

# **OFFERING FRESH FRUIT IN A READY-TO-EAT FORMAT IMPROVES FRUIT CONSUMPTION AMONG ELEMENTARY AND MIDDLE SCHOOL STUDENTS**

## **MINI-ABSTRACT**

Increasing children's intake of fruits and vegetables is a priority of the National School Lunch Program. This study focused on the possibility of increasing fresh fruit consumption by changing the form in which it was served. As a result of slicing fresh apples, treating them with Natureseal™ to maintain color and crispness, and packaging the ready-to-eat slices into individual portions, fruit consumption was increased among elementary and middle school students. When given a choice, students significantly preferred ready-to-eat apple slices to whole apples.

## **ABSTRACT**

This study was developed to see whether changing the form in which fresh fruit was served would increase fruit consumption by elementary and middle school students. One elementary and one middle school in a low income residential area were chosen for this study. Students were offered whole fresh apples in addition to the lunch served two days per week for six weeks. The next six weeks, they were offered sliced fresh ready-to-eat packaged apples treated with NatureSeal™ to maintain the color and crispness of the apple slices. They were then offered both whole and sliced ready-to-eat apples and allowed to choose whichever they wanted. Both the elementary and middle school students consumed more fruit when offered sliced, ready-to-eat, packaged apples; however the increase was significant only for the elementary students. When given a choice, all students significantly preferred the sliced fresh apples to whole apples.

## INTRODUCTION

Elementary, middle, and secondary students, today, usually eat fewer than the recommended daily servings of fruits and vegetables. According to the United States Department of Agriculture (USDA), on school days, “35% of elementary school children and almost 60% of teenagers eat no fruit, and about 25% of school-age children eat no vegetables” (1). Further, less than 20% of children in the United States consume five servings of fruits and vegetables per day (2). In addition, 63% of children ages 2 to 9 years are not consuming the recommended number of servings of fruits; 78% of them are not consuming the recommended number of servings for vegetables (3).

More than 28 million children and adolescents eat lunches provided through the National School Lunch Program (NSLP) annually (4). One of the most important functions of the National School Lunch Program (NSLP) is to provide and encourage students to consume various foods from different food groups. In 1990, the Federal Dietary Guidelines directed the NSLP to provide school meals with lower fat and more fruits, and vegetables (1).

One study reported that students participating in the school lunch program were more likely to consume vegetables and fruit, compared to those who bring their own lunch from home (5). However, other studies have indicated that 40% of the school children did not eat their full servings of fruits or vegetables. About two-thirds of all school lunches offered in the United States include at least two servings of fruits and vegetables; however, a third of lunches chosen by children include no fruit or vegetables at all, and most fruits and vegetables served are thrown away. This situation worsens, if the school provides an a la carte lunch program. Studies have reported that children in middle schools with a la carte lunch programs consumed fewer servings of fruits and vegetables than did children in schools that do not have this option (6,7,8). Further

as children move from elementary to middle school, they tend to consume less milk, fruits, and vegetables (9).

## **METHODS**

Over an 18 week period, either whole red delicious apples or packaged fresh apple slices treated with NatureSeal™ to maintain color and crispness were offered free to all students in one elementary (enrollment = 600) and one middle school (enrollment = 1,200) in a low income residential area on two non-consecutive days per week. There were three observation periods, each six weeks in length. During the first six weeks, whole apples were offered; during the second six weeks, packaged apple slices were offered. During the final six weeks students could choose either whole apples or packaged apple slices. Throughout the trial, students could take as many apples or sliced apple packages as they wanted; however, they were required to eat them in the cafeteria during the lunch period.

The fruit was weighed prior to the service period; un-issued fruit and waste were weighed after the service period. All apple and packaging waste was collected in special waste containers monitored by study personnel and, the waste was weighed after the service period. The weight of the fruit consumed was calculated for each day for each school. The total weight of the whole apples in period one was compared to the total weight of the sliced apples consumed in period two. During period three, the weight of the sliced apples consumed was compared to the weight of the whole apples consumed to determine students' preferences when given a choice in the form in which the apples were served. The consumption patterns and preferences of elementary school students and middle school students were also compared to determine if students of different ages had different consumption patterns and preferences

regarding the form in which the apples were served. The study protocol was approved by the appropriate institutional review boards, and all permissions were obtained for students' participation prior to the beginning of the study.

Data analyses were conducted using SPSS for Windows (version 11.0, 2002, SPSS Inc, Chicago) statistical software. Analyses were based on the data mean values for each of the three observation periods. One-way independent analysis of variance (ANOVA) was conducted to evaluate the relationship between the different forms of apple offerings and apple consumption levels.

## **RESULTS AND DISCUSSION**

When comparing the three study periods, the elementary school students consumed significantly more fruit ( $p < .05$ ) in the second period when only sliced ready-to-eat packaged apples were offered. During this period, these students consumed 61.8% more fruit than they did during the first period when the whole apples were offered (See Table 1). However, even though the middle school students did consume more apples in the second period (sliced ready-to-eat apples) than they did in period one (whole apples), the increase was only 3.3%. Thus there was much less difference in the level of fruit consumption as a result of the offering of the different forms of apples for the middle school students than for the younger, elementary school students.

However, when given a choice in the form in which the apples were offered (study period three), both the elementary and the middle school students significantly preferred ( $p < .005$ ) sliced, ready-to-eat, packaged apples. However, the elementary students again showed a greater preference for the sliced apples than did the middle school students. Almost three times as many elementary students selected the sliced apples as selected the whole apples (ratio = 2.925 to 1).

The 2.06 to 1 ratio for middle school students indicated that about twice as many students preferred the sliced apples compared to those selecting whole apples. Thus, while both the elementary and the middle school students significantly preferred having the apples offered to them in the sliced, ready-to-eat form, the middle school (older) students were more willing than the elementary school (younger) students to accept whole apples as the form in which the fruit was served.

The amount of apples consumed per student in the elementary school was also compared to the amount consumed per student in the middle school. On average, middle school students consumed approximately twice the amount of apples (total consumption = 3.2 ounces per student) than the elementary school students (total consumption = 1.65 ounces per student). This difference in consumption per student is even more noteworthy when considered by the forms in which the apples were offered. Elementary students consumed only .56 ounces of whole apples per students compared to 1.36 ounces per student for the middle school students. For the sliced apples, the elementary school students consumed 1.35 ounces per student compared to 1.80 ounces per student for the middle school students. These figures further underscore all the students' preference for the sliced, ready-to-eat apples while also underscoring that this preference was more pronounced among elementary school students than among middle school students. It is also noteworthy that many middle school students accepted the offered apples, consuming them at approximately twice the level at which the elementary school students did.

## **APPLICATIONS**

Finding ways to improve school nutrition education programs and encourage students to have healthful dietary habits are priorities to school foodservice programs (10). Children are willing to choose fresh fruits and vegetables if they are tasty, well-prepared, and appealing (6).

Slicing fruits or vegetables, such as apples, and treating them with a product such as NatureSeal™ clearly increased the fruit intake of both elementary and middle school students during this study when the fruit was offered during the lunch period in addition to the lunch regularly served. Packaging fruits and vegetables in such a ready-to-eat format would also make it possible to offer these foods as snack items to students during break times or as in-classroom treats; thus offering increased opportunities for children to consume fruits and vegetables other than during the lunch period.

An important lesson learned through this study is that care must be taken to keep the pre-packaged products acceptable to the students as the students were very aware of product quality and would reject any apples or apple slices that they felt were not of acceptable quality. Quality maintenance requires that the product treatment process is carefully followed and that the products are maintained at refrigerated temperatures from the time of treatment until offered to the students. These conditions are challenges that must be addressed by many school districts which may have limited refrigeration space in their kitchens or which utilized centralized food production kitchens with foods transported to satellite kitchens which serve the foods to the students. However, offering elementary and middle school students fresh fruits and vegetables packaged ready-to-eat in individual portions seems to have excellent potential as one means of increasing the fruit and vegetable intake of these students.

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**TABLE 1:** Average apple consumption in pounds for the three observation periods (Mean Standard Deviation )

	Period One	Period Two	Period Three	
	Whole Apples	Sliced apples	Whole apples	Sliced apples
Elementary School (n =600)	15.75 (1.64)	<b>25.48</b> <b>(2.50)</b>	5.27 (0.84)	<b>15.37</b> <b>(1.38)</b>
Middle School (n=1200)	73.80 (16.85)	<b>76.25</b> <b>(11.88)</b>	28.34 (4.10)	<b>58.38</b> <b>(1.65)</b>