

Fruit and Vegetable Consumption in Europe

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1. Introduction

Fruit and vegetables are important elements of a healthy, balanced diet, be it as part of a main meal or as a snack. They bring us vitamins, minerals and fibre, some energy (mainly in the form of sugar), as well as certain minor components - often referred to as phytochemicals or secondary plant products - which are potentially beneficial for our health. Epidemiological studies have shown that high intakes of fruit and vegetables are associated with a lower risk of chronic diseases; particularly, cardiovascular disease¹⁻³, also type 2 diabetes⁴, and certain cancers i.e. of the mouth, pharynx, larynx, oesophageal, stomach and lungs⁵.

A majority of European citizens associate a healthy diet with fruit and vegetable consumption, and many of them believe that their diet is healthy⁶. But is this true? Do people in Europe actually get the amounts of fruit and vegetables recommended for good health? Aiming to answer this question, this review also looks deeper into what factors influence fruit and vegetable consumption in Europe, and what are the best intervention approaches to increase it. Lastly, we will have a glance at on-going European initiatives around fruit and vegetable consumption.

First of all, we need to understand which foods and drinks fall into the category of fruit and vegetables, how much we are recommended to have of these and why it might be difficult to obtain reliable and comparable data on fruit and vegetable consumption.

Definitions of fruit and vegetables

How are fruit and vegetables defined? It might seem like a simple question, but it is actually quite complicated to derive an all-embracing definition. Tomatoes and lettuce, apples and strawberries may be easy to identify as vegetables and fruits, respectively. But how about potatoes? And is fruit juice equal to fruit? Then there are pulses and nuts, which are also plant foods that may or may not be categorised in these food groups. This is important to keep in mind when performing dietary surveys in order to know what is actually being measured.

The definition of fruit and vegetables also varies between countries. Some countries (e.g. Austria, Belgium, Denmark, Iceland, Netherlands, Portugal, Spain and Sweden) have not included potatoes and starchy tubers, following the same principle as the World Health Organization (WHO), whereas the Norwegian recommendations, for example, include potatoes. Juice is sometimes excluded from the fruit and vegetable recommendations (e.g. Belgium, Spain), sometimes included with limitations (e.g. counts as maximum 1 portion (e.g. Denmark, the Netherlands and Sweden), and fully included in other countries (e.g. Iceland and Norway). Austria and Portugal do not provide any specification regarding juice.⁷

Varying definitions of which foods belong to fruit and vegetables present a barrier to comparing data from different studies. This is a major issue when trying to estimate fruit and vegetable consumption in Europe.

Given that many national authorities regularly perform surveys of fruit and vegetable intake, standardising the survey methodology would vastly improve data comparability across different countries.

Measuring fruit and vegetable intake

There are different ways to measure food consumption. Food diaries and dietary recalls (i.e. interviews and questionnaires) are means to obtain information on what individuals eat. Household spend and average food supply based on national statistics may also be used to assess consumption.

Different methods take into account different aspects and the exactitude varies between them. Hence data obtained with different methods are not directly comparable. National Authorities have typically selected methods for their dietary surveys without international comparability in mind⁸.

The lack of comparable data on dietary intake will be tackled by the EU Menu, a pan-European dietary survey by the European Food Safety Authority (EFSA) that uses standardised data collection methods. The 5 year survey will start at the beginning of 2012⁹.

Recommendations

Definitions of fruit and vegetables are not only important to obtain accurate and comparable data on consumption, but they are also crucial for intake recommendations and what their effect will be on population intakes.

WHO recommends eating ≥ 400 g per day of fruits and vegetables, not counting potatoes and other starchy tubers such as cassava¹⁰. In Europe, the recommendations vary between countries. In general, these are in line with the WHO recommendation, but some countries recommend higher amounts e.g. ≥ 600 g per day in Denmark⁷.

2. Fruit and vegetable consumption in Europe

What do food supply data say?

The Food and Agriculture Organization of the United Nations (FAO) provides data on food consumption based on agricultural data which indicates the food supply patterns at national level.

According to the FAO data, the vegetable supply (excluding potatoes and pulses) in Europe has increased over the last four decades. It also shows a north-south gradient; in Northern Europe the vegetable supply is lower than in Southern Europe. For example, in Finland the average supply is 195 g per person per day, which corresponds to 71 kg per person per year, whereas Greece has an average supply of 756 g per person per day (276 kg per person per year)¹¹.

What do household food consumption data say?

National Authorities regularly collect data on food consumption at household level through household budget surveys. Efforts have been made to compile and modulate these data - from a number of European countries (collected at different time points) - to enable comparison.

Household data show that total vegetable consumption (excluding potatoes and pulses) varied from 284 g per day in Cyprus to 109 g per day in Norway. These countries had also the highest and lowest recorded intakes, respectively, of fresh vegetables. Interestingly, Cyprus had the lowest consumption (4 g per day) of processed vegetables (frozen, tinned, pickled, dried and in ready meals, but excluding potatoes). The consumption of processed vegetables was highest in Italy at 56 g per day¹².

Based on household food data on fruit and vegetable consumption it has been suggested that household availability of fruit and vegetables is satisfactory in some Southern European countries and that in a number of countries the availability of fruits is higher than that of vegetables¹¹.

What do dietary survey data say?

EFSA has compiled national food consumption data based on dietary surveys in order to assess food intake in Europe. Adjustments of the compiled data allow for a certain level of comparison¹³.

These data reveal that the mean vegetable intake (including pulses and nuts) in Europe is 220 g per day. Mean fruit intake is 166 g per day, implying that the average consumption of fruit and vegetables is 386 g per day. The data further show that the vegetable consumption is higher in the South than in the North of Europe and that the regions with the highest intake of fruits are those of Central and Eastern Europe followed by those in the South¹³.

Only in Poland, Germany, Italy and Austria the recommendation of consuming ≥ 400 g of fruit and vegetables per day was met. When fruit and vegetable juices were included, Hungary and Belgium also reached the recommended amount¹¹. It is worth noting that the database only contains data from one Southern European country, namely Italy (Figure 1).

Mean fruit & vegetable intake (g/day)

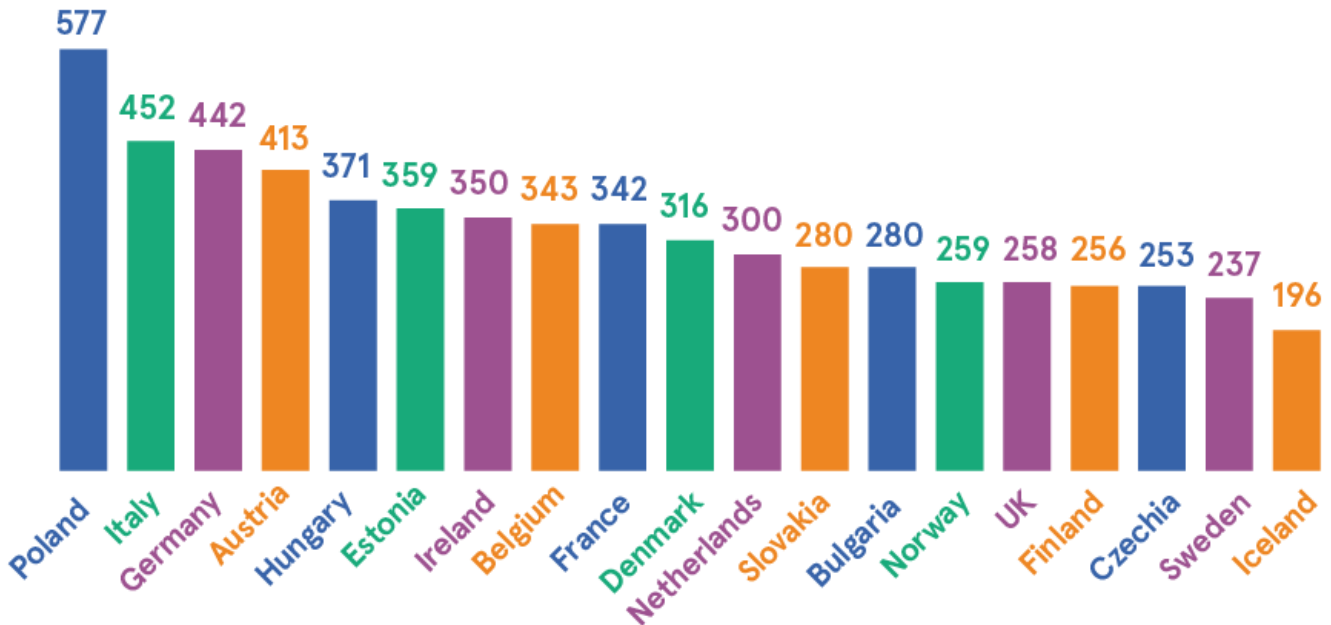


Figure 1 - Mean fruit & vegetable intake per country (in grams per day), excluding juices¹³

There is only limited data on European children's fruit and vegetable consumption, but one study suggests that 6-24% of European children reach the WHO recommendation⁷. The average vegetable intake was estimated to be 86 g per day, the average fruit intake 141 g per day. When fruit and vegetables are combined, the highest intakes are seen in Austria and Portugal and the lowest in Iceland and Spain. The type of vegetables consumed differed according to the geographical location. In the North, consumption of raw vegetables was higher, while vegetable soups were the main sources of vegetables in the South.

Insufficient fruit and vegetable intakes in Europe

The WHO estimates that in more than half of the countries of the WHO European Region the consumption is lower than 400 g per day of fruit and vegetables, and in one third of the countries the average intake is less than 300 g per day (8). EFSA's analysis based on national dietary surveys suggests that the recommended amount is reached only in 4 of the participating EU Member States¹¹.

Disease burden related to low fruit and vegetable intakes

According to the estimates above, a majority of Europeans do not meet the WHO recommendations for fruit and vegetable intake. As eating recommended amounts of these foods helps to ensure health and prevent disease, poor intakes would be expected to negatively impact on health.

To get an idea of the magnitude of the problem, attempts have been made to estimate the contribution of

low fruit and vegetable consumption to the burden of disease. The most recent analysis in the European Union (EU) dates from 1997. At the time, it was estimated that 8.3% of the burden of disease in the EU-15 could be attributed to inadequate nutrition, with low intakes of fruit and vegetables being the cause for 3.5% of the disease burden¹⁴. WHO has estimated that 2.4% of the burden of disease in the WHO European Region was attributable to low intakes of fruit and vegetables in 2004 (Table 1)¹⁵.

Table 1 - Top 10 health risk factors and their estimated relative contribution to the burden of disease (from¹⁵)

Risk factor	Burden of disease (%)
1. Tobacco use	11.7
2. Alcohol use	11.4
3. High blood pressure	11.3
4. Overweight and obesity	7.8
5. High cholesterol	5.9
6. Physical inactivity	5.5
7. High blood glucose	4.8
8. Low F&V intake	2.4
9. Occupational risks	1.7
10. Illicit drug use	1.6

Most of the benefit of consuming fruit and vegetables comes from a reduction in cardiovascular disease risk, but fruit and vegetables may also reduce the risk of certain cancers¹⁶.

WHO has estimated that insufficient intake of fruit and vegetables causes around 14% of gastrointestinal cancer deaths, about 11% of ischaemic heart disease deaths and about 9% of stroke deaths worldwide¹⁵.

3. Determinants

As for dietary habits in general, a wide range of factors influence fruit and vegetable consumption; factors in our physical, social and cultural environment as well as personal factors, such as taste preferences, level of independence, and health consciousness. Many of these factors change throughout life.

Income and education

There are many studies supporting a relation between income level and fruit and vegetable intake; low-income groups tend to consume lower amounts of fruit and vegetables than higher income groups¹⁷. But why is that?

High costs may negatively impact on fruit and vegetable intake levels¹⁸. This does not only concern low income groups. Also people with higher incomes perceive price as a barrier to consumption of these foods. However, it tends to be more of a concern among those with smaller revenues¹⁹. Thus, affordability is likely to be only one of several factors mediating the effect of income level on fruit and vegetable consumption.

Better educated adults show higher vegetable consumption. Besides the financial aspect just mentioned – higher education generally means higher income – this could be related to greater knowledge and awareness of healthy eating habits in those with higher education levels. It is also likely that certain values, ideals and social influence linked to education and income levels influence our eating behaviours, including fruit and vegetable consumption²⁰.

Gender and age

In general, girls and women consume larger amounts of fruit and vegetables than do boys and men^{17, 21-23}. This seems to be the case also for pre-school children²⁴, thus the gender difference already shows at an age when nutrition knowledge is unlikely to have any impact.

There is no simple answer to the question why females eat more fruit and vegetables than males. Social structures linked to the traditional roles of men and women in society could be one explanation²². It has also been suggested that girls like fruit and vegetables more than do boys and hence they eat more of them. Why that is, however, remains unclear²¹.

Age also appears to influence fruit and vegetable consumption. In children and adolescents, consumption tends to decrease with age²³. In adults, the relation between age and intake is inversed, i.e. intake levels increase with age. Possible explanations include higher income and knowledge with age, and social habits and cues, e.g. what type of social activities people take part in, social eating habits and ideals related to food and the time devoted to cooking²⁰.

Accessibility and availability

The availability of a variety of attractively displayed fruit and vegetables all year round positively affect fruit and vegetable consumption, particularly with higher socioeconomic status (19). Similarly, availability of and access to fruit and vegetables in the home is important for consumption in both children and adults^{19, 23, 25}. On the other hand, lack of or limited supply of fruit and vegetables (e.g. little variety offered in canteens or local shops and poor quality) has been reported to be obstacles to consumption of such foods¹⁸.

Family factors and social support

Social support appears to enhance fruit and vegetable consumption²⁶ and family factors influence fruit and vegetable intake in children, adolescents and adults.

In adults, particularly in men, being married positively impacts on the amounts of fruit and vegetables consumed^{19, 22}. Women seem to have a positive influence on their husbands' intake frequency, amounts and variety of the fruit and vegetables eaten¹⁹. In general, family factors seem to be stronger determinants in men than in women. This is thought to be related to their traditional roles in the household; women handle health-related issues and more commonly shop and prepare food than do men^{19, 22}.

Children's fruit and vegetable intake levels are related to how much their parents consume²⁴. There is also

a relationship between family rules and children's vegetable intake. Pressure to eat fruit and vegetables does not have any positive effect on intake in children. However, consumption can be enhanced when parents are good role-models and encourage children to eat fruit and vegetables²⁷. Family meal patterns, in particular shared family meals, also improve fruit and vegetable consumption in children^{23, 24}. Home availability and other factors in the shared environment as well as genetic pre-disposition (inborn food preferences) could explain the link between parents' and children's intake levels²⁴.

Dietary habits learnt in childhood seem to be predictive for intake levels in adulthood¹⁹. The earlier children are introduced to vegetables the more likely they are to have higher consumption levels at pre-school age²⁴. People who eat a lot of fruit and vegetables in childhood remain good consumers²⁸.

Preferences

Food preference is one of the factors related to fruit and vegetable consumption^{23, 25}. When starting to eat solid food the child may initially not seem to like certain foods, but repeated exposure may improve this. As many vegetables have a slightly bitter taste, the child may need to try them more often than other foods before accepting them.

Parents using pressure and rewards to make their children eat fruit and vegetables may not be very successful. Typically such strategies result in even stronger aversions. Giving children a variety of foods, tastes and textures, being patient and repeatedly serving foods they initially seem to dislike, being a role model, and encouragement are far better strategies²⁹.

Although to a large extent developed during childhood³⁰, food preferences change over time and may be modified also in adulthood. As for children, repeated exposure may reduce food neophobia, i.e. being reluctant to try new foods, in adults as well³¹.

Knowledge

To what extent nutritional knowledge and awareness of recommendations influence what we eat is widely discussed and explanations to why certain groups eat more healthily than others have been sought. Among the psychosocial factors, nutritional knowledge is one of the strongest predictors for fruit and vegetable consumption²⁶. The lack of skills to prepare fruit and vegetables for consumption is another factor which could constitute an obstacle to purchase and consumption¹⁸.

There often seem to be gender differences in nutritional knowledge, with women being more knowledgeable than men. Men also tend to be less aware of dietary recommendations and the risks linked to unhealthy dietary habits³², whereas women are more likely to associate a healthy diet with eating more fruit and vegetables⁶.

Psychological factors, attitudes, beliefs and perceived barriers

Attitudes and beliefs towards fruit and vegetables have an impact on consumption levels²⁶. There is

evidence that self-efficacy (belief in one's own ability to perform tasks, attain goals etc.) is a strong predictor for fruit and vegetable intake in adults^{23, 26}. Self-esteem also positively impacts vegetable intake²⁰ as does perceived healthiness of fruits and vegetables³².

The vast majority of the citizens in the EU consider what they eat good for their health, 20% even declare that their eating habits are very healthy. A majority of Europeans believe that it is easy to eat a healthy diet and that eating a healthy diet means eating more fruit and vegetables⁶. Considering what we know about Europeans' dietary habits and their fruit and vegetable intake, this may appear surprising. However, it has been suggested that one important barrier to fruit and vegetable consumption is that people actually believe their diet is satisfactory¹⁷.

Lack of time and control over what they eat are the two main reasons Europeans give to explain the difficulty of eating a healthy diet⁶. Time constraints to eat fruit and vegetables represent a complex issue. For example, there are indications that fruit is often considered convenient food whereas vegetables are not. For Europeans, irregular working hours and a busy lifestyle are perceived as barriers to vegetable consumption. Low consumers of fruit and vegetables consider convenience factors, such as time available for preparation of food and shopping, availability of shops and simplicity of preparation and cooking, of higher importance for their intake than high consumers³¹.

Increasing vegetable intakes

In 2006, 1 in 5 Europeans reported having changed their diet over the last year. Of these more than half indicated that they had increased their fruit and vegetable intake. Weight management and health maintenance were the major reasons for diet changes. Increased fruit and vegetable intake was reported by fewer in the Mediterranean region than elsewhere. On the other hand, as many as 70% of the individuals in Denmark and Slovenia who had changed their diet reported having increased their consumption of these foods. People in countries with relatively high fruit and vegetable consumption could be more likely to consider their intake of fruit and vegetables as sufficient⁶.

4. Interventions – what is effective?

The factors influencing fruit and vegetable intake are numerous and linked to each other in complex ways. As a consequence, changing consumption patterns remains a challenge, particularly at population level. Different intervention programmes addressing low fruit and vegetable consumption have adopted different strategies, with variable success.

Children

Dietary habits and preferences largely form during childhood and hence many initiatives for increasing fruit and vegetable consumption target children. The sad truth is that despite a large number of interventions and intense efforts, impact on consumption levels has been rather limited¹⁸. Some elements of success can be identified, though.

Most often the projects aimed at increasing fruit and vegetable consumption in children are school-based. Implementing programmes in schools ensures wide participation and gives the opportunity to combine different types of activities, such as traditional classroom-based learning, school gardening, cooking classes and feeding³³.

For maximum effect, school-based interventions should consist of a number of different activities. The more intense and multi-faceted the intervention, the higher the increase in intakes³⁴. Skill-building activities, like cooking classes, are more effective than passive learning approaches^{18, 33}. Duration is also important, with programmes running at least one year being the most effective³³.

Distributing fruit and vegetables as well as involving parents, teachers and peers also improves the results of school-based interventions. Involving parents is of great importance since parental intakes, encouragement and home availability of fruit and vegetables are factors with strong influence on children's consumption (35). Active encouragement by food-service personnel in school canteens, training and involvement of peer leaders and the use of cartoon characters are as well positive elements in fruit and vegetable intervention programmes for children. Making fruit and vegetable messages a part of existing school subjects may also help^{18, 33}.

Adults

In fruit and vegetable interventions for adults the strategies with the greatest impact on intake have included some kind of face-to-face counselling. The problem is that individual approaches are very resource-demanding and therefore hardly applicable in population-wide interventions. Individually-tailored printed or computer-based information, may serve as a good alternative to face-to-face counselling as the messages can be adopted to individual needs, attitudes etc.

Adults are often targeted at the workplace. To be effective, such interventions must consist of a number of different strategies, which often makes them costly. Collaboration with the company managers as well as with other stakeholders is also necessary to make workplace interventions successful. It appears to be difficult to recruit and retain participants in such projects, which might be the reason why, so far, the success of worksite interventions has been limited. The time demands and efforts required from workers and managers are considered barriers to their success¹⁸. Another important strategy is to establish supportive structures that will sustain efforts in the long run. Involving workers in planning and running of the programme, addressing the existing barriers and integrating the workers' broader social context by targeting also their families, neighbourhoods etc. are other means to achieve better outcome³⁴.

There are also broader, community-based fruit and vegetable programmes. The effectiveness of these has often been difficult to assess¹⁸. However, some elements for the success of community-based interventions have been identified. As for school- and worksite-based programmes a multi-component strategy seems to be the way to go for increasing intakes of fruit and vegetables^{18, 36}. Clear fruit and vegetable messages, involvement of the family and using a theoretical framework as the basis of the intervention have also been demonstrated to be advantageous. Flexibility and participation of the target population in the intervention design also promotes better outcome, and the duration of the programme is important³⁶.

The average effect obtained by interventions aiming at increasing adults' fruit and vegetable consumption is around half a serving more per day¹⁸.

5. Initiatives across Europe

National nutrition policies

Given the contribution of low fruit and vegetable consumption to the burden of disease, action at national level towards increasing fruit and vegetable consumption has become common.

Most Western and Nordic European countries address insufficient intakes in their national nutrition policies and include fruit and vegetable promotion as one of their objectives. Equally, in Southern European countries, despite having intake levels closer to the recommended amounts, fruit and vegetable goals are part of their nutrition policies⁸. One example of strategies implemented at national level to enhance fruit and vegetable intake of the general population is the 5-a-day campaign, which is run in a number of European countries. In Denmark, where fruit and vegetable intake is also rather low, there is a 6-a-day campaign¹¹.

The EU School fruit scheme

Increasing fruit and vegetable consumption is one of the goals identified in the European Commission's White Paper on Nutrition from 2007³⁷, which among other things addresses childhood obesity in Europe. In the concluding remarks of the White Paper, it is stated that a 'School Fruit Scheme would be a step in the right direction'. This has become reality and an EU-wide scheme to provide fruit and vegetables to school children started in the school year 2009/2010²⁸.

The 'School Fruit Scheme' takes into account several of the aspects identified as factors of success in other school-based programmes: it is a long-term programme providing fruit and vegetables for free, encouraging children to make fruit and vegetable consumption part of their lifestyle. It is involving children, teachers and parents. Additionally it will involve partners from public health, education and agriculture sectors and its effectiveness will continuously be monitored to allow improvements of the strategies throughout the programme (28).

The 'School Fruit Scheme' is partly financed by the European Commission, but participating countries have to contribute as well. The funds from the Commission are aimed at encouraging additional activities, within or in addition to existing programmes. Besides provision of fruit and vegetables, awareness-raising and educational activities will take place to teach children the importance of good eating habits²⁸.

National initiatives promoting fruit and vegetable consumption

There are already national initiatives in place aiming at increasing fruit and vegetable consumption in children²⁸. Examples of such programmes are:

- SchoolGruiten – The Netherlands (schoolgruiten.kennisnet.nl/)
- [Frugt kvarter](#) – Denmark
- 5 am Tag – Germany (www.5amtag.de/)
- 3x3 – Hungary (www.3x3.hu/)
- Fruitness – Italy
- 5 al dia – Spain (www.5aldia.com/)
- 5 a day – UK (www.nhs.uk/LiveWell/5ADAY/Pages/5ADAYhome.aspx)
- [Un fruit pour la récré](#) – France
- All day long – Belgium
- Food dudes – Ireland (www.fooddudes.ie/)

6. Fruit and vegetable consumption in Europe – summary

Despite various issues limiting the possibilities to assess fruit and vegetable intake on a European level, there are some consistent findings on consumption patterns in Europe:

- A majority of Europeans do not reach WHO recommendations on vegetables and fruit consumption (≥ 400 g per day).
- Consumption varies, with higher intakes in Southern compared to the Northern regions.

Fruit and vegetable consumption patterns are determined by a wide range of factors:

- Age, gender and socio-economic status – the influence of these seems to be mediated by other factors, e.g. food preferences, knowledge, skills and affordability.
- Personal factors, e.g. self-efficacy, self-esteem, perceived time constraints, personal values and perception of the healthiness of one's own diet.
- Social environment - social support, social cues and meal patterns and atmosphere at meal time etc. influence food preferences and attitudes towards fruit and vegetables, thus determining our food choices and dietary behaviours.

Increasing fruit and vegetable consumption is a priority for international organisations as well as national governments, which has resulted in many initiatives. There are certain elements that have been shown to improve the results of intervention programmes. Among these are:

- Multi-component strategies addressing both personal factors such as knowledge and skills, as well as the physical and social environment by e.g. increasing the availability of fruits and vegetables and addressing attitudes and practices not only in the defined target group, but also in their social networks.
- Support and involvement of decision makers and representatives of the target population in programme planning and running in order to create support and ownership and to develop strategies that are accepted by the target group.
- Programme duration of at least 12 months.

References

1. Mirmiran P, et al. (2009). Fruit and vegetable consumption and risk factors for cardiovascular disease. *Metabolism* 58(4):460-468.
2. Hung HC, et al. (2004). Fruit and vegetable intake and risk of major chronic disease. *Journal of the National Cancer Institute* 96(21):1577-1584.
3. Rissanen TH, et al. (2003). Low intake of fruits, berries and vegetables is associated with excess mortality in men: the Kuopio Ischaemic Heart Disease Risk Factor (KIHD) Study. *Journal of Nutrition* 133(1):199-204.
4. Harding AH, et al. (2008). Plasma vitamin C level, fruit and vegetable consumption, and the risk of new-onset type 2 diabetes mellitus: the European prospective investigation of cancer--Norfolk prospective study. *Archives of Internal Medicine* 168(14):1493-1499.
5. World Cancer Research Fund (WCRF) Panel (2007). *Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective*. World Cancer Research Fund: Washington, DC
6. European Commission (2006). *Health and food. Special Eurobarometer 246 / Wave 64.3 – TNS Opinion & Social*. European Commission: Brussels.
7. Yngve A, et al. (2005). Fruit and vegetable intake in a sample of 11-year-old children in 9 European countries: The Pro Children Cross-sectional Survey. *Annals of Nutrition and Metabolism* 49:236-245.
8. World Health Organization (2006). *Comparative analysis of nutrition policies in the WHO European Region*. WHO: Copenhagen, Denmark.
9. [European Food Safety Authority \(2010\). The EU Menu](#). [accessed March 2010].
10. World Health Organization (2008). *WHO European Action Plan for Food and Nutrition 2007-2012*. WHO: Copenhagen, Denmark.
11. Elmadfa I, et al. (2009). *European Nutrition and Health Report 2009*. *Forum Nutrition* 62:1-405.
12. [The DAFNE databank](#). [accessed March 2010]
13. [European Food Safety Authority \(2008\). Concise Database summary statistics - Total population](#). [accessed March 2010]
14. Pomerleau J, et al. (2003). The burden of disease attributable to nutrition in Europe. *Public Health Nutrition* 6:453-461.
15. World Health Organization (2009). *Global Health Risks Summary Tables*. WHO: Geneva, Switzerland.
16. World Health Organization (2009). *Global Health Risks*. WHO: Geneva, Switzerland.
17. Dibsall LA, et al. (2003). Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. *Public Health Nutrition* 6:159-168.
18. World Health Organization (2005). *Effectiveness of interventions and programmes promoting fruit and vegetable intake*. WHO: Geneva, Switzerland.
19. Kamphuis CB, et al. (2007). Perceived environmental determinants of physical activity and fruit and vegetable consumption among high and low socioeconomic groups in the Netherlands. *Health Place* 13:493-503.
20. Elfhag K, et al. (2008). Consumption of fruit, vegetables, sweets and soft drinks are associated with psychological dimensions of eating behaviour in parents and their 12-year-old children. *Public Health Nutrition* 11:914-923.

21. Bere E, et al. (2008). Why do boys eat less fruit and vegetables than girls? *Public Health Nutrition* 11:321-325.
22. Friel S, et al. (2005). Who eats four or more servings of fruit and vegetables per day? Multivariate classification tree analysis of data from the 1998 Survey of Lifestyle, Attitudes and Nutrition in the Republic of Ireland. *Public Health Nutrition* 8:159-169.
23. Rasmussen M, et al. (2006). Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: Quantitative studies. *International Journal of Behavioural Nutrition and Physical Activity* 3:22.
24. Cooke LJ, et al. (2004). Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Public Health Nutrition* 7:295-302.
25. Bere E, Klepp KI. (2004). Correlates of fruit and vegetable intake among Norwegian schoolchildren: parental and self-reports. *Public Health Nutrition* 7:991-998.
26. Shaikh AR, et al. (2008). Psychosocial Predictors of Fruit and Vegetable Consumption in Adults: A Review of the Literature. *American Journal of Preventive Medicine* 34:535-543.e11.
27. Pearson N, et al. (2009). Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. *Public Health Nutrition* 12:267-283.
28. [European Commission. DG Agriculture and Rural Development. School Fruit Scheme.](#) [accessed July 2011]
29. Benton D. (2004). Role of parents in the determination of the food preferences of children and the development of obesity. *International Journal of Obesity Related Metabolic Disorders* 28:858-869.
30. Havermans RC, et al. (2010). Increasing Children's Liking and Intake of Vegetables through Experiential Learning. In: *Bioactive Foods in Promoting Health*. pp. 273-283. [RR Watson and VR Preedy, editors]. San Diego: Academic Press.
31. Pollard J, et al. (2002). Motivations for fruit and vegetable consumption in the UK Women's Cohort Study. *Public Health Nutrition* 5:479-586.
32. Baker AH, Wardle J. (2003). Sex differences in fruit and vegetable intake in older adults. *Appetite* 40:269-275.
33. Knai C, et al. (2006). Getting children to eat more fruit and vegetables: A systematic review. *Preventive Medicine* 42:85-95.
34. Sorensen G, et al. (2004). Worksite-based research and initiatives to increase fruit and vegetable consumption. *Preventive Medicine* 39 Suppl 2:S94-100.
35. Kristjansdottir AG, et al. (2009). Children's and parents' perceptions of the determinants of children's fruit and vegetable intake in a low-intake population. *Public Health Nutrition* 12:1224-1233.
36. Ciliska D, et al. (2000). Effectiveness of Community-Based Interventions to Increase Fruit and Vegetable Consumption. *Journal of Nutrition Education* 32:341-352.
37. European Commission (2007). White Paper on A Strategy for Europe on Nutrition; Overweight and Obesity related health issues. COM(2007) 279 final , 30 May 2007. European Commission: Brussels.