Design of the nutritional therapy for overweight and obese Spanish adolescents conducted by Registered Dieticians: The EVASYON study.

María Marqués[1]; Adriana Moleres[2]; Tara Rendo-Urteaga[2]; Sonia Gómez-Martínez[3]; Belén Zapatera[3], Patricia Romero[4]; Pilar De Miguel-Etayo[4]; Cristina Campoy[5]; J. Alfredo Martínez[2]; Cristina Azcona-San Julian[6], Ascensión Marcos[3]; Amelia Marti*[2], for the EVASYON group.

Address:

[1]Department of Preventive Medicine and Public Health, University of Navarra, Pamplona, Spain

[2]Department of Nutrition and Food Sciences, Physiology, and Toxicology, University of Navarra, Pamplona, Spain

[3]Department of Metabolism and Nutrition, Institute of Food Science and Technology and Nutrition (ICTAN), Spanish National Research Council (CSIC), Madrid, Spain

4GENUD (Growth, Exercise, Nutrition and Development) Research Group, EU, Health Science; Department of Physiotherapy and Nursing. School of Health Science, University of Zaragoza, Zaragoza, Spain.

5Department of Paediatrics, University of Granada, Granada, Spain, 6Department of Paediatrics, University of Navarra, Pamplona, Spain.

* Corresponding author

E-mail address:

María Marqués: mmarquesf@unav.es

Adriana Moleres: amoleres@alumni.unav.es

Tara Rendo-Urteaga: trendo@alumni.unav.es

Sonia Gómez-Martínez: sgomez@if.csic.es

Belén Zapatera: bzapatera@if.csic.es

Patricia Romero: patidy@hotmail.com

Pilar De Miguel-Etayo: pilardm@unizar.es

Cristina Campoy: ccampoy@ugr.es

J.Alfredo Martínez: jalfmtz@unav.es

Cristina Azcona: cazcona@unav.es

Ascensión Marcos: amarcos@if.csic.es

Amelia Marti: amarti@unav.es

Abstract

Background

Dietary treatment for obese adolescents should aim to ensure adequate growth and development, by reducing excessive fat mass accumulation, avoiding loss of lean body mass, improving well-being and self-esteem and preventing cyclical weight regain. The aim of this article is to describe the dietary intervention design and the methods used to evaluate nutritional knowledge and behavior in the EVASYON study (Development, implementation and evaluation of the efficacy of a therapeutic programme for overweight/obese adolescents).

Methods/ Design

EVASYON is a multi-centre study conducted in 5 Spanish hospital settings (Granada, Madrid, Pamplona, Santander and Zaragoza), where 204 overweight/obese Spanish adolescents were treated in groups of 9 to 11 subjects over 20 visits. The study was implemented in two stages: an intensive, calorie-restricted period for the first 9 weeks, and an extensive body-weight follow-up period for the last 11 months. A moderate energy intake restriction was applied in the intensive period according to the degree of obesity, on the basis of a balanced diet supplying 50-55% of daily energy as carbohydrates; 30-35% as fats and 10-15% as proteins. In the intensive period, adolescents were prescribed both a fixed full-day meal plan for the first three weeks and a full day meal plan with different food-choices for 6 weeks. Later, adolescents received a flexible meal plan based on food exchanges for the follow-up

period until the end of the trial.

Data on food intake, dietary and meal-related habits and behavior were collected by means of dietary questionnaires. To analyse nutritional knowledge, adolescents were examined regarding nutrient concepts and food items for a healthy diet with the appropriate tools. Participants were given nutritional information with complementary teaching material, which was available on the EVASYON website (www.estudioevasyon.com).

Discussion

The dietary intervention of the EVASYON programme with a moderate calorie restriction for a limited period of time could be a good strategy in treating overweight and obese adolescents and that will be tested further. Moreover, combining fixed plan with free-choice menus may help adolescents and their families to make right decisions for every day meals.

Background

Adolescence is a period of the life cycle characterized by important changes in body size and composition as well as in lifestyle habits **[1, 2]**. The prevalence of overweight and obesity among adolescents is dramatically increasing all over the world **[3, 4, 5]**. This alarming trend is seen as a burden by public health professionals and government agencies and there is now a clear need to develop well founded standardized interventions to treat overweight/obese adolescents, following evidence-based practice criteria.

The risk of obesity depends on the interaction of genetic predisposition and exposure to obesogenic (environmental) risk factors such as inappropriate eating habits and food choice, poor nutritional knowledge, sedentary behavior and low physical activity, all of which are becoming major social problems in many countries **[6, 7, 8, 9]**. These etiological factors are associated with clinically important co-morbidities (cardiovascular disease, hypertension, type 2 diabetes mellitus, eating disorders, cancer…) in adult life **[10]**. It is unlikely that a single-sided intervention can be targeted against all these multi-causal agents. Indeed, lifestyle

changes require a high degree of commitment and active participation from adolescents and their relatives. Therefore, parents are central agents for change in the promotion of healthy eating and activity habits and their involvement in the programme is essential for an intervention to be successful **[11, 12].** A multi-disciplinary approach is necessary with the participation of dieticians, doctors, psychologists and physical activity experts among other professionals as a single team **[13-14].**

Interventions that combined behavioral therapy with dietary and physical activity changes are widely used, and appear to be the most successful strategies for improving long-term weight maintenance and health status **[14, 15, 16]**. Ideally, dietary treatment for obese children and adolescents should aim to ensure adequate growth and development, by reducing excessive fat mass accumulation, avoiding loss of lean body mass, improving well-being and self-esteem and preventing cyclical weight regain **[13]**.

Balanced food patterns constitute a model for healthy living, based on foods to eat rather than foods to avoid, and an understanding of suitable weight-control measures **[17]**. Promoting weekly menus with food variety is also the best defense for avoiding nutritional deficiencies and excess, as well as meeting micronutrient requirements **[1, 18].** Moreover, meal plans with food exchanges represent a useful tool to encourage adolescents to keep to balanced diets.

The timetable for different meals thorough the day and their calorie distribution are also important issues as ways to improve nutritional education and food behavior in this population. Adolescents tend to have high energy density meals and snacks, therefore an important goal is to reduce calorie content **[19]**. This practice involves a wide range of fresh and seasonal food, with a high proportion of vegetables, grains, fresh fruit and pulses, principal sources of vitamins, minerals, carbohydrates and fiber, which could play an important role in weight control and in decreasing dietary energy-density **[13, 20-21].**

The aims of the EVASYON study were: 1) to develop a treatment programme including education on nutrition and physical activity patterns, 2) to implement this programme during

one year in overweight/obese Spanish adolescents and 3) to evaluate the efficacy and limitations of the programme. For dissemination and comparative purposes with previous and future studies, detailed information concerning the design, development and evaluation of the dietary intervention of the EVASYON study is provided here.

Methods/Design

Experimental design

The EVASYON programme is an interventional study implemented in a cohort of overweight/obese adolescents aged 13 to 16 years as described by Martínez-Gómez et al. [7]. The initial treatment programme was conducted in 5 Paediatric hospitals from different cities in Spain (Granada, Madrid, Pamplona, Santander and Zaragoza) in small groups of nine to eleven patients. During the programme period, adolescents made twenty visits over approximately one year, within two specific stages (Figure 1): an intensive intervention period including 9 weekly visits for two months, and the extensive body weight maintenance intervention period including 11 monthly visits. Information on inclusion criteria is given in the work of Martínez-Gómez *et al.* **[7].** Written consent to participate was obtained from both parents and adolescents. The complete study protocol was conducted in accordance with the ethical standards of the Helsinki Declaration (revised in Hong-Kong in 1989, in Edinburgh in 2000 and in Korea in 2008), following the European Community's guidelines for Good Clinical Practice (document EEC 111/3976/88 of July 1990) and current Spanish law regulating clinical research in humans (RD 561/1993 regarding clinical trials). The study was approved by the Ethics Committee of each hospital participating in this project and by the Ethics Committee of the Spanish National Research Council (CSIC). Data obtained during the intervention was confidential and restricted to the participating investigators. Health authorities had full access rights to the database for inspection purposes.

Nutritional therapy and an educational programme on diet and food knowledge, psychological and eating behavior assessment, physical activity and family involvement, were covered

throughout the programme. Nine measurement categories were established: Diet and food habits; physical activity and health-related physical fitness; psychological profile; anthropometry; body composition; haematological profile; biochemistry and metabolic profiles; mineral and vitamin profile; immunological profile and genetic profile. All the parameters in each measurement category, excluding genetic profile, were assessed at least at four points: baseline (visit 1), at the end of the intensive intervention (visit 9), at mid point of the overall intervention (visit 13), and at the end of the EVASYON treatment programme (visit 20) **[7]**.

Measurement of food intake

The EVASYON food and nutrition programme involved trained registered dietitians (RD), professionals who were directly responsible for the dietary and nutrition education programme.

At baseline, participants were personally interviewed by an EVASYON RD to evaluate their meal patterns, appetite, food choices and snacking, with specific dietary questionnaires. A detailed dietary history collected information about the family food-shop organization, usual location for meals during the week and week-ends, meal-related habits before starting the therapy or the personal beliefs about the role of food in the family, among others **[Additional file 1]**. It was important for clinicians and RDs to inquire about specific disordered eating attitudes to assess whether they were likely to increase the risk of further eating disorders or weight gain **[22, 23].**

Moreover, a semi-quantitative food frequency questionnaire (FFQ), previously validated in Spain**,** was administered at the beginning, at six months and at the end of the programme. This tool was used to record usual food frequency consumption according to the standard portion size, energy and nutrient intake, and to detect possible nutritional risks and misbehaviors [24].

Additionally, a visual analogue scale (VAS score) was used for the measurement of appetite and anxiety-related eating habits **[25] [Additional file 2]**.

After personal interview at visit 1, adolescents and their families received a group session where the RD explained how to complete a 24h-dietary recall. Pictures of food portion sizes and tables of equivalences were used to illustrate the size of usual servings. This information helped the participants to fill in the 72h dietary record. The data were transformed into grams or milliliters and were processed with an “ad hoc” computer programme, using validated food composition tables from Spain **[26, 27].**

In different patient assessments (visits 1, 9, 13 and 20) other dietary questionnaires were used to survey information on the adherence and challenges to the programme. A specific dietary record explored food habits that could be modified during the therapy **[Additional file 3]**. Also, the survey for compliance with the diet contained two sections. The first part collected information on the food frequency intake of the main food groups, and favorite foods (but supposedly not healthy items) for adolescents such as sweet drinks, alcohol, cakes and fast food. The second part gathered information on meal-related habits and psychological aspects **[Additional file 4]**. A brand name FFQ and also, the VAS score and the 72h dietary record were completed in each assessment.

Assessing energy, nutritional requirements and calorie restriction

The International Obesity Task Force (IOTF) body mass index (BMI) cut-off values were used for the diagnosis of overweight and obesity in the adolescents **[28]**. To determine basal metabolism rate (BMR), Schofield’s et al. (1985) equation was used **[29]**, where the value of 1.3 was assumed as the activity factor to obtain the total daily energy expenditure (TEE) for most subjects.

The BMI value was normalised to the standard deviation score. The restriction percentage was calculated as follows: If Z = 2-3, the TEE was reduced by 20%; if Z = 3 – 4, it was reduced by 30%; and if Z > 4, TEE was reduced by 40% and on this basis, a daily calorie restriction range was established. In no case were the diets lower than 1300 kcal or higher than 2200 kcal. Furthermore, energy restriction acted as a method to correct the excessive

food portions consumed with reference to age, sex and physical activity level. At the end of each dietary period, it was necessary to adjust the equations according to the current body weight and the basal metabolism rate was measured to identify possible shifts in energy consumption/expenditure **[30]**.

Dietary intervention strategy and exchange list guidelines

The intensive treatment programme with a moderate calorie restriction was divided into two sub-phases: three weeks (visits1 to 3) consisting of fixed full-day meal plan according to the criteria described above, and the next six weeks (visits 4 to 9) consisting of fixed full-day meal plan with food choices. During the extensive intervention period (visits 10 to 20), the adolescents were assigned to a flexible meal plan with food exchanges, maintaining a balanced diet according to sex and age. Daily energy distribution was based on the school period promoting breakfast and avoiding multiple snack consumption along the day. Therefore, dietary patterns maintained a typical distribution of 3 main meals (breakfast providing 20% of daily calories, lunch with 30-35%, and dinner with 20-25% of daily calories) and 2 snacks (mid-morning 5-10%, and afternoon 10-15% of daily calories) **[20,31].** The diets were designed in accordance with the proportions of macronutrients recommended by the Food and Nutrition Board of the National Research Council: carbohydrates 50-55% of total daily energy intake (EI) (sugars < 10%); fats 30-35% of EI (10-20% monounsaturated, <10% saturated, 7-10% polyunsaturated); cholesterol < 300 mg /day, and proteins 10-15% of EI **[32]**.

The initial objective of the intervention was to join both adolescents and their families in the nutritional treatment; therefore, they received an energy-adjusted full-day menu for three weeks, to achieve the established calorie and nutrient objectives. The meal plan specified all daily meals, the type of foods to include with serving sizes (expressed in grams or individual portions), the garnishes, tips for healthy cooking, and daily bread and oil servings **[Table 1].**

The second meal plan used in EVASYON programme consisted of full-day menus with food

choices structured similarly to the diets used before, but specifying the main food group and the serving size, and with the possibility to choose from a list of specific foods. In this context, the meal plans became an easy tool for the family to acquire a degree of self-sufficiency selecting healthy foods and to develop healthy habits for making good decisions for the family's well-being **[Table 2]**.

The next step in the extensive body-weight maintenance programme was the full-day meal plan with exchanges. The exchange lists system used in the EVASYON study was based on the unification of nutrients (carbohydrates, proteins and lipids) and calories taking into account normal Spanish foods and serving sizes **[33]**. The serving sizes of listed food items corresponded to an average of the amount of calories, carbohydrates, proteins and fats supplied, thus, any selection within a food group covered the same energy and macronutrient content **[34]**. Based on the daily established energy requirements per person, the number of exchanges for each food group was quantified, following the dietary guidelines of food consumption in Spain **[35].** This method helped professionals generate uniformity in exchange conversions for recipes and food labels, in order to adapt family and personal food habits. On this basis, meals described the main food groups to be included, and each group was broken down into a list of foods with appropriately exchangeable food-portions (servings expressed in grams and home measures). This system gave flexibility and diversity to the diet and the family became responsible for programming the weekly menu by applying the acquired knowledge **[36] [Table 3]**.

Assessing nutritional knowledge

The understanding of the environmental influences, parents' habits, health concerns and the association within nutritional knowledge and food choices, is relevant to develop effective youth obesity prevention strategies **[36, 37, 38]**. At baseline, the EVASYON adolescents were requested to complete information about basic nutrition concepts, healthy eating and the relationship between several foods items and the corresponding food group to analyse their

nutritional knowledge and food preferences **[Additional file 5]**.

Nutritional assessment and educational materials

The intensive programme included weekly in-person visits with the RD to control the understanding and the fulfillment of the dietetic patterns and lifestyles, to answer possible doubts and to motivate the participants with the previously one-week established objectives. After this, group sessions took place, where the RD emphasized dietary knowledge, teaching of behavioural-change techniques and motivational, life and time management strategies, as well as the importance of the compliance with healthy habits and family support.

Educational materials were developed for EVASYON study to support the dietary treatment targets, such as the childhood food guide pyramid, pictures of portion-sizes, cooking techniques, basic concepts for planning healthy menus, etc., which were available on the EVASYON webpage **[39]**. Similarly, all the incidences and changes related to lifestyle were recorded in a notebook of guidance to be reviewed by the RD in the next interview. A practical guide with recommendations for controlling body weight was handed out to families.

During the extensive body-weight maintenance period, adolescents attended monthly in person follow-up visits with the RD. They and their families received group sessions on different aspects such as diet, physical activity, healthy habits and weight maintenance skills, how to engage in healthy weight control behaviors and relapse prevention. Objectives were planned to be accomplished on a one-month basis. Other studies have reported successful results following these strategies **[40]**.

Discussion

The EVASYON study is a multidisciplinary and multicentre programme for overweight/obese adolescents that involved the management of dietary habits, physical activity and psychological profiles, in order to lower adiposity and prevent the development of chronic adult disease related to obesity such as diabetes, hypertension, and metabolic syndrome.

The EVASYON nutritional programme was monitored by RDs as practitioners qualified to

implement and evaluate nutritional assistance programmes targeted at improving the nutritional status of the population **[41].** These professionals were previously trained according to the work plan of the project with specific workshops and seminars, in order to reduce inter-individual (inter-centre) variations. Moreover, the teaching material and protocols for the different worksheets of the project were available for all centers through a continuously updated website **[39]**.

Many different approaches and therapies have been proposed for weight loss treatment in obese and overweight children **[15, 42, 43, 44].** Unbalanced hypocaloric diets or very low calorie diets probably lack essential vitamins and minerals and should not be recommended during the period of growth.

Programmes including moderate calorie restriction and physical exercise have achieved better results than diet only, showing decreases in total body fat mass, and cardiovascular risk factors, maintaining total body fat-free mass, as well as improving insulin sensitivity and lipid profile, such as an increase of high density lipoprotein cholesterol fraction (HDL-c) levels **[16, 43, 45, 46, 47, 48].** The magnitude of the energy restriction together with the duration of the trial are always a challenge, but more especially in this population group. In adolescents, energy requirement and micronutrient intake are critical issues for appropriate growth and development **[33]**. Our strategy consisted of a moderate calorie restriction for a limited period of time (9 weeks) followed by a maintenance period with a balanced non calorie-restricted diet. In the literature, trials with obese adolescents used different calorie restriction ranges varying from 600 kcal/day to 1800 kcal/day **[15, 43, 49, 50]**. In the current study, a supply of total energy between 1300 kcal/day and 2200 kcal/day for participants was indicated according to the degree of obesity.

It is important to mention that breakfast apparently provides considerable protection for future obesity in adulthood **[51]**. We strongly recommended three food groups (dairy products, cereals and fruit) to be included in menus **[33, 52]**. Semi-skimmed milk, low fat yoghurts and

fresh cheese were also recommended as healthy choices to cover the daily needs of calcium, and contribute to the protein content of the diet **[20].**

Moreover, over the last few years, the type of dietary fat has been receiving more attention regarding its association with obesity and its co-morbidities. Participants were advised by RDs to remove meat fat before cooking, reduce cold meats, and margarines, shortenings, pastries and industrial cakes which contain saturated and hydrogenated fats **[20, 33]**.

Due to the large evidence on the protective effect of olive oil on body weight and lipid control **[53, 54]**, olive oil was recommended as the principal fat source for cooking and dressing meals. To complete the daily nutrient requirements with healthy foods, common choices presented in menus for dinner were vegetables and salads, soups, cereals, eggs, fish and lean meats while for dessert fresh fruit or yoghurt were encouraged.

Furthermore, observational data support that consuming large portions of energy-dense foods could play a role in the etiology of obesity **[6, 55]**. A reduction in the consumption of canned juices and soft drinks containing excess sugar and additives, meat servings, eating away from home, and portion size **[33, 56]** should be encouraged together with increased consumption of moisture-rich foods such as fruits and vegetables, legumes, fish and cereals. These messages seem to be effective in preventing weight gain and promoting weight loss **[6, 44, 55, 57].**

In conclusion, the dietary intervention of the EVASYON programme was developed to improve nutritional education in order to achieve food behavior modification. A moderate calorie restriction for a limited period of time seems to be a good strategy in treating overweight/obese adolescent since it is crucial to maintain their appropriate growth and development. Moreover, combining fixed plan with free-choice menus helps adolescent and their families make the right decisions for every day meals.

Competing interests

The author(s) declare that they have no competing interests'.

Authors' contributions

MM and AdM contributed equally to this work. AsM, AmM and CC designed the study and obtained funding. The RDs MM, TR, BZ, PR and PM intensively participated in the dietary intervention study. All authors provided insight into the study design and contributed to the drafts and approved the final version.

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Figures

Figure 1 - EVASYON study design and dietary intervention in the treatment programme. The dietary intervention was carried out over approximately one year including twenty visits within two specific stages: the intensive period (9 visits) with moderate calorie restriction, and the extensive period (11 visits) with no calorie restriction. The dietary planning was different is each stage, and dietary questionnaires were administered at baseline, and in visits 9, 13 and 20, to complete patient assessments.

Tables

Table 1- Example of one-day detailed meal plan (1700 kcal) in the first three weeks of the intensive intervention.

Table 2: Example of one-day detailed meal plan (1700 kcal) with food choices during weeks 4 to 9 of the intensive intervention.

Table 3: Example of a flexible meal plan (1700 kcal) with food exchanges for the extensive intervention.

Table 4: Multidisciplinary intervention studies in children and adolescent population.

Additional files

Additional file 1 - Dietary History model
Additional file 2 - Visual Analogue Scale (VAS score)
Additional file 3 - Dietary record model
Additional file 4 – Survey for compliance with the diet.
Additional file 5 - Nutritional knowledge survey.

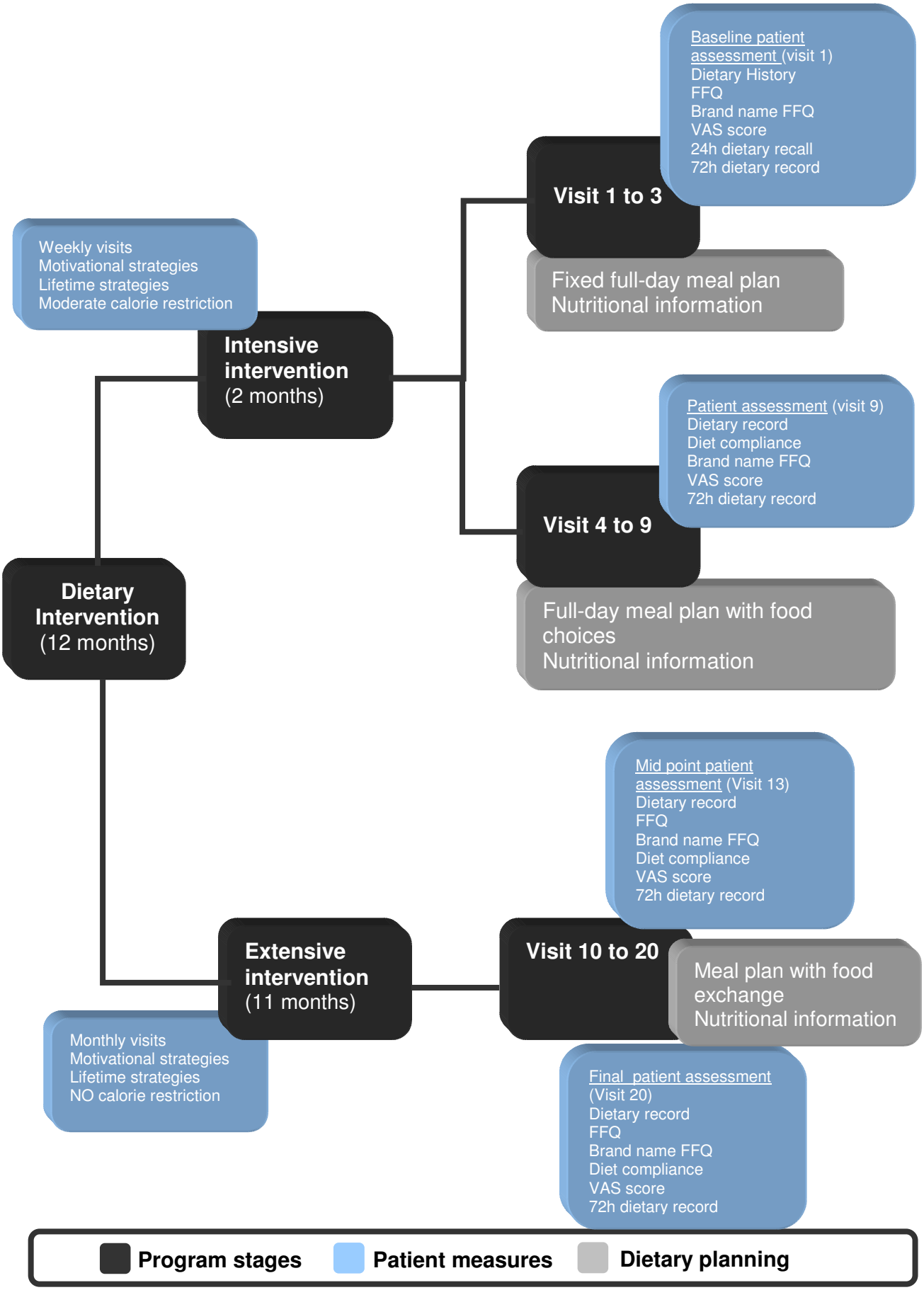
Baseline patient assessment (visit 1)
Dietary History
FFQ
Brand name FFQ
VAS score
24h dietary recall
72h dietary record
Visit 1 to 3
Fixed full-day meal plan
Nutritional information
Weekly visits
Motivational strategies
Lifetime strategies
Moderate calorie restriction
Intensive intervention
(2 months)
Patient assessment (visit 9)
Dietary record
Diet compliance
Brand name FFQ
VAS score
72h dietary record
Visit 4 to 9
Full-day meal plan with food choices
Nutritional information
Dietary Intervention
(12 months)
Mid point patient assessment (Visit 13)
Dietary record
FFQ
Brand name FFQ
Diet compliance
VAS score
72h dietary record
Extensive intervention
(11 months)
Visit 10 to 20
Meal plan with food exchange
Nutritional information
Monthly visits
Motivational strategies
Lifetime strategies
NO calorie restriction
Final patient assessment
(Visit 20)
Dietary record
FFQ
Brand name FFQ
Diet compliance
VAS score
72h dietary record
Program stages
Patient measures
Dietary planning

Table 1: Example of one-day detailed meal plan (1700 kcal) in the first three weeks of the intensive intervention.

	Day 1
Breakfast	1 bowl semi-skimmed milk 2 small slices bread with natural tomato + 15g ham 125g kiwi
Mid-morning snack	150g pear 30g cereal bar
Lunch	200g courgette purée (*150g courgette + 50g onion + 80g potato*) 90g grilled turkey + 100g grilled green asparagus 30g bread Low- fat yoghurt
Afternoon snack	175g orange 3 pieces Melba toast + 30g low fat cheese
Dinner	200g mixed salad Plain omelette (1 egg) + 30g tin natural tuna 30g bread 100g banana
Others	Oil: 30g/day (3 tbsp.)

Table 2: Example of one-day meal plan (1700 kcal) with food choices during weeks 4 to 9 of the intensive intervention.

<table>
<tr><th></th><th>Day 1</th><th colspan="3">Food groups</th></tr>
<tr><td>Breakfast</td><td>milk
cereal + 15g ham
fruit</td><td>Cereal</td><td>Breakfast and mid-morning snack</td><td>30g cereals
2 slices bread
45g bread (normal or whole-grain)
4 pieces Melba toast
4 Marie biscuits</td></tr>
<tr><td>Mid-morning snack</td><td>fruit
cereal</td><td></td><td>Afternoon snack</td><td>20g cereals / 1 cereal bar
1 sliced bread
30g bread (normal or whole-grain)
3 pieces Melba toast
3 Marie biscuits</td></tr>
<tr><td rowspan="2">Lunch</td><td rowspan="2">200g vegetable purée (with 80g potato)

90g white meat + 100g vegetables

30g bread
yoghurt</td><td>Dairy products</td><td colspan="2">1 glass of semi-skimmed milk
1 low-fat yoghurt (natural, flavoured, with fruit…)</td></tr>
<tr><td>Vegetables</td><td colspan="2">Cooked vegetables: borage, artichoke, green beans, vegetable stew, chards, spinach, courgettes, auberginies, mushrooms, peppers (grilled or sautéed).
Raw vegetables: lettuce, chicory, escarole, asparagus, natural tomato, carrot, beetroot, celery….</td></tr>
<tr><td>Afternoon snack</td><td>fruit
cereal + 30g low-fat cheese</td><td>White fish</td><td colspan="2">Hake, grouper, sole, young hake, halibut, gilthead, bream, sea bass, trout, codfish, conger, cuttlefish, prawns.</td></tr>
<tr><td rowspan="3">Dinner</td><td rowspan="3">200g varied salad

1 egg + 30g tin natural tuna

30g bread
fruit</td><td>Pulses and starches</td><td colspan="2">Lentils, beans, chickpeas, peas, broad beans, soya beans.
Baked, boiled or micro-waved potato.</td></tr>
<tr><td>Egg</td><td colspan="2">Omelette, hard-boiled egg, scrambled eggs, poached egg.</td></tr>
<tr><td>White meat</td><td colspan="2">Chicken, turkey, rabbit , partridge, quail</td></tr>
<tr><td>Others:
Oil</td><td>Oil: 30g/day
(3 tbsp)</td><td>Cold meat</td><td colspan="2">Boiled ham, turkey breast or lean cured ham.</td></tr>
</table>

Table 3: Example of a meal plan (1700 kcal) with food exchanges for the extensive intervention.

	Food	Quantity	Portion
Breakfast	**Dairy products**	*Choose one among::*	
		240g semi-skimmed milk	1 bowl
		250g low-fat Yoghurt	2 units
	Cereals	*Choose one between:*	
		45g bread (normal/sliced)	1 big slice bread or 2 small
		37g Melba toast	4 units
		22g Marie biscuits	3-4 units
		30g cereals/ cereal bar	3 tbsp
	Fruit	*Choose one among:*	
		175g orange, peach, strawberries.	
		150g apricot, tangerine, pear	1 small unit /medium-sized
		125g kiwi, apple, pineapple.	
		75g banana	
Mid-morning snack	**Fruit**	*Choose one among:*	
		175g orange, peach, strawberries.	
		150g apricot, tangerine, pear	1 small unit /medium-sized
		125g kiwi, apple, pineapple.	
		75g banana	
	Cereals	*Choose one among:*	
		45g bread (normal/slice)	1 big slice
		37g Melba toast	4 units
		22g Marie biscuits	3-4 units
		30g cereals/ cereal bar	
	Protein	*Choose one among:*	
		15g boiled or cured ham	1 slice
		15g semi-fat cheese or 30g. low-fat white cheese	1 small portion
Afternoon snack	**Cereals**	*Choose one among:*	
		30g. bread (normal/slice)	1 medium-sized slice
		25g. Melba toast	3 units
		15g. Marie biscuits	2-3 units
		20g cereals/ cereal bar	2 tbsp
	Dairy products	*Choose one among:*	
		125g low-fat yoghurt	1 unit
		120g semi-skimmed milk	1 small glass
	Protein	*Choose one among:*	
		15g boiled or cured ham	1 slice
		15g semi-fat cheese or 30g. low-fat white cheese	1 small portion

LUNCH / DINNER		
Food	**Quantity**	**Portion**
FIRST COURSE: *choose one among*		
Vegetables	200g raw or 240g boiled (green beans, cauliflower, leeks, natural tomato, courgettes, lettuce, pepper, chard, thistle…) **+** 80g raw or 90g boiled potato.	1 medium-sized plate *(the potato reduces by **30gr** the total amount of **bread**)*
Cereals	*Choose one among:* 50g uncooked or 175g boiled pasta 50g uncooked or 140g boiled rice 200g raw or 225g boiled potato	1 medium-sized plate
SECOND COURSE: *choose one among:*		
Protein	**LUNCH** *Choose one among:* 120g raw or 105g cooked white or oily fish. 90g raw or 70g cooked lean meat (chicken, turkey, veal, rabbit, pork loin).	1 unit + 1 ½ slices 2 medium-sized slices 2 small portions 3 fine slices
	DINNER *Choose one among:* 80g raw or 70g cooked white or oily fish. 60g raw or 45g cooked lean meat. 60g egg + 30g ham or 40g tin natural tuna 120g low-fat fresh cheese or 60g reduced-fat cheese (Cottage cheese, fromage frais, Quark, Spanish Burgos and Manchego, cheese triangles, Roquefort…) 60g boiled or cured ham 30g ham + 30g reduced-fat cheese or 60g fresh cheese + 30g ham	
Pulses* (Choose 1 dish of vegetable for first dish)	90g uncooked or 225g boiled: beans, chickpeas, lentils or 60g uncooked legumes + 30g ham 300g uncooked or 360g boiled fresh peas or 200g raw + 30g ham	1 big plate
Garnish* (when the first course is cereal)	100g. raw or 120g. boiled vegetables	1 small plate
OTHERS		
Bread (Distribute between lunch and dinner)	60g bread or 30g *(when vegetable + potato are eaten)*	2 medium-sized slices
Olive oil	TOTAL DAY: 30g	3 tbsp
DESSERT: *Choose one among*:		
Dairy products	*Choose one among:* 125g low-fat yoghurt 120g semi-skimmed milk	1 unit 1 small glass
Fruit	*Choose one among:* 175g orange, peach, strawberries. 150g apricot, tangerine, pear 125g kiwi, apple, pineapple. 75g banana	1 small unit or medium-sized

Additional file 1
Dietary History model

NAME: DATE: NUMBER:

Date of birth:
Age:
Sex:
Year/School:
Name of father or mother:
Address:
Town /City:
Province:
Postcode:
Telephone:
E-mail:
Weight at birth:

Recent changes in weight:

- How many people live with you?
- Do you usually eat lunch at home or at school?
- If you eat at home, do you eat with your parents or with other adults?
- Who does the cooking?
- Who does the shopping?
- Do you have a microwave, oven or grill?
- Do you eat out at the weekend? And during the week?
- Do you go to fast food restaurants? How often?
- Do your eating habits change at the weekends? YES, NO, Which day?
- Do you have any special daily eating habits?
- What's the first thing you have when you get up?
- Has anything special happened over the last 3 months that's changed your eating habits?
- What do you usually drink during meals?
- Do you usually have second helpings?
- What do you usually eat between meals?
- How frequently do you buy sweets, confectionary or salty snacks?

HABITS

How many meals do you have every day and at what time?
Do you watch TV when you eat?
Do they make you eat food that you don't like?
How long do you take to eat your meals?
When do you feel really hungry?
Do you think you eat healthily?
Do you like cooking for your family?
Do you think you have good healthy eating habits at home?
What do they think in your house about eating? Is getting a healthy diet important or not?
Do you prefer eating on your own or accompanied? Why?
Do you eat on your own in secret? Yes, No. Do you feel bad when you do that?

Additional file 2
Visual Analogue Scale (VAS score)

Visual scale hungry/full

Date: Time: *Name:* *Number:*

The line for each question must be exactly 10 cm (100 mm) long from 0 to 10. From 0 to more patients should draw in how they feel. The dietician should then measure the score in mm with a ruler.

This test can be done referring to the nearest main meal, lunch or supper from the previous day.

Do you feel hungry? How hungry?

Not at all hungry — Very hungry
0_____100mm

Do you feel full? How full?

Not at all full — Absolutely full
0_____100mm

Are you satisfied? How satisfied?

Absolutely empty — I couldn't eat a thing
0_____100mm

Would you like to eat more? How much more?

Nothing — A lot
0_____100mm

Are you thirsty? How thirsty?

Not at all thirsty — I've never been so thirsty
0_____100mm

Additional file 3
Dietary record model

1.- Do you usually eat slowly chewing your food properly?
YES NO
Do you watch TV when you're eating?
YES NO

2.- Have you eaten out (in a restaurant, pizzeria or fast-food place) one day this week?
YES NO

3.- Have you had breakfast before leaving the house every day this week?
YES NO

4.- Have you had a mid-morning snack every day this week?
YES NO
Have you eaten fruit in your mid-morning snack?
YES NO

5.- Have you eaten lunch or dinner on your own one day this week?
YES NO

6.- Have you watched television when you were eating something?
YES NO
Can you remember what it was?

7.- Have you bought something to eat when you were with friends?
YES NO
Can you remember what it was?

8.- Do you usually have second helpings when you eat?
YES NO
What type of food do you usually have for a second helping?

9.- How many times a week do you eat nuts and dried fruit?
a) Never
b) Once
c) Twice
d) Three times
e) Four times
f) More than four times

10.- Do you eat at set times? YES NO
How many times do you eat a day?
a) Two
b) Three
c) Four
d) Five
e) Six
f) More than six

11.- Do you usually eat everything that is served on your plate?
YES NO

Does it sometimes seem to be a lot of food?
YES NO

At which meal? a) Breakfast; b) Mid-morning break; c) Lunch; d) Mid-afternoon break; e) Dinner.

Additional file 4
Survey for compliance with the diet

Part A:

1.- Do you have olive oil? Do you know how much you have every day? (including oil used for cooking, meals out, salads, etc)

2.- How many portions of vegetables and greens do you have every day?

3.- How many pieces of fruit (including fresh fruit juice) do you have every day?

4.- How many portions of red meat, hamburgers, sausages and spicy cold meats do you have every day?

5.- Do you sometimes eat between meals? What sort of food do you eat then?

6.- How many carbonated and / or sugary drinks (soft drinks, sodas, colas, pop, lemonade, etc.) do you have every day?

7.- Do you drink any alcohol? How many alcoholic drinks do you have during the weekend?

8.- How many portions of legumes do you have a week?

9.- How many portions of fish or seafood do you have a week?

10.- How many times a week do you eat bought shop cakes (not homemade) and similar sweet products like biscuits, caramel custards, cakes, confectionary etc?

11.- Do you prefer to have food like chicken, turkey or rabbit rather than red meat, pork, hamburgers or sausages?

Part B

1.- Do you usually eat slowly taking time to chew your food properly? Do you watch TV when you eat?

2.- Have you eaten out (in a restaurant, pizzeria or McDonalds) one day this week?

3.- Have you had breakfast before leaving the house every day this week?

4.- Have you had a mid-morning break every day of the week? Have you had fruit for your mid morning break?

5.- Have you eaten lunch or dinner on your own any day this week?

6.- Have you watched TV when you were eating? Can you remember what it was?

7.- Have you bought something to eat when you were with friends? Can you remember what it was?

8.- Do you usually have second helpings? What sort of food do you have second helpings of?

9.- How many times have you eaten nuts and dried fruit this week?

10.- Do you eat your meals at set times? How many times do you eat a day?

11.- Do you usually eat everything that is served onto your plate? Does it sometimes seem too much?

Additional file 5
Nutritional knowledge survey

Classify the following foods into main food groups (cereals, vegetables, fruits, dairy products, meat, fish, pulses, dry fruits, cold meats, fats, pastries, sweets):

Lentils	Rice	Chard	Carrots
Banana	Green beans	Sardine	Leek
Chickpeas	Sole	Kiwi	Cauliflower
Sponge cake	Cookies	Chicken	Cabbage
Olive oil	Veal	Lettuce and tomato	Macaroni
French Omelette	Pork loin	Beef liver	Yogurt
Rabbit	Orange	Noodle soup	Pear
Sirloin steak	Milk	Apple	Beans
Boiled ham	Courgette	Grapefruit	Pineapple juice
Nuts	Cured ham	Sliced bread	Strawberries
Marmalade	Butter	Sugar	Borage
Cheese	Croissant	White bread	Hazelnuts
Peanuts	Lemon	Salmon	Potatoes
Hake	Spinach	Crème caramel	Cardoon

Which three do you like best?

Which three do you like least?

Do you know what the following are: **Proteins, Carbohydrates, Lipids, Vitamins and Minerals**? (Explain them briefly).

How would you define the term **Balanced Diet**?