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« INCREASING F&V CONSUMPTION TO REDUCE ENERGY INTAKE »

Editorial

Increased consumption of Fruits and Vegetables (F&V) can help to facilitate weight loss; however, several clinical trials testing this effect have reported a decline in intake over time. A sustained increase may be more likely if people are taught specific strategies for incorporating more F&V into their diets to manage their hunger and eat fewer calories. This can be achieved when F&V displace high-energy-dense foods so that the overall energy density of the diet is reduced. A simple and effective strategy is to increase the proportion of vegetables or fruits at a meal, for example by substituting them for more energy-dense ingredients in mixed dishes or by serving larger portions as side dishes. Another approach is to fill up at the start of a meal with a low-energy-dense salad or whole fruit so that intake of more energy-dense foods during the rest of the meal is reduced. People also need to be aware of strategies that are ineffective in reducing energy intake, such as consuming fruit as juice rather than eating it whole. In addition, simply advising people to add F&V to their meals may have little effect on energy intake and could even increase it if the additions are not very low in energy density. There are many reasons why people may not sustain an increased intake of F&V in order to manage their weight, and one of these could be that this approach is not perceived to be effective. Future interventions should explore whether teaching people specific strategies to enhance satiety by incorporating F&V in their diets will not only prevent a decline in intake, but will also promote greater weight loss.

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The effect of fruit in different forms on energy intake and satiety

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Identifying strategies to reduce energy intake and enhance satiety at meals is important for effective weight management. One strategy that may affect energy intake is changing the form in which food is consumed (solid, pureed, or liquid). While the literature on this topic is inconclusive, several studies have suggested that solid foods have a greater effect on satiety than liquids consumed as beverages[1-3]. Fruit is particularly useful for investigating the effects of food form on satiety, because it is readily available in different forms.

This study had aims:

1) to determine whether food served in different forms affects satiety and energy intake independent of variations in energy density or fiber content.

2) to determine whether consumption of fruit, which is low in energy density, affects satiety and energy intake at a meal.

Testing the effects of different forms of fruit on satiety

Fifty-eight adults, ages 18-45 years with a body mass index of 18-40 kg/m^2, were recruited for this study. Subjects came to the laboratory for breakfast and lunch once a week for five weeks. At the beginning of each lunch meal, subjects were served one of four preloads (apple, applesauce, and apple juice with and without added fiber) or no preload. At the start of the meal, the preload was served and subjects were instructed to consume the entire food or beverage. They were then served a lunch meal, and were instructed to eat and drink as much or as little as they wanted. All foods and beverages were weighed before and after being served to subjects to determine the amount consumed. Subjects also rated their hunger, fullness, and thirst.

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All preloads were apple-based and were matched for weight (266g) and energy content (~125 kcal), but each differed in form. The apple preload consisted of peeled apples cut into segments. The applesauce preload was prepared by baking apples and then pureeing them to produce applesauce. The apple juice preload was commercially made from freshly pressed apples and contained no added sugar and no measurable fiber. The apple juice with fiber preload consisted of the same type of apple juice combined with an apple-derived pectin supplement.

Whole apple was the most satiating form of fruit

Results showed that eating apple reduced lunch energy intake (preload + test meal) by 15% (187 kcal) compared to control ($p<0.0001$). Consuming apple also significantly reduced total energy intake at lunch by 91 kcal compared to applesauce, by 152 kcal compared to apple juice with fiber, and by 178 kcal compared to apple juice without fiber (all $p<0.02$). Lunch intake was significantly lower when applesauce was consumed compared to both types of apple juice ($p<0.05$); in the two juice conditions, however, total energy intakes at lunch did not differ significantly from each other.

Hunger and fullness ratings differed significantly after preload consumption (apple>applesauce>both juices>control). Ratings of thirst were significantly lower following intake of apple and both juices compared to control, applesauce, and apple ($p<0.001$).

Fruit, energy density, and management of energy intake and weight

This study builds on previous research shows that consuming whole fruit before a meal can enhance satiety and reduce subsequent food intake, leading to a substantial reduction in total energy intake at the meal.

There are number of reasons that have been proposed to explain the greater effect on satiety of whole fruit compared with juice. One possibility is the low fiber content of juice, although we did not find that adding fiber affected satiety following juice consumption[4]. It is also possible that subjects perceived the beverages to be more effective at reducing thirst, while they expected the apple segments and applesauce to satisfy hunger, leading to differences in food intake and satiety[5]. Different forms of fruit may also have different effects on satiety due to intrinsic structural properties that affect volume and chewing. However, more research is needed to explore how differences in fiber, cognition, volume, and chewing interact to affect food intake and satiety when different forms of fruit are consumed.

Fruit consumption has also been associated with diets lower in energy density[6], and research has shown that consuming a diet lower in energy density is related to reduced energy intake and body weight[7]. However, more research is needed to test the effects of consuming different forms of fruit on weight management. This study adds to the research suggesting that starting a meal with a low-energy-dense food, such as soup, salad, or whole fruit, reduces energy intake at the meal.

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REFERENCES

1. Bolton RP et al. (1981) American Journal of Clinical Nutrition 34, 211-217.
2. Haber GB et al. (1977) Lancet 2, 679-682.
3. DiMeglio DP & Mattes RD. (2000) International Journal of Obesity and Related Metabolic Disorders 24, 794-800.
4. Burton-Freeman B. (2000) Journal of Nutrition 130, 272S-275S.
5. Louis-Sylvestre J et al. (1989) International Journal of Obesity 13: supplement.
6. Ledikwe JH et al. (2006) Journal of the American Dietetic Association 1006, 1172-1180.
7. Ledikwe JH et al. (2007) Am J Clin Nutr 85, 1212-21

Using portion size to increase fruit and vegetable intake in children

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Background

Eating habits are established during early childhood. It therefore is crucial to promote consumption of healthy foods, such as Fruits and Vegetables (F&V), early in life. Despite the high nutritional value of F&V, cross-sectional studies show that many children in the United States do not meet the national dietary recommendations for these foods. It is estimated that fewer than ten percent of US children who are between four and eight years of age consume the recommended number of servings of F&V daily[1].

F&V not only provide essential nutrients for children, but they are also believed to play an important role in the regulation of energy intake. F&V have a high water and fiber content but are low in energy density (calories per gram). These properties have been shown to enhance fullness in adults, but few studies have assessed these effects in children. Given the inadequate consumption patterns of F&V in many children, it is crucial to identify dietary strategies that can be used by parents and caregivers to increase children's intake of F&V.

Increasing the portion size of fruit and vegetable side dishes

The portion size of foods has been identified as a strong determinant of energy intake in both children and adults[2, 3]. Studies have shown that when served larger portions of food, children as young as two years of age ate more. Many of the earlier studies have focused on changing the portion size of energy-dense entrées such as pasta dishes. Few studies, however, have focused on changing portion size of more healthy foods, such as F&V. Therefore, it is important to determine if portion size can be used strategically to promote intake of healthy foods.

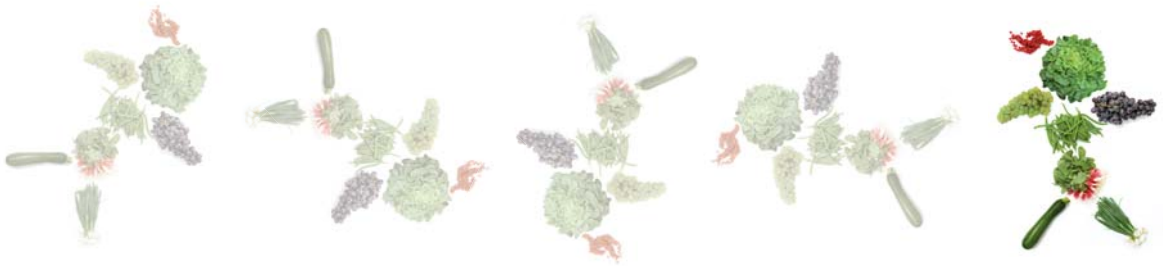
The aim of a recent study in Philadelphia was to test the effects of doubling the portion size of F&V side dishes at a meal on children's intake[4]. Boys and girls between five and six years of age were served dinner once a week for two weeks. Each dinner consisted of pasta with tomato sauce, three F&V side dishes (broccoli, carrots, applesauce), and milk. The portion size of the F&V side dishes was doubled between visits, while the size of the pasta remained the same. Children could eat as much or as little as they desired.

The results of the study showed that doubling the portion size of the F&V side dishes led to a 43% increase in children's intake of the fruit side dish, which corresponded to approximately one third of a serving of applesauce. Children's intake of the vegetable side dishes, however, remained unaffected by the portion size changes in this study. Interestingly, when served the large portions of F&V, children spontaneously ate less pasta despite the fact that the portion size of the pasta did not change. It is possible that the increased consumption of the fruit side dish when large portions were served may have displaced intake of the main entrée.

With respect to children's vegetable intake, which remained similar between portion size conditions, it is possible that the preparation method of the two vegetables may have influenced children's intake (both vegetables were served plain with no added butter or seasoning). Findings from a similar study by Fisher and colleagues[5], which showed greater intakes of vegetables when larger portions were served, suggest that adding small amounts of fat or a dip to vegetables can enhance children's liking of the vegetables which in turn may promote intake. Another study showed that doubling the portion size of a single vegetable (carrots with a dip) served as a first course increased carrot intake in children by 47%[6].

Conclusion

These findings suggest that increasing the portion size of healthy foods, such as F&V, at a meal can be an effective strategy to promote children's intake of these foods while displacing consumption of more energy-dense entrées. Parents and foodservice providers at schools and daycare settings should be encouraged to use these strategies to promote F&V consumption among children.



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REFERENCE

1. Guenther PM et al. J Am Diet Assoc 2006; 106: 1371-1379.
2. Fisher JO & Kral TV. Physiol Behav 2008; 94: 39-47.
3. Rolls BJ. Nutr Today 2003; 38: 42-53.
4. Kral TV et al. Obesity 2010; 18: 521-527.
5. Mathias KC et al. Obesity, 2009, p S90.
6. Spill MK et al. Am J Clin Nutr, in press.

Strategies to enhance weight loss should include high vegetable consumption

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Current MyPyramid dietary recommendations in the United States include consuming 3.5 to 5.5 cups of Fruits and Vegetables (F&V) each day for 1,600 to 2,600 kilocalorie eating plans. F&V are low in calories relative to other foods and provide nutrients and other phytochemicals not found in other food groups. Consumption of large amounts of vegetables and moderate fruit could reduce overall caloric intake, induce weight loss, or maintain weight long-term in obese and overweight individuals. Therefore, effective strategies to incorporate more vegetables into the daily eating plan are needed.

An intervention to increase F&V intake and reduce caloric intake

A recent study hypothesized that a daily eating plan that included four cups of vegetables and 1 to 1.5 cups of fruit would reduce overall caloric intake and induce weight loss in obese individuals. The study was designed to determine if individuals could maintain a diet high in vegetables and moderate in fruit for 18 months.

Sixty subjects with an average body mass index of 33.5 kg/m^2 and an average body weight of 95 kg were recruited and split into two groups. The first group was taught to eat the high vegetable and modest fruit daily plan, while the second group was instructed to lower caloric intake by 500 kcal/day and to reduce total fat to less than 25% of energy. Both groups were instructed to increase physical activity. This was encouraged by providing simple pedometers as incentives.

During the first three months, subjects were provided with two meals each day, five days per week. Periodic morning educational sessions were held. The vegetable group received 3.5 to 4 cups of vegetables and two fruits, while the reduced calorie group received half the amount of vegetables and the same amount of fruit as the vegetable group. It was hypothesized that after the three-month intervention, subjects would follow the dietary advice and continue to lose weight by consuming high amounts of vegetables and moderate fruit. Weight and body composition were measured at baseline, 3, 12, and 18 months. Serum chemistry profiles were measured at baseline, 3 and 12 months.

Increased F&V intake associated with long-term weight loss

The vegetable group had an increased vegetable intake for at least 12 months. Both groups decreased energy intake over time and it did not differ between groups, which was due in part to reduced fat intake. The reduced calorie intervention group was able to maintain a reduced fat intake for the 18-month period. Both groups lost weight during the first three months, but only the reduced calorie group maintained weight loss at 12 and 18 months. However, the vegetable group did not gain weight in reference to baseline during the observation period. Other benefits recorded in response to this intervention included a total cholesterol reduction at three months, due mostly to a reduction in low-density lipoproteins. This led to improved (lower) cholesterol to high density lipoprotein ratios. In addition, the subjects maintained an increased step count as measured by the pedometers for 12 months.

Recommendations to individuals seeking to lose weight and maintain weight loss should include an emphasis on increasing F&V intake in addition to controlling total energy intake.

Consistently consuming high amounts of vegetables may be more sustainable than counting calories and fat grams from food labels to decrease total energy and fat intake, and high vegetable consumption may assist in maintaining initial weight loss. Weight loss is difficult to maintain over time; therefore, strategies to improve the long-term sustainability of increasing vegetable intake need to be developed. This message needs to be continually repeated to be effective among the general population. When the subjects ate greater than three cups of vegetables each day they lost weight, but they were not able to maintain this level of intake when they were left on their own with only phone and email support.

In addition to modest weight loss or weight maintenance, a diet high in vegetables may reduce the risk of cancer and cardiovascular disease, and improve bone health. Vegetables are nutrient rich and low in energy density and should be part of everybody's daily eating plan.

REFERENCE

- Tanumihardjo, S.A., Valentine, A.R., Zhang, Z, Whigham, L.D., Lai, H.J., Atkinson, R.L. (2009). Strategies to increase vegetable or reduce energy and fat intake induce weight loss in adults. Experimental Biology and Medicine. 234:542-52.

- Valentine, A.R., Whigham, L.D., Tanumihardjo, S.A. (2009). Pedometers are perceived as useful tools for weight loss. Journal of Extension. 42(2):2TOT6.