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myAirCoach - Analysis, modelling and sensing of both physiological and environmental factors for the customized and predictive self-management of Asthma"

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Executive Summary

The myAirCoach project aims to create a holistic mHealth tool for people with asthma. A healthy diet is crucialfor health and well-being and therefore dietary monitoring and interventions should be considered for inclusion in the myAirCoach system. This deliverable comprises:

- A review of the literature regarding relevant links between diet and general health, as well as asthma

- Identification of any specific dietary recommendations that exist for people with asthma

- Assessment of available data collection tools

- Production of a dietary data collection and analysis protocol for the myAirCoach quantification campaign (D2.3)

- Recommendations on how such information should be incorporated into the myAirCoach system

This report is a living document and provides an overview of the current literature regarding nutritional guidelines. We highlight several national and international guidelines, which should be considered during the design of the myAirCoach system. We also provide examples of good practice regarding the effective communication ofnutritional guidelines. The literature regarding dietary advice for individuals with asthma does not support the need for specific asthma dietary guidelines. However, evidence for certain dietary practices exist, such as:general increase in fruit and vegetable consumption, allergy avoidance and healthy weight management. Finally, the review of dietary data collection techniqueshighlighted the use of

the Global Allergy and Asthma European Network (GA^{2}LEN) food frequency questionnaire as the most suitable for use in the myAirCoach quantification campaign.

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List of abbreviations and acronyms

GA^{2}LEN	Global Allergy and Asthma European Network
GINA	Global Initiative for Asthma
SACN	Scientific Advisory Committee on Nutrition
WHO	World Health Organisation

1   Introduction

A healthy diet is integral for health and well-being. The World Health Organisation (WHO) recognise that an unhealthy diet may both cause and modulate a range of non-communicable diseases and highlights poor dietary practices as a leading global risk to health (World Health Organisation 2015). Furthermore, the WHO global action plan for the prevention and control of non-communicable diseases includes implementing policies on promoting a healthy diet (World Health Organisation 2013). The exact structure of what constitutes a healthy diet varies depending on individual needs, e.g., age, height, gender, activity level and, in some instances, will varydepending on underlying disease states. Although individual differences exist, there are key principles of what constitutes a healthy diet, and various guidelines have been produced to help people improve their nutritional health.

Traditional nutritional guidelines wererepresented in long written reports. However, as technology has developed, these guidelines are now available via mHealth devices and many applications have been developed to monitor and provide feedback regarding food intake. For instance, a quick search for 'diet' on the Apple app store returned 5969 hits (search date 30/06/2016). The myAirCoach project aims to develop a holistic mHealth system empowering people to managetheir own health. As a holistic mHealth tool, the myAirCoach system will benefit from dietary advice and/or analysis. The end-users of the myAirCoach system are people with asthma and, therefore, it is important to determine any specific dietary recommendations for people with asthma.

The Global Initiative for Asthma (GINA) Guidelines encouragepeoplewith asthma to consume a diet high in fruit and vegetables for general health benefits (Global Initiative for Asthma 2014), but provide no further specific recommendations. Asthma is characterised by chronic airway inflammation, and pro-inflammatory diets may have adverse effects for people with asthma(Garcia-Larsen, Del Giacco, Moreira, Bonini, Haahtela, et al. 2016). Conversely, diets and dietary supplementation targeting airway inflammatory pathways may have the potential to modulate disease progression(Garcia-Larsen, Del Giacco, Moreira, Bonini, Haahtela, et al. 2016).

The aim of this report was to examine the literature regarding nutritional guidelines and determine whether specific guidance should be given to people with asthma. We also aimed to develop a protocol for the collection and analysis of nutritional information in the myAirCoach Quantification Campaign. At each stage we provide suggestions on whatand how nutritional guidelines should be incorporated in the myAirCoach system.

2 Review of the literature

2.1 Nutritional guidelines

Proper nutrition forms the foundation for health and well-being. Essential nutrients are those that cannot be synthesised from within the body and therefore must be provided by the diet, and are crucial for a range of physiological functions. They provide energy for work, support the repair of damaged cells, allow the synthesis of new cells and allow for cognitive processes to occur. A healthy balanced diet, rich in essential and non-essential nutrients is integral for optimal health and diets lacking in these essential nutrients may both cause and modulate disease(World Health Organisation 2015).

Various national and internationalnutritional guidelines provide general guidance on what constitutes a healthy diet. For example the WHO guidelines (World Health Organisation 2015)on nutrition suggest that a healthy diet contains:

- Fruits, vegetables, legumes (e.g. lentils, beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat, brown rice).
- At least 400 g (5 portions) of fruits and vegetables a day.
- Less than 10% of total energy intake from free sugars.
- Less than 30% of total energy intake from fats. Unsaturated fats are preferable to saturated fats. Industrial trans fats are not part of a healthy diet.
- Less than 5 g of salt per day and use iodized salt.
- Energy intake (calories) inline with energy expenditure

Various other guidelines have been developed by governmental agencies across the world(Table 1). The UK's national food guide, the'Eatwell Guide', is a policy tool designed by the UK government to provide advice and guidance on maintaining optimal nutrition health (Public Health England 2016). These guidelines are regularly updated based on the recommendations made by the Scientific Advisory Committee on Nutrition (SACN). In order to maintain a consistent message, Public Health England encourage all organisations and individuals to adopt the use of the Eatwell guide(Public Health England 2016).

Table 2: Dietary guidelines from across the World

Country	Guideline name	Source
Australia	Dietary Guidelines for Australian Adults	http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n33.pdf
Canada	Canada's Food Guide to Healthy Eating	http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php
Greece	Dietary Guidelines for Adults in Greece	http://www.mednet.gr/archives/1999-5/pdf/516.pdf
The Netherlands	Dutch dietary guidelines	http://www.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Consumenten/Schijf%20van%20Vijf%202016/VC_Richtlijnen_Schijf_van_Vijf_2016.pdf
The United Kingdom	The Eatwell Guide	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/528200/Eatwell_guide_booklet.pdf
Singapore	Healthy Diet Pyramid	http://www.healthhub.sg/live-healthy/10/build_healthy_food_foundation

As nutritional information can be complex and is often seen as confusing and overwhelming by the general public, clear and effective communication of nutritional guidelines is essential. Food-based visual representations of national guidelines have been developed to overcome such problems (Painter et al. 2002). The Eatwell Guide (Figure 1) and the development of simple nutritional labelling of food products (Figure 2) are examples of good practice for the effective communication of nutritional information.
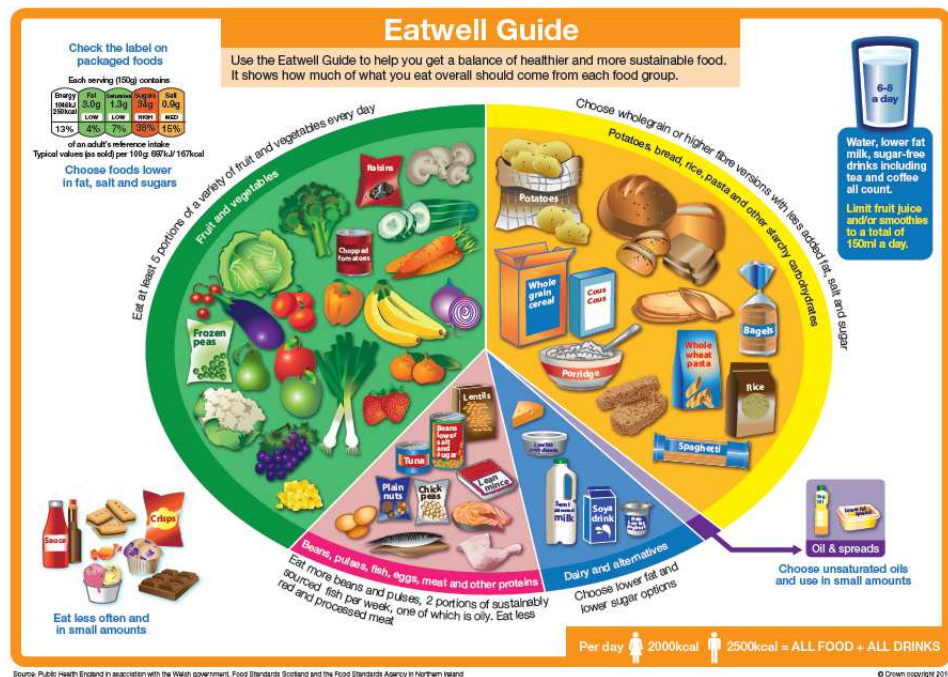
Figure 1. The Eatwell Guide(Public Health England 2016).
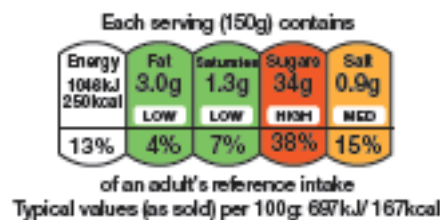
Figure 2. Example of simple representation of nutrition information(Public Health England 2016)

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These guidelines cover the main principles of a healthy diet and effectively communicate this information to the end-user,however they may not be applicable to everyone. For instance, food intolerances, allergies, medical conditions and taste preferences make specific guidance difficult. As the myAirCoach project aims to provide individuals with asthma a holistic mHealth tool, it is important to recognise any specific dietary recommendations for individuals with asthma.

Recommendations for the myAirCoach project

- National and/or international guidelines on what constitutes a healthy diet should be incorporated into the myAirCoach system.

- Guidance should be effectively communicated and the use of visual representations is highly recommended.

2.2   Specific guidance for people with asthma

Asthma is characterised by chronic airway inflammation, and is often associated with specific allergies. For this reason, the avoidance of dietary allergy triggers and pro-inflammatory foods may be beneficial for the management of asthma. Similarly, diets and dietary supplementation targeting airway inflammatory pathways may have the potential to improve asthma management. Finally, obesity may adversely affect asthma control and therefore weight-loss has the potential to improve asthma management. This section aims to discuss the literature and the latest guidance on dietary recommendations for people with asthma.

2.2.1 Specific food avoidance/restriction

There is a high prevalence of atopyin people both with and without asthma (Simpson et al. 2001) and many allergies relate to certain foods. Peoplewith both asthma and food allergies may be at greater risk of severe asthma attacks if they consume or contact the food that they're allergic to. People with food allergies are therefore advised to strictly avoidsuch food (Asthma.org.uk/advice/triggers/food accessed 01/07/2016).

Diets high in salt intake have been proposed to adversely affect asthma. A Cochrane review in 2004 pooled the results from fourrandomised controlled trials (RCTs). Whilst the data were suggestive that diets with low salt intake were associated with small improvement in lung function and rescue medication usage, the variation aroundthese effects was large and the authors concluded the currently available limited evidence suggests that reducing the amount of dietary salt probably has little or no effect on asthma (Ardern 2004).

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- People with existing food allergies should be strongly advised to avoid such foods.

- Normal dietary salt guidelines are appropriate for individuals with asthma.

2.2.2 Anti-inflammatory foods

A summary of systematic reviews that examine dietary factors and asthma are presented in table 2. An overview of these systematic reviews was recently publishedby Garcia-Larsen and colleagues (2016), in the prestigious Journal of Allergy. A search on PubMed failed to identify more recent systematic reviews for consideration here. Theresults from this review suggest that diets high in vitamin D, fruit and adherence to a Mediterranean diet are associated with reduced childhood wheeze. Similarly, vitamin D and E intake was negatively associated with asthma prevalence at the age of 10. The results from these studies support that the intake of antioxidants may be beneficial for individuals with asthma (Garcia-Larsen, Del Giacco, Moreira, Bonini, Charles, et al. 2016). However, investigations into nutritional supplementation with such antioxidants has yet to provide evidence to justify the inclusion of anti-oxidant supplementation (Garcia-Larsen, Del Giacco, Moreira, Bonini, Charles, et al. 2016). The principal conclusion from this review was that people with asthma may benefit from a net increase of fruit and vegetable consumption(Garcia-Larsen, Del Giacco, Moreira, Bonini, Charles, et al. 2016). This is inline with general guidance from GINA, which suggestspeople with asthma should consume a diet high in fruit and vegetables for general health benefits (Global Initiative for Asthma 2014).

Table 2. Systematic reviews on dietary factors and asthma

Author	No. Studies / No. Participants	Population	Intervention
Allen et al. 2009	40 studies / No. of participants not stated	Children or Adults	Vitamin A, C and E
Ram & Ardern 2004	6 studies / No. of participants ranged between 17-36 in each trial	Children or Adults	Normal, high or low sat intake
Garcia-Marcos et al. 2013	8 studies / 39804 participants in total	Children	Mediterranean diet score
Nurmatov et al. 2011	62 studies / No. of participants not stated	Children (incl. exposure during pregnancy)	Vitamins and minerals and food groups
Pogson & McKeever 2011	9 studies [5 in asthma and 4 in exercise induced asthma (EIA)] / Asthma 318 participants / EIA 63 participants	Children and adults	Increased or decreased sodium intake
Yang et al. 2013	15 studies / No. of participants not stated	Children or adults	Dietary intake of fish or fish oil
Thien et al. 2002	9 studies / No. of participants not stated	Children or adults	Dietary fish oil supplementation

One of the most promising nutrient groupswith regards to asthma management aren-3 fatty

acids. The proposed anti-inflammatoryeffects ofn-3 fatty acids is linked to altered

inflammatory membrane composition, which may modify lipid mediator generation (Kumar et

al. 2016). A recent review of n-3 fatty acids documented some positive findings with regards

to n-3 fatty acid supplementation, including; i) improved lung function, ii) reduced airway

inflammation and iii) reduced airway hyper-responsiveness (Kumar et al. 2016). However, a

similar number of investigations have concluded no such effects and the efficacy of dietary

supplementation with n-3 fatty acids remains in inconclusive (Kumar et al. 2016). Currently, the use of n-3 fatty acid supplementation is not mentioned in the any asthma management guidelines, however it is a promising nutrient that warrants further investigation.

Recommendations for the myAirCoach project

- The promotion of diets high in fruit and vegetables are recommended for people with asthma and should be included in the myAirCoach system

- Dietary n-3 consumption should be examined thoroughly during the analysis of the dietary data in the quantification campaign.

2.2.3 Obesity and asthma

High calorie diets, particularly when coupled with low levels of physical activity, may lead to weight gain. One in Four British adults are obese and the obesity levels in Britain have trebled in the last 30 years(Food and Agriculture Organization of theFood and Agriculture Organization of the United Nations 2014). Although Britain has the highest prevalence of obesity in Europe, table 2 highlightsthat an alarming number of people all across Europe are overweight or obese. Being overweight and obese is well known to cause many health issues and maintaining healthy weight is an obvious dietary recommendation.

Table 3. Europe's obesity league

Country	Obesity prevalence
UK	24.9%
Ireland	24.5%
Spain	24.1%
Portugal	21.6%
Germany	21.3%
Belgium	19.1%
Austria	18.3%
Italy	17.2%
Sweden	16.6%
France	15.6%

Evidence now exist that suggests that being overweight or obese is a risk factor for developing asthma(Rönmark et al. 2005). Importantly, individuals with obesityrelated asthma are less responsive to traditional asthma therapies compared with people of healthy weight(Peters-Golden et al. 2006; Boulet & Franssen 2007). A recent randomised trial demonstrated that dietary restriction and exercise were able to improve airway inflammation in overweight and obese people with asthma (Scott et al. 2014), thus providing support for the inclusion of weight management guidance as an important recommendation for people who suffer with asthma.

Recommendations for the myAirCoach project

- Advice and guidance with regards to achieving and/or maintaining a healthy weight should be incorporated in the myAirCoach system.

- Assessments into medication efficacy should consider weight as a confounding variable in any data analysis arising from the myAirCoach system.

3 Protocol for dietary data collection

Many different tools for dietary analysis are available and presented in table 3. Each tool has advantages and disadvantages that needed careful consideration when selecting the most appropriate data collection tool for the quantification campaign. Furthermore, results from our focus group discussions with people with asthma, as part T1.2 (User requirements, clinical procedures and myAirCoach use cases), with respect to patient's willingness to input regular dietary information were considered.

3.1 Data collection

The use of a food frequency questionnaire was considered the most appropriate tool for the Quantification Campaign as it;i) can be self-completed, ii) has low participant burden, iii) is suitable for large scale surveys, and iv) may allow for automated analysis. Furthermore, our focus group data highlighted that people were not willing or keen to input dietary data regularly. Therefore, a one-off, detailed analysis of general dietary practices was considered the most suitable for our purpose.

Table 4. Dietary data collection techniques

Data collection technique	Description	Advantages	Disadvantages
Weighed food records	Food intake catalogued and weighed by participant	+Precision portion sizes	- Expensive - High respondent burden - Mis-reporting
Estimated food records	Similar to above, however portion size is estimated	+Lower respondent burden than weighed food records	- Estimation of portion size - Expensive - Mis-reporting
24 Hour recall	Trained interviewer asks respondent to remember all food and drink, inclusive of portion size, consumed in the previous 24 h	+ Low respondent burden + Can be administered by phone	- Estimation of portion sizes - Single or limited observation - Possible reporting bias - Memory dependent
Multiple pass recall	Trained interviewer asks respondent to remember all food and drink, inclusive of portion size, consumed in the previous 24 h. The multiple pass recall refers to steps involved in the interview i.e., 1st pass, a quick list of meals/snacks; 2nd pass, information about the meal/snack; 3rd pass prompts for forgotten foods; final pass, review of the details.	+ Improved precision over 24 h recall + Low respondent burden + Can be administered by phone	- Estimation of portion sizes - Single or limited observation - Possible reporting bias - Memory dependent
Food frequency questionnaire	A list of foods and a selection of options relating to the frequency of consumption of each of the foods listed (e.g. times per day, daily, weekly, monthly).	+ Low respondent burden + Suitable for large scale surveys + Can be self-completed + Can be posted or completed online + Can be automatically analysed	- Estimation of portion sizes - Reflective of general diet - Possible reporting bias
Household food surveys	Household food intake calculated, often by using supermarket bills	+ Suitable for large scale studies + Low respondent burden + Used for trends at a population level	- Data not collected at an individual level

A searchof the literature regarding commonly used food frequency questionnaireswas conducted to select the most appropriate for the myAirCoach quantification campaign. The myAirCoach project aims to create a mHealth device that can be used internationally. However, for dietary analysis, international comparable data is hindered by heterogeneity of dietary surveys (Garcia-Larsen et al. 2011). To overcome this issue the Global Allergy and Asthma European Network (GA^{2}LEN) designed the GA^{2}LEN food frequency questionnaire (Appendix 1).

The GA^{2}LEN food frequency questionnaire is a representative dietary questionnaire for most countries across Europe (Garcia-Larsen et al. 2011).It includes a list of 200 foods and provides seven options to report frequency of food intake (i.e., ≥2 per day; once per day; 5–6 per week; 2–4 per week; once per week; 1–3 times per month; and rarely or never). Food portion sizes are assumed to be standard, as detailed in the Food Standard Agency Food Portion Sizes Guidelines (Food Standard Agency, 2006). Foodsare categorised into food groups classified using the European Food Groups (EFG) classification system (Brussaard et al. 2002).

A pilot study of the GA^{2}LEN food frequency questionnaire was conducted across seven European countries, to determine its accuracy and reproducibility. The study concluded that the GA^{2}LEN food frequency questionnaire is an appropriate tool to estimate dietary intake for a range of nutrients across Europe, regardless of cultural and linguistic differences(Garcia-Larsen et al. 2011). Furthermore, this study had a particular focus on allergy and asthma and measured plasma phospholipid free acids, and revealed a good correlation between total phospholipid n-3 fatty acids and questionnaire estimated dietary fatty acids. As discussed

above, fatty acidsmay have a beneficial effect for people with asthma. For these reasons the use of GA²LEN food frequency questionnaire was considered the most appropriate for the myAirCoach Study.

Recommendations for the myAirCoach project

- A food frequency questionnaire is the most appropriate tool for the myAirCoach quantification campaign.
- The GA²LEN food frequency questionnaire allows for international comparisons of dietary practices and should be used in the quantification campaign.

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3.2 Data analysis

As discussed above, the GA[2]LEN food frequency questionnaire includes a list of 200 foods along with seven options to report frequency of food intake. These are entered into a bespoke computer program for analysis. The food portion sizes in the analysis are assumed to be standard and the nutritional composition of each food is calculated using the sixth edition of the McCance and Widdowson's Composition of Foods (McCance and Widdowson, 2006).

Currently, the bespoke program for the analysis of the GA[2]LEN food frequency analysis is only available at the institution of the authors of the questionnaire. However, personal correspondence with the author confirmed their intention make the analysis program available online. In the meantime, the authors have kindly agreed to help with any data analysis required for the quantification campaign.

The GA[2]LEN food frequency provides analysis of; total energy intake, macro-nutrient content (i.e., protein,fat and carbohydrate) and micronutrient content [i.e., n-6 polyunsaturated fatty acids (PUFAs), n-3 PUFAs,saturated fatty acids (SFAs), monounsaturated fatty acids(MUFAs),PUFAs, cholesterol,total sugars, sodium, potassium, calcium, magnesium, phosphorus, iron,copper,zinc,selenium, vitamin D, vitamin E, riboflavin, thiamine, vitamin C and Retinol].An example of dietary analysis output from the GA[2]LEN food frequency questionnaire has been published by Garcia-Larsen et al. 2011.

Dietary analysis will be conducted as part of work package T2.2 'Clinical monitoring of patients with asthma', as we anticipate the information will be more insightful when analysed in combination with other physiological, environmental and behavioural parameters. In short, macro and micro-nutrient content (as described above) will be analysed, along with other physiological, environmental and behavioural parameters by UPAT and Certh using various techniques, such as;principal component analysis, multiple regression analysis, cluster analysis, spectral analysis and factor analysis, in order to reveal which parameters allow for the predictions of periods of uncontrolled asthma and asthma exacerbations. Furthermore,a spatial – temporal model will be generated using artificial intelligence methods and data related to user activityand physiological classification.

4 Conclusion

This report provides a review of the literature with regards to the latest national and international nutritional guidelines and provides general advice regarding the presentation of nutritional information. Moreover, we discuss dietary recommendations specific for people with asthma. The collection and analysis of nutritional data is examined for the purpose of developing a protocol for collecting dietary information for the myAirCoach Quantification Campaign.

The reports achieves its aims and provides evidence based recommendations for consideration in the myAirCoach project, as follows:

- National and/or international guidelines on what constitutes a healthy diet should be incorporated into the myAirCoach system.
- Guidance should be effectively communicated and the use of visual representations is highly recommended.
- The promotion of diets high in fruit and vegetables are recommended for people with asthma and should be included in the myAirCoach system
- Dietary n-3 fatty acid consumption should be examined thoroughly during the analysis of the dietary data in the quantification campaign.
- Advice and guidance with regards to achieving and/or maintaining a healthy weight should be incorporated in the myAirCoach system.
- Assessments into medication efficacy should consider weight as a confounding variable in any data analysis arising from the myAirCoach system.
- A food frequency questionnaire is the most appropriate tool for the myAirCoach quantification campaign.
- The GA[2]LEN food frequency questionnaire allows for international comparisons of dietary practices and should be used in the quantification campaign.

Appendix 1 GA^{2}LEN food frequency questionnaire

Dear Participant:

We would like to ask you to complete and return this food frequency questionnaire (FFQ). Please tick (√) in the box to indicate how often, on average, you have eaten the specified amount of each food during the last 12 months. Do not tick more than one box per food.

- Because this FFQ is being used in several countries, YOU WILL BE UNFAMILIAR WITH some of the foods listed in this questionnaire. If you do not eat some of these, please tick the option "Rarely/never".
- If you make a mistake and put a tick in the wrong box just cross through the tick as shown below, and put a tick in the correct box.

EXAMPLE

Vegetables excluding potatoes (medium serving)	Rarely/ Never	1-3 times a month	Once a week	2-4 per week	5-6 per week	Once a day	2-3 day	4+ day
Lettuce			√	✗				

- PLEASE TICK **ONE BOXONLY** PER LINE AND DO NOT LEAVE FOODS WITHOUT ANSWER.

- For seasonal fruits such as strawberries or grapes, if you eat them about once a week when in season, you should put a tick in the column "once a week".

Tick one box for every food to show how often you ate it. Please answer every question, if you are uncertain about how to answer a question then do best you can, but please do not leave a question blank.

1. Bread and rolls

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q1p1 Any type of bread	1	2	3	4	5	6	7	8
q1p2 Wholemeal or brown bread (with or without seeds)	1	2	3	4	5	6	7	8
q1p3 White bread (e.g. baguette, rolls, sliced)	1	2	3	4	5	6	7	8
q1p4 Rye bread (any)	1	2	3	4	5	6	7	8
q1p5 Nan bread	1	2	3	4	5	6	7	8
q1p6 Chapatti	1	2	3	4	5	6	7	8
q1p7 Yeast based bread	1	2	3	4	5	6	7	8

2. Breakfast cereals

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q2p1 Any breakfast cereals (e.g. oatmeal, wheat germ, cornflakes, Quaker, kasha)	1	2	3	4	5	6	7	8
q2p2 Wheat germ	1	2	3	4	5	6	7	8
q2p3 Quaker (or other oat cereal)	1	2	3	4	5	6	7	8
q2p4 Corn-flakes	1	2	3	4	5	6	7	8
q2p5 All-bran cereals	1	2	3	4	5	6	7	8

3. Semolina

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q3p1 Couscous	1	2	3	4	5	6	7	8

4. Pasta (and wheat derived foods)

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q4p1 Any pasta (on average)	1	2	3	4	5	6	7	8
q4p2 Plain (refined) pasta (e.g. spaghetti)	1	2	3	4	5	6	7	8
q4p3 Plain wholemeal (unrefined) pasta	1	2	3	4	5	6	7	8
q4p4 Filled pasta (with meat/cheese/vegetables)	1	2	3	4	5	6	7	8
q4p5 Noodles (excluding rice noodles)	1	2	3	4	5	6	7	8

5. Bakery products/desserts

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q5p1 Any cakes or pastries (on average)	1	2	3	4	5	6	7	8
q5p2 Cakes (e.g. sponge, chocolate)	1	2	3	4	5	6	7	8
q5p3 Pastries (e.g. croissants)	1	2	3	4	5	6	7	8
q5p4 Rolls (with/without stuffing)	1	2	3	4	5	6	7	8
q5p5 Muffins	1	2	3	4	5	6	7	8
q5p6 Doughnuts, buns (plain or filled)	1	2	3	4	5	6	7	8
q5p7 Rice pudding	1	2	3	4	5	6	7	8
q5p8 Cheese cake	1	2	3	4	5	6	7	8

	1	2	3	4	5	6	7	8
q5p9 Pancakes	1	2	3	4	5	6	7	8
q5p10 Plain biscuits (with no fillings or cream)	1	2	3	4	5	6	7	8

6. Rice

	1	2	3	4	5	6	7	8
q6p1 Rice (any)	1	2	3	4	5	6	7	8
q6p2 White rice	1	2	3	4	5	6	7	8
q6p3 Brown/wholemeal (unrefined) rice	1	2	3	4	5	6	7	8
q6p4 Rice noodles	1	2	3	4	5	6	7	8

7. Sugar & jam

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q7p1 Table sugar (white)	1	2	3	4	5	6	7	8
q7p2 Jam	1	2	3	4	5	6	7	8
q7p3 Marmalade	1	2	3	4	5	6	7	8
q7p4 Honey	1	2	3	4	5	6	7	8

8. Sugar products excluding chocolate

	1	2	3	4	5	6	7	8
q8p1 Any sweets or bonbons	1	2	3	4	5	6	7	8
q8p2 Boiled sweets, toffees, caramels	1	2	3	4	5	6	7	8
q8p3 Mixed candies	1	2	3	4	5	6	7	8
q8p4 Cereal bars, flapjacks/fruit bar	1	2	3	4	5	6	7	8
q8p5 Water ice (lolly ice)	1	2	3	4	5	6	7	8

9. Chocolate

	1	2	3	4	5	6	7	8
q9p1 Chocolates (any)	1	2	3	4	5	6	7	8
q9p2 Chocolate snack bars (e.g. Mars bar)	1	2	3	4	5	6	7	8
q9p3 Dark chocolate	1	2	3	4	5	6	7	8
q9p4 Milk chocolate	1	2	3	4	5	6	7	8

10. Vegetable oils

	1	2	3	4	5	6	7	8
q10p1 Vegetable oil (blended, any)	1	2	3	4	5	6	7	8
q10p2 Sunflower oil	1	2	3	4	5	6	7	8
q10p3 Olive oil	1	2	3	4	5	6	7	8
q10p4 Extra virgin olive oil	1	2	3	4	5	6	7	8
q10p5 Palm oil	1	2	3	4	5	6	7	8

11. Margarine and lipids of mixed origin

	1	2	3	4	5	6	7	8
q11p1Any margarine or spread (excluding soya spread)	1	2	3	4	5	6	7	8

q11p2 Low-fat margarine	1	2	3	4	5	6	7	8
q11p3 Normal margarine	1	2	3	4	5	6	7	8
q11p4 Blended spreads	1	2	3	4	5	6	7	8
q11p5 Soya-based margarine or spreads	1	2	3	4	5	6	7	8
q11p6 Any margarines or vegetable spreads fortified with omega-3	1	2	3	4	5	6	7	8

12. Butter and animal fats

q12p1 Any butter	1	2	3	4	5	6	7	8
q12p2 Low/reduced fat butter	1	2	3	4	5	6	7	8
q12p3 Normal butter	1	2	3	4	5	6	7	8
q12p4 Lard	1	2	3	4	5	6	7	8

13. Nuts

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q13p1 Any nuts	1	2	3	4	5	6	7	8
q13p2 Peanuts	1	2	3	4	5	6	7	8
q13p3 Cashew nuts	1	2	3	4	5	6	7	8
q13p4 Almonds	1	2	3	4	5	6	7	8
q13p5 Walnuts	1	2	3	4	5	6	7	8

14. Legumes

q14p1 Any legumes	1	2	3	4	5	6	7	8
q14p2 Kidney (red), black beans	1	2	3	4	5	6	7	8
q14p3 Lentils	1	2	3	4	5	6	7	8
q14p4 Chickpeas (also hummus)	1	2	3	4	5	6	7	8
q14p5 Cluster beans (guar)	1	2	3	4	5	6	7	8
q14p6 French beans (string beans)	1	2	3	4	5	6	7	8
q14p7 Fava beans	1	2	3	4	5	6	7	8
q14p8 Soya beans	1	2	3	4	5	6	7	8

15. Vegetables excluding potatoes

q15p1 Any vegetables (excluding potatoes)	1	2	3	4	5	6	7	8
q15p2 Lettuce	1	2	3	4	5	6	7	8

q15p3 Spinach (including lamb's quarters)	1	2	3	4	5	6	7	8
q15p4 Chard	1	2	3	4	5	6	7	8
q15p5 Fenugreek	1	2	3	4	5	6	7	8
q15p6 Wild greens (e.g. purslane, watercress)	1	2	3	4	5	6	7	8
q15p7 Okra	1	2	3	4	5	6	7	8
q15p8 Tomato	1	2	3	4	5	6	7	8
q15p9 Aubergine	1	2	3	4	5	6	7	8
q15p10 Courgette	1	2	3	4	5	6	7	8
q15p11 Sweet peppers (e.g. red, green, yellow)	1	2	3	4	5	6	7	8
q15p12 Cucumber	1	2	3	4	5	6	7	8
q15p13 Bitter melon (Karela)	1	2	3	4	5	6	7	8
q15p14 Carrots	1	2	3	4	5	6	7	8
q15p15 Parsnip	1	2	3	4	5	6	7	8
q15p16 Turnip or Swede	1	2	3	4	5	6	7	8
q15p17 Artichokes	1	2	3	4	5	6	7	8
q15p18 Radish	1	2	3	4	5	6	7	8
q15p19 Beetroot	1	2	3	4	5	6	7	8
q15p20 Celery	1	2	3	4	5	6	7	8
q15p21 Coleslaw	1	2	3	4	5	6	7	8
q15p22 Sweet Corn	1	2	3	4	5	6	7	8
q15p23 Asparagus	1	2	3	4	5	6	7	8
	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q15p24 Herbs (e.g. mint, fennel, chive, basil, dill, coriander, parsley)	1	2	3	4	5	6	7	8
q15p25 Leek	1	2	3	4	5	6	7	8
q15p26 White/other mushrooms	1	2	3	4	5	6	7	8
q15p27 Onion	1	2	3	4	5	6	7	8
q15p28 Garlic	1	2	3	4	5	6	7	8
q15p29 Cauliflower	1	2	3	4	5	6	7	8
q15p30 Pumpkin	1	2	3	4	5	6	7	8
q15p31 Brussels sprouts	1	2	3	4	5	6	7	8
q15p32 Peas (green)	1	2	3	4	5	6	7	8
q15p33 Broccoli	1	2	3	4	5	6	7	8
q15p34 Cabbage (e.g. white, green red, Savoy)	1	2	3	4	5	6	7	8
q15p35 Stuffed vegetables (e.g. vine/green leaves with rice or meat)	1	2	3	4	5	6	7	8

q15p36 Pickled vegetables (e.g. cucumber, radish, cabbage)	1	2	3	4	5	6	7	8
q15p37 Ginger (e.g. in savoury and sweet dishes, in infusion)	1	2	3	4	5	6	7	8

16. Starchy roots or potatoes

q16p1 Potatoes (on average, in all forms)	1	2	3	4	5	6	7	8
q16p2 Mashed potatoes	1	2	3	4	5	6	7	8
q16p3 Baked/roasted/casserole	1	2	3	4	5	6	7	8
q16p4 Chips/French fries	1	2	3	4	5	6	7	8
q16p5 In salads	1	2	3	4	5	6	7	8
q16p6 Potato dumpling, bread dumpling, gnocchi	1	2	3	4	5	6	7	8
q16p7 Potato tortilla (omelette)	1	2	3	4	5	6	7	8
q16p8 Sweet potato	1	2	3	4	5	6	7	8

17. Fruits

q17p1 Fresh fruits (any)	1	2	3	4	5	6	7	8
q17p2 Apple	1	2	3	4	5	6	7	8
q17p3 Pear	1	2	3	4	5	6	7	8
q17p4 Avocado	1	2	3	4	5	6	7	8
q17p5 Mango	1	2	3	4	5	6	7	8
q17p6 Apricot	1	2	3	4	5	6	7	8
q17p7 Nectarine	1	2	3	4	5	6	7	8
q17p8 Peach	1	2	3	4	5	6	7	8
q17p9 Plum	1	2	3	4	5	6	7	8
q17p10 Cherries	1	2	3	4	5	6	7	8
q17p11 Rhubarb	1	2	3	4	5	6	7	8
q17p12 Berries (e.g. blueberry, strawberry, blackcurrants, blackberry raspberry)	1	2	3	4	5	6	7	8

Fruit (continued)

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q17p13 Banana	1	2	3	4	5	6	7	8
q17p14 Melon/ Watermelon	1	2	3	4	5	6	7	8
q17p15 Grape	1	2	3	4	5	6	7	8
q17p16 Squeezed fresh fruit	1	2	3	4	5	6	7	8
q17p17 Pineapple	1	2	3	4	5	6	7	8
q17p18 Kiwi	1	2	3	4	5	6	7	8

q17p19 Lemon	1	2	3	4	5	6	7	8
q17p20 Orange	1	2	3	4	5	6	7	8
q17p21 Mandarin/Tangerine	1	2	3	4	5	6	7	8
q17p22 Grapefruit	1	2	3	4	5	6	7	8
q17p23 Tinned fruits	1	2	3	4	5	6	7	8
q17p24 Raisin, sultana	1	2	3	4	5	6	7	8
q17p25 Fig	1	2	3	4	5	6	7	8
q17p26 Prune	1	2	3	4	5	6	7	8
q17p27 Olives (e.g. black, green)	1	2	3	4	5	6	7	8
q17p28 Dates	1	2	3	4	5	6	7	8

18. Fruit juices (1 glass 200 ml)

q18p1 Concentrated juice, with sugar	1	2	3	4	5	6	7	8
q18p2 Concentrated juice, without sugar (with sweetener)	1	2	3	4	5	6	7	8

19. Non-alcoholic beverages (1 glass 200ml)

q19p1 Carbonated/soft drinks with sugar	1	2	3	4	5	6	7	8
q19p2 Carbonated/soft drinks with artificial sweetener	1	2	3	4	5	6	7	8
q19p3 Tap water	1	2	3	4	5	6	7	8
q19p4 Mineral water (e.g. still or sparkling)	1	2	3	4	5	6	7	8

20. Tea/coffee

q20p1 Black tea (any)	1	2	3	4	5	6	7	8
q20p2 Coffee (instant or ground)	1	2	3	4	5	6	7	8
q20p3 Greek (Turkish) Coffee	1	2	3	4	5	6	7	8
q20p4 Green tea	1	2	3	4	5	6	7	8
q20p5 Peppermint tea	1	2	3	4	5	6	7	8
q20p6 Other herbal infusions	1	2	3	4	5	6	7	8

21. Beer (1/2 pint or 1 glass 200 ml)

q21p1 Beer (any)	1	2	3	4	5	6	7	8

22. Wine (1 glass125 ml)

q22p1 Any wine	1	2	3	4	5	6	7	8
q22p2 Red wine	1	2	3	4	5	6	7	8
q22p3 White wine	1	2	3	4	5	6	7	8
q22p4 Rose wine	1	2	3	4	5	6	7	8

23. Other alcoholic beverages (1 glass 50 ml)

	Rarely/	1-3 times	Once a	2-4	5-6	Once	2-3 day	4+ day

	Never	a month	week	week	week	a day		
q23p1 Fortified wines (Liqueurs) (e.g. Sherry, port, Madeira)	1	2	3	4	5	6	7	8
q23p2 Spirits (e.g. whisky, vodka, rum, gin)	1	2	3	4	5	6	7	8

24. Red meat and meat products

q24p1 Any red meat (e.g. beef, veal, lamb, pork, game)	1	2	3	4	5	6	7	8
q24p2 Hot/cold roast beef, boiled beef, beef steak, fillet, loin	1	2	3	4	5	6	7	8
q24p3 Beef burger (hamburger)	1	2	3	4	5	6	7	8
q24p4 Minced beef meat (e.g chilli con carne, Bolognese sauce, meatballs)	1	2	3	4	5	6	7	8
q24p5 Beef meat in stew, casserole, in curry	1	2	3	4	5	6	7	8
q24p6 Pork cutlet, chop, steak, fillet, loin, pork ribs, minced	1	2	3	4	5	6	7	8
q24p7 Meat pies	1	2	3	4	5	6	7	8
q24p8 Sausages	1	2	3	4	5	6	7	8
q24p9 Veal	1	2	3	4	5	6	7	8
q24p10 Small game (e.g. rabbit, goat, pheasant, duck)	1	2	3	4	5	6	7	8
q24p11 Other game (e.g. deer, moose)	1	2	3	4	5	6	7	8
q24p12 Lamb (e.g. in stews, kebabs)	1	2	3	4	5	6	7	8
Smoked/cured meat (3 slices)								
q24p13 Cured pork (cold or hot-cooked)	1	2	3	4	5	6	7	8
q24p14 Gammon, ham (e.g. Serrano, prosciutto)	1	2	3	4	5	6	7	8
q24p15 Dried cured sausages (chorizo, salchichon, salami)	1	2	3	4	5	6	7	8
q24p16 Frankfurter	1	2	3	4	5	6	7	8
q24p17 Bacon, bacon cubes	1	2	3	4	5	6	7	8
q24p18 Smoked lamb	1	2	3	4	5	6	7	8
q24p19 Smoked game (any)	1	2	3	4	5	6	7	8

25. Poultry

q25p1 Any poultry with skin	1	2	3	4	5	6	7	8
q25p2 Any poultry without skin	1	2	3	4	5	6	7	8
Fresh (un-smoked)								
q25p3 Chicken (e.g. boiled, roasted, chicken burgers)	1	2	3	4	5	6	7	8
Q25p4 Chicken (e.g. stews or casserole)								
q25p5 Turkey (e.g. roasted, boiled, strips)	1	2	3	4	5	6	7	8

Smoked or cured poultry								
q25p6 Any smoked/cured poultry	1	2	3	4	5	6	7	8

26. Offal

	Rarely/ Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q26p1 Liver, pates, potted meat	1	2	3	4	5	6	7	8
q26p2 Other offal (e.g. tongue, brain, heart, kidney, tripe)	1	2	3	4	5	6	7	8

27. Fish and seafood

q27p1 Any fish or seafood (fresh, tinned, smoked, etc)	1	2	3	4	5	6	7	8
q27p2 Fresh fatty fish (e.g. salmon, tuna, trout, anchovy, herring, mackerel, sardine, gravalex, eel)	1	2	3	4	5	6	7	8
q27p3 Fresh white fish (e.g. hake/burbot, cod, haddock, plaice, whiting)	1	2	3	4	5	6	7	8
q27p4 Other fresh fish/seafood products (e.g. taramasalata)	1	2	3	4	5	6	7	8
q27p5 Fresh Crustaceans and molluscs (e.g. mussel, crab, calamari, octopus, cuttlefish, shrimp, clam)	1	2	3	4	5	6	7	8
q27p6 Cured or smoked fatty fish (e.g. sardines, tuna, salmon, kipper)	1	2	3	4	5	6	7	8
q27p7 Cured or smoked white fish (e.g. cod, bacalhau)	1	2	3	4	5	6	7	8
q27p8 Tinned fish (sardine, tuna or salmon)	1	2	3	4	5	6	7	8
q27p9 Tinned crustaceans and molluscs (e.g. mussel, crab, calamari, octopus, cuttlefish, shrimp, clam)	1	2	3	4	5	6	7	8

28. Eggs (from hen)

q28p1 Eggs (any, on average)	1	2	3	4	5	6	7	8
q28p2 Eggs (fried/poached/boiled/hard boiled/in sandwiches)	1	2	3	4	5	6	7	8
q28p3 Egg-based savoury dishes	1	2	3	4	5	6	7	8
q28p4 Egg-based desserts (e.g.	1	2	3	4	5	6	7	8

Egg cakes, tarts, egg and nuts sweets)								

29. Milk, dairy and soya

q29p1 Milk (any, excluding soya)	1	2	3	4	5	6	7	8
Cow milk								
q29p2 Full-fat milk	1	2	3	4	5	6	7	8
q29p3 Semi-skimmed milk	1	2	3	4	5	6	7	8
q29p4 Skimmed milk	1	2	3	4	5	6	7	8
q29p5 Milk fortified with omega 3 fatty acids	1	2	3	4	5	6	7	8
q29p6 Yogurt (any type including fromage)	1	2	3	4	5	6	7	8
Soy								
q29p7 Soy milk	1	2	3	4	5	6	7	8
q29p8 Yogurt from soy	1	2	3	4	5	6	7	8
q29p9 Tofu	1	2	3	4	5	6	7	8

30. Cheese

	Rarely Never	1-3 times a month	Once a week	2-4 week	5-6 week	Once a day	2-3 day	4+ day
q30p1 Any cheese	1	2	3	4	5	6	7	8
q30p2 Hard cheeses (e.g. Cheddar, parmesan)	1	2	3	4	5	6	7	8
q30p3 Soft cheeses (e.g. Brie, camembert, Philadelphia, tomini, boursault, brinza, chaource, coulommiers, Humboldt fog, kochkase)	1	2	3	4	5	6	7	8
q30p4 Semi-hard cheeses (e.g. Gouda, Emmental/Edam)	1	2	3	4	5	6	7	8
q30p5 Cottage cheese (cheese curd) (natural/with scents)	1	2	3	4	5	6	7	8
q30p6 Hard and semi-hard Greek cheeses (e.g. Kaseri, kefalotiri, Grafiera, Kefalograviera, Ladotiri)	1	2	3	4	5	6	7	8
q30p7 Freshcheeses (e.g. Feta, mozzarella)	1	2	3	4	5	6	7	8

31. Othermilk-derivedproducts

q31p1 Ice cream	1	2	3	4	5	6	7	8
q31p2 Single cream crème	1	2	3	4	5	6	7	8
q31p3 Crème fraîche	1	2	3	4	5	6	7	8
a31p4 Sour cream	1	2	3	4	5	6	7	8
q31p5 Double or clotted cream	1	2	3	4	5	6	7	8

32. Miscellaneous food

q32p1 Dressing sauces (e.g. French, Cesar, thousand islands)	1	2	3	4	5	6	7	8
q32p2 Mayonnaise)	1	2	3	4	5	6	7	8
q32p3 White sauce	1	2	3	4	5	6	7	8
q32p4 Ketchup	1	2	3	4	5	6	7	8
q32p5 Instant soup	1	2	3	4	5	6	7	8
q32p6 Pizza (any)	1	2	3	4	5	6	7	8
q32p7Brown sauce	1	2	3	4	5	6	7	8

Additional questions:

33. Products for special nutritional use

Do you REGULARLY take any nutritional supplement? e.g. vitamin C, selenium etc?

Yes ☐   No ☐

If you answered yes to question 33, please indicate:

Nutrient supplement (or brand name)	Dose taken	Times per week dose is taken
q33p1	q33p1dose	q33p1daily
q33p2	q33p2dose	q33p2daily
q33p3	q33p3dose	q33p3daily
q33p4	q33p4dose	q33p4daily
q33p5	q33p5dose	q33p5daily

34. Are there any other foods you normally eat once or more a week?

Yes ☐   No ☐

If yes, please list below:

Food (if it is a local dish, and you know the main components or ingredients, please name them)	Usual serving size	Number of times eaten per week
q34p1	q34p1size	q34p1times
q34p2	q34p2size	q34p2times

q34p3	q34p3size	q34p3times
q34p4	q34p4size	q34p4times

35. What kind of fat did you most often use for frying, roasting, grilling, etc?

Select one only please:

Butter	1
Lard/dripping	2
Sunflower oil	3
Solid vegetable fat	4
Margarine	5
Olive oil	6
None	0

36. How often do you add salt to food while cooking?

Always	1
Sometimes	2
Rarely	3
Never	0

37. In the last year, on average, how many times a week did you eat a medium serving (unit/glass or cup) of the following food groups?

Food type	Times/week
q37p1 Vegetables (excluding potatoes)	q37p1times
q37p2 Potatoes	q37p2times
q37p3 Fruits and fruit products (excluding fruit juice)	q37p3times
q37p4 Fish	q37p4times
q37p5 Fish products	q37p5times
q37p6 Meat, meat products or meat dishes (including bacon, ham and chicken)	q37p6times
q37p7 Milk (skimmed, full fat, any)	q37p7times

38. Are there any foods you do not eat because they cause you allergy or intolerance?

Yes   No

If yes, please name these foods below:

Food not consumed	Reason
q38p1	q38p1reason
q38p2	q38p2reason
q38p3	q38p3reason
q38p4	q38p4reason

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