

# EUFIC-ÜBERSICHT

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## ... Is eating between meals good for our health? ...

Over the last few decades, there have been great changes in how Europeans work, rest and play and our eating habits have adapted accordingly. One consequence of our modern fast paced lifestyles is that we tend to eat on the go and it is commonly believed that we are having more eating episodes outside meals than in the past. This review will examine if this is the case and consider the health implications of this aspect of our dietary habits.

### Snack and snacking

There is much discussion over what constitutes a snack (portion size, timing, type of food etc) but for the purposes of this review a snack will be defined as any intake of food or energy-containing beverage outside of the usual meal times (breakfast, lunch and dinner). In the scientific literature snacks are also called Between Meal Eating Episodes (or BMEE). The products ingested in those extra eating occasions can be savoury like nuts, cheese, crisps, pretzels and breads, they can be sweet like cakes, yoghurts, fruit, biscuits, chocolate and confectionery, and can include beverages like fruit juices, squashes, carbonated soft drinks or milk.

### Why do we eat between meals?

What and when we eat varies widely between countries and communities according to cultural norms, social influences and religious beliefs.(1) But despite wide variation in food choice and meal timing, eating episodes outside meals or snacking is common. From an evolutionary perspective, snacking may reflect our hunter-gatherer days when people had to spend much of the day searching, gathering and subsequently eating food immediately. Larger meals, allowing many people to eat together, would only occur after the successful hunting of a large animal.(2)

At the individual level there are also a number of reasons why we may choose to snack. Practical considerations like lack of time or irregular access to 'proper' meals may make it necessary to eat on the go or snack regularly. But genetic factors may also be at work. There is now evidence that many aspects of our eating behaviour, for example the amount of food and drink consumed at any one time, how hungry we are before eating, and how many people we like to eat with are influenced by genetic factors.(3) The reasons why we snack are complex; a combination of cultural, social, religious, practical, and personal influences are involved.

### Is snacking on the increase?

Although it is generally assumed that snacking is on the increase, this may not be the case.

A comparison of the dietary habits of almost 40,000 American adults between the early seventies and late nineties found that the overall number of reported eating episodes (meals and snacks combined) remained remarkably constant (around 5) .(4) Over a similar time period, 10 year old American children have reduced the amount of food consumed outside meals and the overall number of eating episodes has dropped from 6.6 in 1973 to 5.2 in 1994.(5) In the United Kingdom, a recent study looked at children's snacking habits over 20 years, from 1980 to 2000. The types of foods consumed between meals (i.e. eaten as snacks) were not different from those consumed as part of meals. The total amount and the proportion of energy derived from foods eaten as snacks did not increase and there was no change in the frequency of consumption of foods between meals.(6) In Dutch adults the amount of daily calories consumed as snacks appears to have remained fairly constant over the last fifteen years at about 30-35% .(7) Analysis of food intake over time in Portuguese adults has revealed a fall in traditional Southern European meals since the mid eighties, and an increase in snacking, but only in younger adults.(8) So although eating episodes between meals are common in developed countries, they may not have risen dramatically in recent times. The impression that we are snacking more may have arisen from the decline in formal family meals and the fact that many people tend to eat alone or on the go.

### Eating between meals: particular cases

Eating between meals is common amongst consumers of all ages in Western societies but for people with little appetite or a small stomach, snacking may play an important role in helping them eat enough. Children for example have relatively high calorie needs as they are growing and tend to be very physically active. Many studies have suggested that children in general tend to be well tuned into their appetites and, given the opportunity, will only eat what they need. (9) So offering nutritious meals and snacks – the little and often approach – might give them a good chance of meeting their calorie and nutrient needs. Obviously, if one is to eat often, the size of the numerous eating occasions must be aligned with the total daily energy needs (some children do have a large appetite, in spite of their small body size!).

Some elderly people have poor appetites and tend to find large meals off-putting. Instead they prefer smaller portions at meal times with a few snacks in between. The SENECA study which examined the diets of elderly people born between 1912 and 1918 in 12 European countries found that people who ate more frequently had a better nutritional status(10) than those eating only at meal times.

### Snacking and calorie control

Avoidance of eating between meals is standard advice for body weight control, the rationale being that snacking leads to over consumption and thus contributes to weight gain. Some short term laboratory studies support this theory. Studies have demonstrated for example that when people are given a snack prior to a meal, the size of their subsequent meal is not affected. (11) In other words they do not cut down on calories in the meal even after consuming a high calorie snack.

If this happened repeatedly, it would lead to overeating and weight gain. However a long term snacking study found that this is not necessarily what happens in real life. A group of 66 lean, active men consumed a chocolate bar in addition to their usual food intake six days a week for six months. If the men had not reduced their food intake at other eating occasions they would have put on 4-5kg over the six months, but their weight remained the same. Complete and accurate compensation for the additional calories was



made as the days of snacking progressed in these lean and active healthy subjects.(12) Eating between meals will only induce weight gain if you regularly eat more calories than you need.

## Calorie intake compensation

Research is still needed to evaluate inter-individual differences in the ability to compensate in response to extra-meal eating episodes. It is interesting that the children participating in the Bogalusa heart study<sup>5</sup> had, after 21 years, smaller snacks but larger meals so their overall food intake remained the same. Evidence suggests that men are better compensators than women, young people better than the elderly, the lean better than the overweight and people who do not restrain their food intake for weight control purposes are better than people who do so by consciously ignoring their internal hunger signals. (13)

## Eating frequency and body weight

It has been suggested for some time now that there are a number of benefits to nibbling, in other words eating little and often, compared with gorging, which means eating fewer larger meals. Early observational studies found that nibblers were thinner than gorgers but it is now thought that this finding is biased due to underreporting of snacks (especially by the overweight).(14) This has been confirmed by studies using sophisticated techniques to measure energy expenditure - there is no difference in the amount of energy expended when the same amount of food is consumed in a few large meals or in several little ones. In other words eating more often does not burn more calories. However there are other possible advantages to eating frequently that could have a beneficial effect on body weight:(12)

- Eating small frequent snacks often leads to a flatter hunger profile which means that people do not get so hungry between meals and so are less likely to gorge at mealtimes.
- Regular eating gives a person more opportunities to compensate for any calorie deficits or excesses as they can adjust both snack frequency and meal size, whereas infrequent eaters are limited to adjusting meal size.
- Frequent eating is likely to shift food consumption towards the earlier part of the day. Nibblers tend to eat breakfast and daytime snacks and eat less in the evening, whereas gorgers do the opposite, often having most of their calories in the evening. The gorging pattern of eating is often seen in overweight and obese people. More research is needed to understand whether any metabolic consequences of this eating pattern might lead to weight gain.
- Frequent eating may help increase the amount of carbohydrates relative to fat in the diet as many foods and drinks, like juices, fruits, dairy products, low fat wholegrain biscuits etc., eaten between meals are higher in carbohydrates and lower in fat than main meals.

## Eating patterns and cholesterol

The idea that eating frequency might have an impact on blood fats has been around for over thirty years. Short term studies in humans have indicated that people who eat frequently (six times a day or more) have lower total blood cholesterol and lower LDL (the "bad") cholesterol(15) compared to those eating only three times a day or less. A recent large scale study was carried out in over 14,000 middle-aged British adults.(16) The study found that in both men and women, as meal frequency increased, blood cholesterol fell (both total and LDL cholesterol). These findings held true even when possible confounding factors like body mass index (a measure of weight relative to height), cigarette smoking, physical activity and dietary intake were taken into account. The lower blood cholesterol observed in men eating six times a day compared to two times a day is equivalent to a 10-20% reduction in the risk of heart disease.

## Eating patterns and blood sugar

There has been much interest in the glycaemic index (GI) in recent years with a number of GI diets becoming popular. The idea is that by eating foods which enable the sugars they contain to be digested and released slowly, we remain full for longer and avoid metabolic highs and lows in insulin production (insulin is vital for keeping blood sugar levels within healthy limits). Low GI foods basically spread out the release of carbohydrates, including sugars, into the bloodstream over a longer period of time. A similar effect can be achieved simply by eating smaller but more frequent meals. Short term studies show that eating more frequently is associated with beneficial reductions in insulin production and a fine tuning in blood sugar control.(17) In patients with Type 1 diabetes who have to control their blood sugar by carefully balancing food intake with insulin administration, no long term beneficial or detrimental effects on blood sugar control have been observed with an increased meal frequency.(15) Patients with diabetes should obtain their physician's advice about their daily intake pattern and consequent insulin use.

## Frequency of eating and oral health

Tooth decay is caused by acid attacks on the teeth. When there are more acid attacks than the teeth can cope with, tooth decay develops. Acid attacks are caused when plaque bacteria acts on the fermentable carbohydrates in our foods and drinks. These sugars can come from sweet foods like cakes, biscuits, fruit and confectionery but also from easily digestible starches like bread, fries and savoury snacks. Almost every time we eat our teeth will be affected, but teeth can cope with acid attacks as long as there is enough time for recovery and repair between bouts of eating and drinking.

Recently tooth erosion has become more common. Erosion occurs where there is prolonged, regular exposure to acidic food or drink. The acids directly attack the tooth enamel. Many foods and drinks contain acids including fruit juices, squashes, all types of carbonated drinks (including diet ones), fruit and even yoghurt. Fortunately it is not necessary to cut out all these foods to have healthy teeth as long as good oral hygiene is practiced and attention is given to the frequency of consumption.

Teeth that are brushed regularly in the morning and evening with fluoride toothpaste are stronger and more resistant to acid attacks (whether from bacteria or directly from food and drink) and can cope with up to six eating occasions per day.(18) So as long as snacks are consumed over a short period of time (not nibbled or sipped continuously), it is possible to eat or drink up to six times a day and have healthy teeth.(19)

## Eating pattern and sport

Athletes and sports men and women have increased calorie requirements compared to sedentary people. It is now known that carbohydrates (sugar and starch) are the fuel of choice for physical activity. Regular consumption of carbohydrate-containing food and drink keeps working muscles topped up and improves performance.(20) From a practical point of view spreading food intake evenly throughout the day allows the athlete to consume enough food without the discomfort and bloating of eating large meals. It is also important that sportsmen and women ingest enough fluids: the body needs at least an extra litre of water for every hour spent in activity, and more in hot temperatures. Water (which is the natural choice for hydration), sports drinks (specially formulated to provide quickly absorbed carbohydrates and electrolytes lost during exercise), and regular soft drinks are all suitable for



consumption before, during and after activity.

## Frequency of eating and an active lifestyle

These days an active lifestyle is strongly encouraged to promote general good health and to help with weight control. Even if you are not a top athlete, eating plenty of carbohydrates will give your muscles the fuel they need to keep active and drinking enough fluids will keep your body properly hydrated. An analysis of almost 2000 Scottish adults found that people who were more physically active ate more frequently.<sup>12</sup> So snacking may be compatible with a more physically active lifestyle as it provides regular fuel for the muscles and avoids the discomfort experienced after consuming large meals.

## Snacking and nutrient intakes

Snacks contribute a substantial amount of protein, carbohydrate, fat, vitamins and minerals to the diet. Snack choices vary for different types of people:

- Children should be encouraged to eat a wide range of different snacks so they can try out different tastes and textures. Sliced fruit, vegetable or bread sticks with dips, wholegrain foods, cheese, yoghurts, dairy drinks and juices are some suggestions.
- Adolescents are growing rapidly and boys in particular tend to have high calorie needs. Adequate choices might include fresh and dried fruit, nuts - rich in beneficial fats, protein, vitamins and minerals-, dairy products and an occasional high-energy density treat.
- In the elderly, chewing and preparation of food can be a problem. Their choices might include: soft and easy to peel fruits, dairy products, and a variety of palatable soft, ready to eat foods.
- Sporty or active people need to choose high carbohydrate snacks to keep them going. Good choices include dried fruit, fresh fruit, sandwiches with low fat fillings (ideally wholegrain), sports drinks and fruit juices.
- People who are trying to lose weight may feel less hungry if they include nutritious snacks like fruit, yoghurts, nuts(21) and bread as part of their calorie controlled diet.

## Snacking for health?

There is evidence that eating three meals and two or three snacks per day (nibbling) might be better for you than eating fewer, larger meals (gorging) as long as the total caloric intake remains the same. Compared to the gorging eating pattern, the nibbling eating pattern:

- Has been shown to produce a lower level of blood cholesterol
- Spreads the absorption of nutrients more evenly throughout the day
- Leads to a smoother insulin response which is beneficial for blood glucose control
- Does not lead to weight gain if calorie intake remains stable
- May help people control their calorie intake more effectively
- Helps active people and those with high energy requirements meet their calorie needs
- Helps those with a small appetite meet their calorie needs

In many circumstances, having up to 3 snacks a day and ingesting a wide range of foods and drinks can have a positive, rather than a negative, impact on health. Snacking should not be systematically discouraged, as long as the foods ingested as snacks contribute to a healthy energy and nutrient intake.

## Summary

Snacking, defined as eating episodes between meals, is a result of cultural, social, religious, practical, and personal influences. Contrary to common belief, snacking has not increased in recent years. Eating between meals can be helpful in meeting calorie and nutrient requirements, especially for some groups of the population, such as children, the elderly, or people with a very active lifestyle. Although snacking has been thought to contribute to weight gain, this will only happen if one regularly consumes more energy than one needs. Furthermore, as long as energy intake is maintained, snacking may even help some individuals improve their weight control because eating more frequently may promote satiety, favours eating earlier in the day, and may increase carbohydrate intake while decreasing fat consumption. In addition, snacking seems to be associated with a lower risk of heart disease due to a lower level of both total and LDL cholesterol. It does not interfere with blood sugar control in patients with diabetes. As far as oral health is concerned, if teeth are cleaned regularly (at least twice a day with fluoride toothpaste), eating up to 6 meals per day should not create problems.

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## References

1. De Castrol JM (1997) Socio-cultural determinants of meal size and frequency. *British Journal of Nutrition* (Suppl 1): S39-54
2. de Graaf C (2006) Effects of snacks on energy intake: an evolutionary perspective. *Appetite* 47:18-23
3. De Castro JM (2002) Independence of heritable influences on the food intake of free-living humans. *Nutrition* 18:11-16
4. Kant AK & Graubard BI (2006) Secular trends in patterns of self-reported food consumption of adult Americans: NHANES 1971-1975 to NHANES 1999-2002 *American Journal of Clinical Nutrition* 84:1215-23
5. Nicklas TA, Demory-Luce D, Yang SJ, Baranowski T, Zakeri I & Berenson G (2004) Children's food consumption patterns have changed over two decades (1973-1994): The Bogalusa heart study. *Journal of the American Dietetic Association* 104:1127-40
6. Adams J, O'Keeffe M, Adamson A. Change in snacking habits and obesity over 20 years in children aged 11 to 12 years. (September 2005) Vol. 1: 1-114; Vol. 2: 115-166. FSA Project Code: N09019
7. RIVM/TNO (2004) Results of the food consumption survey 2003 Bilthoven, The Netherlands RIVM/TNO
8. Marques-Vidal P, Ravasco P, Dias CM & Camilo ME Trends of food intake in Portugal, 1987-1999: results from the National Health Surveys. *European Journal of Clinical Nutrition* 60:1414-22
9. Evers C (1997) Empower children to develop healthful eating habits. *Journal of the American Dietetic Association*.(suppl 2) S116
10. de Groot CP, van Staveren WA (2002) Undernutrition in the European SENeca studies. *Clinical Geriatric Medicine* 18:699-707
11. Marmonier C, Chapelot D, Fantino M & Louis-Sylvestre J (2002) Snack consumed in a non hungry state has poor satiating



- efficiency: Influence of snack composition on substrate utilization and hunger. *American Journal of Clinical Nutrition* 76:518-528
12. Kirk TR & Cursiter MC (1999) Long-term snacking intervention did not lead to weight gain in free-living man. *Scandinavian Journal of Nutrition* 2 (Suppl 34): 3-17
13. Kirk TR (2000) Role of dietary carbohydrate and frequency of eating in body weight control. *Proceedings of the Nutrition Society*. 59:349-58
14. Bellisle F (2004) Impact of the daily meal pattern on energy balance. *Scandinavian Journal of Nutrition* 48:114-118
15. Jenkins DJA, Wolever TMS, Vuksan V, Brighthen F, Cunnane SC, RAo AVet al (1989) Nibbling versus gorging: metabolic advantages of an increased meal frequency. *New England Journal of Medicine* 321:929-34
16. Titan SMO, Bingham S, Welch A, Luben R, Oakes S, Day N Khaw KT (2001) Frequency of eating and concentrations of serum cholesterol in the Norfolk population of the European prospective investigation into cancer (EPIC-NORFOLK) cross sectional study. *British Medical Journal* 323:1-5
17. Jenkins DJ (1997) Carbohydrate tolerance and food frequency. *British Journal of Nutrition* 77 (Suppl 1) S71-81
18. Kandelman D (1997) Sugar, alternative sweeteners and meal frequency in relation to caries prevention: new perspectives. *British Journal of Nutrition* 77 (Suppl 1): S121-8
19. Zaura E, Van Ioveren C., & ten Cate J.M. Efficacy of fluoride toothpaste in preventing demineralisation of smooth dentin surfaces under frequent exposures to sucrose or bananas *Caries res* (2005); 39: 116-122
20. Position of the American Dietetic Association, Dietitians of Canada and the American College of Sports Medicine on Nutrition and athletic performance (2000). *Journal of the American Dietetic Association* 100:1543-56
21. Garcia-Lorda P, Megias Rangil I, Salas-Salvado J (2003) Nut consumption, body weight and insulin resistance. *European Journal of Clinical Nutrition* 2003; 57(suppl 1): S8-S11

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