_  
 Once each day \_\_\_\_\_  
 Three times weekly \_\_\_\_\_  
 Once a week \_\_\_\_\_  
 Less than once a week \_\_\_\_\_
5. If you do eat snacks, put a check by the two of the following that you eat most often.

Fruits or raw vegetables \_\_\_\_\_

Candy \_\_\_\_\_

Potato chips or other salty snack foods \_\_\_\_\_

Milk or milk products \_\_\_\_\_

Soft drinks \_\_\_\_\_

Cookies \_\_\_\_\_

Other (list) \_\_\_\_\_

#### APPENDIX A

#### QUESTIONNAIRE AND COMPILATION OF RESPONSES OF ALL STUDENTS

6. Do you presently have a cold or any nasal congestion? yes \_\_\_\_\_  
 no \_\_\_\_\_
7. Have you smoked a cigarette in the past 30 minutes? yes \_\_\_\_\_  
 no \_\_\_\_\_
8. Please evaluate the sweet potato sticks that you have just eaten by placing a check beside the word in each group that best describes your opinion of the sticks.

8. As a snack food, how would you rate the samples of sweet potato sticks?

Sample 373      Sample 392

Very good \_\_\_\_\_

Good \_\_\_\_\_

Fair \_\_\_\_\_

Poor \_\_\_\_\_

Undecided \_\_\_\_\_

9. If sweet potato sticks were on the market, would you buy?

Sample 373? \_\_\_\_\_

Sample 392? \_\_\_\_\_

Both samples? \_\_\_\_\_

Neither sample? \_\_\_\_\_

Why or why not? \_\_\_\_\_

Thank you for cooperating and for taking time to try the sweet potato sticks and to fill out this questionnaire.



Directions: Please place a check (✓) in the blank beside the answer that best describes you.

1. Sex: Male \_\_\_\_\_  
Female \_\_\_\_\_
2. Age \_\_\_\_\_
3. Do you like sweet potatoes (yams)? yes \_\_\_\_\_  
no \_\_\_\_\_
4. How often do you eat snacks?  
Several times daily \_\_\_\_\_  
Once each day \_\_\_\_\_  
Three times weekly \_\_\_\_\_  
Once a week \_\_\_\_\_  
Less than once a week \_\_\_\_\_
5. If you do eat snacks put a check by the two of the following that you eat most often.  
Fruits or raw vegetables \_\_\_\_\_  
Candy \_\_\_\_\_  
Potato chips or other salty snack foods \_\_\_\_\_  
Milk or milk products \_\_\_\_\_  
Soft drinks \_\_\_\_\_  
Cookies \_\_\_\_\_  
Other (list) \_\_\_\_\_
6. Do you presently have a cold or any nasal congestion? yes \_\_\_\_\_  
no \_\_\_\_\_
7. Have you smoked a cigarette in the past 30 minutes? yes \_\_\_\_\_  
no \_\_\_\_\_

Please evaluate the sweet potato sticks that you have just eaten by placing a check beside the word in each group that best describes your opinion of the sticks.

8. As a snack food, how would you rate the samples of sweet potato sticks?
- |           | Sample 373 | Sample 392 |
|-----------|------------|------------|
| Very good | _____      | _____      |
| Good      | _____      | _____      |
| Fair      | _____      | _____      |
| Poor      | _____      | _____      |
| Undecided | _____      | _____      |
9. If sweet potato sticks were on the market would you buy:  
Sample 373? \_\_\_\_\_  
Sample 392? \_\_\_\_\_  
Both samples? \_\_\_\_\_  
Neither sample? \_\_\_\_\_  
Why or why not? \_\_\_\_\_

Thank you for cooperating and for taking time to try the sweet potato sticks and to fill out this questionnaire.



## Responses of Students from all Schools Tested

1. Sex: Male 107 Female 143 Total 250
2. Mean Age: 16.5
3. Do you like sweet potatoes (yams)?
- |     | Number | Percentage |
|-----|--------|------------|
| Yes | 191    | 77.6       |
| No  | 55     | 22.4       |
4. How often do you eat snacks?
- |                       | Number | Percentage |
|-----------------------|--------|------------|
| Several times daily   | 177    | 71.4       |
| Once each day         | 60     | 24.2       |
| Three times weekly    | 7      | 2.8        |
| Once a week           | 3      | 1.2        |
| Less than once a week | 1      | 0.4        |
5. If you do eat snacks, put a check by the two of the following that you eat most often.
- |   | Number | Percentage |
|---|--------|------------|
| Fruits or raw vegetables                | 41     | 8.5        |
| Candy                                   | 60     | 12.5       |
| Potato chips or other salty snack foods | 136    | 28.3       |
| Milk or milk products                   | 41     | 8.5        |
| Soft drinks                             | 152    | 31.6       |
| Cookies                                 | 39     | 8.1        |
| Other                                   | 12     | 2.5        |
6. Do you presently have a cold or any nasal congestion?
- |     | Number | Percentage |
|-----|--------|------------|
| Yes | 57     | 22.9       |
| No  | 192    | 77.1       |
7. Have you smoked a cigarette in the past 30 minutes?
- |     | Number | Percentage |
|-----|--------|------------|
| Yes | 41     | 16.5       |
| No  | 207    | 83.5       |
8. As a snack food how would you rate the samples of sweet potato sticks?
- |           | Sample 373 |            | Sample 392 |            |
|-----------|------------|------------|------------|------------|
|           | Number     | Percentage | Number     | Percentage |
| Very good | 18         | 7.4        | 45         | 18.3       |
| Good      | 51         | 20.7       | 79         | 32.7       |
| Fair      | 96         | 38.9       | 93         | 38.5       |
| Poor      | 76         | 30.9       | 20         | 8.4        |
| Undecided | 5          | 2.1        | 5          | 2.1        |

9. If sweet potato sticks were on the market, would you buy:

	Number	Percentage
Sample 373	31	12.6
Sample 392	120	48.6
Both samples	29	11.7
Neither sample	67	27.1

APPENDIX B

COMPILATION OF RESPONSES OF INDIVIDUAL  
SCHOOLS

## Responses from Individual Schools

	Page	North Moore	Forest Hills
1. Sex:			
Male	21	53	32
Female	21	37	54
Total	24	90	86
2. Mean Age:	17.0	16.3	16.3
3. Do you like sweet potato (yams)?			
Yes	68.5	79.7	83.3
No	31.5	20.3	16.7
4. How often do you eat snacks?			
Several times a day	6.4	85.4	67.8
Once each day	28.8	11.1	33.7
Three times weekly	3.4	1.1	2.3
Once a week	1.6	2.3	0.0
Less than once a week	0.0	0.0	1.1
5. If you do eat snacks, put a check by the two of the following that you eat most often:			
Fruits or vegetables	15	10.7	10.1
Candy	10	7.1	11.8
Potato chips or other salty snack foods	38	33.3	26.0
Milk or milk products	13	8.6	8.3
Soft drinks	42	36.6	32.0
Cookies	17	4.3	8.9
Other	5	1.2	2.9

## APPENDIX B

## COMPILATION OF RESPONSES OF INDIVIDUAL SCHOOLS

Responses from Individual Schools

	Page	North Moore		Forest Hills	
1. Sex: Male	22	53		32	
Female	52	37		54	
Total	74	90		86	
2. Mean Age	17.0	16.3		16.3	
3. Do you like sweet potato (yams)?	Page	North Moore		Forest Hills	
	No.	No.	%	No.	%
Yes	50	71	79.7	70	83.3
No	23	18	20.3	14	16.7
4. How often do you eat snacks?	Page	North Moore		Forest Hills	
	No.	No.	%	No.	%
Several times a daily	47	76	85.4	54	62.8
Once each day	21	10	11.2	29	33.7
Three times weekly	4	1	1.1	2	2.3
Once a week	1	2	2.3	0	0.0
Less than once a week	0	0	0.0	1	1.2
5. If you do eat snacks, put a check by the two of the following that you eat most often.	Page	North Moore		Forest Hills	
	No.	No.	%	No.	%
Fruits or vegetables	15	9	5.6	17	10.1
Candy	10	20	12.4	20	11.8
Potato chips or other salty snack foods	38	54	33.3	44	26.0
Milk or milk products	13	14	8.6	14	8.3
Soft drinks	42	56	34.6	54	32.0
Cookies	17	7	4.3	15	8.9
Other	5	2	1.2	5	2.9

6. Do you presently have a cold or any nasal congestion?

Sample 371	Page		North Moore		Forest Hills	
	No.	%	No.	%	No.	%
Sample 371	21	28.4	19	21.1	17	20.0
Sample 371	53	71.6	71	78.9	68	80.0

7. Have you smoked a cigarette in the past 30 minutes?

	Page		North Moore		Forest Hills	
	No.	%	No.	%	No.	%
	19	26.0	11	12.2	11	12.9
	54	74.0	79	87.8	74	87.1

8. As a snack food, how would you rate the samples of sweet potato sticks?

Sample 373	Page		North Moore		Forest Hills	
	No.	%	No.	%	No.	%
Very good	6	8.2	9	10.0	3	3.6
Good	15	20.6	16	17.8	20	24.1
Fair	26	35.6	35	38.9	35	42.2
Poor	25	34.2	27	30.0	24	28.9
Undecided	1	1.4	3	3.3	1	1.2

Sample 392	Page		North Moore		Forest Hills	
	No.	%	No.	%	No.	%
Very good	11	14.9	18	21.4	16	19.9
Good	24	32.4	22	26.2	33	39.3
Fair	32	43.2	35	41.7	26	31.0
Poor	6	8.1	6	7.1	8	9.5
Undecided	1	1.4	3	3.6	1	1.2

9. If sweet potato sticks  
were on the market,  
would you buy:

	Page		North Moore		Forest Hills	
	No.	%	No.	%	No.	%
Sample 373	10	13.7	11	12.4	10	11.8
Sample 392	30	41.1	47	52.8	43	50.6
Both samples	11	15.1	9	10.1	9	10.6
Neither sample	22	30.1	22	24.7	23	27.0

## Attitudes Toward Sweetpotatoes

School	Like		Dislike		t-value	D.F.	2-tail prob.
	N	M	SD				
Page	73	1.32	0.47		1.65	160	0.10
North Moore	89	1.20	0.40				
Forest Hills	84	1.17	0.38		-0.60	171	0.55
North Moore	89	1.20	0.40				
Page	73	1.32	0.47		1.22	155	0.03*
Forest Hills	84	1.17	0.38				

## Frequency of Snack Consumption

1. Several times daily

2. Once each day

## STATISTICAL TABLES

School	1		2		t-value	D.F.	2-tail prob.
	N	M	SD				
Page	73	1.44	0.67		-0.16	157	0.89
Forest Hills	84	1.45	0.71		-0.15	172	0.89
Page	73	1.44	0.67		1.34	161	0.02*
North Moore	90	1.21	0.57		1.11	159	0.03*
Forest Hills	84	1.45	0.71		2.49	174	0.01*
North Moore	90	1.21	0.57				

\*Indicates significance at 0.05 level

FOREST HILLS

NORTH MOORE

PAGE

0. It never brought anyone  
 news on the subject.

## Attitude Toward Sweetpotatoes

School	1=like		2=dislike		t-value	D.F.	2-tail prob.
	N	M	SD				
Page	73	1.32	0.47				
North Moore	89	1.20	0.40		1.65	160	0.10
Forest Hills	84	1.17	0.38				
North Moore	89	1.20	0.40		-0.60	171	0.55
Page	73	1.32	0.47				
Forest Hills	84	1.17	0.38		2.21	155	0.03*

## Frequency of Snack Consumption

1=Several times daily

2=Once each day

School	1=Several times daily		2=Once each day		t-value	D.F.	2-tail prob.
	N	M	SD				
Page	73	1.44	0.67				
Forest Hills	86	1.45	0.71		-0.14	157	0.89
Page	73	1.44	0.67				
North Moore	90	1.21	0.57		2.34	161	0.02*
Forest Hills	86	1.45	0.71				
North Moore	90	1.21	0.57		2.49	174	0.01*

\*Indicates significance at 0.05 level



## Frequency of Colds and Nasal Congestion

<u>1=yes</u>	<u>2=no</u>					
School	N	M	SD	t-value	D.F.	2-tail prob.
Page	74	1.72	0.45	-1.08	162	0.28
North Moore	90	1.79	0.41			
Forest Hills	85	1.81	0.39	0.38	173	0.71
North Moore	90	1.79	0.41			
Page	74	1.72	0.45	-1.42	157	0.16
Forest Hills	85	1.81	0.39			

## Smoking Within 30 Minutes of Taste Testing

<u>1=yes</u>	<u>2=no</u>					
School	N	M	SD	t-value	D.F.	2-tail prob.
Page	73	1.74	0.44	-2.28	161	0.02*
North Moore	90	1.89	0.33			
Forest Hills	85	1.88	0.34	-0.14	173	0.89
North Moore	90	1.88	0.33			
Page	73	1.74	0.44	-2.11	156	0.04*
Forest Hills	85	1.87	0.34			

\*Indicates significance at 0.05 level

## Opinion of Cinnamon Sample

	1="very good"	2="good"	3="fair"	4="poor"	5="undecided"		
School	N	M	SD	t-value	D.F.	2-tail prob.	
Page	73	3.00	0.97				
North Moore	90	2.99	1.01	0.14	161	0.89	
Forest Hills	83	3.01	0.85				
North Moore	90	2.98	1.01	0.24	171	0.81	
Page	73	3.00	0.98				
Forest Hills	83	3.01	0.85	-0.08	154	0.93	

## Opinion of Salted Sample

	1="very good"	2="good"	3="fair"	4="poor"	5="undecided"		
School	N	M	SD	t-value	D.F.	2-tail prob.	
Page	74	2.47	0.90				
North Moore	83	2.48	1.03	-0.06	155	0.95	
Forest Hills	84	2.33	0.95				
North Moore	83	2.48	1.03	-0.97	165	0.33	
Page	74	2.47	0.90				
Forest Hills	84	2.33	0.95	0.95	156	0.35	

## Students Who Would Buy the Sweet Potato Sticks

	1=Cinnamon	2=Salt	3=Both	4=Neither		
School	N	M	SD	t-value	D.F.	2-tail prob.
Page	73	2.62	1.06	0.93	161	0.36
North Moore	90	2.47	1.00			
Forest Hills	85	2.53	1.02	0.41	173	0.68
North Moore	90	2.47	1.00			
Page	73	2.62	1.06	0.52	156	0.60
Forest Hills	85	2.53	1.02			