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***Nutrition science education and information:
facing these new challenges in catering schools and oncology centres.***

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**NUTRITION SCIENCE EDUCATION AND INFORMATION: FACING THESE NEW
CHALLENGES IN CATERING SCHOOLS AND ONCOLOGY CENTRES.**

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CHAPTER 1

INTRODUCTION

1.1 Global burden of diseases and dietary factors

In 2015, an estimated 40 million deaths occurred due to noncommunicable diseases (NCDs), accounting for 70% of the overall total of 56 million deaths. The majority of such deaths were caused by the four main NCDs, namely: cardiovascular disease (accounting for 45% of all NCD deaths); cancer (22%); chronic respiratory disease (10%); and diabetes (4%) [1].

Of the six WHO regions, the European Region is the most affected by noncommunicable diseases, and their growth is startling. The impact of the major NCDs (diabetes, cardiovascular diseases, cancer, chronic respiratory diseases and mental disorders) is equally alarming. Taken together, these five conditions account for an estimated 86% of the deaths and 77% of the disease burden in the Region [2].

The risk for these NCDs rises up with increases in Body Mass Index (BMI). BMI is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2). For adults, WHO defines overweight and obesity as follows: overweight is a BMI greater than or equal to 25; obesity is a BMI greater than or equal to 30. BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals. In 2016, BMI was the fifth-ranked Level 3 risk factor for death globally, accounting for more than 4.5 million deaths and 135.4 million attributable disability-adjusted life-years (DALYs) [3].

An improved understanding of dietary patterns and changes around the world is crucial to inform, design, and implement strategies to reduce global obesity-related diseases. Nutritional epidemiology has established the associations of specific foods and nutrients or overall dietary patterns with cancers, cardiovascular diseases, and diabetes and with intermediate outcomes such as weight gain, increased blood pressure, and insulin resistance and hyperglycemia. The large body of observational studies is increasingly complemented by well-designed randomized trials that have, for example, shown the benefits of lower salt intake, the replacement of saturated fats with polyunsaturated fats, and healthy dietary patterns [4]. Another recent study evaluated global consumption levels of key dietary items (foods and nutrients) in order to characterize global changes (or trends) related to NCDs. The investigation focused the attention on 17 foods and nutrients having at least probable or convincing evidence of effects on major NCDs,

including cardiovascular diseases, diabetes, and diet-related cancers. The authors found that between 1990 and 2010, global dietary patterns based on more healthy items (fruits, vegetables, beans and legumes, nuts and seeds, whole grains, milk, total polyunsaturated fatty acids, fish, plant omega-3s, and dietary fiber) improved modestly (by 2.2 points, 95% UI 0.9–3.5). By contrast, global dietary patterns based on fewer unhealthy items (unprocessed red meats, processed meats, sugar sweetened beverages, saturated fat, trans fat, dietary cholesterol, and sodium) worsened (–2.5; 95% UI –3.3 to –1.7), indicating concomitant increased consumption of these unhealthy foods and nutrients. Improvements in healthier foods were seen in high-income and middleincome countries; by contrast, no improvements were seen in the poorest regions. They conclude that even if the consumption of healthier foods and nutrients has modestly increased during the past two decades, the consumption of unhealthy foods and nutrients has increased to a greater extent [5].

Moreover, in The Global Burden of Diseases, Injuries, and Risk Factors (GBD) Study 2016, poor dietary habits were the second leading risk factor at Level 2 of the hierarchy for mortality globally, accounting for nearly one in every five deaths. Suboptimal diet was also the second-leading risk factor for DALYs globally, accounting for 9.6% (8.2–11.1) of all DALYs. Among the individual dietary risks, a diet low in whole grains accounted for the largest number of deaths (4.6%), followed by a diet low in fruits (4.3%) and a diet high in sodium (4.2%). Leading dietary risks for DALYs were low intakes of whole grains (2.6%), fruits (2.6%), and nuts and seeds (2.1%). The greatest increase in attributable deaths and DALYs between 1990 and 2016 occurred for a diet high in red meat, followed by a diet high in sugar-sweetened beverages and a diet low in milk, respectively [3].

1.2 Online health and nutrition information

Socio-technical systems and microblogging platforms such as Facebook and Twitter have created a direct path from producers to consumers of content, changing the nature and speed of information and interaction between individuals and health organizations [6]. Particularly, thanks to the advances in these new communication technologies, there has been an explosion in the amount of available information regarding several health-related topics. Nowadays searching for health information is the third most popular use of the Internet. In the United States, periodic telephone surveys of American adults conducted by the Pew Research Center revealed that the percentage of adults who look for health information online increased substantially between 2002 and 2008. By 2006, 80% of American Internet users had searched for information on at least 1 health-related topic [7]. Significant growth in the use of the Internet for health purposes was also found in seven European countries participating in a survey [8,9,10]. In Italy, a multicentre survey

found that the rate of e-health use (use of the Internet for any health-related purposes) accounted for 56.5% of Internet users [11].

Recent research highlights the Internet also as an increasingly important source of nutrition information and estimates that almost half of Internet users search for information on diet and nutrition. For example, in 2007, among the Norwegian population that uses the internet for health purposes, 44% had searched for information about nutrition [12]. Another investigation on 6420 Canadian adults showed that magazines, newspapers, and books were the second most common source of nutrition information in 2004 (used by 73% of respondents), while in 2008 the Internet became the second most common source of nutritional information (used by > 50% of respondents) [13]. An Australian survey found dramatic growth in use of the Internet as a main source of nutrition and dietary information from 9.1% in 2004 to 33.7% in 2012, when it became the most popular main source of nutrition information [14].

In this context, the knowledge regarding the role of nutrition in health promotion is no more exclusively available to health professionals, and people want to receive as much information as possible. Unfortunately, misinformation on internet and social media is pervasive and represents one of the main threats to our society [15]. Moreover, many individuals have beliefs about foods and nutrition that are not necessarily grounded in empirical evidence, and such beliefs, coupled with food awareness and misinformation, does not necessarily lead to proper behavior change [16]. Accordingly, an interesting position paper of the American Dietetic Association (ADA) states that food and nutrition misinformation can have harmful effects on the health, well-being, and economic status of consumers [17]. In 2009 a multicenter survey was designed to provide information concerning the rate of Internet use for health-related purposes in the general Italian population and to assess the possible behavioral consequences. Respondents were asked if, after their search, they made any decisions that the medical doctor (during the interview) classified in “choices in health delivery”, “choices in self-medication”, “negative behaviors”, “positive behaviors”. The most relevant and significant results were found in the “self-medication” and “negative behaviors” categories. The rate of users adopting any dangerous modifications of behavior based on information found on the Internet was quite high and noteworthy, especially in those with chronic diseases. These results are very important because such behaviors may be dangerous, especially if they are executed on the basis of false information [11]. Also in a European Survey, among the factors that positively affected the use of Internet for health purposes there was the presence of long-term illness or disabilities [18]. There is growing evidence that what people read in the media can affect their health behaviors and given the abundance of misreporting about

diet and cancer in the media and online, cancer survivors are one of the targets more at risk of misinformation [19].

1.3 Influencing food choices

In the context of both high incidence of diet-related chronic diseases and the ever-increasing bulk of available information about health and nutrition, it becomes essential to explore and better understand the impact of these ongoing issues on people's food choices. In this way, it is possible to know who is more easily influenced, the entity and quality of food choices triggered by this situation, and accordingly build up focused interventions.

In an attempt to influence food choices and facilitate the adoption of better dietary patterns, several nutrition-education interventions and nutrition tools have been developed. These initiatives represent a variety of strategies such as simplifying the labelling of food products, improving dietary behaviour through food environment changes, developing targeted digital tools and food reformulation. In addition, nutritional education alone is increasingly recognized as being unlikely to deliver the scale of change required. Therefore, a truly multi-disciplinary approach may be the right plan of action [20].

Regarding food labelling, one recent study showed the efficacy of a visual presentation of nutrient information on the ability of users to process and recall that information in a simulated environment, compared with a standard numerical presentation. The application of this graphical method in a cafeteria also changed purchasing behaviour toward the intended direction (reducing of calories purchased without reducing protein purchased), demonstrating the power of a well-designed communication message on guiding food choices [21]. Also the presence of words with healthy symbolic meaning can influence food choices. For example, it was shown that simply indicating the ingredient sugar as "fruit sugar" leads to a higher perceived healthiness of the ingredient, compared with the labelling as "sugar" [22].

A systematic literature review conducted in 2015 suggests that environment changes in tertiary education settings in the United States and Europe, like colleges and universities, may improve dietary behaviours. Interventions such as food labelling, promotional materials, increasing the availability of healthy products, and providing price incentives to increase purchases of healthy foods were identified as being potentially useful. Particularly, increasing the availability of healthy foods and decreasing portion size of unhealthy foods improved dietary intake [23]. Restaurants also represent an important setting for interventions to improve the food environment, even though a review of community-based restaurant interventions indicates that the level of evidence available across intervention categories is still limited. However, among the revised studies, there

was sufficient evidence to support the implementation of interventions that pair the strategies classified as of “point-of-purchase information” (healthy choices, based on nutrition criteria, on a menu, menu board, or sign) with “Availability” (addition of healthy choices to the menu or modification of menu items to make them healthier) [24].

The growth in mobile technologies has also stimulated the growth in health and fitness apps to provide behavioural interventions that can reach large populations. A recent systematic review of the literature indicates that apps can be an effective tool to improve health behaviours. Despite the potential of apps, half of the interventions identified, used apps in conjunction with other intervention strategies. These multi-component interventions appeared to be more effective than stand-alone app interventions [25].

There is a growing interest in the potential of interventions aimed to change lifestyle factors, such as diet, also for secondary prevention. Projections also indicate that this segment will expand rapidly as a result of aging, continued advances in early detection, and rates of cure. Moreover, this population shows higher levels of interest in multiple behaviour interventions. Thus, the disease diagnosis or event may signal an opportune time - a teachable moment - for undertaking health behaviour change and all the initiatives presented above can have even more impact on this specific target [26,27,28].

Taking into account the central role of communication in the different types of interventions for health promotion and secondary prevention, more effort is required in order to disseminate clear messages. One of the approaches that can guarantee the appropriateness of communication interventions and, at the same time, contrast the current misinformation, is to build up messages based on solid scientific evidences and institutional sources.

1.4 Aims of the doctoral thesis

As previously mentioned, there is convincing body of evidence that dietary patterns and physical activity cannot only influence existing health status, but also determine whether an individual will develop chronic diseases such as cancer, cardiovascular disease and diabetes. According to the WHO Report “Diet, nutrition and the prevention of chronic diseases” there is a need for data on current and changing trends in food consumption, including research on what influences people’s eating behaviour and physical activity and what can be done to address this. There is also a need, on a continuing basis, to develop strategies to change people’s behaviour towards adopting healthy diets and lifestyles, including research on the supply and demand side related to this changing consumer behaviour [29]. In line with these statements, in the present thesis are described two distinct projects:

1. SMARTFOOD, a school-based training program aimed to improve knowledge on nutrition, health and food preparation of apprentice cooks;
2. ECHO, a proposal to investigate dietary changes after cancer diagnosis in the Italian population, starting from the analysis of the available literature about this issue.

There are some key-concepts in the “Strategic directions and recommendations for policy and research” section of the aforementioned WHO call for action, that can mark the work carried out during the doctoral program and sustain the aims that guided the two main projects:

a. Effective communication

The core role of health communication is to bridge the gap between technical experts and the general public. The proof of effective communications is its capacity to create awareness and improve knowledge. In this view, for the SMARTFOOD project we set up a highly scientific and evidence-base lesson plan but at the same time easy to understand for the students. We often used graphics and infographics to explain difficult topics and summarize key concepts, in order to improve students’ knowledge and fill the gap between science and society. Regarding the ECHO project, we planned to investigate what kind of changes cancer patients undertake, in order to intercept patients’ information needs and guide them to make conscious choices. Moreover, the ECHO project will allow us to know the main sources of information that guided the changes and the type of professionals they referred to. Thereby, the purpose is to improve patients’ awareness by means of the most common communication channels and create training programs targeted to specific professional figures.

b. Partnerships

Change can be accelerated if several groups establish alliances to reach the common

objective. Taking this into account, we launched a national network between public catering schools, with the support of the Italian Ministry of Education, in order to achieve higher social impact of the SMARTFOOD project. In the same perspective, the ECHO project involves about 20 oncology centres across Italy, linked to the Italian Association of Medical Oncology.

c. Enabling environments

As consumers increase their preference for healthy diets, there is the need to orient food offer to respond to this emerging demand. In addition, individual change is more likely to be facilitated and sustained if the environment where choices are made supports options that are perceived both healthy and rewarding. The ideal is an environment that not only promotes but also supports and protects healthy living.

One of the long-term outcomes of the SMARTFOOD project is to have more competent and skilled caterers, able to offer healthy and rewarding food choices, consequently improving restaurant and canteen environment. In the current scenario of emerging demand not only of healthy food, but also of healthy nutrition information, the results derived from the ECHO project can shed the light on cancer patients' interests regarding diet. This data can give rise to health facilities that could drive better food choices thanks to the presence of trained health professionals and visual educational materials.

Additionally, according to the "Action plan for the prevention and control of noncommunicable diseases in the WHO European Region" new scientific information will be essential to permit adjustment not only of the policy levers, but also of the strategic processes to introduce change. This constitutes an important focus for applied research that would help people achieve and maintain healthy dietary patterns in a simple and rewarding manner, contextualized in specific settings [30].

The present doctoral thesis explores two of the several settings of application of communication-based nutrition interventions.

Firstly, it explores the efficacy of nutrition science education, aimed to improve the knowledge of students through frontal lesson and practical cooking sessions in catering schools.

Secondly, it explores the available literature about dietary changes after cancer diagnosis, the reasons and the common sources of information that drive these changes, in order to build up a survey for the Italian population and consequently support people affected by or living with NCDs.

CHAPTER 2

SMARTFOOD: SCIENCE AND NUTRITION FOR THE FUTURE COOKS

2.1 Background and rational

Eating out-of-home and consuming ready-prepared food have been increasing during the last decades as a result of social, cultural and environmental changes [31]. In response, the number of studies on eating out of home has increased across the world, not only in developed countries [32] but also in many middle-income and rapidly growing developing countries [33].

Regarding Europe, most of the available data come from the European Prospective Investigation into Cancer and Nutrition (EPIC) study, a multi-centre prospective cohort based on healthy, middle-aged subjects who agree, following an active invitation, to participate in the study and to have their health status followed up for the rest of their lives. The project started in 1990, initially in seven countries (from north to south: UK, Germany, Netherlands, France, Italy, Spain and Greece), later nine, when the study was expanded to include centres in Denmark and Sweden. The study is now based in 22 collaborating centres in the nine European countries and includes populations characterized by large variations in dietary habits and cancer risk. Data are collected on diet, physical activity, sexual maturation and reproductive history, lifetime consumption of alcohol and tobacco, previous and current illnesses and current medication [34].

In the context of out-of-home (HO) eating, a single 24-h dietary recall (24-HDR) was collected from a random sample of 5–12% of each EPIC cohort, for a total of 36 994 individuals. For each eating (and drinking) occasion recalled in the 24-HDRs, the place of consumption was reported. Locations other than household premises included the following: restaurant, friend's house, work, cafeteria, bar, fast food establishment, school, street, car/boat and 'other'. In general, the contribution of OH eating to total energy intake decreased with increasing age in both men and women, and this trend was more evident in the Italian centres. In particular, the contribution of OH eating to total energy intake ranged from 40.4% (35–44 age class, Turin) to 7.0% (65–74 age class, Varese) in men and from 36.9% (35–44 age class, Ragusa) to 5.9% (65–74 age class, Varese) in women. The contribution of OH eating to total energy intake was higher in men than in women, both overall and in all age classes, except in the Scandinavian centres where it was similar in both genders [35]. According to a recent market research, eating out at lunch in Italy has been increasing in the last decades, with lunch frequently consumed at canteens (36.6%) and restaurants (13.3%) [36].

These data are also confirmed by a web-based survey regarding OH eating frequency in more than 3000 European citizens, in which the highest rates of eating out at lunchtime ≥ 3

times a week were observed in Denmark (23.2%) and in Italy (21.3%). Moreover, in Italy considerable percentages of subjects ate out for the evening meal on a regular basis (25.6%, 1-2 times a week) [37].

Data analysis from the HECTOR (Eating Out: Habits, Determinants and Recommendations for Consumers and the European Catering Sector) project found that the contribution of eating out to daily energy intake was higher in Central and North than in South Europe. However, even if Europeans consumed more calories through eating out at work than at restaurants, in Italy and Austria there was an opposite situation and the energy intake at restaurants was higher than at work, among both men and women [38]. With the same data-set they also noted that the OH dietary choices were more energy dense than the at home (AH) ones. In particular, sugar, desserts, sweet and savory bakery products and beverages were consumed more OH than AH by both men and women in the majority of the populations under study [39].

Given the growing importance of OH consumed food in modern life, the catering sector plays an important role in ensuring healthy eating. The WHO fully recognized the key role of catering sector in food provision and emphasized the governments' action in ensuring this sector recognizes its responsibility in making healthier food choices available for consumers [40,41].

A review of the literature was conducted to identify appropriate OH eating and health-related policies for Australia, Canada, the US and the WHO's European Region (EUR) Member States. This review found that catering sector was included in 41% of the nutrition policies and encompassed a variety of different recommendations to increase the quality of food served OH. For example, Colorado and Slovenia are trying to improve the quality of food provided OH with voluntary menu labelling initiatives to indicate healthier menu choices; Washington aims to increase access to healthier foods OH and has recommended altering recipes to make them lower in energy and fat. Only 29% of reviewed nutrition policies recommended that catering staff should have training in nutrition. It is interesting to note that the EUR policies were more likely to recommend this (50%) compared with the other countries (Australia: 0%; Canada: 0%; US: 11%), by advocating that the catering staff be trained either at the beginning of, or during their career, to ensure they have adequate expertise to plan and cook nutritious meals. Slovenia had the most detailed specification for this criterion and recommended that nutrition and health should be incorporated in the curriculum of all catering courses [42].

Lachat et al presented a very interesting SWOT analysis evaluating the strengths, weaknesses, opportunities and threats for a number of strategies for promoting healthier eating out, in order to identify and assess actions through which the catering sector could be engaged in such strategies in Europe. During a 2 days workshop, involving thirty-eight

participants from sixteen European countries and international organizations, came up that engaging in strategies for healthy eating may present interesting business opportunities for the catering sector, since healthy eating is a current societal trend paralleled with an increased demand for traditional and local foods. Among the weaknesses is the catering sector's dependence on the supply of ingredients, the lack of financial means, the human resources profile (predominantly untrained, migrant or low skilled) and limited technical capacity with regard to determination of the nutritional composition of the food prepared [43].

In this context, it is reasonable to consider that the proper management of the catering industry could promote healthy food choices, starting from a good training of professionals in the hospitality industry. A key issue to put forward for the catering sector is to provide training to improve knowledge on nutrition, health and food preparation of apprentice cooks that will look at the world of work with a greater awareness of how food can affect health.

2.2 Methods

2.2.1 Participants and study design

The study was carried out during the 2015-2016 school year and the population consisted of students (17-18 years old) from 10 catering schools located in four Italian regions (4 in Lombardy, 2 in Tuscany, 2 in Lazio and 2 in Sicily) divided in two-arms [Figure 2.1]. The intervention arm (N=128) received six theoretical lessons regarding health and nutrition and four practical sessions in the kitchen, in collaboration with resident cooking teachers; the control arm (N=116) followed the standard school program. At the beginning of the school year, a thirty-questions multiple-choice questionnaire was administered to assess the students' level of knowledge regarding science and nutrition. An identical questionnaire was administered at the end of the school year to assess the efficacy of the intervention. At the end of the school year, a national cooking contest was organized to challenge the students involved in the project.

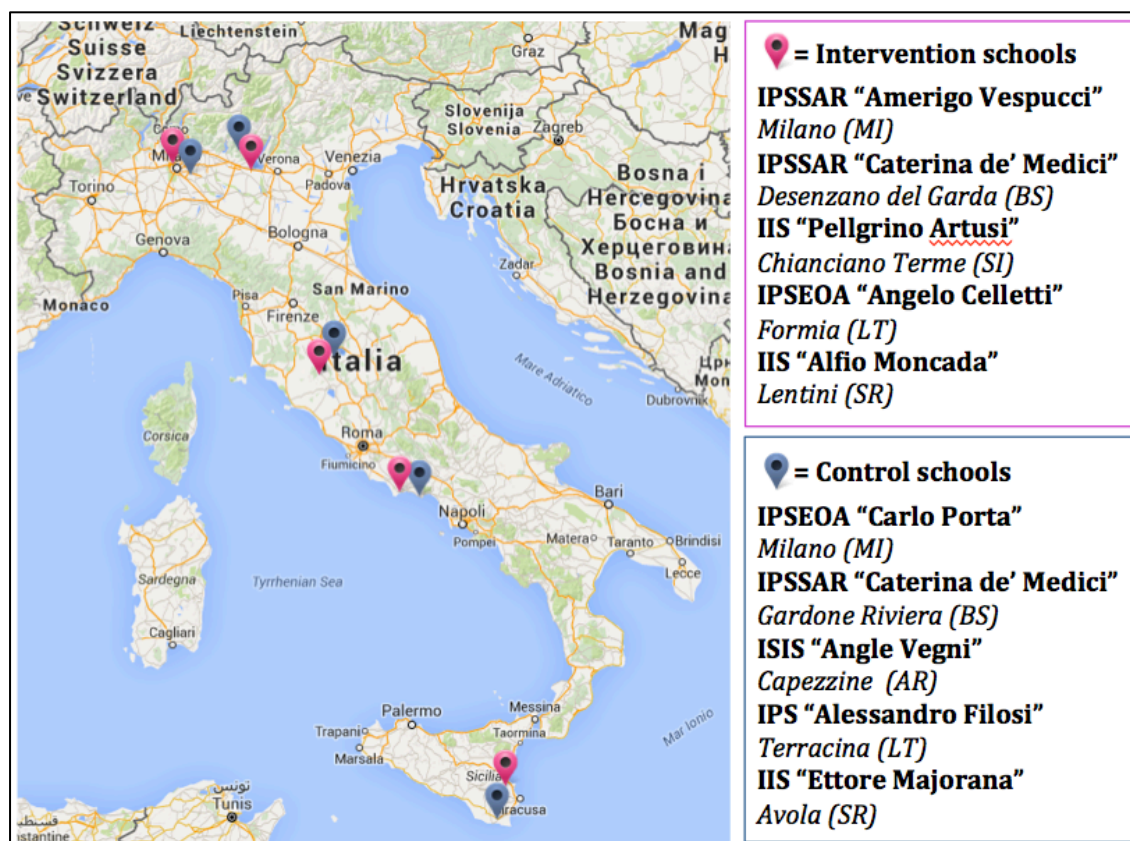


Figure 2.1 catering schools involved in the project

2.2.2 Intervention

The five catering schools in the intervention arm were involved in six theoretical lessons and four cooking classes throughout the school year, during the regular school days.

Theoretical lessons

The themes of the six theoretical lessons were decided by the SmartFood team at the European Institute of Oncology and the selection was based on the large previous experience in the science and nutrition communication field. One PowerPoint presentation has been designed for each theme; all the six presentations had a similar structure, with an introduction to the theme, a core of scientific contents and a summary of the key concepts contextualized in the cooking practice. The slides were characterized by the presence of several visual messages, such as infographics and illustrations.

All the presentations, with other helpful educational material, were provided to the students in a USB memory. A copy of all the slides is showed in the Appendix 2.1.

Nutritional science research (NR)

In the first lesson we gave students an overview about the scientific method used to develop nutritional evidences and guidelines. We deepened the following topics:

- need and complementarity of in vitro and in vivo models ;

- different types of human studies, clinical and observational, with a focus on nutritional epidemiology;
- critical interpretation of the scientific evidences;
- objectives, process and time required to develop nutritional guidelines.

Metabolic syndrome (MS)

We highlighted the link between overweight, obesity and the risk of developing diabetes and cardiovascular diseases (CVD). We described the following topics:

- concept of glycemic index and glycemic load, how to calculate, use and interpret them;
- insulin mechanism and the risk related to the alteration of it;
- insulin sensitivity alteration as a starting point for the MS;
- other dietary factor related to MS and CVD, such as salt, dietary fiber, polyunsaturated fatty acids.

Cancer prevention (CP)

In the first part of this lesson we explained the scientific method used by the World Cancer Research Fund (WCRF) to classify the evidences regarding food, nutrition, physical activity and the risk of cancer. Then, we described the latest WCRF report :

- the 10 recommendations included in the report;
- examples of studies included in the report;
- how to translate into practice and adapt the 10 recommendation to the daily life;
- summed up the prevention estimates in the Italian context.

Food sustainability (FS)

In this lesson we introduced different themes, all contextualized in the environmental impact of the diet. In particular we described:

- the most common indicators of food sustainability;
- the most sustainable sources of different macro and micronutrients;
- the health benefits of a sustainable diet;
- how to carry out an healthy and sustainable diet.

Mediterranean Diet (MD)

We narrated the evolution of the scientific evidences regarding the Mediterranean Diet (MD), from Ancel Keys' studies to the most recent publications, with a focus on these specific points:

- findings from the Seven countries study;
- findings from the PREDIMED study;
- food groups and key components of the traditional MD;

- Science and cultural updates of the MD pyramid.

SmartFood Guidelines (SG)

In the last lesson we summed up the key points of the previous lessons and we provided practical advices in the form of guidelines:

- “SMART ingredients” to develop healthy recipes;
- different cooking methods in order to improve the bioavailability of protective components;
- the right combination of ingredients, in order to realize healthy recipes and meals;
- list of ingredients and cooking methods that could not be considered “healthy”.

Teachers

The power point lessons, ready to use, were provided to registered nutritionist of the SmartFood network, that were resident in the area close to the schools involved in the project. We planned a two-days training at the European Institute of Oncology, before starting the project, with all the nutritionist. This meeting was realized in order to instruct them about the aims of the project, the contents of the lessons and the mode in which these contents had to be delivered.

Practical sessions

Four cooking lessons were planned after the theoretical classes, in order to have the opportunity to participate and interact with the cooking teacher. Specific guidelines were drawn up for each cooking class, to ensure the congruence of the recipes with the content of the lessons. All the menus and the recipes were designed by the cooking teacher, starting from the guidelines, with the help of the students and the advice of the nutritionists. A copy of the guideline and examples of menus are showed in the Appendix 2.2.

2.2.3 Questionnaire

A multiple-choice questionnaire with thirty questions about the nutritional themes taught during the six lessons was designed. Each question had four answers and only one was correct. The questionnaire was delivered at the beginning of the school year, to the 10 catering schools, to assess the level of knowledge regarding science and nutrition; then, the same identical questionnaire was delivered at the end of the school year to assess the efficacy of the intervention.

Questions and related answers are reported in the Appendix 2.3.

Project activities are summarized in Figure 2.2

	July 2015	September 2015	October 2015	November 2015	December 2015	January 2016	February 2016	March 2016	April 2015
Teachers training									
Questionnaire									
Theoretical lessons									
Practical sessions									

Figure 2.2 project timetable

2.2.4 Data analysis

Questionnaires were collected and analyzed. Based on given answers a *SmartFood* (SF) score was calculated for each region and arm, both at the beginning and at the end of the school year. The SF score of each single questionnaire could have a minimum value of 0 and a maximum of 600 (max 100 points for each theme).

Normality of continuous variables was checked and rejected. Medians and interquartile ranges (IQR) were calculated for continuous variables, and non-parametric tests were employed to compare outcomes between groups.

The Kruskal-Wallis test was performed to pairwise compare the median score of the four regions at baseline.

The Mann-Witney (U) test was used to compare intervention and control groups, in each region, at baseline. The same test was applied to compare the median score of each group at the beginning and at the end of the study (T0 and T1 respectively).

Six different scores were also calculated, by grouping the given answers according to the six themes explained in the theoretical lessons: *NR* (*Nutritional science research*) score, *MS* (*Metabolic syndrome*) score, *CP* (*Cancer prevention*) score, *FS* (*Food sustainability*) score, *MD* (*Mediterranean Diet*) score, *SG* (*SmartFood Guidelines*) score. The same data analysis described above were performed for each score.

All the statistical tests were two-tailed, and $p < 0.05$ was taken as indicating statistical significance.

Moreover, a descriptive analysis was made for each question, to examine all factors involved in the changing of cultural-nutritional awareness, and chi-square test was used to compare the % of right answer at T0 and T1.

2.3 Results

2.3.1 Baseline characteristics

The total number of administered questionnaires and the median values with interquartile range (IQR), for each region at baseline, are shown in Table 2.1.

Table 2.1 Administered questionnaires and median SF score at baseline

	Lombardy	Tuscany	Lazio	Sicily	Total
Administered questionnaires	N=93	N=60	N=55	N=36	N=244
Median SF score (IQR)	306 ^a (271-362)	320 ^a (274-381)	284 ^b (231-311)	230 ^c (200-269)	297 (250-340)

^{a,b,c} Post hoc Pairwise Comparisons tests for the Kruskal-Wallis was performed
Significance was accepted for $p < 0.05$

The overall median SF score at baseline was 297 (IQR 250-340). Sorting data by region and comparing the median SF scores, significant differences were found among regions at baseline (Table 2.1). Tuscany and Lombardy had the higher SF score, 320 (IQR 274-381) and 306 (IQR 271-362), respectively, followed by Lazio, 284 (IQR 231-311), and Sicily, 230 (IQR 200-269).

A significant difference was found in the overall SF score between intervention and control at baseline, 309 (IQR 260-367) and 274 (235-316) respectively ($p < 0.001$). However, when data were clustered by region, a significant difference in the baseline score between intervention and control was observed only for Tuscany ($p < 0.001$) (Table 2.2).

Table 2.2 Median SF score at baseline, by region and arm

Region	Intervention group Median SF score (IQR)	Control group Median SF score (IQR)	<i>p</i>-Value*
Lombardy	328 (285-367) (N=49)	288 (266-357) (N=44)	0.171
Tuscany	370 (314-408) (N=30)	297 (250-326) (N=30)	<0.001
Lazio	294 (258-320) (N=30)	272 (178-306) (N=25)	0.085
Sicily	231 (212-272) (N=19)	227 (141-258) (N=17)	0.738
Total	309 (260-367) (N=128)	274 (235-316) (N=116)	<0.001

**p*-Value from Test U of Mann-Whitney for differences between intervention and control at baseline

2.3.2 Changes in SF score

Median SF scores with IQR for both T0 and T1 are shown in Table 2.3. Overall data of the intervention group show a significant difference between T0 and T1, 309 (IQR 260-367) and 421 (IQR 359-466) respectively, ($p < 0.001$). No significant difference was found in the control group, between T0, 274 (IQR 235-316), and T1, 286 (IQR 238-333), ($p = 0.238$).

Table 2.3 Median SF score at T0 and T1, by region and arm

Region	T0	T1	p-Value*
	Median SF score (IQR)	Median SF score (IQR)	
Lombardy			
Intervention arm	328 (285-367)	429 (378-474)	<0.001
Control arm	288 (266-357)	294 (246-335)	0.744
Tuscany			
Intervention arm	370 (314-408)	433 (376-470)	<0.001
Control arm	297 (250-326)	318 (274-359)	0.112
Lazio			
Intervention arm	294 (258-320)	339 (300-395)	<0.001
Control arm	272 (178-306)	271 (221-306)	0.669
Sicily			
Intervention arm	231 (212-272)	466 (437-480)	<0.001
Control arm	227 (141-258)	262 (197-280)	0.074
Total			
Intervention arm	309 (260-367)	421 (359-466)	<0.001
Control arm	274 (235-316)	286 (238-333)	0.238

*p-Value from Test U of Mann-Whitney for differences between T0 and T1 for both intervention and control arms

Lombardy

The median SF score in the intervention group significantly improved, changing from 328 (IQR 285-367) at T0 to 429 (IQR 378-474) at T1, ($p < 0.001$). No significant difference was found in the control group, between T0, 288 (IQR 266-357), and T1, 294 (IQR 246-335), ($p = 0.744$).

Tuscany

The median SF score in the intervention group significantly improved, changing from 370 (IQR 314-408) at T0 to 433 (IQR 376-470) at T1, ($p < 0.001$). No significant difference was found in the control group, between T0, 297 (IQR 250-326), and T1, 318 (IQR 274-359), ($p = 0.112$).

Lazio

The median SF score in the intervention group significantly improved, changing from 294 (IQR 258-320) at T0 to 339 (IQR 300-395) at T1, ($p < 0.001$). No significant difference was found in the control group, between T0, 272 (IQR 178-306), and T1, 271 (IQR 221-306), ($p = 0.669$).

Sicily

The median SF score in the intervention group significantly improved, changing from 231 (IQR 212-272) at T0 to 466 (IQR 437-480) at T1, ($p < 0.001$). No significant difference was found in the control group, between T0, 227 (IQR 141-258), and T1, 262 (IQR 197-280), ($p = 0.074$).

2.3.3 Changes in single theme scores

Median scores with IQR of each theme, for both T0 and T1 are shown in Table 2.4. Significant differences were found at baseline between intervention and control groups for NR score ($p < 0.001$), CP score ($p < 0.05$), FS score ($p < 0.05$) and MD score ($p < 0.05$). No differences were found for MS score and SG score, ($p = 0.098$ and $p = 0.755$).

Significant differences were found between T0 and T1 for the intervention group, for five out of six scores: NR ($p < 0.05$), MS ($p < 0.001$), CP ($p < 0.001$), FS ($p < 0.001$) and MD ($p < 0.001$). No significant difference was found for the SG score ($p = 0.187$). In the control group, no significant differences were found for any score, between T0 and T1 (Table 2.4).

Table 2.4 Single theme scores at T0 and T1, by region and arm

Theme	T0 Median score (IQR)	T1 Median score (IQR)	p -Value*
NR score			
Intervention arm	67 (67-100)	100 (67-67)	<0.05
Control arm	67 (67-67)	67 (67-67)	0.796
p -Value**	<0.001	<0.001	
MS score			
Intervention arm	57 (43-71)	71 (57-86)	<0.001
Control arm	43 (43-57)	43 (43-57)	0.941
p -Value**	0.098	<0.001	
CP score			
Intervention arm	43 (29-57)	57 (43-71)	<0.001
Control arm	43 (29-57)	43 (29-57)	0.956
p -Value**	<0.05	<0.001	
FS score			
Intervention arm	40 (40-60)	80 (60-100)	<0.001
Control arm	40 (20-60)	40 (40-60)	0.212
p -Value**	<0.05	<0.001	
MD score			
Intervention arm	60 (40-80)	80 (80-100)	<0.001
Control arm	40 (40-60)	60 (40-60)	0.055
p -Value**	<0.05	<0.001	
SG score			
Intervention arm	33 (33-33)	33 (33-33)	0.187
Control arm	33 (33-33)	33 (33-33)	0.830
p -Value**	0.755	0.059	

* p -Value from Test U of Mann-Whitney for differences between T0 and T1 for both intervention and control arms

** p -Value from Test U of Mann-Whitney for differences between intervention and control for both T0 and T1

Nutritional science Research (NR) score

Median NR scores with IQR for both T0 and T1, divided by region, are shown in Table 2.5.

When data are divided by region, differences at baseline between intervention and control groups remain statistically significant for Lombardy, Tuscany and Lazio ($p < 0.05$). No significant difference was found for Sicily at baseline.

In Lombardy, the NR score significantly improved in the intervention group, from 67 (IQR 67-100) at T0 to 100 (IQR 100-100) at T1, ($p < 0.05$). In Tuscany and Sicily, the median NR score improved, but changes were not supported by statistical significance. In Tuscany, the score changed from 67 (IQR 67-100) to 100 (IQR 100-100), ($p = 0.264$); in Sicily from 67 (IQR 33-67) to 67 (IQR 67-67), ($p = 0.093$). No improvement was addressed for Lazio, where the NR score remained 67 (IQR 67-100). No significant differences between T0 and T1 were found in control groups for any region.

Table 2.5 Median NR score at T0 and T1, by region and arm

Region	T0 Median NR score (IQR)	T1 Median NR score (IQR)	<i>p</i>-Value*
Lombardy			
Intervention arm	67 (67-100)	100 (100-100)	<0.05
Control arm	67 (67-100)	67 (67-67)	0.788
<i>p</i> -Value**	<0.05	<0.001	
Tuscany			
Intervention arm	67 (67-100)	100 (100-100)	0.264
Control arm	67 (67-100)	67 (67-67)	0.582
<i>p</i> -Value**	<0.05	<0.001	
Lazio			
Intervention arm	67 (67-100)	67 (67-100)	0.160
Control arm	67 (33-67)	67 (67-67)	0.264
<i>p</i> -Value**	<0.05	<0.05	
Sicily			
Intervention arm	67 (33-67)	67 (67-67)	0.093
Control arm	67 (33-67)	67 (33-67)	0.958
<i>p</i> -Value**	0.975	0.136	

* *p*-Value from Test U of Mann–Whitney for differences between T0 and T1 for both intervention and control arms

** *p*-Value from Test U of Mann–Whitney for differences between intervention and control for both T0 and T1

Metabolic Syndrome (MS) score

Median MS scores with IQR for both T0 and T1, divided by region, are shown in Table 2.6. Significant difference was found at baseline, between intervention and control groups, only for Tuscany ($p < 0.05$). Conversely, no differences were found in Lombardy, Lazio and Sicily at baseline between intervention and control groups ($p = 0.135$, $p = 0.496$ and $p = 0.975$ respectively).

In all the regions the MS score significantly increased from T0 to T1 in the intervention groups, while did not change in the controls. Regarding the intervention groups, in Lombardy the score improved from 57 (IQR 43-57) to 71 (IQR 57-86), ($p < 0.001$); in Tuscany from 71 (IQR 57-71) to 71 (IQR 57-86), ($p < 0.001$); in Lazio from 43 (IQR 43-57) to 57 (IQR 43-57), ($p < 0.05$); in Sicily from 43 (IQR 29-50) to 86 (IQR 86-100), ($p < 0.001$).

Table 2.6 Median MS score at T0 and T1, by region and arm

Region	T0 Median MS score (IQR)	T1 Median MS score (IQR)	p-Value*
Lombardy			
Intervention arm	57 (43-57)	71 (57-86)	<0.001
Control arm	43 (43-57)	57 (43-57)	0.264
p-Value**	0.135	<0.001	
Tuscany			
Intervention arm	71 (57-71)	71 (57-86)	<0.001
Control arm	57 (43-71)	57 (43-57)	0.182
p-Value**	<0.05	<0.001	
Lazio			
Intervention arm	43 (43-57)	57 (43-57)	<0.05
Control arm	43 (43-57)	43 (29-57)	0.437
p-Value**	0.496	<0.05	
Sicily			
Intervention arm	43 (29-50)	86 (86-100)	<0.001
Control arm	43 (14-57)	36 (29-43)	1.000
p-Value**	0.975	<0.001	

* p-Value from Test U of Mann-Whitney for differences between T0 and T1 for both intervention and control arms

** p-Value from Test U of Mann-Whitney for differences between intervention and control for both T0 and T1

Cancer Prevention (CP score)

Median CP scores with IQR for both T0 and T1, divided by region, are shown in Table 2.7. Significant difference was found at baseline, between intervention and control groups, only for Tuscany ($p < 0.05$). Conversely, no differences were found for Lombardy, Lazio and Sicily at baseline between intervention and control groups ($p = 0.237$, $p = 0.3$ and $p = 0.778$ respectively).

In three out of four regions the CP score significantly increased in the intervention groups from T0 to T1. In Lombardy the score improved from 43 (IQR 43-57) to 57 (IQR 43-71), ($p < 0.001$); in Tuscany from 57 (IQR 43-71) to 71 (IQR 43-86), ($p < 0.001$); in Sicily from 29 (IQR 21-43) to 86 (IQR 71-86), ($p < 0.001$). In Lazio the median CP score improved from 43 (IQR 29-43) to 43 (IQR 36-57), but changes were not supported by statistical significance), ($p = 0.122$). No significant differences between T0 and T0 were found in control groups for any region.

Table 2.7 Median CP score at T0 and T1, by region and arm

Region	T0 Median CP score (IQR)	T1 Median CP score (IQR)	<i>p</i>-Value*
Lombardy			
Intervention arm	43 (43-57)	57 (43-71)	<0.001
Control arm	43 (29-57)	43 (29-57)	0.262
<i>p</i> -Value**	0.237	<0.001	
Tuscany			
Intervention arm	57 (43-71)	71 (43-86)	<0.001
Control arm	43 (29-57)	43 (43-57)	0.065
<i>p</i> -Value**	<0.05	<0.05	
Lazio			
Intervention arm	43 (29-43)	43 (36-57)	0.122
Control arm	43 (29-43)	29 (29-43)	0.710
<i>p</i> -Value**	0.3	<0.05	
Sicily			
Intervention arm	29 (21-43)	86 (71-86)	<0.001
Control arm	29 (14-43)	29 (21-50)	0.345
<i>p</i> -Value**	0.778	<0.001	

* *p*-Value from Test U of Mann–Whitney for differences between T0 and T1 for both intervention and control arms

** *p*-Value from Test U of Mann–Whitney for differences between intervention and control for both T0 and T1

FS score

Median FS scores with IQR for both T0 and T1, divided by region, are shown in Table 2.8. Even if the overall FS score was different at baseline between intervention and control groups (Table X), when data are divided by region no significant differences emerge for Lombardy, Tuscany, Lazio and Sicily ($p = 0.527$, $p = 0.118$, $p = 0.521$ and $p = 0.81$ respectively).

In all the regions the FS score significantly increased in the intervention groups from T0 to T1. In Lombardy the score improved from 40 (IQR 40-60) to 80 (IQR 60-80), ($p < 0.001$); in Tuscany from 60 (IQR 40-60) to 80 (IQR 60-100), ($p < 0.001$); in Lazio from 40 (IQR 20-40) to 60 (IQR 40-80), ($p < 0.001$); in Sicily from 40 (IQR 30-50) to 100 (IQR 80-100), ($p < 0.001$). No significant differences were found in control groups in three out of four regions, with the exception for Tuscany, where the score changed from 40 (IQR 40-60) to 40 (IQR 40-80), ($p < 0.05$).

Table 2.8 Median FS score at T0 and T1, by region and arm

Region	T0	T1	<i>p</i> -Value*
	Median FS score (IQR)	Median FS score (IQR)	
Lombardy			
Intervention arm	40 (40-60)	80 (60-80)	<0.001
Control arm	40 (20-60)	40 (40-60)	0.903
<i>p</i> -Value**	0.527	<0.001	
Tuscany			
Intervention arm	60 (40-60)	80 (60-100)	<0.001
Control arm	40 (40-60)	40 (40-80)	<0.05
<i>p</i> -Value**	0.118	<0.001	
Lazio			
Intervention arm	40 (20-40)	60 (40-80)	<0.001
Control arm	40 (20-60)	40 (20-40)	0.848
<i>p</i> -Value**	0.521	<0.001	
Sicily			
Intervention arm	40 (30-50)	100 (80-100)	<0.001
Control arm	40 (20-40)	40 (10-40)	0.606
<i>p</i> -Value**	0.81	<0.001	

* *p*-Value from Test U of Mann–Whitney for differences between T0 and T1 for both intervention and control arms

** *p*-Value from Test U of Mann–Whitney for differences between intervention and control for both T0 and T1

MD score

Median MD scores with IQR for both T0 and T1, divided by region, are shown in Table 2.9. Significant difference was found at baseline, between intervention and control groups, only for Tuscany ($p < 0.001$). Conversely, no differences were found for Lombardy, Lazio and Sicily between intervention and control groups at baseline ($p = 0.842$, $p = 0.18$ and $p = 0.087$ respectively). In all the regions the MD score significantly increased in the intervention groups from T0 to T1. In Lombardy the score improved from 60 (IQR 40-80) to 80 (IQR 60-100), ($p < 0.001$); in Tuscany from 80 (IQR 60-80) to 100 (IQR 80-100), ($p < 0.001$); in Lazio from 60 (IQR 20-80) to 80 (IQR 60-80), ($p < 0.05$); in Sicily from 40 (IQR 20-60) to 100 (IQR 80-100), ($p < 0.001$). No significant differences were found between T0 and T1 in the control groups in Lombardy ($p = 0.940$), Tuscany ($p = 0.544$) and Lazio ($p = 0.840$). Conversely, in Sicily the control group improved its MD score from 20 (IQR 20-40) to 40 (IQR 40-60), ($p < 0.05$).

Table 2.9 Median MD score at T0 and T1, by region and arm

Region	T0 Median MD score (IQR)	T1 Median MD score (IQR)	<i>p</i>-Value*
Lombardy			
Intervention arm	60 (40-80)	80 (60-100)	<0.001
Control arm	60 (40-80)	60 (40-80)	0.940
<i>p</i> -Value**	0.842	<0.001	
Tuscany			
Intervention arm	80 (60-80)	100 (80-100)	<0.001
Control arm	40 (40-60)	50 (40-60)	0.544
<i>p</i> -Value**	<0.001	<0.001	
Lazio			
Intervention arm	60 (20-80)	80 (60-80)	<0.05
Control arm	40 (20-60)	60 (40-60)	0.840
<i>p</i> -Value**	0.18	<0.05	
Sicily			
Intervention arm	40 (20-60)	100 (80-100)	<0.001
Control arm	20 (20-40)	40 (40-60)	<0.05
<i>p</i> -Value**	0.087	<0.001	

* *p*-Value from Test U of Mann–Whitney for differences between T0 and T1 for both intervention and control arms

** *p*-Value from Test U of Mann–Whitney for differences between intervention and control for both T0 and T1

SG score

Median SG scores with IQR for both T0 and T1, divided by region, are shown in Table 2.10. At baseline no significant differences emerged between intervention and control groups for Lombardy ($p=0.487$), Tuscany ($p=0.298$), Lazio ($p=0.082$) and Sicily ($p=0.51$).

In Lombardy the SG score significantly improved in the intervention group, from 33 (IQR 33-33) at T0 to 33 (IQR 33-67) at T1, ($p<0.05$). In Tuscany, Lazio and Sicily, the median SG score did not improve from T0 to T1 ($p=0.527$, $p=0.493$, $p=0.145$ and $p=0.802$ respectively). No significant differences between T0 and T0 were found in control groups for any region.

Table 2.10 Median SG score at T0 and T1, by region and arm

Region	T0 Median SG score (IQR)	T1 Median SG score (IQR)	<i>p</i>-Value*
Lombardy			
Intervention arm	33 (33-33)	33 (33-67)	<0.05
Control arm	33 (33-67)	33 (0-33)	0.293
<i>p</i> -Value**	0.487	<0.05	
Tuscany			
Intervention arm	33 (33-33)	33 (33-33)	0.493
Control arm	33 (33-33)	33 (33-33)	0.537
<i>p</i> -Value**	0.298	0.5	
Lazio			
Intervention arm	33 (33-67)	33 (33-33)	0.145
Control arm	33 (0-33)	33 (33-33)	0.965
<i>p</i> -Value**	0.082	0.21	
Sicily			
Intervention arm	33 (33-33)	33 (33-33)	0.802
Control arm	33 (0-33)	33 (33-50)	0.510
<i>p</i> -Value**	0.51	0.736	

* *p*-Value from Test U of Mann–Whitney for differences between T0 and T1 for both intervention and control arms

** *p*-Value from Test U of Mann–Whitney for differences between intervention and control for both T0 and T1

Data regarding different scores at the beginning and at the end of the school year, for each region and divided by intervention and control are summarized in Figure 2.3.

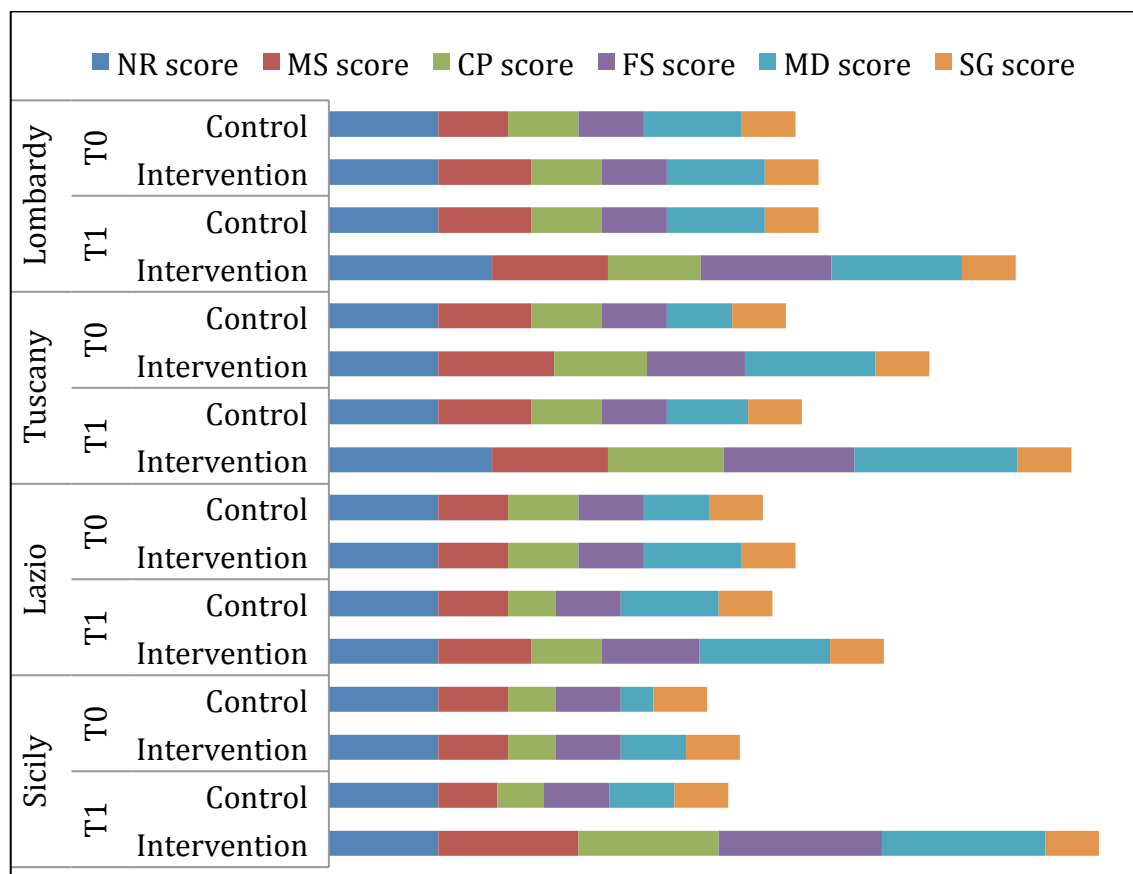


Figure 2.3 contribution of each theme to the median SF scores at T0 and T1, divided by region and arm

2.3.4 Descriptive analysis of each question at baseline

The number and percentage of right answers for each question at baseline, divided by region, are shown in Table 2.11. According to the data regarding the SF score at baseline, these data confirm the different knowledge of the students among the regions.

Table 2.11 Number and percentage of right answers at baseline, by region

	Correct answers Lombardy			Correct answers Tuscany			Correct answers Lazio			Correct answers Sicily		
	N	%		N	%		N	%		N	%	
Nutritional science research (NR)												
Which types of research are necessary to confirm a scientific hypothesis?	50	38.8		33	55.0		17	30.9		5	13.9	
Which of these sources of information is less reliable?	82	88.2		55	91.7		45	81.8		26	72.2	
What is the goal of the healthy nutrition guidelines?	87	93.5		55	91.7		49	89.1		32	88.9	
Metabolic syndrome (MS)												
Which are the macronutrients?	67	72.0		48	80.8		36	65.5		7	19.4	
Which of these condiments are the richest in saturated fats?	34	36.6		27	45.0		15	27.3		4	11.1	
Choose the group of foods rich in omega-3 fatty acids:	92	98.9		57	95.0		51	92.7		30	83.3	
What is the effect of the regular consumption of nuts?	44	47.3		44	73.3		23	41.8		11	30.6	
What does the glycemic index measure?	17	18.3		7	11.7		10	18.2		7	11.7	
What does insulin control?	54	58.1		46	76.7		31	56.4		25	69.4	
Which is the condition that subjects with metabolic syndrome have altered?	18	19.4		15	25.0		5	9.1		9	25.0	
Cancer prevention (CP)												
How many cases of cancer could be prevented with healthy lifestyle and nutrition?	44	47.3		29	48.3		20	36.4		9	25.0	
What is the meaning of being in a "normal weight"?	61	65.6		34	56.7		20	36.4		9	25.0	
What is the maximum amount of red meat you can eat weekly to prevent certain types of cancer?	38	40.9		19	31.7		17	30.9		8	22.2	
Which of these foods are the richest in dietary fiber?	59	63.4		48	80.0		40	72.7		19	52.8	
What is the ideal daily level of physical activity recommended?	78	83.9		46	76.7		42	76.4		24	66.7	
How many portions of fruit and vegetables should be eaten?	13	14.0		14	23.3		8	14.5		1	2.8	
Which are the risks related to high salt consumption?	8	8.6		13	21.7		2	3.6		3	8.3	

Table 2.11 (continued)

Food sustainability (FS)										
What is the right ratio between animal and plant foods for a healthy diet?	72	77.4	41	63.8	29	52.7	14	68.3		
What does the double pyramid show?	16	17.2	25	41.7	4	7.3	5	13.9		
Which of these foods are the richest in iron?	22	23.7	5	8.3	12	21.8	13	36.1		
Which of these statements regarding milk is false?	75	80.6	46	76.7	39	70.9	19	52.8		
Which of these statements regarding tap water is false?	30	32.3	13	21.7	15	27.3	11	30.6		
Mediterranean diet (MD)										
Who was the first that studied the so called "Mediterranean diet"?	51	54.8	30	50.0	24	43.6	7	19.4		
Which foods are present at the base of the Mediterranean diet pyramid?	53	57.0	39	65.0	29	52.7	21	58.3		
What is the right frequency of consumption of the foods at the top of the Mediterranean diet pyramid?	68	73.1	35	58.3	34	61.8	13	36.1		
Which are the protective food components contained in the Mediterranean diet?	30	32.3	23	38.3	9	16.4	5	13.9		
Which food components can increase the risk of cardiovascular diseases?	63	67.7	50	83.3	36	65.5	21	58.3		
SmartFood guidelines (SG)										
Which of the following sweeteners is the healthiest?	7	7.5	1	1.7	1	1.8	0	0.0		
Which of the following options reflect a healthy balanced meal?	66	71.0	52	86.7	44	80.0	30	83.3		
What is the best cooking method to preserve the nutritional properties of plant foods?	25	26.9	9	15.0	15	27.3	7	19.4		

Nutritional science research (NR) theme

Different percentages of right answers for the four regions, related to the NR topic, are illustrated in Figure 2.4a.

a) Which types of research are necessary to confirm a scientific hypothesis?

The percentage of right answers at baseline varied between regions. In Sicily only the 13.9% chose “In vitro, animal models and human studies” as the right answer; in Lazio and Lombardy the percentage was 30.9 and 38.8 respectively. The maximum was got in Tuscany, with 55.0% of right answers.

b) Which of these sources of information is less reliable?

The percentages of right answers to this question were quite high in all the regions, from 72.2% in Sicily to 91.7% in Tuscany. These data indicate that the students were pretty much aware about the less reliability of “Focus” as source of information, compared to institutional and official sources.

c) What is the goal of the healthy nutrition guidelines?

The high percentages of right answers in all the regions, from 88.9 in Sicily to 93.5 in Lombardy, indicate that the students were already conscious that the goal of the healthy nutrition guidelines is “to prevent diseases” and not cure diseases, avoid illnesses or promote local foods.

Metabolic Syndrome (MS) theme

Different percentages of right answers for the four regions, related to the MS topic, are illustrated in Figure 2.4b.

a) Which are the macronutrients?

There are broad differences among regions in the percentage of right answers to this question. In Tuscany the students showed more knowledge about macronutrients, with 80.8% of right answers; less in Lombardy (72%) and Lazio (65.5%). In Sicily only the 19.4% chose “Carbohydrates, proteins, lipids” as the right answer.

b) Which of these condiments are the richest in saturated fats?

In all the regions, the percentage of right answers was less than 50%, but nonetheless there were relevant differences. In Tuscany the 45.0% of the students chose “Palm oil and butter” as the right answer, in Lombardy the 36.6%, in Lazio the 27.3 and in Sicily only the 11.1%.

c) Choose the group of foods rich in omega-3 fatty acids:

In all the regions the students showed to be very aware about “Fatty fish, walnuts, flaxseeds” as main sources of omega-3. In Sicily the 83.3% chose the right answer, while in the other regions the percentages passed the 90%.

d) What is the effect of the regular consumption of nuts?

There are broad differences among regions in the percentage of right answers to this question. In Tuscany the students showed more knowledge about the effect of nuts consumption on “Cholesterol reduction”, with 73.3% of right answers. In Lombardy, Lazio and Sicily the percentages were 47.3, 41.8 and 30.6 respectively.

e) What does the glycemic index measure?

The amount of right answers was very low in all regions, with 18.3% and 18.2% in Lombardy and Lazio, followed by Tuscany and Sicily with 11.7% of students that chose “The increase of glycemia produced by a food” as right answer.

f) What does insulin control?

The students showed to be quite confident regarding the role of insulin in the “Carbohydrates metabolism”. The percentage of right answers was 76.7 in Tuscany, 58.1 in Lombardy, 56.4 in Lazio and 69.4 in Sicily.

g) Which is the condition that subjects with metabolic syndrome have altered?

The amount of right answers was very low in all regions, with 9.1% and 19.4% in Lazio and Lombardy, followed by Tuscany and Sicily with 25.0% of students that chose “Waist circumference” as right answer.

Cancer Prevention (CP) theme

Different percentages of right answers for the four regions, related to the CP topic, are illustrated in Figure 2.4c.

a) How many cases of cancer could be prevented with healthy lifestyle and nutrition?

The percentages varied a lot among regions. In Sicily the 25% of the students chose “One third” as the right answer, in Lazio the 36.4%, in Lombardy the 47.3% and in Tuscany the 48.3%.

b) What is the meaning of being in a “normal weight”?

Lombardy and Tuscany showed more knowledge regarding “Having minor risk of developing diseases” related with normal weight, with 65.6% and 56.7% of right answers. In Lazio the percentage was 36.4 while in Sicily was 25.0%.

c) What is the maximum amount of red meat you can eat weekly to prevent certain types of cancer?

The amount of right answers was quite low in all regions. In Sicily only the 22.2% of the students chose “500 grams”, while in Lazio, Tuscany and Lombardy the 30.9%, 31.7% and 40.9% chose the right answer.

d) Which of these foods are the richest in dietary fiber?

In Sicily, the 52.8% of the students chose “Whole grains and pulses” as the right answer. The percentage was higher in the other regions, 63.4% in Lombardy, 72.7% in Lazio and 80.0% in Tuscany.

e) What is the ideal daily level of physical activity recommended?

The amount of right answers was quite high in all regions. The 66.7% of the students from Sicily chose “At least 30-40 minutes” as the right answer, 76.4% in Lazio, 76.7% in Tuscany and 83.9% in Lombardy.

f) How many portions of fruit and vegetables should be eaten?

The amount of right answers was very low in all regions. In Sicily only the 2.8% chose “At least 5 per day”, followed by Lombardy with 14.0%, Lazio with 14.5% and Tuscany with the 23.3% of right answers.

g) Which are the risks related to high salt consumption?

Food Sustainability (FS) theme

Different percentages of right answers for the four regions, related to the FS topic, are illustrated in Figure 2.4d.

a) What is the right ratio between animal and plant foods for a healthy diet?

The amount of right answers was quite good among regions. The percentage of students that chose “2/3 plant and 1/3 animal foods” as the right answer were 52.7 in Lazio, 63.8 in Tuscany, 68.3 in Sicily and 77.4 in Lombardy.

b) What does the double pyramid show?

The percentage of right answer differed a lot between regions and was generally low. In Lazio only the 7.3% knew that the double pyramid shows the “Link between food and sustainability”, in Sicily and Lombardy only the 13.9% and the 17.2% respectively. In Tuscany the 41.7% of the students chose the right answer.

c) Which of these foods are the richest in iron?

This is one of the few questions in which the amount of right answers is higher in Sicily, with 36.1% of the students that chose “Liver, beans and herbs” as the right answer, followed by Lombardy with 23.7%, Lazio with 21.8% and lastly the Tuscany with 8.3%.

d) Which of these statements regarding milk is false?

The amount of right answers was good among regions. In Sicily the 52.8% selected “Is the only food that contains calcium” as the false statement about milk. In the other regions the percentages were even higher, with 70.9% of right answers in Lazio, 76.7% in Tuscany and 80.6% in Lombardy.

e) Which of these statements regarding tap water is false?

The percentage of students that endorsed “Contains limestone that can cause kidney stones” as the false statement about tap water was quite low. The higher percentages were found in Lombardy, 32.3%, and Sicily, 30.6%, followed by Lazio, 27.3%, and Tuscany, 21.7%.

Mediterranean Diet (MD) theme

Different percentages of right answers for the four regions, related to the MD topic, are illustrated in Figure 2.4e.

a) Who was the first that studied the so called “Mediterranean diet”?

The percentages varied a lot among regions. In Lombardy and Tuscany, the 54.8% and 50.0% respectively, picked “Ancel Keys”. In Lazio and Sicily only the 43.6% and 19.4% of the students, respectively, chose the right answer.

b) Which foods are present at the base of the Mediterranean diet pyramid?

The amount of students that selected “Fruit, vegetables, cereals and olive oil” as right answer was quite high, 65.0% in Tuscany, 58.3% in Sicily, 57.0% in Lombardy and 52.7% in Lazio.

c) What is the right frequency of consumption of the foods at the top of the Mediterranean diet pyramid?

Also for this question, the percentage of students that chose “Occasionally” as the right answer was quite high, except for Sicily, where the 36.1% picked the right question. In Tuscany the percentage of right answers was 58.3, In Lazio 61.8 and in Lombardy 73.1.

d) Which are the protective food components contained in the Mediterranean diet?

The knowledge regarding “Fiber, phytochemicals and unsaturated fats” as protective components of the Mediterranean diet was quite low in all the regions. The percentages of right answers were 38.3 in Tuscany, 32.3 in Lombardy, 16.4 in Lazio and 13.9 in Sicily.

e) Which food components can increase the risk of cardiovascular diseases?

The percentages varied a lot among regions. In Tuscany the 83.3% of the students endorsed “Saturated fats” as the right answer, in Lombardy and Lazio 67.7% and 65.5% respectively. In Sicily the percentage was lower, with 58.3% of the students that chose the right answer.

SmartFood Guidelines (SG) theme

Different percentages of right answers for the four regions, related to the SG topic, are illustrated in Figure 2.4f.

a) Which of the following sweeteners is the healthiest?

This is the question that received the lower percentages of right answers in all the regions. Only 7.5% of the students in Lombardy, 1.8% in Lazio, 1.7% in Tuscany and 0.0% in Sicily knew that honey, sugar cane and barley malt syrup have the same effect on health.

b) Which of the following options reflect a healthy balanced meal?

The percentages of right answer were overall quite high. The 86.7% of the students in Tuscany, the 83.3% in Sicily, the 80.0% in Lazio and the 71.0% in Lombardy selected “Pasta with beans+spinach+fresh fruit” as the best option among the four choices.

c) *What is the best cooking method to preserve the nutritional properties of plant foods?*

Unexpectedly, the question about cooking methods did not receive a high percentage of right answers. In Tuscany only the 15% of the respondents selected “Depends on the type of food” as the right answer, followed by Sicily with 19.4% of right answers, Lombardy with 26.9% and Lazio with 27.3%.

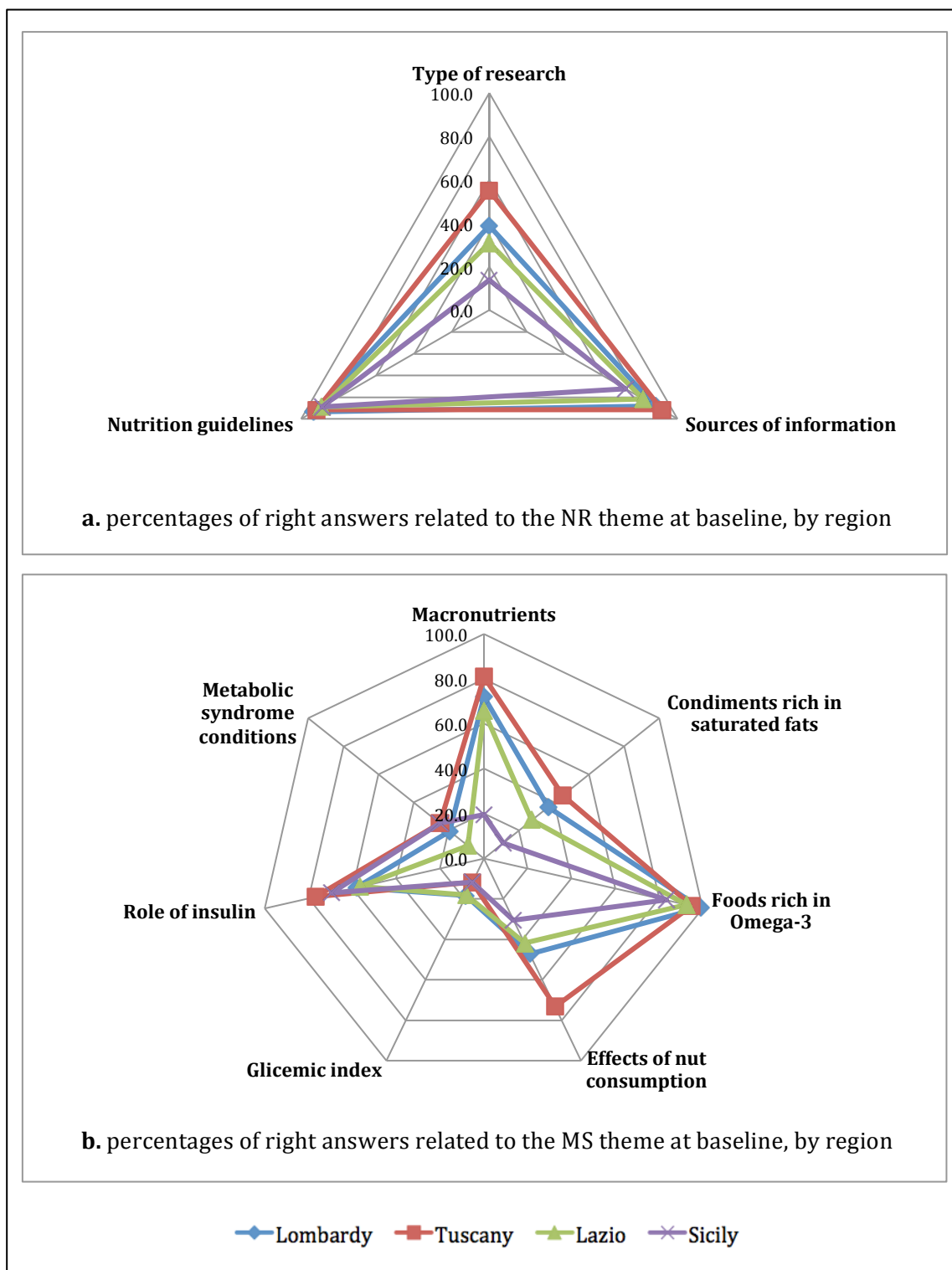


Figure 2.4 Percentage of right answers at baseline, by region, grouped by theme

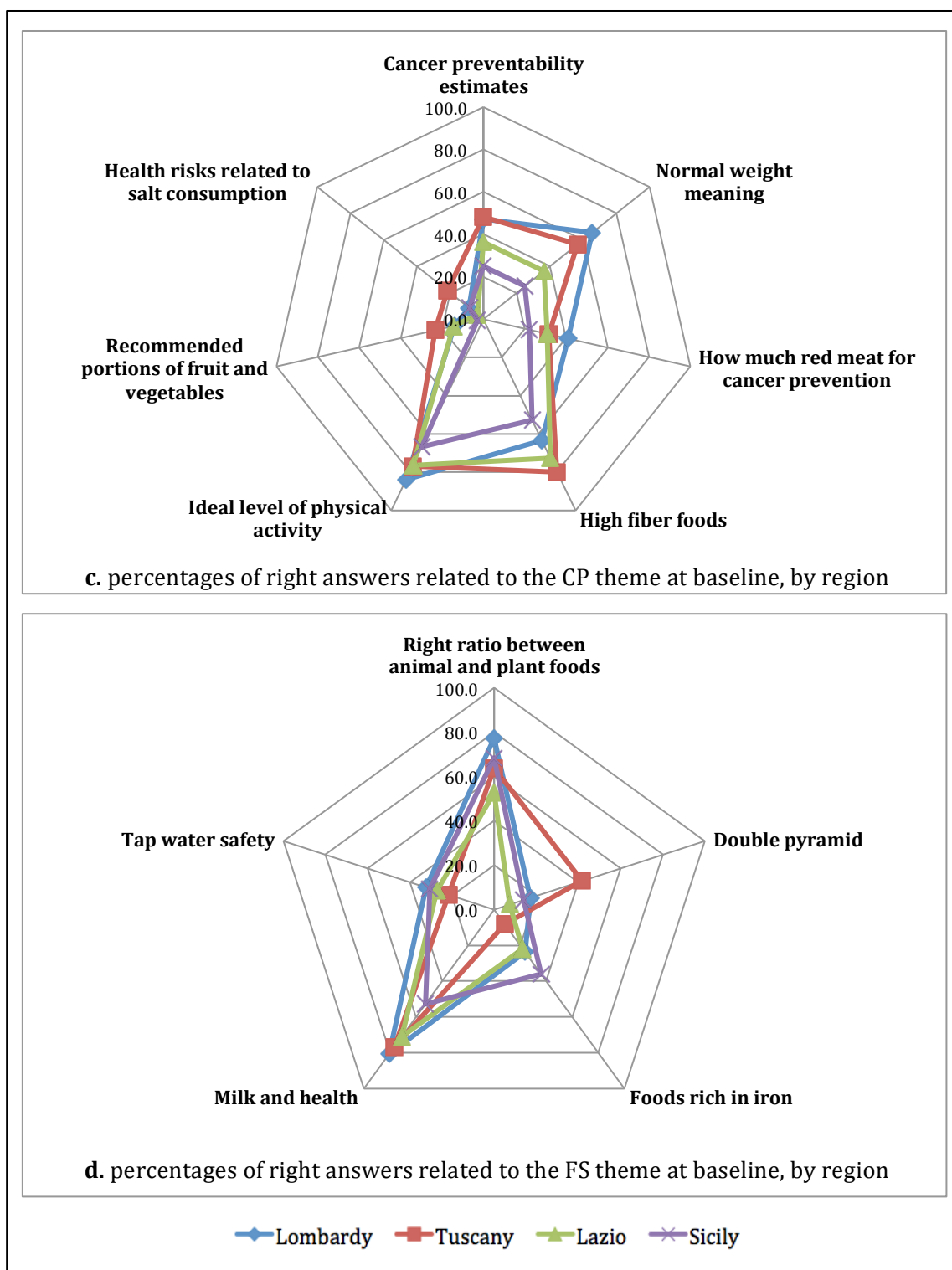


Figure 2.4 Percentage of right answers at baseline, by region, grouped by theme
(continued)

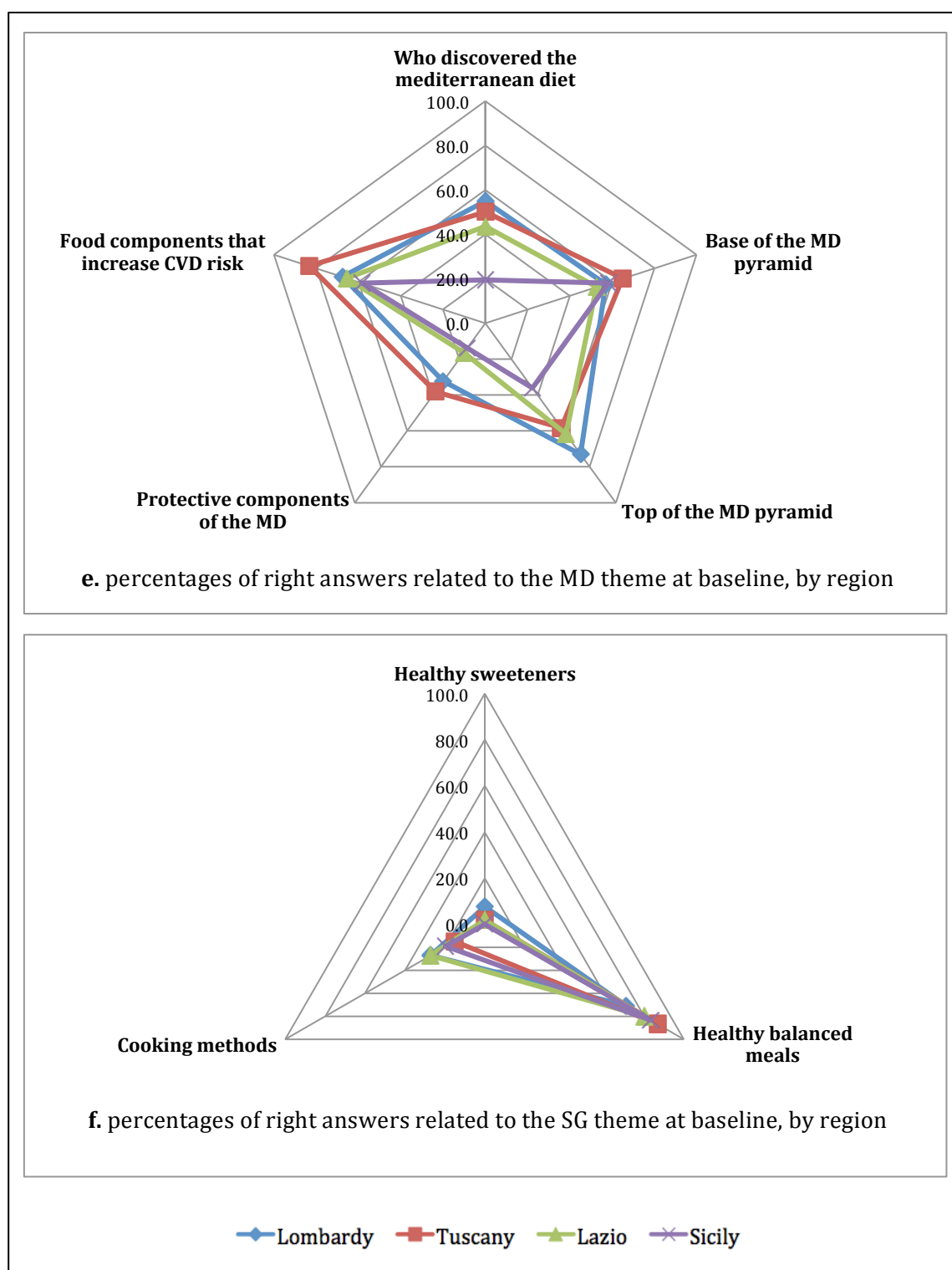


Figure 2.4 Percentage of right answers at baseline, by region, grouped by theme (continued)

2.3.5 Analysis of each question in intervention and control groups, between T0 and T1

The number and percentage of right answers for each question, at T0 and T1, in intervention and control arms, are shown in Table 2.12.

Table 2.12 Number and percentage of right answers at T0 and T1, by arm

	Correct answers T0		Correct answers T1		p-Value*
	N	%	N	%	
Nutritional science research (NR)					
Which types of research are necessary to confirm a scientific hypothesis?					
Intervention arm	69	53.9	86	70.5	0.007
Control arm	36	31.0	36	30.8	0.965
Which of these sources of information is less reliable?					
Intervention arm	112	87.5	117	95.9	0.017
Control arm	96	82.8	99	84.6	0.701
What is the goal of the healthy nutrition guidelines?					
Intervention arm	124	96.9	119	97.5	0.750
Control arm	99	85.3	102	87.2	0.684
Metabolic syndrome (MS)					
Which are the macronutrients?					
Intervention arm	94	73.4	105	86.1	0.013
Control arm	64	55.2	65	55.6	0.953
Which of these condiments are the richest in saturated fats?					
Intervention arm	47	36.7	63	51.6	0.018
Control arm	33	28.4	26	22.2	0.275
Choose the group of foods rich in omega-3 fatty acids:					
Intervention arm	124	96.9	121	99.2	0.193
Control arm	106	91.4	112	95.7	0.176
What is the effect of the regular consumption of nuts?					
Intervention arm	59	46.1	102	83.6	<0.001
Control arm	63	54.3	57	48.7	0.393
What does the glycemic index measure?					
Intervention arm	17	13.3	37	30.3	0.001
Control arm	24	20.7	21	17.9	0.596

* *p*-Value from Pearson chi-square test

Table 2.12 (continued)

What does insulin control?						
Intervention arm	88	68.8	97	79.5	0.053	
Control arm	68	58.6	85	72.6	0.024	
Which is the condition that subjects with metabolic syndrome have altered?						
Intervention arm	22	17.2	64	52.5	<0.001	
Control arm	25	21.6	22	18.8	0.601	
Cancer prevention (CP)						
How many cases of cancer could be prevented with healthy lifestyle and nutrition?						
Intervention arm	51	39.8	67	54.9	0.017	
Control arm	51	44.0	44	37.6	0.323	
What is the meaning of being in a “normal weight”?						
Intervention arm	85	66.4	105	86.1	<0.001	
Control arm	39	33.6	53	45.3	0.068	
What is the maximum amount of red meat you can eat weekly to prevent certain types of cancer?						
Intervention arm	44	34.4	65	53.3	0.003	
Control arm	38	32.8	33	28.2	0.45	
Which of these foods are the richest in dietary fiber?						
Intervention arm	89	69.5	93	76.2	0.234	
Control arm	77	66.4	75	64.1	0.715	
What is the ideal daily level of physical activity recommended?						
Intervention arm	107	83.6	108	88.5	0.261	
Control arm	83	71.6	96	82.1	0.058	
How many portions of fruit and vegetables should be eaten?						
Intervention arm	17	13.3	53	43.4	<0.001	
Control arm	19	16.4	20	17.1	0.884	
Which are the risks related to high salt consumption?						
Intervention arm	13	10.2	34	27.9	<0.001	
Control arm	13	11.2	8	6.8	0.244	

* *p*-Value from Pearson chi-square test

Table 2.12 (continued)

Food sustainability (FS)						
What is the right ratio between animal and plant foods for a healthy diet?						
Intervention arm	87	68.0	111	91.0	<0.001	
Control arm	69	59.5	83	70.9	0.066	
What does the double pyramid show?						
Intervention arm	34	26.6	84	68.9	<0.001	
Control arm	16	13.8	24	20.5	0.174	
Which of these foods are the richest in iron?						
Intervention arm	23	18.0	77	63.1	<0.001	
Control arm	29	25.0	22	18.8	0.253	
Which of these statements regarding milk is false?						
Intervention arm	110	85.9	103	84.4	0.737	
Control arm	69	59.5	84	71.8	0.048	
Which of these statements regarding tap water is false?						
Intervention arm	29	22.7	70	57.4	<0.001	
Control arm	40	34.5	36	30.8	0.545	
Mediterranean diet (MD)						
Who was the first that studied the so called “Mediterranean diet”?						
Intervention arm	73	57.0	109	89.3	<0.001	
Control arm	39	33.6	58	49.6	0.14	
Which foods are present at the base of the Mediterranean diet pyramid?						
Intervention arm	75	58.6	105	86.1	<0.001	
Control arm	67	57.8	73	62.4	0.47	
What is the right frequency of consumption of the foods at the top of the Mediterranean diet pyramid?						
Intervention arm	87	68.0	103	84.4	0.002	
Control arm	63	54.3	68	58.1	0.558	
Which are the protective food components contained in the Mediterranean diet?						
Intervention arm	42	32.8	89	73.0	<0.001	
Control arm	25	21.6	30	25.6	0.462	

* *p*-Value from Pearson chi-square test

Table 2.12 (continued)

Which food components can increase the risk of cardiovascular diseases?						
Intervention arm	88	68.8	98	80.3	0.036	
Control arm	82	70.7	84	71.8	0.852	
SmartFood guidelines (SG)						
Which of the following sweeteners is the healthiest?						
Intervention arm	2	1.6	8	6.6	0.044	
Control arm	7	6.0	10	8.5	0.461	
Which of the following options reflect a healthy balanced meal?						
Intervention arm	102	79.7	113	92.6	0.003	
Control arm	90	77.6	89	76.1	0.784	
What is the best cooking method to preserve the nutritional properties of plant foods?						
Intervention arm	32	25.0	23	18.9	0.241	
Control arm	24	20.7	21	17.9	0.596	

* *p*-Value from Pearson chi-square test

Nutritional science research (NR) theme

Percentages of right answers for intervention and control at T0 and T1, related to the NR topic, are illustrated in Figure 2.5a.

a) Which types of research are necessary to confirm a scientific hypothesis?

The percentage of right answers significantly improved in the intervention group, from 53.9% at T0 to 70.5% at T1 ($p = 0.007$). This shows that the students, after the lesson regarding nutritional science research, had a more clear idea regarding the process required to confirm a scientific hypothesis. In the controls, the percentage at T0 was lower (31.0%) than in the interventions, but did not improve at T1 ($p = 0.965$).

b) Which of these sources of information is less reliable?

The percentage of right answers was already high in both interventions and controls at T0, 87.5% and 82.8% respectively. Nevertheless, a significant improvement was observed in the intervention group ($p = 0.017$), while in the control the knowledge remained stable ($p = 0.701$). This shows that students were able to identify institutional brands, like “Ministry of health”, “World cancer research fund” and “Italian society of nutrition” as reliable sources of information, and “Focus” as less reliable.

c) What is the goal of the healthy nutrition guidelines?

The percentages of right answers were very high at baseline, 96.9% in the intervention and 85.3% in the control, showing the knowledge of the students regarding the important role of nutrition guidelines in the prevention of chronic disease. The slight increment in the percentages at T1 was not supported by statistical significance in both intervention and control groups ($p = 0.750$ and $p = 0.684$ respectively).

Metabolic Syndrome (MS) theme

Percentages of right answers for intervention and control at T0 and T1, related to the MS topic, are illustrated in Figure 2.5b.

a) Which are the macronutrients?

The percentage of right answers significantly improved in the intervention group, from 73.4% at T0 to 86.1% at T1 ($p = 0.013$). This shows that the students improved their knowledge regarding carbohydrates, lipids and proteins. In the controls, the percentage at T0 was lower (55.2%) than in the interventions and did not improve at T1 ($p = 0.953$).

b) Which of these condiments are the richest in saturated fats?

The percentages of right answers were low at T0, 36.7% in the interventions and 28.4% in the controls. This means that only few students were aware about palm oil and butter as major sources of saturated fats. At the end of the study there was a significant improvement in this knowledge in the intervention group, with 51.6% of right answers ($p = 0.018$), while no improvement was addressed in the control group ($p = 0.275$).

c) Choose the group of foods rich in omega-3 fatty acids:

The students showed to know very well that fatty fish, walnuts, flaxseeds are the major source of omega-3, the percentages of right answers at T0 were 96.9% in the intervention group and 91.4% in the control. The slight increment in the percentages at T1 was not supported by statistical significance in both intervention and control groups ($p=0.193$ and $p=0.176$ respectively).

d) What is the effect of the regular consumption of nuts?

About half of the students at the beginning of the study knew that the regular consumption of nuts could improve cholesterol levels. The percentage of right answers significantly improved in the intervention group, from 46.1% at T0 to 83.6% at T1 ($p < 0.001$). No improvement was addressed in the control group ($p=0.393$).

e) What does the glycemic index measure?

The percentages of right answers were very low at T0, 13.3% in the interventions and 20.7% in the controls. At the end of the school year, there was a significant improvement in the intervention group, even if the percentage of right answers was still low, 30.3% ($p=0.001$). No improvement was addressed in the control group ($p=0.596$).

f) What does insulin control?

The percentages of right answers were quite good at baseline, 68.8% in the intervention and 58.6% in the control, showing the knowledge of the students regarding the role of insulin in carbohydrates metabolism. The slight increment in the percentages at T1 was not supported by statistical significance in the intervention group ($p=0.053$) and surprisingly significant in control group ($p=0.024$).

g) Which is the condition that subjects with metabolic syndrome have altered?

The percentages of right answers were very low at T0, 17.2% in the interventions and 21.6% in the controls, showing that the students were not aware about the waist circumference as a marker for metabolic syndrome. At the end of the school year, the students in the intervention group significantly improved their knowledge, 52.5% ($p=0.001$), while no improvement was addressed in the control group ($p=0.596$).

Cancer Prevention (CP) theme

Percentages of right answers for intervention and control at T0 and T1, related to the CP topic, are illustrated in Figure 2.5c.

a) How many cases of cancer could be prevented with healthy lifestyle and nutrition?

The percentage of right answers significantly improved in the intervention group, from 39.8% at T0 to 54.9% at T1 ($p=0.017$). This shows that the students improved their knowledge regarding cancer preventability estimates. In the controls, the percentage at T0 was 44.0% and did not improve at T1 ($p=0.323$).

b) What is the meaning of being in a “normal weight”?

The knowledge about the relationship between body weight and risk of diseases was already higher in the intervention than in the control, 66.4% and 33.6% respectively. However, the percentage of right answers significantly improved in the intervention group after the lessons, 86.1% ($p < 0.001$), and did not change in the control ($p = 0.068$).

c) What is the maximum amount of red meat you can eat weekly to prevent certain types of cancer?

About one third of the students at T0 knew that for cancer prevention is recommended to not exceed 500 grams of red meat per week. This knowledge significantly improved in the intervention group at T1, 53.3% of right answers ($p = 0.003$), and did not change in the control ($p = 0.45$).

d) Which of these foods are the richest in dietary fiber?

The percentages of right answers were quite high at baseline, 69.5% in the intervention and 66.4% in the control, showing the good knowledge of the students regarding whole grains and pulses as major sources of dietary fiber. The slight increment in the percentages at T1 was not supported by statistical significance in the intervention group ($p = 0.234$). The control group remained stable ($p = 0.715$).

e) What is the ideal daily level of physical activity recommended?

The percentages of right answers were already high at baseline, 83.6% in the intervention and 71.6% in the control, meaning that the students were aware about the current recommendations on physical activity. The slight increment in the percentages at T1 was not supported by statistical significance, neither in the intervention group ($p = 0.261$) nor in the control ($p = 0.058$).

f) How many portions of fruit and vegetables should be eaten?

Surprisingly, the amount of right answers at baseline was extremely low, 13.3% in the intervention and 16.4% in the control, showing a gap in the students' knowledge regarding the famous “five a day”. The percentage of right answers significantly increased in the intervention group at 43.4% ($p < 0.001$) and remained low in the control ($p = 0.884$).

g) Which are the risks related to high salt consumption?

The percentages of right answers were extremely low at baseline, and only one student in ten knew that high salt consumption is not only related to hypertension, but also to stomach cancer and loss of bone density. At the end of the school year the knowledge significantly improved in the intervention, with 27.9% of right answers ($p < 0.001$), and remained stable in the control ($p = 0.244$).

Food Sustainability (FS) theme

Percentages of right answers for intervention and control at T0 and T1, related to the FS topic, are illustrated in Figure 2.5d.

a) *What is the right ratio between animal and plant foods for a healthy diet?*

The percentages of right answers were quite high at baseline, 68.0% in the intervention and 59.5% in the control. In the intervention group, this percentage significantly improved at T1, 91.0% ($p < 0.001$), while the slight increment in the control group was not supported by statistical significance ($p = 0.066$).

b) *What does the double pyramid show?*

Only 26.6% of the students in the intervention group and 13.8% in the control, knew that the double pyramid shows the link between food and sustainability. In the intervention group, the percentage significantly improved at T1, 68.9% ($p < 0.001$), while the slight increment in the control group was not supported by statistical significance ($p = 0.174$).

c) *Which of these foods are the richest in iron?*

The percentage of right answers significantly improved in the intervention group, from T0, 18.0%, at T1, 63.1%, ($p < 0.001$). This means that the students improved their knowledge regarding plant sources of iron, like beans and herbs. The percentage did not improve in the control group, actually decreased from 25.0% to 18.8% ($p = 0.253$).

d) *Which of these statements regarding milk is false?*

The knowledge regarding milk was quite good at the baseline, with 85.9% of right answer in the intervention group and 59.5% in the control. At the end of the study, no significant improvement was addressed in the intervention group ($p = 0.737$), while a significant improvement was observed in the control ($p = 0.048$).

e) *Which of these statements regarding tap water is false?*

The knowledge regarding the safety of tap water was quite low at the baseline, with 22.7% of right answer in the intervention group and 34.5% in the control. At the end of the study, a significant improvement was observed for the percentage of right answers in the intervention ($p < 0.001$), while the percentage did not improve in the control ($p = 0.545$).

Mediterranean Diet (MD) theme

Percentages of right answers for intervention and control at T0 and T1, related to the MD topic, are illustrated in Figure 2.5e.

a) *Who was the first that studied the so called "Mediterranean diet"?*

The percentage of students that knew Ancel Keys at T0 was higher in the intervention, 57.0% than in the control, 33.6%. However, the percentage of right answers in the intervention group significantly improved after the intervention, 89.3% ($p < 0.001$), while the slight improvement observed in the control group was not statistically significant ($p = 0.14$).

b) *Which foods are present at the base of the Mediterranean diet pyramid?*

More than half of the students knew at baseline that fruit, vegetables, cereals and olive oil are at the base of the Mediterranean diet pyramid. The percentage of right answer

significantly increased in the intervention group, 86.1% ($p < 0.001$) and remained stable in the control ($p = 0.47$).

c) What is the right frequency of consumption of the foods at the top of the Mediterranean diet pyramid?

The percentage of students that knew that the foods at the top of the pyramid have to be consumed frequently was 68.0% in the intervention and 54.3% in the control. The percentage significantly improved after the intervention, 84.4% ($p = 0.002$), and remained stable in the control ($p = 0.558$).

d) Which are the protective food components contained in the Mediterranean diet?

At baseline, a low percentage of student was familiar with fiber, phytochemicals and unsaturated fats, 32.8% in the intervention and 21.6% in the control. The knowledge regarding protective food components of Mediterranean diet, significantly improved in the intervention, 73.0% ($p < 0.001$), while did not change in the control ($p = 0.462$).

e) Which food components can increase the risk of cardiovascular diseases?

The students at baseline were already aware that saturated fats can increase the risk of cardiovascular diseases, with 68.8% of right answer in the intervention and 70.7% in the control. At the end of the school year, the percentage of right answers significantly improved in the intervention, 80.3% ($p = 0.036$) and did not change in the control, 71.8% ($p = 0.852$).

SmartFood Guidelines (SG) theme

Percentages of right answers for intervention and control at T0 and T1, related to the SG topic, are illustrated in Figure 2.5f.

a) Which of the following sweeteners is the healthiest?

This question received the lowest percentage of right answers, with 1.6% in the intervention and 6.0% in the control. In the intervention group, a significant improvement was observed, but the percentage of right answers was still dramatically low, 6.6% ($p = 0.044$). in the control, no improvement was observed ($p = 0.461$).

b) Which of the following options reflect a healthy balanced meal?

The students showed to be familiar with a healthy balanced meal, composed by “Pasta with beans+spinach+fresh fruit”, with 79.7% of right answers in the intervention and 77.6% in the control. The percentage significantly improved in the intervention group, with 92.6% of right answers ($p = 0.003$), and did not changed in the control ($p = 0.784$).

c) What is the best cooking method to preserve the nutritional properties of plant foods?

The students showed to be confused regarding the best cooking methods for plant foods. Only the 25.0% in the intervention and the 20.7% in the control group knew that the right method depends from the kind of plant food. Moreover, at the end of the school year, the

percentages of right answers decreased, 18.9% in the intervention group ($p = 0.241$) and 17.9% in the control ($p = 0.596$).

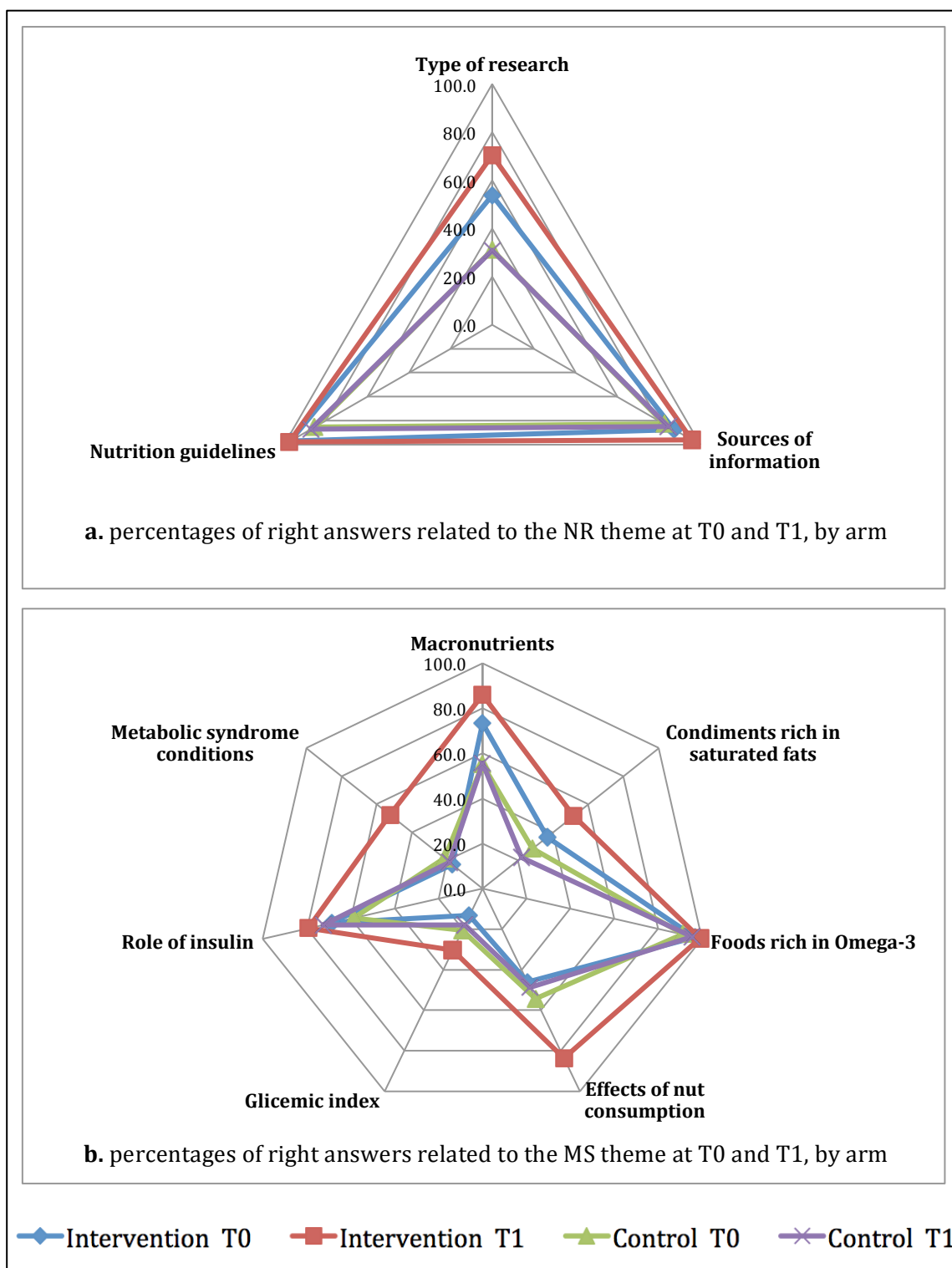


Figure 2.5 Percentage of right answers at T0 and T1, by arm, grouped by theme

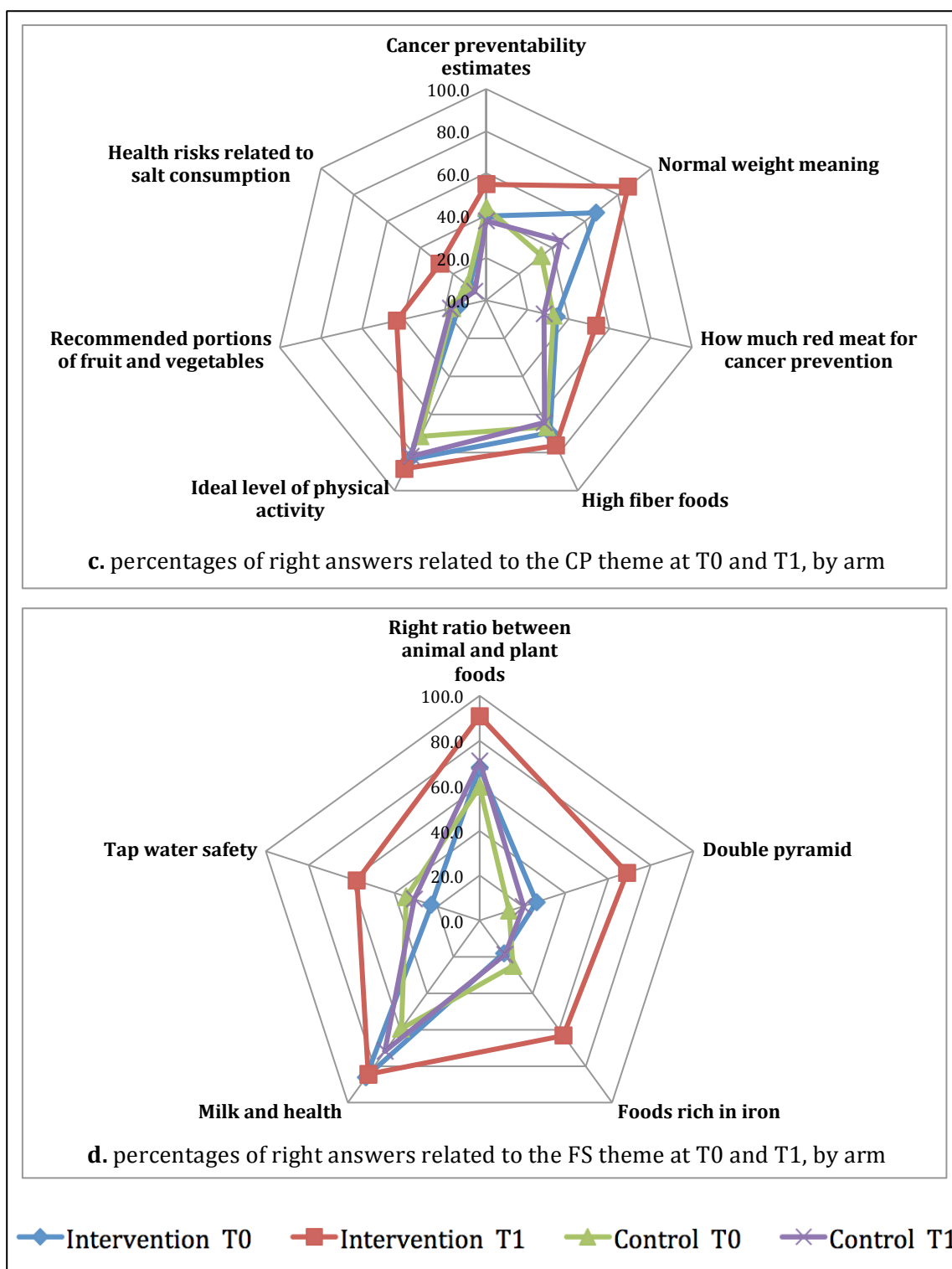


Figure 2.5 Percentage of right answers at T0 and T1, by arm, grouped by theme (continued)

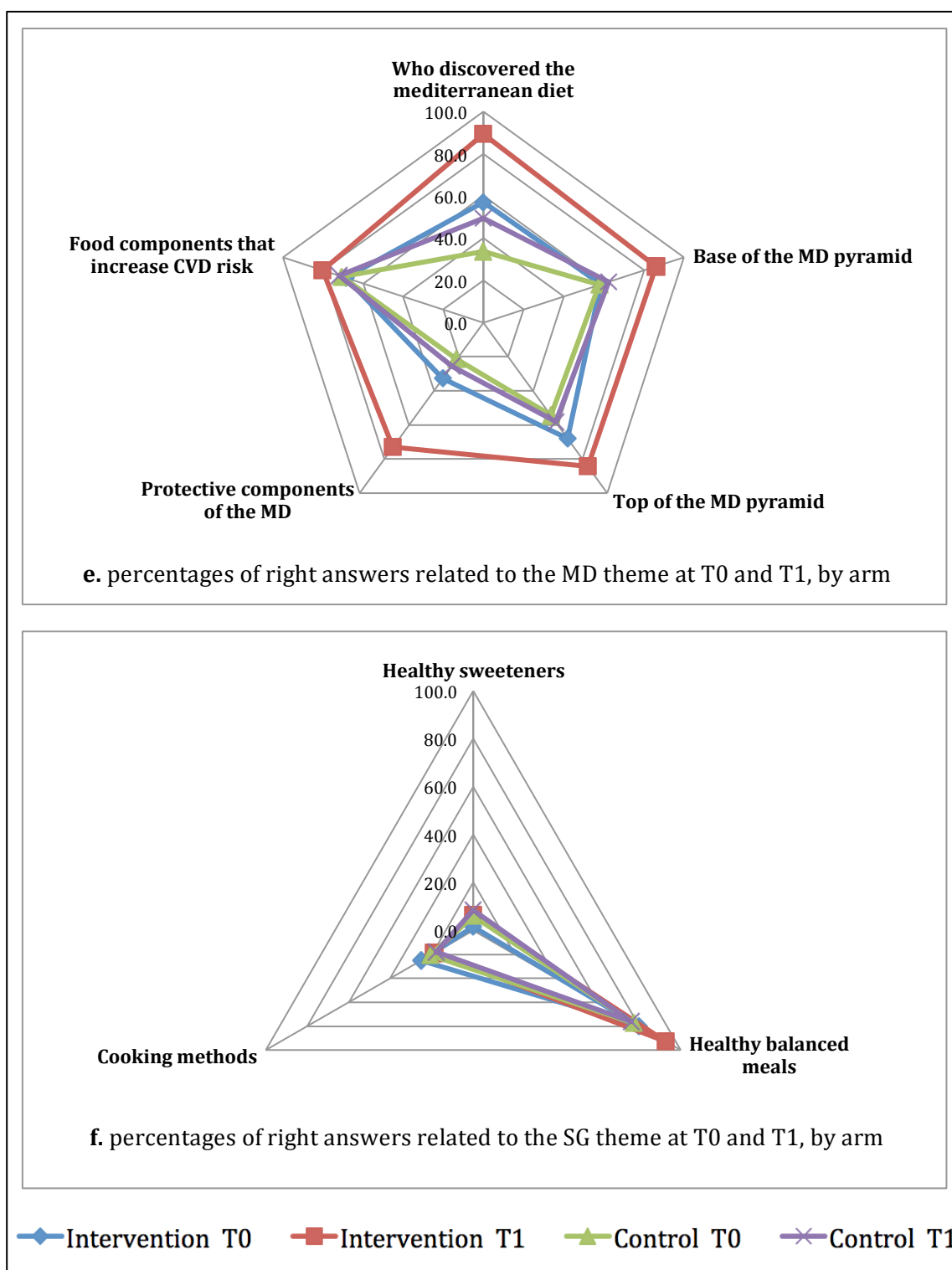


Figure 2.5 Percentage of right answers at T0 and T1, by arm, grouped by theme (continued)

2.4 Discussion

The primary aim of the project was to improve the knowledge regarding science and nutrition of students in their final year of catering school. In order to assess the starting level of knowledge, a pre-intervention questionnaire was administered to the students involved. The overall median SF score, calculated from the thirty-multiple-choice questionnaire at baseline was 297/600. The observed differences in scores at baseline among Italian regions highlight a geographically different level of knowledge regarding science and nutrition. Specifically, students from Sicily showed the lowest SF score, followed by students from Lazio. The higher score at baseline was found in Tuscany and Lombardy. Food and nutrition literacy is related with broader socio-cultural (food tradition, culture and history), and learning environments[44,45], which are substantially diversified among Italian areas. Despite this baseline difference, a significant increase in the SF score was reached for all the four regions, demonstrating the efficacy of the intervention toward the improvement of the knowledge regarding science and nutrition, regardless the different level of competence at the beginning of the study. The specifically designed questionnaires, based on the themes presented during the six lessons, seem to be a valid tool to evaluate the knowledge on specific topics. However, test retest reliability of the questionnaires was not performed, which is a clear limitation of these tools.

The large size of the sample and the multi-centric structure of the project, with a control arm for each region, represent some of the strengths of the study.

The training of the nutritionists that delivered the lessons, with the ready to use learning material, allowed a standardized intervention in all the schools. Undoubtedly, this could represent also a source of variability, because of the inevitable differences in the delivery of the lessons, but at the same time it is in line with the reality of the school system. Actually, even if there is a fixed program for all the catering schools in Italy, the characteristics of each teacher could influence the learning level of the students.

Specific guidelines were also drawn up for the cooking classes. However, checking the exact congruence of the recipes with the content of the guidelines was one of the hurdles identified in the protocol. For this reason, the cooking lessons could be considered at the same point of strength of the project, as they provided the students the opportunity to practice healthy cooking, but also a potential source of confusion. Unfortunately, personal data like gender and age were not recorded, and this may represent a limitation. In addition, selection bias could have been present, since the schools involved in this project had previous interactions with the SmartFood program at the European Institute of Oncology, letting assume that a school environment already promoting awareness about healthy nutrition was present.

Looking at the literature, no similar studies performed in catering schools seem to be available, specifically in Italy. This makes a comparison between data from the present study and existing numbers extremely difficult.

An exhaustive review published in 2014 [46] explored recognised factors about the effectiveness of food literacy programs targeting adolescents. The majority of programs revised were designed with a single intervention group, and only two programs used a control group in the study design. Most of the programs were evaluated by conducting a pre- post-intervention questionnaire to assess primary endpoints, such as change in attitudes to cooking, or an increase in use of cooking skills, self-efficacy, or nutrition knowledge. Significant changes were reported in the area of food and nutrition-related knowledge but there was a clear difficulty in judging and comparing the overall effectiveness of the programs because of the variability in designs and objectives.

In our study, the intervention included six lessons and each of them was aimed to explain a specific theme. Considering that the level of right answers was different among the specific themes at baseline, and the increase in the students' knowledge was not homogeneous, it is worth to deepen and discuss the results by theme.

The median NR score (67/100), calculated from three questions, could be considered already quite high at baseline in all the regions, as 50% of the students replied to at least two questions with the right answer. The question that received the lowest percentage of right answers was related to the types of research that are necessary to confirm a scientific hypothesis. This is understandable since this topic is not present in the standard lesson plan of the catering schools. Moreover, this data reflect the existing gap between the world of research and the general public, included young students [47,48]. However, the percentage of right answer to this question was significantly increased in the intervention group at the end of the school year, meaning that the students, after the nutritional science research lesson, had a clearer idea of the process required to confirm a scientific hypothesis.

The questions related to the MS theme received very different levels of right answers at baseline. Questions that contained scientific terms, such as “glycemic index” or “metabolic syndrome”, received less right answers. Particularly, only one in five students knew that higher waist circumference is related to the metabolic syndrome. Even if the concept of the metabolic syndrome has existed as a constellation of metabolic disturbances for at least 80 years, it was not until 1998 that there was an initiative to develop an internationally recognised definition [49]. The disorder is still defined in various ways,

and the public is not often exposed to the term “metabolic syndrome” through awareness or prevention campaigns, partially explaining the low level of knowledge of the students about this topic. The significant increase of right answers after the lessons means that the intervention was effective and the students could easily learn the characteristics of this syndrome, which is of paramount importance, representing one of the most relevant array of risk factors for type 2 diabetes and cardiovascular diseases.

Conversely, the question regarding food sources of omega-3 fatty acids received, at baseline, more than 90% of right answers. Taking into account the general acceptance that fish is an important component of a healthy and balanced diet, it is reasonable to think that the presence of the option “fish” only in one answer helped the students to identify it. In line with this, an investigation conducted in Belgium on consumer perception about the health benefits of fish consumption, showed that the youngest respondents (<25 years) were better aware that fish contains omega-3, in comparison with consumers aged >40 years [50].

The median CP score was quite low at baseline, equalling 43/100, and only two questions received more than 50% right answers at baseline. It is noteworthy that only one student out of seven knew that is recommended to eat at least five portions of fruit and vegetables per day. This recommendation has formed the backdrop to a number of health campaigns in English speaking countries. In 1991, the Produce for Better Health Foundation and the U.S. National Cancer Institute initiated the “5 A Day for Better Health” (5 A Day) campaign. Gradually the “at least five portions a day” message has been used by the Europe Against Cancer (1994) programme, and then adopted by various European countries and by popular media, especially in the UK [39]. As a result, in a recent study that involved young UK adults, all participants were aware that the recommended amount of fruits and vegetables to be consumed everyday was five portions [51]. In the same line, a US survey on the awareness of fruit and vegetables recommendations found that a high proportion of adults appeared to be aware of the 5 A Day campaign and recommendation [52]. Our data show that in Italy, students from catering schools are not aware about this recommendation but, after the lesson regarding cancer prevention, their knowledge about “at least five portions a day” significantly improved.

Unexpectedly, the question related to the CP theme with the highest percentage of right answer was about the food sources of dietary fiber. This high level of knowledge could be explained by the fact that recommendations have been present for the population since the 70s, with the aim of increasing the intake of dietary fiber in Western countries, and many of these have included figures for the daily amount to be consumed and also suggested various high-fiber foods in dietary guidelines [53].

The median FS score, related to the food sustainability theme, was one of the lowest at baseline (40/100), meaning that the students were not aware about the relationship between food choices and environment. However, this score showed the greater net improvement in all the regions after the intervention and there was also an increase in the percentage of right answers for 4 out of 5 questions, showing not only an improvement in the knowledge, but also a high interest of the students for this topic.

Only few students were familiar with the concept of the double pyramid at the beginning of the school year, while at the end of the year the percentage of right answers increased from 26.6% to 68.9%. In this case, the support of PowerPoint presentations and infographics was essential to make this topic understandable.

The median MD score was already quite high at baseline in all the regions, but an increase in the right answers was observed for all the five questions, meaning that the lesson about Mediterranean Diet (MD) was well understood and remembered until the end of the school year, when the questionnaire was administered for the second time. Remarkably, also for the question about typical food components of MD, that received little right answers at baseline (38%), the percentage of right answers was high at the end of the year (73%), showing that the students learned that “Fiber, phytochemicals and unsaturated fats” are the main protective food components of the MD.

The SmartFood questionnaire included also three more practical questions (SG theme) related to sweeteners, balanced meals and cooking methods. Surprisingly, SG score was the lowest both at baseline and at the end of the study, and did not improve in any region with the exception of the intervention arm in Lombardy. It is very interesting to note that 58.2% of the students, after the intervention, replied that “honey” is the “healthiest sweetener”. Only few students chose the right answer (none of the above), even though in several occasions during the six lessons the health effects of simple sugars were explained. As mentioned in the introduction, many individuals share beliefs about foods and nutrition that are not necessarily grounded in empirical evidence, and this is evident in the case of sugars [16]. Just to mention some examples, results of a recent study showed that consumers perceive a product labelled as containing “fruit sugar” as healthier than one labelled with the unspecific term “sugar” [22]. Another Swiss study showed that two thirds of the study participants erroneously believed that brown sugar is healthier than white sugar [54]. Moreover, honey is becoming increasingly popular with consumers for its hypothesized nutritional benefits, and because it is not subjected to any “technological processes” [55]. All these trends and beliefs around the world of sugars shed light on a clear need to find the right way to improve people’s awareness and knowledge. Moreover,

particular attention should be given to caterers and other food operators that are often exposed to the food marketing, from one side, and customer requests, from the other side. In this context, it is evident that an intervention with scientific contents could just partially reduce the effects derived by years of beliefs, generated and fuelled by misinformation.

Comprehensively, the study resulted in general knowledge improvement for all the schools that received the intervention. Among the control groups, an improvement was observed exclusively for the FS score, only in Tuscany. All other scores did not change in control groups, in any region. This reveals a lack of attention to science and nutrition themes in the standard study schedule of catering schools in Italy. In the current context of both ever-increasing trends in out-of-home eating and attention about health and nutrition, it is essential that the catering staff receives adequate training. All the caterers' initial training should allow them to create healthy, cost effective menus that are appealing to consumers, while also providing them with the knowledge to explain to consumers why they are healthy [42]. Furthermore, caterers are concerned that paying for staff training will be a waste of money, due to the typical high turnover of employees [43]. To overcome this limitation, a solution could be represented by the training of caterers on nutrition and health at the beginning of their careers.

In this context, it becomes essential to demand the responsiveness of institutions and policy makers. A suitable step forward could be represented by the introduction of these important themes in pilot catering schools, with the support of qualified and trained personnel.

CHAPTER 3
LIFESTYLE, NUTRITION AND BREAST CANCER:
FACTS AND PRESUMPTIONS FOR CONSIDERATION
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3.1 Introduction

Breast cancer is the most common cancer in women and its frequency is rising in countries with low and middle incomes. Approximately, one in eight women worldwide will develop breast cancer during her life and breast cancer is the first-leading cause of cancer deaths among women [56]. A number of risk factors have been identified in the pathogenesis of breast tumours; among these, a great number are linked to nutrition and life-style (for example alcohol consumption, obesity and eating patterns) [57].

The influence of diet on mammary carcinogenesis has been clearly demonstrated in animal models. Obesity induced by high-fat diets increases the risk of several cancers, including breast cancer in several animal species [58]. On the contrary, soybean products act as cancer preventive agents in rodents and other animals [59].

Epidemiological studies provide clear evidence of association between breast cancer incidence, mortality and dietary patterns or dietary constituents in humans, but frequently there is a discrepancy between the studies on human populations and investigations performed in more controlled conditions, such as cellular or animal studies. Many other variables such as race, age, menopausal status, onset of puberty and the number of pregnancies are in fact associated with diet and life-style in humans, acting as confounding factors [60]. Among the prospective epidemiological studies on diet and breast cancer incidence, to date, there is no association that is strong, reproducible and statistically significant, with the exception of alcohol intake, overweight and weight gain [61]. Over the past decade, there have been fundamental advances in breast cancer genomics.

As nutrition deeply impacts on genome, it is critical to investigate this interaction. Nutrigenomics can clarify how genetic and epigenetic variations, which control gene expression, are influenced by nutrients and how development, progression and recurrence of cancer are modified by foods [62].

In this review we will summarize the current scientific evidence regarding the association between food, lifestyle and breast cancer risk in women.

3.2 Evidence of body weight and breast cancer

Increased Body Mass Index (BMI) is associated with a significant increase in the risk of breast cancer although with some differences in age and menopausal status. The association between being overweight (defined as a BMI of 25 to 29.9 kg/m²) or obese (BMI of 30 kg/m² or greater) and breast cancer incidence has been found in many studies. Most studies and meta-analysis showed an increased risk of breast cancer for postmenopausal women and an inverse association between obesity and survival after breast cancer [63]. Controversial data exist in premenopausal subjects. Several studies, including the Million Women Study, report that the risk of breast cancer decreases with increasing BMI with a linear relationship along the BMI scale starting from 20kg/m² [64]. On the contrary, obesity increases breast cancer incidence in premenopausal women in the Asian population [65]. Furthermore, abdominal fatness is closely associated with premenopausal cancer risk [66]. A meta-analysis showed that the premenopausal breast cancer risk is 79% higher in women with the highest Waist Height Ratio (WHR) compared with those with the lowest WHR [65].

Obesity, particularly abdominal obesity, has been associated with the production of adipokines in fat tissues [67], which, in turn, causes insulin insensitivity in peripheral tissues [68]. Insulin-resistance leads to elevated blood glucose levels, which stimulate the production of insulin and insulin-like growth factors (IGFs) from pancreatic β cells [58]. Insulin-like growth factor 1 (IGF-1) induces the activation of oestrogen receptor- α (ER α) in a ligand- independent manner through the involvement of mitogen-activated protein kinase (MAPK) signalling. ER α is responsible for many of the effects of oestrogen on normal and cancerous breast tissue, through ligand-activated transcriptional regulation (genomic actions) and by acting as a component of membrane and cytoplasmic signalling cascades (non-genomic actions) [69].

Body fat increases oestrogen production through the aromatization of steroidal precursors of both ovarian and adrenal origin. Tumorigenic properties of oestrogen are regulated through the oestrogen receptor (ER), making the understanding of the mechanisms that activate this receptor highly relevant. In addition to oestrogen activating the ER, other growth factor pathways, such as IGFs, can activate the ER.

Recently, a possible interaction between leptin and insulin, and obesity-related markers of inflammation have been linked to breast cancer outcomes. Numerous studies have examined the relationship between obesity and prognosis in breast cancer: the majority of them demonstrate an inverse association between obesity and survival after breast cancer

[70,71]. However, it is still unknown whether intentional weight loss improves outcomes for women with breast cancer [72] and the number of trials of weight loss interventions in these patients, while increasing, is still small [73].

More recently the International Agency for Research on Cancer (IARC) and the World Cancer Research Fund (WCRF) have remarked that a diet strongly influences cancer prevention, disease development, treatment tolerance and cancer recurrence and also provide advice and recommendations for body weight management in breast cancer primary and secondary prevention [74,75].

3.3 Evidence of alcohol consumption and breast cancer

A number of epidemiological studies have provided convincing evidence that alcohol consumption is an important risk factor for the incidence and mortality of breast cancer [76,77]

A pooled analysis of six prospective cohort studies showed that alcohol consumption is associated with a linear increase in breast cancer incidence. The adjusted relative risk for total alcohol intakes of 30-60 g/day (about 2-5 drinks) versus non-drinkers was 1.41 (95% CI 1.18-1.69) [78]. Furthermore the Million Women Study showed that the relative risk of developing breast cancer increases by 7.1% for each 10 g/day of alcohol [79]. The relationship between breast cancer and alcohol was confirmed by the reanalysis of 53 epidemiological studies performed by Hamajima et al [77].

Ferrari et al collected data on 380395 men and women (among whom 20453 fatal events occurred) for which information on lifetime alcohol use was available, allowing separate consideration of former drinkers from lifetime abstainers. Lifetime average alcohol use was strongly associated with total mortality, in that heavy drinkers (≥ 30 g/day) had notably higher mortality rates than did light to moderate drinkers (0.1–4.9 g/day), a pattern that was consistently apparent among female and male study participants [76].

The mechanisms of carcinogenesis induced by alcohol on breast cancer are still unknown but there is accumulating evidence that regular intakes of moderate amounts of alcohol affect sex hormone levels in premenopausal and postmenopausal women [80]. Several lines of evidence indicate that acetaldehyde, a product of alcohol metabolism, might play a role in alcohol-related carcinogenic effects in different target tissues [62,77].

As alcohol is a lipid solvent, the substance could modify cell membranes enhancing cellular permeability to carcinogens. Furthermore, alcohol can modulate their metabolism, enhance the production of reactive oxygen species (ROS) and inhibit DNA repair [81].

The role of alcohol intake on breast cancer survival was investigated in The Life After Cancer Epidemiology (LACE) Study, a cohort of 2321 early stage breast cancer survivors designed to examine modifiable lifestyle predictors of recurrence, survival, and quality of

life. Results suggested that alcohol consumption equivalent to three to four standard drinks or more per week was associated with the risk of breast cancer recurrence, particularly among postmenopausal and overweight/obese women [82]. Alcohol consumption also impairs folate metabolism and may thereby alter gene methylation since folate plays a pivotal role in DNA methylation [62]. The analysis of methylation of a cluster of cancer-related genes has revealed that alcohol consumption is associated to a specific pattern of DNA methylation, thus suggesting that alcohol produces specific epigenetic changes.

3.4 Evidence of lifestyle and breast cancer

Many behavioural choices during life are likely to enhance the risk of developing breast cancer. There is strong scientific evidence that not having children or having them after 30 years, avoiding breast feeding, prolonged use of the contraceptive pill, having hormone replacement therapy after menopause increase the incidence of mammary tumours. Other aspects of lifestyle have also been investigated. Among these, physical activity is associated with lower risk of invasive breast cancer [83]. However breast cancers are heterogeneous for histopathology, hormone receptor status and gene expression profile, and whether increased physical activity offers a true protection in all cases, is controversial. A considerable number of studies have been conducted world-wide on physical activity and breast cancer risk. On average, a 20-25% reduction in breast cancer risk has been observed amongst physically active women in comparison to the least active ones [84].

These results were confirmed in the recent European Prospective Investigation into Cancer and Nutrition (EPIC) study which demonstrated that moderate and high physical activity are associated with modest reduction in breast cancer risk [85]. According to these results, the Breast Cancer Report of WCRF and American Institute for Cancer Research (AICR) states that the evidence for reduction in cancer incidence in physically active women is probable [86]. A number of studies deal with the relationships between dietary habits and breast cancer incidence and mortality.

In evaluating the impact of diet and physical activity on cancer progression and survival, evidence from prospective observational studies suggests that physical activity and diet may be associated with improved cancer progression and recurrence [87].

In particular, a review by Davies et al suggests that a low-fat, high-fibre diet might be protective against breast cancer recurrence and progression; in this review a large prospective study (n=90655) found that dietary fat increases the risk of recurrence or death in premenopausal women with breast cancer [88]. Any findings from observational studies need to be interpreted with caution and findings from observational studies need

to be evaluated against findings from the more rigorous Randomized Controlled Trials (RCTs), like the Women's Intervention Nutrition Study (WINS) n=2437, a large-scale multicentre RCT which found a protective effect of a reduced-fat diet. This protective effect was more evident in women with hormone-receptor-negative breast cancer [57].

Pierce et al have also shown that patients that consume a healthy diet and are physically active may increase their years of survival after diagnosis of breast cancer and those who reported eating a minimum of 5 vegetable and fruit servings daily and performing weekly physical activity equivalent to 30 minutes of walking at a moderate pace for 6 days a week had a higher 10-year survival rate than those who did not adhere to these lifestyle practices [89].

Spark et al evaluated post intervention maintenance of physical activity and dietary behaviour change outcomes; their findings suggest successful maintenance was more common in trials using a theoretical model for intervention development that included behavioural change strategies [90].

Due to these positive results many Public Health agencies tend to promote a healthy lifestyle focused on reducing adiposity through a low-fat, high-fibre diet and regular physical activity. Among these are the WCRF/AICR (2007), the British Association of Sport and Exercise Sciences (2011), the Department of Health, Physical Activity Health Improvement, and Protection (UK) (2011), and the American College of Sports Medicine Roundtable on Exercise Guidelines for Cancer Survivors (2010) [87].

3.5 Presumptions of a plant-based diet and the risk of breast cancer

Substances contained in vegetable foods are studied as possible ways to prevent cancer, since a number of studies have suggested that people who eat more fruit and vegetables are less likely develop cancer. Although there is evidence to show that a diet rich in plant foods may be protective against cancer risk and provide many health benefits, published data are not univocal [91]; in particular the analysis of the correlation between diet and breast cancer is still a controversial issue.

By the 1980s, most reports dealing with the prevention of chronic diseases recommended relatively high intakes of vegetables and fruit, either because these foods were seen as nourishing substitutes for energy-dense fatty or sugary foods, or else because they were identified as positively protective agents against cardiovascular diseases. Evidence that vegetables and fruit might be protective against some cancers emerged in the 1990s [92]. Since the 1990s, a number of studies tried to understand what the role of plant foods was in the prevention of various types of cancer, including breast cancer, and despite that evidences in support of this statement are inconclusive.

In 1992 Block et al. reviewed 156 studies and concluded that 'for most cancer sites, people with low fruit and vegetable intake experience approximately twice the risk of cancer compared to those with a high intake, even after checking for potentially confounding factors. The risk decreased for cancers of the mouth and pharynx, oesophagus, stomach, colorectum and lung. Breast cancer risk was not affected [93]. Other large prospective studies have investigated whether high intakes of fruit and vegetables might be associated with a reduced risk of breast cancer, but overall the results are close to null. In the Women's Health Initiative randomised trial, an increase in fruit and vegetable intake of 1.1 servings per day, did not cause a significant change in the incidence of breast cancer after 8 years [94].

Accordingly, in the 2007 WCRF/AICR report it was stated that the evidence for an association between fruit and vegetable intake and breast cancer risk was too limited or inconsistent for a conclusion to be made. However a more recent meta-analysis, which reviewed fifteen prospective studies, revealed a lower risk of breast cancer for the highest versus the lowest intake of fruit and vegetables combined; but when fruit and vegetable were separated, data were significant only for fruit consumption [95]. Interestingly this study highlights that dietary changes during follow-up can obscure associations between dietary intake and disease risk if dietary intake is only assessed at baseline; in support of this statement, one of the studies analysed in this systematic review reported a RR of 0.59 (95 % CI: 0.40–0.87) for high versus low intake of fruit, berries and vegetables among women without a dietary change in the past, while there was no association among people who reported that they had changed their dietary intake, RR=1.26 (95 % CI: 0.63–2.55). This finding supports the hypothesis of epigenetic modulation through nutrition in early life and their role in the prevention of chronic diseases.

In addition, the results seem to be clearer when they are analysed in combination with the different type of tumours, in particular the expression of the ER. In this matter, the Pooling Project of Prospective Studies of Diet and Cancer analysed 20 studies and reported that only for oestrogen receptor-negative (ER-) breast cancer there was a statistically significant inverse trend for total fruit and vegetable consumption; in this case, when intakes of fruit and vegetables were examined separately, statistically inverse associations were observed only for vegetable intake [96]. It should be stressed that one of the main difficulties in these kinds of studies is the assessment of food intake, highly variable because of the different methods and nutrient database utilized [91]. To improve knowledge in this issue, exposure assessment can be measured using biomarkers of fruit and vegetable intake, such as circulating carotenoids. A pooled analysis of eight cohort studies published in 2012 analysed the associations between circulating carotenoids and breast cancer risk. Results showed statistically significant inverse associations between

circulating levels of total carotenoids and breast cancer risk. Associations were generally stronger among women of a healthy weight and for ER- tumours [97]. Several potential mechanisms may explain the inverse association between fruit and vegetables and breast cancer risk. These foods are important sources of fibre which may prevent breast cancer by binding oestrogens and reducing reabsorption of oestrogens in the colon. Moreover, fruit and vegetables are good sources of various phytochemicals, such as carotenoids, glucosinolates, indoles, and isothiocyanates, which may prevent breast cancer by inducing the activity of detoxifying enzymes, reducing oxidative stress, inflammation and changing the epigenome [98]. A high intake of fruit and vegetables may also reduce the risk of overweight/obesity, which is an important risk factor for postmenopausal breast cancer [65].

3.6 Presumptions about soy products and the risk of breast cancer

Soybeans and its products have been a staple part of the Asian diet for centuries; they are the predominant source of isoflavones, which belong to the family of phytoestrogens. Genistein and daidzein are the most known and studied phytoestrogens. Laboratory data show that isoflavones have a wide range of biological actions, including the growth inhibition of breast cancer cell lines [99]. From this, much has been said about their role in carcinogenesis but what we know about the role of soy consumption in breast cancer risk in human is unclear.

Since 1991, after the publication on Lancet by Lee HP and colleagues [100], many observational studies reported that soy intake may lower breast cancer risk, but these findings are highly variable. On the contrary, due to the apparent estrogenicity of genistein, women diagnosed with breast cancer have frequently been advised to avoid it. So, it would be useful to make sense of this issue.

In 2008 Wu et al conducted 2 separate meta-analyses of studies carried out in Asian and Western populations. A meta-analysis of 8 studies showed that Asian women consuming the highest amount of dietary isoflavones had a reduction in breast cancer risk, as compared with those with low consumption of isoflavones. When stratified by the amount of soy consumed, a dose-response relationship was reported with a statistically significant trend of decreasing risk with increasing soy food intake, translating to a 16% risk reduction per 10 mg of daily isoflavone consumed. In contrast, a meta-analysis of 11 studies of women eating Western diets found no association between isoflavone intake and breast cancer risk [101]. A more recent meta-analysis tried to discriminate soy isoflavone intake and breast cancer risk for menopausal status with similar results [102].

Studies that investigate the relationship between soy food intake after the diagnosis of breast cancer and health status reported a slightly protective effect especially among the Asian population [103,104] confirming the results collected so far.

There are different mechanisms that try to explain these various outcomes: first of all the role of diet in the epigenetic modulation especially during early life; indeed, the protective role of soy is more evident in Asian countries, where soy products are the basis of the typical diet since childhood. In support of this statement, several case-control studies found that soy intake during childhood or adolescence affects breast cancer risk in adulthood [105]. Similar studies also show that lifetime soy consumption at a moderate level may prevent breast cancer recurrence through mechanisms that change the biology of tumours; in particular, women who consumed soy during childhood are more likely to develop breast cancers that express significantly reduced Human epidermal growth factor receptor 2 levels (hEGFR2). Another mechanism that may explain the differences between populations could be related to the intestinal microbial transformation of phytoestrogen, since the metabolism of isoflavone can vary greatly between individuals. Equol (EQ), a metabolite of daidzein produced in the intestine, is absorbed more efficiently and has higher oestrogenic activity than daidzein but it was found that more than half of the adult population did not have a gut microbiota able to convert daidzein into EQ. This phenomenon has led to the classification of subjects into “EQ producers” or “non-EQ producers” [106]. The prevalence of EQ-producers appears to be higher in Japanese than in Caucasian women, which might explain the additional benefits conferred on Japanese women in terms of reduced breast cancer risk [107]. It is possible that the consumption of soy since early life can promote a suitable gut microbiota, however there is a lack of data to support this hypothesis. In summary, there is no evidence to advise against soy food consumption for the female population or women diagnosed with breast cancer. It is important to have a different approach with isoflavones supplements, as they provide a greater concentration of phytoestrogen, which indicates that interactions with biological mechanisms can be hazardous to health.

3.7 Presumptions about milk, dairy products, and the risk of breast cancer

Milk and dairy consumption has, over time, been suspected of playing a role in the development of breast cancer. The hypotheses that have been put forth to suggest an increased cancer risk associated with milk consumption include overall high dietary fat content, contaminants in milk and hormones contained in milk such as oestrogens and IGF-1 [108]. IGFs are also self-produced by the human body and have both immediate and long-term effects on various cellular activities, for example impact on cell proliferation, differentiation, migration and survival. The mitogenic and survival function of IGFs is not

only observed in normal mammary cells, but also in breast cancer cells. Additionally, in some cases the IGF-1 receptor is overexpressed and highly activated in breast cancer tissue compared with normal or benign tissue. What is important to emphasize is that the actions of IGFs can be modulated by interaction with a family of six insulin-like growth factor-binding proteins (IGFBPs) and their functions at the cellular level are not fully understood [109].

In a consistent systematic literature review that summarized and quantified the current findings on milk and dairy products consumption and its effect on the serum concentration of IGF-1, ten cross-sectional studies showed statistically positive correlation between milk consumption and the circulating IGF-1 level, and randomized controlled trials indicated that the circulating IGF-1 level was significantly higher in the milk intervention group. However, only three out of 12 studies reported a statistically positive correlation between dairy products consumption and IGF-1 serum concentration [110].

Many epidemiologic studies that examined the association between dairy product consumption and the risk of breast cancer have produced conflicting results, with inverse, positive or null associations reported [111].

A former meta-analysis published in the British Journal of Cancer concerning dietary fat and breast cancer risk, reported a positive association between milk and cheese consumption and the incidence of breast cancer [112].

However, a more recent similar meta-analysis showed a significant dose–response inverse association between all dairy food, but not milk, consumption and breast cancer risk [113].

A single study was published recently with regard to the association between milk and dairy consumption and recurrence and mortality after breast cancer diagnosis. In this cohort 1893 women diagnosed with early-stage invasive breast cancer were included and dietary habits were assessed with a Food Frequency Questionnaire. Consistent with previous literature, the results showed no overall association between dairy intake and recurrence or breast cancer–specific survival. However high-fat dairy intake was related to poorer overall survival in long-term breast cancer survivors [114].

Evidence of the relationship between milk and dairy products and the risk of cancer points in different directions thus making it difficult to draw a conclusion; the best advice towards milk, dairy products and breast cancer prevention is to consume these foods in line with the recommendations for a healthy diet, which favours low-fat dairy products in order to restrict the intake of saturated fats.

3.8 Discussion

One of the main limitations in the field of nutritional science is that food and nutrients are not consumed in isolation and, from an epidemiological point of view, form a complex network of correlated influences. Therefore, it is difficult to study dietary patterns, which simultaneously reflect these exposures[115]. Moreover, prospective studies are required to improve dietary assessment instruments and develop new biomarkers, particularly recovery biomarkers of dietary intake. In the same way, the stratification of breast cancer by specific characteristics should be further considered, particularly the individual metabolism, genetics, receptor status (Oestrogen Receptor, Progesterone Receptor, Human Epidermal growth factor Receptor-2), substantial decline of ovarian hormones after menopause and other molecular classifications.

It is possible that the beneficial effects of dietary exposures are restricted to subgroups of women defined by specific genetic characteristics; therefore, future studies of gene-diet interactions will have to take into account genetic polymorphism when associations between dietary exposures and breast cancer risk are analysed.

In addition, most of the evidence in the literature has been obtained from studies that have evaluated diet during midlife and later, whereas the food exposures during menarche and first pregnancy may be more important in the development of breast cancer [116]. This is an example of the importance of the critical time period of exposures and of the long-term diet effects of diet and other lifestyles on the epigenetic mechanisms.

There are few strong reproducible and convincing associations between dietary patterns and breast cancer incidence and/or mortality. This fact is reflected in the conclusion of the last Continuous Update Project (CUP) on breast cancer by WCRF, which attributes only to alcoholic drinks and body fatness a convincing role as dietary factors that increase breast cancer risk [86].

The lack of clear evidence for an effect of other nutritional parameters, such as the use of fruit and vegetable, fibre-rich diet and reduced red-meat consumption, is reflected in the absence of agreed procedures for health professionals; as a result, despite the “healthy diet and lifestyle” suggested by WCRF/AICR and other cancer agencies, healthcare providers do not have a landmark for breast cancer prevention [62]. According to Teegarden and colleagues, the best study that could provide direct evidence of the causal relationship between diet and cancer and to assess whether the adherence to the WCRF/AICR recommendations may modify cancer risk in a population, would be a randomised controlled trial. However the methodological difficulties in applying, maintaining and verifying the dietary intervention for a sufficient period of time, make this kind of study infeasible.

However, indirect but quite robust evidence can also be obtained from observational prospective studies, such as the European Prospective Investigation into Nutrition and Cancer (EPIC). EPIC is a multicenter prospective study aimed at investigating the complex relationships between nutrition and various lifestyle factors and the etiology of cancer and other chronic diseases. The study was initiated in 1993 in nine European countries and the field work was completed in 1998 with the inclusion of 484,042 subjects. All had provided questionnaire data [117]. Romaguera et al in 2012 constructed a score based on WCRF/AICR recommendations using EPIC questionnaires data from 386,355 participants. After a median follow-up time of 11 years, the results suggest that adherence to the WCRF/AICR recommendations for cancer prevention on diet, nutrition, physical activity and weight management, is associated with a lower risk of developing most types of cancer, including breast cancer [118]. This confirms that “healthy diet and lifestyle” are important tools for the prevention of cancer.

Moreover, after a diagnosis of cancer, individuals are often motivated to change their diet, exercise habits, and other lifestyles. Many are also interested in learning more about dietary supplements and nutritional complementary therapies to manage persistent symptoms of disease or treatment [119].

For these reasons, it should be a primary goal of the International Institutions to design a “Breast Cancer Survivorship Care Plan” considering the necessity of nutritional support for secondary prevention [120]. This plan can be targeted to meet individual needs of each patient, help improve survival and the quality of life [121].

As breast cancer remains a significant scientific, clinical and social challenge, establishing a multidisciplinary research consortium is essential to demonstrate the real power of lifestyle interventions in order to reduce the risk of developing breast tumours in women. More efforts should be placed to promote models of innovative approaches for preventing breast cancer, reducing the side effects of treatment and increasing survivorship.

CHAPTER 4

DO CANCER PATIENTS CHANGE THEIR DIET IN THE E-HEALTH INFORMATION ERA? A REVIEW OF THE LITERATURE AND A SURVEY AS A PROPOSAL FOR THE ITALIAN POPULATION. (accepted by Food Research International)

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4.1 Introduction

According to GLOBOCAN, in 2012, 14.1 million new cancer cases occurred worldwide. Lung cancer is the most common cancer in the world, both in term of new cases (1.8 million cases, 12.9% of total) and deaths (1.6 million deaths, 19.4%) due to its high mortality. Breast cancer is the second most common cancer overall (1.7 million cases, 11.9%) but ranks 5th as a cause of death (522,000, 6.4%) due to its relatively favourable prognosis; these two are followed, in terms of incidence, by colorectal cancer, prostate cancer, stomach cancer and liver cancer. These six cancers account for 55% of the global incidence burden in 2012 [56]. The Italian Association of Cancer Registries estimated that over 365,000 new cases of cancer would be diagnosed in Italy in 2016 [122]. In Italy, breast cancer is the most common cancer in terms of new cases (14%), followed by colorectal, lung, prostate and bladder cancers. In terms of mortality, lung cancer remains the primary cause of death by tumour followed by colorectal and breast cancers.

The high incidence of cancer, coupled with improvements in early detection and initial treatments, has led to an ever-increasing number of cancer survivors. In Italy, the number of people living beyond a cancer diagnosis reached nearly 3 million in 2015 (4.9% of the population). Based on these trends, cancer survivors' health is rapidly emerging as a major public health concern [123].

Although non-modifiable risk factors influence the incidence of cancer, most differences in the cancer risk between people is due to factors that are not inherited. Lifestyle factors have long been recognised as potentially important determinants of cancer risk: avoiding

tobacco products, maintaining a healthy weight, staying active throughout life and following a healthy diet may greatly reduce a person's lifetime risk of developing or dying from cancer [124].

The most extensive review of the existing evidence on diet and cancer is the 2007 World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) report and its subsequent updates [125]. Lifestyle recommendations for cancer prevention were drawn up on the basis of nutrition-related factors judged to be convincingly or probably related to cancer, according to predefined criteria for judging the strength of the evidence regarding causality.

A growing body of evidence also suggests that diet, exercise and body weight status can influence cancer survivors' health [126]. Due to the complexity of this field of research, evidence is too limited to develop specific recommendations; therefore, current recommendations for cancer survivors are based on primary prevention recommendations and emphasise achieving and maintaining a healthy weight, regular physical activity, a diet rich in vegetables, fruits and whole grains and limited in red meat and alcohol [127].

Sources of health-related information

Thanks to the advances in new communication technologies, there has been an explosion in the amount of available information on cancer [128]. This knowledge is not exclusively available to health professionals, since modern communication channels, such as the Internet, are changing the nature and speed of information and interaction between individuals and health organisations [129].

The readily available, large amount of information has enormous potential to influence what people know about cancer, but the main challenge is the difficulty in separating quality from quantity of cancer information [128].

A study by Hesse et al. has shown that, even though physicians remain the most highly trusted source of information, patients reported first going online for information. This first study provided evidence for the observation that people were turning to the Internet as an information source of first resort [130].

In the United States, periodic telephone surveys of American adults conducted by the Pew Research Center revealed that the percentage of adults who look for health information online increased constantly and those with chronic conditions are likely to report that online searching has affected their treatment decisions and their interactions with doctors [129]. Significant growth in the use of the Internet for health purposes was also found in seven European countries participating in a survey [9,10,131].

In Italy, a multicentre survey was designed to provide information about Internet use for health-related purposes and to assess the possible behavioural consequences. Internet users accounted for 64.6% of the total sample and the rate of e-health use (use of the Internet for any health-related purposes) amounted to 56.5% of Internet users. The rate of users adopting any dangerous modifications of behaviour based on information found on the Internet was quite high and noteworthy, especially in women and in those with chronic diseases [11].

In this context, there is a growing interest in health promotion through education and people want to receive as much information as possible; this desire for information about healthy living is undoubtedly an increasing trend among cancer patients and the Internet has become a major source of medical and health information for patients and families [9,132].

eHealth in cancer patients

Little is known about the impact of health information obtained from the Internet (eHealth) on cancer patients' behaviour and choices, as only a few studies have been published in some countries.

A small structured Spanish survey found that the rate of Internet use amounted to 27% for cancer patients and 58% for their relatives. Around half of Internet searchers felt more optimistic after the search, whilst negative feelings were less reported by the interviewees [133].

In Canada, another small survey of radiation oncology patients found similar results and most patients wished their doctors had supplied them with links to medically relevant websites [134].

Information needs in cancer patients

Since effective communication is known to be a key for optimal health outcomes, understanding *what* patients need to know, *when* during their care pathway and from *whom* they receive this information becomes vital to ensuring the delivery of quality cancer care [132].

Many investigations and reviews of the literature were conducted to identify cancer patients' information needs and the sources used to obtain cancer-related information. In most of these publications, different typology of information needs were created and grouped into categories and subcategories. As would have been expected, one of the most frequently cited categories during the diagnosis and treatment phase was related to treatment options and side effects (i.e. "*treatment-related information*" or "*tests and treatments*"). A greater proportion of cited needs during the post-treatment phase were

“rehabilitation information”, “self-care issues/home care during recovery” and “health promotion”. The few studies that investigated the level of information needed about diet and nutrition recorded that around half of the interviewees wanted information about this topic and approximately one in four patients look for information about “prevention of cancer”. When asked, over half of the respondents also reported that they trust Internet-derived information “a lot” or “some” [132,135,136].

A study conducted in Boston by the Harvard School of Public Health and the Dana Farber Cancer Institute found that health information-seeking is associated with social determinants. The research shows a relationship between the level of education and need for information about “self-care management” (such as diet/nutrition, staying healthy, etc.). These types of information were sought by 28% of the respondents with less than high-school education and by 60% of those with a post-graduate degree [137].

Most studies on cancer patients and survivors’ information needs have been conducted in the United States, while only few investigations have been performed in other countries. During the period September 2010 - March 2011, an online multi-lingual questionnaire was designed and administered to cancer patients in 24 European countries. Among the several options proposed, 80% of the patients strongly agreed or agreed to the statement “I want information on diet and nutrition”. However, over 50% of respondents *strongly agreed* or *agreed* that they wanted information on all of the information suggested in the questionnaire, meaning the results of the study were not very remarkable [138].

From this background, four points emerge:

1. There has been an explosion in the amount of available information on cancer in parallel with an ever-increasing number of cancer survivors
2. Cancer survivors could be influenced by this amount of information in terms of subsequent health-related choices
3. The perceived importance of the Internet as a health information source is increasing and there is relative growth in Internet use for health purposes, especially among young women and in those with chronic diseases
4. People with cancer are interested in finding out information about their disease and in exploring information about a range of cancer topics.

Considering these factors and taking into account that cancer-related information could drive food choices in cancer patients, our purpose is, firstly, to explore the available literature about dietary changes after cancer diagnosis. Secondly, we propose a method to investigate this issue in the Italian population, based on papers considered in this publication.

4.2 Methods

We conducted a search for all English language articles on MEDLINE via PubMed with publication dates from 2000 to 2017. The search for the “dietary changes” section included the following terms: dietary changes / dietary habit changes / dietary intake changes / food habit changes / dietary changes AND after cancer diagnosis / after cancer / cancer survivors / cancer patients / following cancer diagnosis. The search for the “supplement use” section included: supplements / supplement use / vitamin and mineral use AND after cancer diagnosis / after cancer / cancer survivors / cancer patients / following cancer diagnosis.

The search gathered only 27 papers on the topic, as it is a relatively newly-studied phenomenon. We discarded non-observational studies and studies that did not focus on cancer patients.

Finally, we included 20 observational studies, mostly original articles, with the main aim of evaluating changes in cancer patients’ diet after diagnosis.

4.3 Dietary changes after cancer diagnosis

Cancer patients are known to be more sensitive to health-related information, therefore, their ability to make informed health-care decisions is enormous. However, due to the overall variable quality of information available, there is a concrete possibility of them acting upon erroneous messages or misunderstood advice. This topic has been investigated mostly in breast cancer (BC), colorectal cancer (CC) and prostate cancer (PC) patients.

In this context, knowing that it is not possible to draw conclusions representative for all cancer patients, our aim is to explore the literature about the extent and type of dietary changes among these cancer patients, as a potential consequence of this huge availability of information.

How many patients change their dietary habits?

Breast cancer

Changes in dietary habits, after a cancer diagnosis, have been mainly investigated in breast cancer (BC) patients, as it is the most common cancer in women and the most prevalent cancer in the world.

Salminen et al. conducted, in Finland in 2000, one of the first studies in Europe that investigated the role of BC diagnosis in changing dietary habits. They surveyed 123 patients and found that one-third of BC patients had changed their dietary habits following diagnosis (31.9%)[139]. In 2002, the same group again collected information about ideas

and attitudes of BC patients in two cohorts from two countries, one with 215 Australian BC patients and the other with 139 Finnish BC patients. They found that 30% of Finnish BC patients and 38% of Australian BC patients changed their diet after diagnosis [140]. Other groups also found similar percentages of change. Maunsell et al. reported that among the 250 BC patients who were interviewed, 41% made dietary changes in the 12 months after diagnosis [141].

These data were slightly higher in Patterson et al., where 59.5% BC patients among 126 reported, during a telephone interview, made dietary changes and in Shahrudin et al. where 57.8% of 116 BC patients changed their diet after finding out about their cancer [142,143].

Only one study, conducted in the U.S., found a very high percentage of BC patients who declared to have changed their diet after diagnosis [144]. They accounted for over 80% of the study population. In this study, a questionnaire from the Women's Healthy Eating and Living Study (WHEL) was given to 3,084 women who were treated for breast cancer within the past four years. Women had to report their changes in the consumption of selected food items before and after diagnosis. The authors addressed the discrepancy in data with other studies in different cultural norms or variability in the awareness of a diet and cancer link. Also, U.S. women may be demonstrating a recall bias based on their understanding of what they perceive they should be consuming to improve their health status. In addition, this was the study with the highest number of women involved compared with the other studies mentioned above and also with the longest time since diagnosis.

To summarise, in the studies here analysed, breast cancer patients reported changing their eating habits after diagnosis in a percentage varying from approximately 30% to about 60%, or even higher (80%) when a longer time since diagnosis is investigated.

Colorectal cancer and Prostate cancer

Fewer studies have explored the topic of dietary changes in colorectal cancer patients (CC) and prostate cancer patients (PC) after diagnosis. In a study in which colorectal, prostate and breast cancer patients were asked in an interview whether they had made any behavioural changes in the past 12 months, dietary changes occurred in 32.8% of CC patients (n=116) and in 27.7% of PC patients (n=114) [142].

Similar data were found in two recent studies with both CC and PC patients. One involved 1,458 CC survivors, both female and male, who participated in a survey; it emerges that 36% of them reported having changed their diet since diagnosis [145]. Another study with 6,407 PC patients, who were given a food frequency questionnaire, showed a significant

change in the intake of one to five food/nutrient categories for 29.2 % of the subjects [146].

Overall, in these studies, changes in dietary habits occurred in approximately 33%-36% of CC patients and in around 28%-29% of PC patients.

Why do cancer patients change their dietary habits?

Reasons for changing eating habits were reported only by few studies. In Salminen et al., the most common reasons reported for changing diet were a desire for cure in more than half of the patients (52.9%), to alleviate symptoms of nausea and to follow doctor's instructions (11.8% each) in a smaller percentage of women [139]. Whereas, in a following study with Finnish and Australian BC patients, a higher proportion of Australian women declared changing their diet in an attempt to alleviate symptoms of nausea [140]. In another study with Malaysian BC patients, the most common reason reported for changing diet was to follow doctors' instructions (58.2%), while a lower percentage of patients changed their diet due to their increased desire to cure their cancer (35.8%) [143].

The most frequent reason reported by CC survivors for having changed their diet after diagnosis was to prevent the cancer from recurring (44 %). Other reasons for dietary changes were to support therapy and recovery (20 %) and cancer-related complaints (19 %) [145].

Cancer diagnosis has been referred to as a possible "teachable moment" in which survivors are more likely to be motivated to undertake lifestyle changes to improve health outcomes. A substantial number of reports suggest that cancer survivors spontaneously adopt lifestyle changes in the hope of achieving improved health. Dietary modification is a prevalent behaviour change noted after diagnosis. Many cancer survivors are strongly motivated to make dietary changes based on a variety of beliefs on how to control their disease, however, it is unclear what guides these dietary choices [28,147].

Longitudinal studies investigating the impact of a cancer diagnosis on health behavioural changes, have reported different results in eating habits, levels of smoking, alcohol consumption and physical activity in cancer survivors compared with the general population. Generally, cancer patients are more likely, after diagnosis, to make changes to their dietary choices and smoking habits [148,149].

Differences in dietary changes by age, sex and education

What essentially emerged from the previous survey investigating dietary changing after cancer diagnosis is that age, sex and level of education are related to changes.

Age

In several studies with BC patients, it was found that younger women, mostly <50-60 years old, were more likely to change their eating habits, whereas older women were more likely not to change their dietary selection after diagnosis. This phenomenon was observed in Finnish, Australian, American and Canadian populations, although data did not always reach statistical significance [139,140,141,142,144,150]

Similar data were also found in CC patients, in which self-reported dietary changes were significantly more likely among survivors who were under 65 years of age [145].

Sex

When a study investigated a population representative for both women and men, it emerges that women were more sensitive than men to making changes to their diet after a cancer diagnosis. Data were significant only when dietary changes were associated with supplement use [145].

Education

Another common association found was in patients' educational levels. Cancer patients with higher educational levels (e.g. university education) had a greater probability of changing their eating habits [140,142].

Time since diagnosis and therapies

Time since diagnosis and therapies, in some studies, were a factor contributing towards influencing dietary changes. In particular, changes in diet were less likely to occur in newly diagnosed Australian patients, with a similar trend for Finnish patients [140]. This was also noted in a study by Thomson et al., in which the longer the time since diagnosis, the more likely BC patients were to have made dietary changes [144]. In the study by Skeie et al. BC patients were divided in two equal groups according to time since diagnosis and compared to the cancer-free women; the largest differences in eating habits were found between the group diagnosed more than 2.4 years and the cancer-free women [151]. Conversely, in the study with Malaysian BC patients, more than a half changed their diet after learning of their cancer soon after diagnosis, whereas others changed their food choices after having undergone surgery (about 1 in 3) and a very small portion did so with chemotherapy and radiation treatment [143]. Whereas Patterson et al. reported that patients diagnosed from 12 to 24 months, were equally as likely to report making lifestyle changes as those diagnosed less than 12 months ago [142].

Regarding cancer therapies to which patients were subjected, Maunsell et al. found that BC women with regional stage disease at diagnosis, who received adjuvant radiotherapy or

chemotherapy were more likely to report dietary changes. Interestingly in this study, they also observed that higher psychological distress at baseline was a driver for modifying food choices [141].

In another study, it emerges that patients (BC, CC, PC) receiving three or more medical treatments were two to three times more likely to make dietary changes compared with patients receiving only one medical treatment [142].

Types of dietary changes

Methods used to evaluate the extent of patient's eating habit changes included questionnaires, such as Food Frequency Questionnaire validated in a previous study (EPIC, WHEL study), ad-hoc questionnaires and face-to-face or telephone interviews.

Therefore, given that the different nature of the methodologies used (qualitative vs. quantitative) to investigate this topic entails a lot of possible bias, such as recall bias, social desirability bias, also even due to the target population in terms of stage of cancer and treatments, we will try to summarise the main findings on what kind of dietary changes cancer patients commonly make after diagnosis.

Interestingly, a lot of cancer patients undertake positive and healthy food choices after learning of their cancer diagnosis. In fact, the adoption of "healthier dietary patterns" is reported by the majority of the study analysed, these generally include: an increase in the consumption of fruits and vegetables, reduction in the consumption of fats, red meat, sugary foods [139,141,142,143,144,145,148,150,152,153,154].

In the first study with Finnish BC patients, an increased consumption of fruits, berries and vegetables was reported by 60.5% of patients who had changed their dietary habits, while 36.8% reported avoiding fatty foods, sugar/sugary products by 26.3% and red meat by 21.1% [139]. In the study of the same group with both Finnish and Australian BC, they reported equivalent findings in food choices. But a major difference emerged in milk product consumption, which 1.5% of Finnish patients compared with 18% of Australian patients reported having reduced [152].

Furthermore, in a large US study with over 3,000 BC patients, it emerges that the most frequently reported changes after diagnosis were a decrease in red meat intake in 61% of women, a decrease in the intake of cheese, hamburgers, fast foods, fried foods, cakes/sweets/desserts and pizza in a percentage around 50% for each food item. On the other hand, women were more likely to increase their consumption of vegetables (60%), fruit (58%) and whole grains (39%) [144].

The same results also emerged when trained interviewers used a computer-assisted telephone interview system to administer a structured questionnaire to BC, and PC

patients. Among reported dietary changes, the most common was eating more fruits and vegetables (45%), followed by eating less red meat (26 %) and less fats (28%) [142].

Healthier food choices were observed as well in other cohorts. For instance, in a study with CC patients in which they had to complete a self-administrated questionnaire, most survivors reported having started using less fats, meat, sugar, alcohol, and salt since their CC diagnosis, while consuming more fish, vegetables, fruit, fibre, wholegrain and water [145].

Moreover, Avery et al showed that PC patients change their diet generally in a healthier direction. Results are presented by risk and protective factors for PC and cancer and heart diseases in general. Over a third of men increased their fresh tomato intake and 23.5% ate more tomato products. A further 28.6% of men drank more fruit/vegetable juice (including tomato juice). In around 40.0% of men, there was a small increase in protein intake after diagnosis and 19.0% ate less red meat, though 26.5% ate more [146].

These data were also confirmed by a recent large survey with over 16,000 people representative of both cancer and the general population, included in a cross-sectional Scottish survey. Cancer survivors, compared with those with no history of cancer, were significantly more likely to eat at least five portions of fruit and vegetables a day (21% vs. 15%, ORadj 1.41, 95% CI 1.19–1.66). Within each major cancer site, breast cancer survivors were more likely to eat fruit and vegetables, with most of them more likely to eat five or more portions per day [148].

Conversely, the study by Skeie et al. showed that all groups in the Norwegian Women and Cancer cohort (cancer free women, BC and CC survivors) made some dietary changes during two data collection periods (1996-1999 and 2002-2005). The changes went in the same direction for both cancer free and cancer survivors groups and seemed to be in line with general health and nutrition advice and not particularly related to cancer diagnosis. As many others, even Skeie et al. found an increase in fruit and vegetable consumption, significantly higher for BC survivors than CC survivors [151].

Other studies processed the results reporting dietary changes by considering them positive or negative, based on current recommendations for cancer prevention. In particular, one study by Maunsell et al., with BC patients, changes in diet were considered positive if intake of fish, fruit and vegetables and legumes was reported as increased (or introduced) and if intake of meat, desserts and alcohol was reported as reduced (or eliminated). Changes in dairy products were qualified as positive if women reported consuming products with a lower milk fat content. Changes in consumption of cereals and bread were rated as positive if women reported consuming varieties with a higher fibre content. Only a very small percentage of reported changes were classified as negative. The

most frequent negative change was increased dessert intake, although, overall, the large majority of women still reported positive changes with respect to this food type [141].

Few countertrends were observed in the study by Fassier et al. in which data were obtained from 'The NutriNet-santé cohort', a large French on-going web-based cohort. Every year, participants are invited to complete three non-consecutive 24-h dietary records, randomly assigned over a 2-week period. Fassier et al. analysed data from participants who self-declared a cancer diagnosis during follow-up and completed at least two 24-h dietary records before diagnosis. They observed in a sample of 696 cancer patients (cancer location: 246 breast; 119 prostate; 71 digestive; 260 other) a decrease in vegetables habitual intake. They also reported, differently from other studies, an increase in fats consumption [155].

Among possible explanations of the decrease in vegetable intake hypothesized by authors there are gastrointestinal/oral symptoms and fear of dietary pesticide exposure, which have been associated with some cancer (prostate and hematopoietic) among professional users. The first hypothesis could be plausible as the follow-up dietary records collected refer to a relatively short time after diagnosis (5.9 ± 3.9 months), a period in which food intake can possibly still be affected by cancer therapies' side effects [156].

One interesting study on this topic was recently conducted by Mardas et al. with a small group of patients undergoing chemotherapy for epithelial ovarian cancer. In this study, they compared food intake, assessed with both a 7-day food record and a semi-quantitative questionnaire, of patients undergoing either a first-line chemotherapy or a subsequent-line chemotherapy. It emerged that women who were undergoing subsequent-line chemotherapy more frequently consumed ('eat much more often' and 'eat more often') rye bread, pasta, buttermilk, vegetables: onion, leafy, red and legumes, fruits: berries, drupe and pome, oils, nuts, and juices. In contrast, women undergoing first-line chemotherapy were characterised by a higher intake of milk, cottage cheese, cream, eggs, fish and seafood, meat offal, salty snacks and jam [157].

To give an overview about the most frequently reported dietary changes, we have summarised in Table 4.1 the main outcomes of the 11 studies that specifically reported changes in food items or food groups consumption. For this summary we discarded studies that did not have a comparison with the pre-diagnosis period and studies focused only on supplement use.

As it can be seen from Table 4.1, changes are mostly oriented in healthier dietary patterns. The most common reported dietary changes are the increase in fruit and vegetable consumption and the decrease in the consumption of red meat, followed by the decrease in fats and sugary foods consumption and the increase in wholegrain consumption.

However, the majority of these studies describe qualitative changes, so it is not always possible to determine the extent of a positive or negative change. For example, Wayne et al. commented in their paper that the increase in fruit and vegetable servings intakes they noted is, on average, still below the recommended five servings per day. They also commented that two important points should be established: if women are accurately reporting true dietary changes and, if so, how much of a change they are making.

Table 4.1. Main outcomes in dietary changes among cancer patients

Study	Increase in fruit & vegetable consumption	Increase in wholegrain consumption	Decrease in fat consumption	Decrease in red meat consumption	Decrease in sugary foods consumption
Salminen (2000) No. patients: 123 breast cancer Time since diagnosis: 0 - more than 5 years	✓		✓	✓	✓
Maunsell (2002) No. patients: 250 breast cancer Time since diagnosis: 0 - 1 year	✓	✓	✓	✓	✓
Thomson (2002) No. patients: 3084 breast cancer Time since diagnosis: 0 - 4 years	✓	✓	✓	✓	✓
Patterson (2003) No. patients: 126 breast cancer; 114 prostate; 116 colorectal Time since diagnosis: 0 - 2 years	✓		✓	✓	
Salminen (2004) No. patients: 354 breast cancer Time since diagnosis: 0 - more than 5 years	✓		✓	✓	✓
Wayne (2004) No. patients: 260 breast cancer Time since diagnosis: 0 - 9 months	✓		✓		
Valentzis (2011) No. patients: 1560 breast cancer Time since diagnosis: 9 - 15 months	✓		✓	✓	
Shaharudin (2013) No. patients: 116 breast cancer Time since diagnosis: 2 years	✓			✓	
Yaw (2014) No. patients: 368 breast cancer Time since diagnosis: from 1 year to 4.9±3.5 years	✓		✓	✓	✓
Bours (2015) No. patients: 1458 colorectal cancer Time since diagnosis: after treatments (average time 6.9 years)	✓	✓	✓	✓	✓
Fassier (2017) No. patients: 246 breast cancer; 119 prostate cancer; 71 digestive cancer; 260 other cancer Time since diagnosis: 3-12 months				✓	✓

Although studies often find similar dietary changes for a great number of food groups, the consumption of milk is a bit controversial. While some studies found an increased intake [143,145,153] some others found a decrease in the habitual consumption [144,155], with differences for milk's fat content: generally the intake of full fat milk was reduced and skimmed one was increased. This could reflect a sort of confusion in cancer patient's minds, especially for breast cancer patients, as the role of milk consumption in breast cancer development is often debated by media in both negative or positive way [158].

Supplement use

One of the most common changes in health behaviour that cancer patients often make concerns the use of supplements. Although many studies investigating this topic were conducted in countries in which, for the general population, it is very common to use supplements, it was found that cancer patients are often more likely to use supplements or to start using them after a cancer diagnosis [139,141,142,145,152,153,159].

It also emerged that the use of supplements is more common among patients with a higher degree of education than those with a lower level of education and in younger patients compared with older ones [139,142,152]. In some cases, patients with a longer history of cancer were more likely to use supplements compared with newly-diagnosed patients. Also, when studies considered a target population with both women and men, it was found that use of supplements was higher in women [139,142,145].

The majority of these studies only asked patients if they were taking supplements at the time of the interview/questionnaire, while only a few of them explored whether cancer patients started or stopped taking supplements after their diagnosis, i.e., if they had changed their habitual intake consequently to cancer. In any event, it emerged that the proportion of cancer patients taking supplements was frequently high, in most cases ranging from around 40% to 50% [139,141,142,152,153].

For example, in the study by Patterson et al., 356 BC, CC and PC patients were asked if they had taken, in the past 12 months, any vitamin, mineral, herbal or other supplements. It emerged that out of a large proportion of the sample, 48% declared having started to take new dietary supplements after learning of their cancer. The most common supplements taken were: multivitamins and/or vitamin E, followed by calcium and vitamin C compounds. Female patients and younger patients were statistically more likely to take new dietary supplements. Also, patients with distant/regional disease were around 2 times more likely to take new supplements compared with those with local disease [142].

In a large recent study with 1,458 colorectal survivors, participants were asked to report in a questionnaire whether they had made changes to their diet and in the use of supplements since their CC diagnosis. In total, 32% of the CC survivors reported to use

dietary supplements. Among these, 41% reported to have been using supplements since before their CC diagnosis and 59% reported to have started using supplements since after their diagnosis. The median number of different types of supplements reported was 2 (interquartile range 1–3). Use of multivitamins and minerals was most frequently reported by the survivors (50%), followed by vitamin C (37%), vitamin D (34%), magnesium, fish oil and glucosamine. Interestingly, reasons reported for using dietary supplements rarely concerned cancer-related complaints (4%), but were more frequently to prevent the cancer from recurring (25%), to support therapy and recovery (33%), or other reasons (38%). The most frequently mentioned other reasons for supplement use were to improve general health and prevent disease [145].

In 2008, a review of studies published between 1999 and 2006 considering the U.S. population, confirmed that vitamin and mineral supplement use is widespread among cancer patients and longer-term cancer survivors and that, after a diagnosis of cancer, individuals tend to increase their use of vitamin and mineral supplements. The use of these products by the cancer population is frequently higher than their use in the general population. In the studies that combined survivors of different cancers, estimates of prevalence of any vitamin or mineral use ranged from 64% to 81% and use of any multivitamins ranged from 26% to 77%. Between 14% and 32% of survivors initiate supplement use after diagnosis and use differs according to cancer type: breast cancer survivors reported the highest use, whereas prostate cancer survivors reported the least. In addition, a higher level of education and female sex emerged as factors most consistently associated with supplement use [159]. One of the most interestingly data emerging from this review is that 31% to 68% of cancer patients and survivors who use supplements or complementary alternative medicines (CAM) do not discuss their choice with their physicians. However, the reasons for this lack of communication are not entirely clear. Several studies indicate that physicians are simply not asking about CAMs and supplement use or are not recording their use in medical records when patients mention it.

4.4 Discussion

From the literature analysed herein, it is possible to summarise that changing dietary habits are frequently reported by breast cancer patients in a percentage ranging from 30% to 60% of the investigated population. When asked, patients commonly reported that changes in their diets were driven by an attempt to alleviate symptoms caused by treatments, a desire for cure from cancer or to prevent a recurrence of disease. Patients who reported changes were more likely to be younger (<50/60 years old), with higher educational levels and with a longer period of time since diagnosis of cancer. Changes in

eating habits were generally oriented in a healthier direction, commonly including an increase in fruit and vegetable consumption, a decrease in the consumption of red meat, fats and sugary foods. In addition, it also emerged that cancer patients are often more likely to use supplements (multivitamins, minerals or a specific vitamin or mineral) or to start taking them after finding out about their cancer, in a percentage of about 40-50%.

Possible implications of dietary changes

The interest in expanding the knowledge about the effects of diet after cancer is increasing and a lot of research fields are currently investigating the molecular mechanisms, from experimental models to human studies. While for cancer primary prevention there is a general agreement regarding diet's role, and specific recommendations are already published, research into the effects of nutrition in cancer survivors is still in its early stages. For instance, several studies have investigated this issue on different outcomes, such as cancer prognosis, risk of recurrences and survival. Still, there are numerous trials and cohort studies currently on-going. Here we cite some relevant publications.

A 2016 systematic review and meta-analysis of 117 cohort studies (n=209,597 cancer survivors) found an inverse association for the risk of mortality for the highest intake of vegetables and fish, compared to the lowest. Conversely, alcohol consumption was associated with both increased risk of overall mortality and risk of cancer recurrence. This association was also seen among breast cancer survivors for post-diagnosis alcohol intake. No significant associations between cancer recurrence and vegetable intake could be observed. Considering the whole diet, higher diet-quality indices and prudent/healthy dietary patterns were associated with a decreased risk of mortality in cancer survivors, whereas Western dietary patterns resulted in the opposite outcome [160]. Consuming a Western diet showed as well greater risk of recurrence and overall mortality, compared to those with a prudent diet, in a prospective study with 1009 colorectal cancer survivors [161].

Moreover, a meta-analysis of 56 observational studies (n=1,784,404 cancer survivors) showed that greater adherence to a Mediterranean-style diet was associated with lower all-cause cancer mortality, whereas for cancer specific mortality and cancer recurrences data were not statistically significant [162].

For specific nutrients, a recent meta-analysis of four prospective cohort studies (n = 3675) found that high saturated fat intake, but not total fat intake, increased breast cancer-specific mortality [163].

Recently, a study also examined the association of post-diagnosis dietary insulin scores with survival among 2006 patients from two large prospective cohorts who were diagnosed with colorectal cancer. Investigators found that higher post-diagnosis dietary

insulin load and dietary insulin index were associated with a statistically significant increase in the risk of both colorectal-specific and overall mortality, principally observed among patients who were overweight or obese. Interestingly, pre-diagnosis dietary insulin scores were not associated with colorectal cancer survival [164].

Although epidemiological studies show that healthy dietary patterns are associated with reduced cancer recurrence and mortality, randomised controlled trials of diet-related factors have not yet shown any conclusive associations. Furthermore, results from Randomized Controlled Trials (RCTs) are controversial or inconclusive, since cancer survivors represent a heterogeneous population. This is true even with a specific target like breast cancer patients, known to be characterized by different hormone receptor status, that can influence both response to treatments and lifestyle intervention, specifically diet. The Women's Intervention Nutrition Study (WINS) concluded that reducing dietary fat intake was marginally associated with longer relapse-free survival of breast cancer patients, an effect most noted in the subgroup with estrogen negative tumors. They also observed a reduction in body weight in the intervention group that followed the low fat diet, compared to the control one [165]. Conversely, in the Women's Healthy Eating and Lifestyle (WHEL) study, fruit and vegetable consumption above five servings a day, a high fiber intake and a low intake in fat did not affect prognosis (additional breast cancer events or mortality) in previously treated early stage breast cancer patients, during a 7-year follow-up period, neither did it lead to changes in body weight between the intervention group and the control group [166].

Cancer survivors are a complex population, considering differences in the health at various stages, cancers of various sites, and the effects of the many types of conventional and other therapies used. Moreover, survival could be influenced by genetics, different lifestyle factors such as diet, physical activity, sedentary behavior, which seem also to interplay [167]. The 2007 WCRF/AICR expert report stated that no conclusions could be derived from the results of studies on 'healthy diets' for cancer survivors. Therefore, WCRF's advice for cancer survivors is to follow the dietary recommendations for cancer prevention: be as lean as possible within the normal range and be physically active, eat mostly plant foods, limit intake of red meat, alcoholic drinks, energy-dense foods and salt, and avoid processed meat and sugary drinks [125].

Knowing that it is not possible to find a one-fits-all approach and that more researches are needed to understand the role of diet and other lifestyle factors, we think that it is crucial to intercept patients' attitudes regarding diet after diagnosis. Changes in food choices, both in positive or negative ways, if maintained, could result in long term eating behaviour. Even though specific food choices would not be effective in influencing directly cancer prognosis, they could possibly have an effect in reducing or increasing the risk of

other diseases, for which cancer patients are known to be more exposed, such as cardiovascular diseases [168].

Although dietary changes are not very well investigated in the European population and available data come from mixed methods of study, mostly on breast cancer patients, they undoubtedly suggest that patients might consider changing their diet after diagnosis and, in some cases, do so.

4.5 The ECHO survey as a proposal

Among studies on the Italian population, we found only one survey aimed at evaluating oncologists' awareness and consideration of malnutrition. They reported a frequent and increasing tendency of patients to adhere to hypo-caloric dietary regimens with a putative anticancer effect [169]. To our knowledge, the topic of dietary habit changes has not been investigated in cancer patients in Italy. Therefore, we propose an approach to explore it with a structured questionnaire: The "ECHO SURVEY - Eating habits CHanges in Oncologic patients".

The review of the literature available was essential to develop a questionnaire that could be exhaustive in covering aspects previously examined and then adapted to the Italian cancer population. Among methods for exploring dietary changes in cancer patients, those most frequently used by other studies were food frequency questionnaires, ad-hoc questionnaires and interviews. All these techniques could imply a bias towards reporting socially desirable behaviour; another limitation commonly reported by authors is the recall bias when patients are asked to report their dietary intake from 1 or 2 years before and, in particular, when filling out a semi-quantitative questionnaire.

In this view, we designed the ECHO questionnaire as an ad-hoc questionnaire and, taking into account the incidence and survival of breast cancer in Italy, we planned to administer it firstly to this target: breast cancer patients who received their diagnosis 1 to 18 months before. In defining this period, we considered that time may be necessary for a cancer patient to start lifestyle changes, as life plans and daily activities soon after receiving diagnosis may represent barriers to dietary changes. On the other hand, a period no longer than one year and a half from diagnosis could be reasonable to recall dietary intake, also because our questionnaire does not investigate quantitative consumptions. Lastly, it was designed to be completed by the respondents without intervention of the researchers collecting the data. This enables a large number of people to be reached at a relatively low cost and to reduce interviewer bias. Considering all these points, in our opinion, the ECHO questionnaire could be an accurate method for qualitatively assessing eating habit changes in cancer patients.

The ECHO questionnaire consists of three sections: 'personal data', 'supplements and specific diets after diagnosis' and 'dietary changes after diagnosis'. In the first section, patients are asked to report their data about age, education, on-going and completed treatments.

The second section investigates the use of supplements and products claimed for their anti-cancer properties and specific diets undertaken after the diagnosis. In this part, it is also asked about the sources of information that guided these behaviours and if patients discuss them with their own oncologist.

In the last part, in order to investigate patients' dietary changes, questions were drawn up with semantic differential responses (e.g. 'never eaten', 'reduced', or 'increased') to indicate the consumption for each of the 24 food items in 9 food domains. We selected foods representative of the typical Italian diet and also took into account the more popular myths and presumptions about food and breast cancer [158,170]. The last question of this section investigates the sources of information that guided dietary changes.

Please see the Appendix 4.1 for additional information about the items investigated using the ECHO questionnaire.

To define the final version of the ECHO questionnaire, we conducted a pilot evaluation aimed to test the level of comprehension of the questions, to determine the time required for filling them out and to identify critical aspects not considered during the design phase. To this end, the questionnaire was administered to 19 Italian breast cancer patients. After they completed the questionnaire, we interviewed every single patient using a semi-structured debriefing form based on pre-test methods. The oncologists of the cancer centre selected the patients on the basis of the inclusion and exclusion criteria of the ECHO Survey protocol, essentially breast cancer patients with carcinoma in situ (stage 0) or invasive breast cancer (stage I–II), able to fill in the questionnaires. The 63% of breast cancer patients reported that the comprehension of the questions was "very easy" while the other 37% answered that it was "slightly easy". Other options were "somewhat difficult" and "very difficult" but no one chose these. As a result of the pilot study we re-defined few questions by changing certain words that were misunderstood by the patients especially regarding supplements and other product uses.

The ECHO questionnaire is ready to be tested, with a single administration, in the Italian breast cancer population. Taking into account the variety of the Italian territory in terms of cancer statistics, food habits, educational levels and economic status, we are about to conduct a multicentric survey involving centres from different regions [170,171].

4.6 Future perspectives

The results obtained by the ECHO survey with breast cancer patients will represent a first step towards focusing on this emerging issue not yet investigated in Italy; they may also shed the light on patients' interests and behaviour regarding diet after diagnosis.

It is extremely important to understand what kind of changes cancer patients undertake, in order to intercept patients' information needs and guide them to make conscious choices. Therefore, an important task in practice would be to develop adequate evidence-based information, specific to this target population.

Physicians and specialist oncologists may have a key role in both identifying specific behaviours and understanding patients' needs, in order to fulfil this necessity with tailored advice. Several actions could be effective to improve doctor-patient communication on this topic, such as:

- creating networks with healthcare professionals in the field of nutrition;
- developing tools aimed at improving scientific updates on the role of nutrition in cancer management;
- providing continuous education training.

Also, the organisation of public "question time" meetings, where patients can interact with health professionals and vice versa, could give patients a more active role.

Furthermore, cancer diagnosis, referred to as a possible "teachable moment", has the potential of triggering positive lifestyle changes, as individuals may be receptive to behavioural change interventions. Knowing that, more efforts are required from healthcare systems to provide appropriate nutritional counselling targeted to cancer patients during treatment and follow-up (Demark-Wahnefried et al., 2005).

Indeed, it is fundamental to better define the role of dietetic professionals in the cancer patient setting, since, until now, it has been known mainly for nutritional status assessment and support during the early phases of treatment and recovery. However, both tailored nutritional interventions and counselling may be beneficial to cancer survivors during the health maintenance phase of cancer, in which the goals are improved quality of life as well as preventing cancer recurrence, second primary tumours and other preventable diseases.

These considerations could be made not only for breast cancer patients but for all cancer survivor populations. Therefore, a second step of the ECHO survey would consist in the application of the same method of investigation in other cancer patient populations, especially those with a higher rate of incidence as well as survivorship, such as colorectal and prostate cancers.

CHAPTER 5

GENERAL CONCLUSIONS

Nutrition research frequently gets into the news through multiple media channels. There is wide agreement that this massive exposure to science-based nutrition-related messages influences people's knowledge and attitudes toward food and health, across the different stages of their life. The work described in the current thesis emphasizes the impact of nutrition communication, and it is contextualized in two specific settings: public catering schools and oncology environment.

With the "future cooks" project we highlighted a clear geographically varied level of knowledge in students from catering schools about the fields of science and nutrition. This confirms that the cultural environment could influence the perception of communication messages, and consequently impact on the level of knowledge of young adults about these themes. In addition, the observed increase in the knowledge of the students shows the efficacy of a training intervention that combined food and nutrition notions with the respective explanations about the scientific method, with a focus on how to interpret research evidence and related messages. The decision to involve nutritionists to perform the teaching lessons and to interact with cooking teachers in schools was essential to efficiently accomplish the project objectives. Their competence about nutrition science allowed us to plan a single two-days training about the aims of the project, the content of the lessons, and the way contents had to be delivered. For intervention studies based on science communication, the proper choice of disseminators should not be underestimated, and having nutrition-related professionals with basic proficiency in communication and dissemination is essential to both optimize and improve the educational message. In response to this need, a new professional figure is getting under the spotlight, with competence in both food and nutrition science and communication. The institutions and academia have now the duty to offer a proper training to this new generation of professionals, and to integrate them into the modern working society.

The second part of this work shows the desire of people affected by a disease, specifically cancer patients, to receive reliable health and nutrition information aiming to implement adequate dietary changes. In this context, we also observed an deranged translation of research into clinical practice, where the use of inconsistent and unconfirmed assumptions, at both dissemination and clinical level, is still persistent.

In this framework, the need to identify figures like nutritionists and dietitians able to fulfil this need is becoming every day more urgent.

Currently, nutritionists, dietitians and other nutrition-related professionals are adequately identified in the clinical and hospital environment. On the other hand, there is a wide discussion on their role in the communication of health messages.

This scenario gives rise to a plethora of new career opportunities for nutritionists and dietitians, who should be considered the representative professionals to disseminate nutrition information in different frameworks, such as educational and care settings. At the same time, nutritionists and dietitians must gain the ability to accurately evaluate and communicate the nutrition research findings to a diverse audience, in order to meet the ever-increasing demand of reliable information from patient communities.

In conclusion, this doctoral thesis highlights the requirement of professionals in food science and nutrition dissemination, and provides two specific evidence-based examples of suitable settings for this emerging profession.

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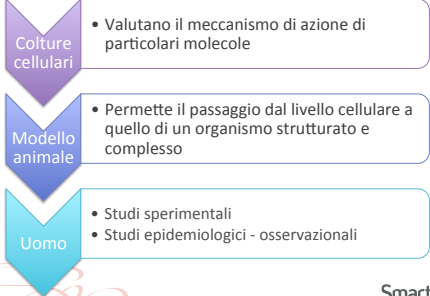
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**LA RICERCA SCIENTIFICA
IN AMBITO NUTRIZIONALE**



SCIENZA E NUTRIZIONE PER I
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- Colture cellulari**
 - Valutano il meccanismo di azione di particolari molecole
- Modello animale**
 - Permette il passaggio dal livello cellulare a quello di un organismo strutturato e complesso
- Uomo**
 - Studi sperimentali
 - Studi epidemiologici - osservazionali

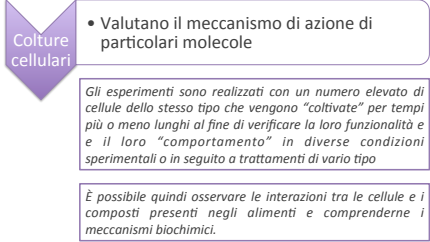




COLTURE CELLULARI



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- Colture cellulari**
 - Valutano il meccanismo di azione di particolari molecole

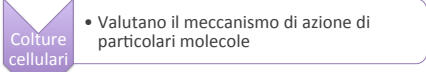
Gli esperimenti sono realizzati con un numero elevato di cellule dello stesso tipo che vengono "coltivate" per tempi più o meno lunghi al fine di verificare la loro funzionalità e il loro "comportamento" in diverse condizioni sperimentali o in seguito a trattamenti di vario tipo

È possibile quindi osservare le interazioni tra le cellule e i composti presenti negli alimenti e comprenderne i meccanismi biochimici.





SCIENZA E NUTRIZIONE PER I
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- Colture cellulari**
 - Valutano il meccanismo di azione di particolari molecole



Estratto di arancia
contenente diverse sostanze



Vitamina C
isolata

L'effetto di un estratto alimentare (o di un singolo nutriente o composto) a livello cellulare non sempre rispecchia l'effetto che avrà il consumo dell'alimento fresco sull'uomo, poiché questo tipo di ricerca non tiene conto di diversi fattori:

- Modificazioni subite dall'alimento durante la digestione e l'assorbimento
- Ruolo dei microrganismi intestinali
- Biodisponibilità del composto
- Sinergia tra i diversi composti presenti nello stesso alimento e/ in altri cibi quando consumati insieme



MODELLO ANIMALE

Appendix 2.1

RICERCA SCIENTIFICA

Modello animale

- Permette il passaggio dal livello cellulare a quello di un organismo strutturato e complesso

- ❖ ha il vantaggio di permettere lo studio di funzioni metaboliche, biodisponibilità, effetto tossico di composti con specifico interesse per la salute umana, effetti più a lungo termine
- ❖ ha come svantaggio il sacrificio dell'animale e il limite di non portare a conclusioni definitive sulle eventuali risposte nell'uomo

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RICERCA SCIENTIFICA

Modello animale

- Permette il passaggio dal livello cellulare a quello di un organismo strutturato e complesso

Il modello animale non sostituisce il modello umano

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RICERCA SCIENTIFICA

Culture cellulari

- Valutano il meccanismo di azione di particolari molecole

Modello animale

- Permette il passaggio dal livello cellulare a quello di un organismo strutturato e complesso

Questi studi di laboratorio hanno diversi limiti:

- I dati sono difficili da adattare all'uomo
- I dati sono quasi sempre ottenuti con concentrazioni di composti attivi molto superiori a quelli consumati con gli alimenti
- I tempi di esposizione sono limitati

STUDI SULL'UOMO

Uomo

- Studi epidemiologici-osservazionali
- Studi sperimentali

STUDI OSSERVAZIONALI

Studi RETROSPETTIVI

Studi PROSPETTICI

STUDI SPERIMENTALI

STUDI DI INTERVENTO NUTRIZIONALE

STUDI OSSERVAZIONALI

Appendix 2.1

STUDI OSSERVAZIONALI



I ricercatori si limitano ad OSSERVARE un gruppo più o meno grande di persone e a raccogliere dati sullo stile di vita e sullo stato di salute.

Analizzando i dati raccolti si cerca di trovare delle "correlazioni" tra alcune caratteristiche dello stile di vita e l'insorgenza di fattori di rischio o di malattie.



STUDI OSSERVAZIONALI



Lo SCOPO degli studi osservazionali è quello di individuare la causa di una malattia oppure, nel caso dell'alimentazione, individuare i fattori che possono favorirne o ostacolarne l'insorgenza, la diffusione e il decorso.



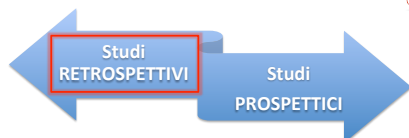
STUDI OSSERVAZIONALI



Uno studio retrospettivo, nella ricerca in ambito nutrizionale, ha lo SCOPO di confermare il sospetto che il consumo di un determinato alimento o gruppo di alimenti possa essere associato ad una patologia, aumentandone o diminuendone il rischio.

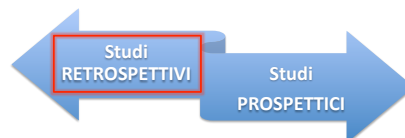


STUDI OSSERVAZIONALI



L'epidemiologia osservazionale si avvale frequentemente degli **studi caso-controllo**, studi retrospettivi in cui si confronta un gruppo di soggetti con una certa malattia (caso) ed un gruppo simile ma privo della malattia (controllo) e si valuta l'eventuale correlazione con fattori di rischio o fattori protettivi della dieta. I ricercatori raccolgono i dati del PASSATO attraverso la somministrazione di questionari sulle abitudini alimentari e di vita.

STUDI CASO-CONTROLLO



VANTAGGI

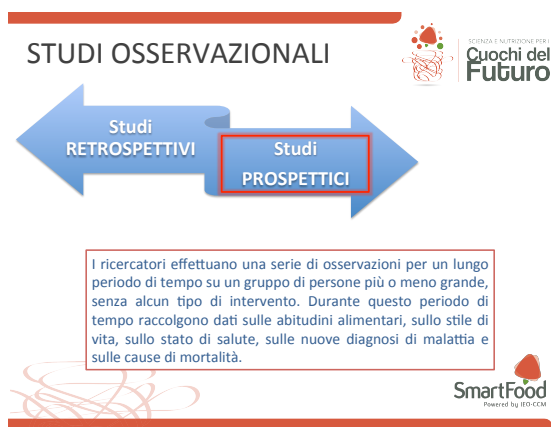
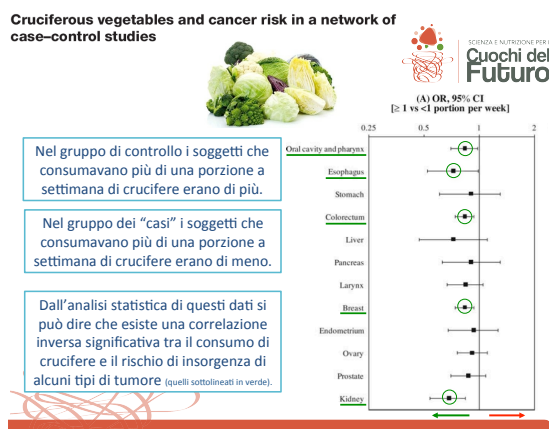
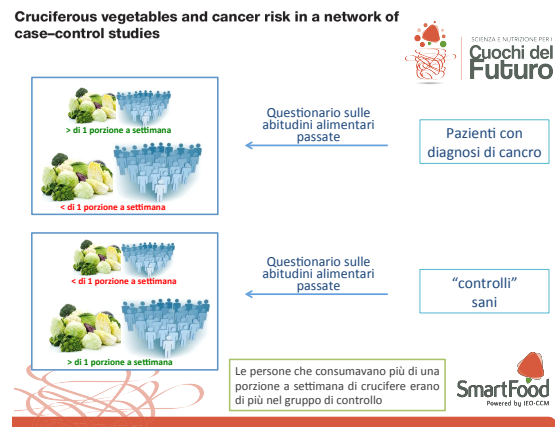
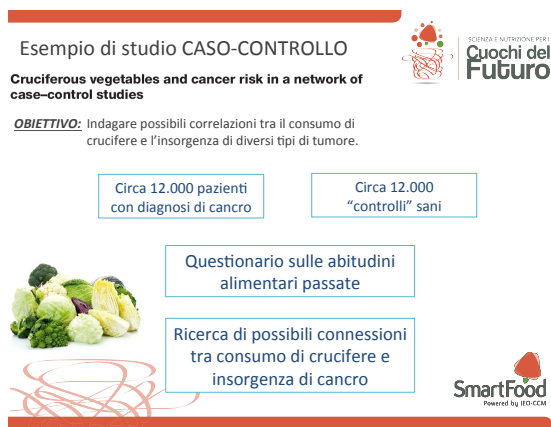
- Costi più bassi per realizzare gli studi
- Possibilità di valutare l'effetto di più alimenti per un'unica malattia
- Possibilità di studiare malattie più rare

LIMITI

- Maggior rischio di errori legati a ricordi distorti delle abitudini alimentari
- Inadeguatezza allo studio di alimenti poco consumati dalla popolazione



Appendix 2.1



Appendix 2.1

Esempio di studio osservazionale prospettico

STUDIO EPIC
European Prospective Investigation into Cancer and Nutrition (EPIC)

Dal 1990 ad oggi

**10 NAZIONI
23 COORTI**

**Quasi
500.000
soggetti
coinvolti**

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Studio EPIC

1990 → **oggi**

- Questionari sullo stato di salute e sullo stile di vita
- Prelevi ematici e altri controlli
- Diagnosi di una malattia

I ricercatori danno un punteggio allo stile alimentare dei partecipanti e cercano di capire se le persone con un punteggio migliore hanno meno diagnosi di malattia.

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I soggetti con alto punteggio di “Dieta Mediterranea” hanno un minor rischio di morte per malattie cardiovascolari e cancro.

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The NEW ENGLAND JOURNAL of MEDICINE				
Table 4. Hazard Ratios for Death Associated with a Two-Point Increment in the Mediterranean-Diet Score. ^a				
Variable	No. of Deaths/ No. of Participants	Hazard Ratio for Death (95% CI)		
		Crude	Age- and Sex-Adjusted	Fully Adjusted
Death from any cause	275/22,043	0.74 (0.65–0.86)	0.79 (0.69–0.91)	0.75 (0.64–0.87)
Death from coronary heart disease	54/22,043	0.68 (0.50–0.94)	0.74 (0.54–1.02)	0.67 (0.47–0.94)
Death from cancer	97/22,043	0.81 (0.64–1.03)	0.85 (0.67–1.08)	0.76 (0.59–0.98)

I soggetti con alto punteggio di “Dieta Mediterranea” hanno un minor rischio di cancro del colon.

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	Score category				p trend
	0–1	2–3	4–5	6–11	
Entire cohort					
Cases	53	123	172	87	
Person-years	36,840	168,369	193,671	111,862	
HR ^b	1	0.48 (0.35–0.67)	0.57 (0.42–0.78)	0.49 (0.35–0.70)	0.030
HR ^c	1	0.49 (0.35–0.67)	0.58 (0.42–0.79)	0.50 (0.35–0.71)	0.043
Men					
Cases	20	62	71	28	
Person-years	13,792	57,140	60,167	30,001	
HR ^b	1	0.71 (0.43–1.18)	0.73 (0.44–1.21)	0.56 (0.30–0.90)	0.085
HR ^c	1	0.70 (0.42–1.17)	0.72 (0.44–1.19)	0.54 (0.30–0.90)	0.087
Women					
Cases	33	61	101	59	
Person-years	22,849	111,129	133,504	81,362	
HR ^b	1	0.36 (0.23–0.55)	0.48 (0.32–0.72)	0.45 (0.29–0.70)	0.188
HR ^c	1	0.36 (0.23–0.55)	0.49 (0.33–0.73)	0.46 (0.30–0.72)	0.238

STUDI SPERIMENTALI

STUDI SPERIMENTALI

STUDI DI INTERVENTO NUTRIZIONALE

Uno studio di intervento nutrizionale permette di **validare** gli effetti osservati nei modelli cellulari e/o animali legati ai fattori protettivi della dieta.

In uno studio di intervento si valuta l'effetto del consumo di un alimento misurando specifici marcatori nei partecipanti. Questi studi implicano non soltanto l'osservazione dei soggetti in studio ma anche interventi sperimentali.

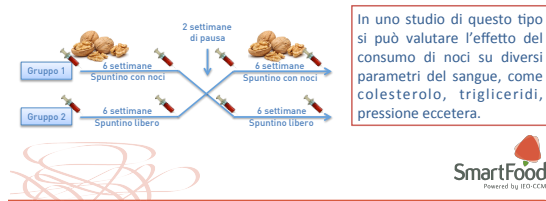
SCIENTIA E NUTRIZIONE PER I
Cuochi del Futuro

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Appendix 2.1

STUDI SPERIMENTALI

STUDI DI INTERVENTO NUTRIZIONALE



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Esempio di studio di intervento nutrizionale

Studio effettuato su 48 persone
Somministrazione di una dieta standardizzata
In cui l'unica differenza è rappresentata dallo spuntino

Valori nutrizionali dello spuntino	Mandorle (42.5g)	Muffin alla banana (107g)
Energia, kcal	253	273
Proteine, g	9.0	3.3
Carboidrati, g	9	47.9
Grassi, g	22.1	8.5
Fibra, g	4.6	1.7



RISULTATI

Quando lo spuntino era rappresentato dalle mandorle:

- ↓ Colesterolo LDL
- Miglior rapporto LDL/HDL
- Miglior rapporto Col.Tot/HDL
- ↓ Circonferenza vita
- ↓ Grasso addominale

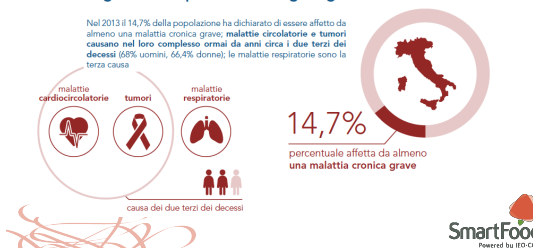
J Am Heart Assoc. 2015
doi: 10.1161

Le malattie che più colpiscono la nostra popolazione sono dette malattie croniche multifattoriali.

MALATTIE

Malattie circolatorie e tumori causano due decessi su tre
Migliorano le percentuali di guarigione

Nel 2013 il 14,7% della popolazione ha dichiarato di essere affetto da almeno una malattia cronica grave; malattie circolatorie e tumori causano nel loro complesso ormai da anni circa i due terzi dei decessi (68% uomini, 66,4% donne); le malattie respiratorie sono la terza causa



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Le malattie che più colpiscono la nostra popolazione sono dette malattie croniche multifattoriali.

Caratteristiche di queste malattie:

- Sono a lenta insorgenza
- Sono precedute da fattori di rischio intermedi
- Spesso questi fattori di rischio non causano sintomi riconoscibili
- Vengono dette multifattoriali poiché non derivano da un'unica causa ma da diversi fattori che insieme concorrono all'insorgenza della malattia
- Tra questi fattori alcuni non sono modificabili, ad esempio l'età o i fattori genetici; altri si possono invece modulare prevenendo o aumentando il rischio di malattia, come alimentazione, attività fisica e fumo di sigaretta.

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Le malattie croniche multifattoriali.

- Le peculiarità che caratterizzano le malattie croniche rendono difficile studiarne e comprenderne le possibili relazioni con il cibo. Questo perché gli altri fattori possono rappresentare delle cause di confondimento.
- Inoltre la lenta insorgenza rende ulteriormente complesso distinguere o individuare gli stili alimentari protettivi o rischiosi per la salute.
- Risulta quindi fondamentale fare molta attenzione alle notizie che si leggono sui giornali o si sentono in TV e ricordare che non è sufficiente un singolo studio per confermare un'ipotesi ma è necessario avere conferme a tutti i livelli della ricerca, dal laboratorio fino all'uomo.

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Appendix 2.1

A chi affidarsi?

- Esistono enti ed istituzioni che si occupano di revisionare tutti gli studi più importanti su un determinato argomento e realizzare dei report con l'aiuto di esperti del settore.
- È da questi documenti che nascono le linee guida e le raccomandazioni per la prevenzione delle malattie attraverso l'alimentazione e lo stile di vita.
- Le raccomandazioni nate da questi report rappresentano le fonti più affidabili dalle quali reperire informazioni utili riguardanti alimentazione e salute.

ALCUNI ESEMPLI:



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Di seguito alcuni consigli su come valutare le informazioni scientifiche in ambito nutrizionale

- ❖ **Leggi attentamente:** il progresso scientifico necessita di tempo per ottenere risultati convincenti. Attenzione quindi ai termini "scoperta scientifica" oppure "miracolo" in quanto anche una scoperta apparentemente plausibile ha bisogno di tempo per essere confermata;
- ❖ **Cerca la "versione integrale" della storia:** i report che si possono vedere in tv o leggere sui giornali sono troppo brevi per includere tutti i dettagli di un argomento;
- ❖ **Non affidarti a soluzioni troppo facili:** Le malattie croniche sono complesse che non possono trovare soluzioni "magiche" né tantomeno cure miracolose. Anche l'organismo umano è una macchina complessa e il cibo che consumiamo con la dieta è ricco di centinaia, o addirittura migliaia, di composti diversi che possono interagire con il nostro organismo. La strategia migliore per la prevenzione va quindi cercata in uno stile di vita complessivo e non in un solo alimento;
- ❖ **Mantieni un sano scetticismo:** non è necessario screditare o diffidare di ogni articolo o report che leggiamo o vediamo, ma è sufficiente utilizzare il buonsenso. Probabilmente se una soluzione suona troppo facile e comoda per essere vera, probabilmente non lo sarà.

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Non affidarti a soluzioni troppo facili:
Il cancro è una malattia complessa che non può trovare soluzioni "magiche" né tantomeno cure miracolose.

Leggi attentamente:
Il progresso scientifico necessita di tempo per ottenere risultati convincenti, quindi anche una scoperta apparentemente plausibile ha bisogno di tempo per essere confermata.

Come è stato condotto lo studio:
una cosa fondamentale è capire se lo studio è stato svolto su cellule cellulari, su modelli animali o sull'uomo.

Mantieni un sano scetticismo:
non è necessario screditare o diffidare di ogni articolo che leggiamo o vediamo, ma è fondamentale utilizzare il buonsenso.

Scoperta la vitamina che cura il cancro

Guarda al di là del titolo: probabilmente non ti sta raccontando la versione completa della storia.

Types of Research

Translational Research

Basic Research

Cellular & Experimental Research

In Vitro → In Animals → In Vitro → In Clinical

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DOMANDE?



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SINDROME METABOLICA

Malattie cronicodegenerative

Alla base ci sono fattori di rischio comuni e modificabili, come alimentazione poco sana, consumo di tabacco, abuso di alcol, mancanza di attività fisica. Queste cause possono generare quelli che vengono definiti fattori di rischio intermedi, come l'ipertensione, la glicemia elevata, l'eccesso di colesterolo e l'obesità. Ci sono poi fattori di rischio che non si possono modificare, come l'età o la predisposizione genetica.





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Malattie cronicodegenerative

La prevenzione è l'arma più valida per combattere le malattie croniche. **Tutti** possono ridurre in modo significativo il rischio di sviluppare queste malattie semplicemente adottando abitudini salutari, in particolare evitando il fumo, seguendo un'alimentazione corretta, limitando il consumo di alcol e svolgendo attività fisica regolare.

I numeri delle malattie croniche ccm

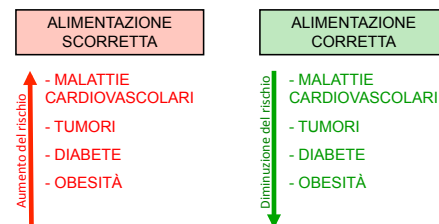
- 60% decessi nel mondo causati da malattie croniche
- cardiovascolari
- diabete
- tumori
- respiratorie croniche

35 milioni di morti nel 2005

80% nei paesi a basso e medio reddito

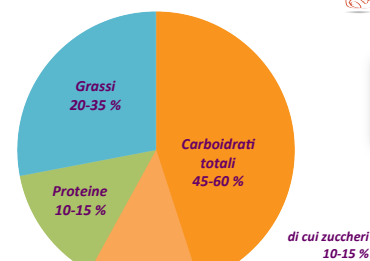
+17% le morti da malattie croniche nei prossimi 10 anni

L'alimentazione è l'unico fattore ambientale a possedere un duplice effetto sulla salute

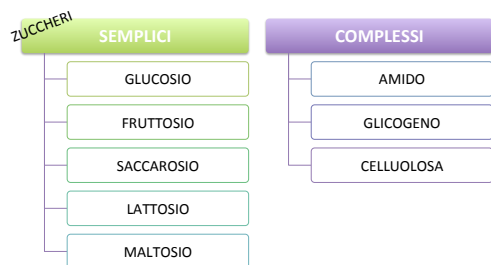


RIPASSIAMO I CARBOIDRATI

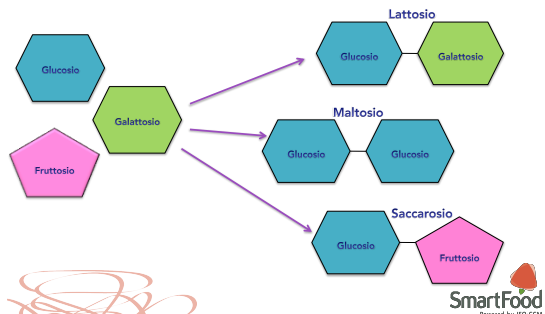
Ripartizione calorica ideale dei nutrienti



Suddivisione dei carboidrati



Carboidrati semplici (zuccheri)



Alimenti che contengono zuccheri



Alimenti che contengono zuccheri



Zuccheri utilizzati per dolcificare



Qual è la differenza?

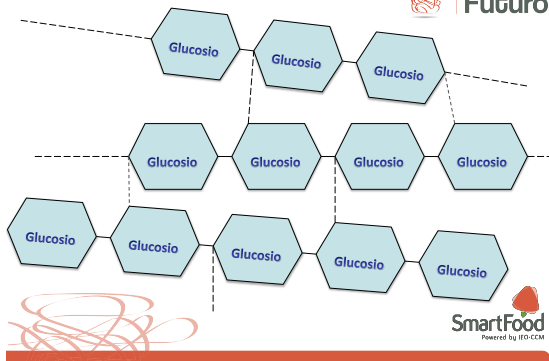


Dolcificante	Zuccheri semplici, g	Kcal
Sciroppo d'acero	67.9	260
Sciroppo d'agave	68	310
Malto	71.3	318
Miele	80.3	304
Saccarosio	100	392
Zucchero di canna	100	380
Glucosio	100	400

↑ L'unica vera differenza sta nel contenuto di acqua



Carboidrati complessi

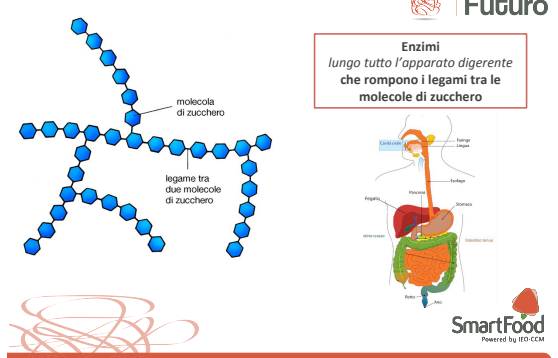


Carboidrati complessi: fonti alimentari



METABOLISMO DEI CARBOIDRATI

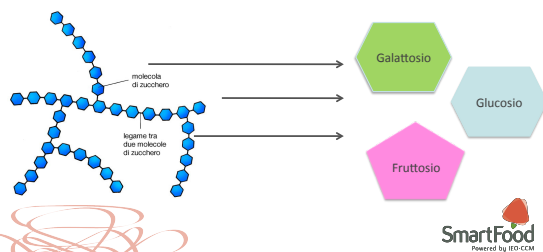
Digestione dei carboidrati



Digestione dei carboidrati

Quando gli enzimi hanno rotto i legami tra le molecole di zucchero, queste possono essere assorbite nel circolo sanguigno

Aumento della GLICEMIA, cioè del livello di zuccheri nel sangue



Ruolo dell'insulina

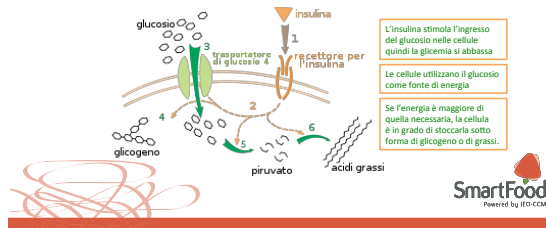
L'insulina è un ormone che ha il compito di stimolare l'ingresso del glucosio nelle cellule dell'organismo, sottraendolo al circolo sanguigno.

Abbassamento della GLICEMIA, cioè del livello di zuccheri nel sangue



Ruolo dell'insulina

- Tutte le cellule del nostro organismo hanno bisogno del glucosio per produrre energia
- Quando la cellula ha abbastanza energia crea una **riserva energetica** sotto forma di **glicogeno** e di **tessuto adiposo**



DIABETE

Diabete

- Nei pazienti affetti da diabete la produzione e/o il funzionamento dell'insulina sono alterati
- Di conseguenza si riscontrano alti livelli di glicemia (glucosio nel sangue)

DIABETE DI TIPO 1

DIABETE DI TIPO 2

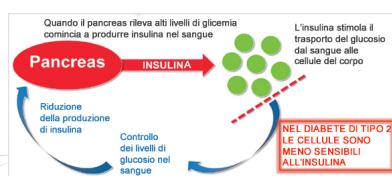
Diabete di tipo 1

- Malattia autoimmune in cui le cellule del pancreas che producono insulina vengono progressivamente distrutte
- Di conseguenza le cellule del pancreas non sono più in grado di produrre l'insulina e gli zuccheri continuano a circolare nel sangue
- Senza insulina inoltre le cellule non ricevono zucchero per produrre energia
- Questa patologia rappresenta una minima parte del totale dei casi di diabete
- Generalmente insorge in età giovanile
- L'unica terapia è l'iniezione di insulina

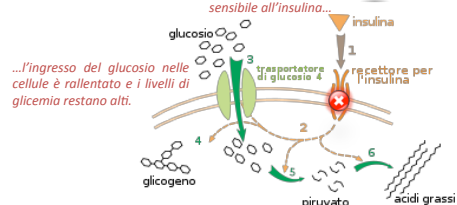


Diabete di tipo 2

- In questa patologia le cellule perdono la sensibilità all'insulina lentamente nel corso della vita
- Il pancreas quindi produce ancora insulina ma le cellule non sono in grado di rispondere al suo stimolo



Diabete di tipo 2

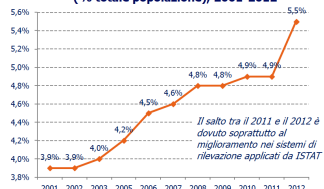


Livelli troppo elevati di glucosio possono portare, oltre che a diabete, a nefropatia, retinopatia, malattie cardiovascolari, problemi neurologici, ipertensione. Tutte queste conseguenze sono dovute alla compromissione della salute dei vasi sanguigni.

Diabete di tipo 2

Rappresenta il 90% di tutti i casi di diabete

Andamento della prevalenza del diabete in Italia (% totale popolazione), 2001-2012



3 milioni di Italiani +
1 milione
non diagnosticato

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Diabete di tipo 2

- Non è una malattia che insorge improvvisamente
- Generalmente è preceduto da una fase di "insulino-resistenza", accompagnata da un'elevata circonferenza della vita

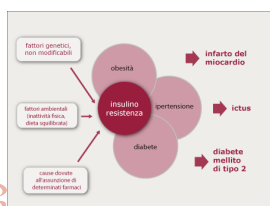
Con il termine "insulino-resistenza" si intende una situazione in cui i recettori iniziano a perdere la loro sensibilità all'insulina ma l'organismo compensa producendo più insulina. Grazie a questa compensazione la glicemia non raggiunge livelli critici quindi non vi è ancora una diagnosi di diabete, ma con buona probabilità ci sarà in futuro. Per questo motivo risulta fondamentale riconoscere una situazione di "insulino-resistenza" per poter intervenire modificando la dieta e prevenendo l'insorgenza di diabete.

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Sindrome metabolica

L'insulino-resistenza unita ad altri fattori di rischio rappresenta una condizione chiamata **SINDROME METABOLICA**.

Questa condizione rappresenta a sua volta un fattore di rischio, cioè aumenta la probabilità di insorgenza di diabete, malattie cardio e cerebrovascolari.



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Sindrome metabolica

DIAGNOSI

Ancora oggi numerosi Enti ed Istituzioni non sono completamente d'accordo su quale sia il metodo migliore per diagnosticare una situazione di sindrome metabolica.

Si inizia a concordare che un parametro essenziale possa essere l'obesità addominale, cioè un'elevata circonferenza della vita

Il dibattito è ancora aperto anche sui parametri di riferimento per la circonferenza vita. I valori più condivisi indicano una circonferenza vita > di 80 cm per la donna e > di 94 cm per l'uomo.

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Sindrome metabolica



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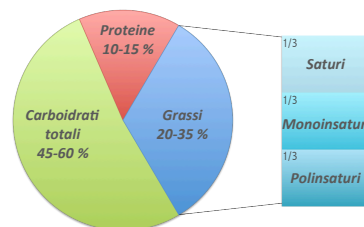
Prevenzione della sindrome metabolica

- Qualità dei grassi nella dieta
- Alimenti poco raffinati e ricchi di fibra
- Composti vegetali
- Apporto moderato di sale
- Apporto moderato di alcol
- Stile di vita attivo
- Evitare il fumo di sigaretta

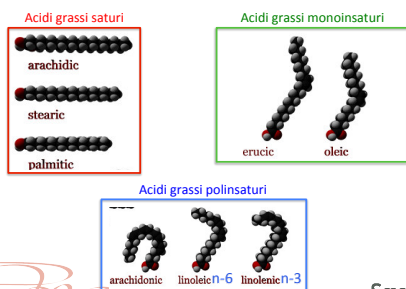
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QUALITÀ DEI GRASSI NELLA DIETA

Ripartizione calorica ideale dei nutrienti

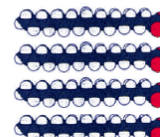
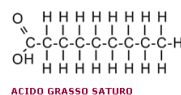


GRASSI: stesso apporto calorico ma differente effetto sulla salute



Grassi saturi

- possono essere a catena corta o lunga
- hanno una struttura lineare e rigida
- si aggregano molto facilmente
- questo li rende solidi a temperatura ambiente



Grassi saturi: fonti animali

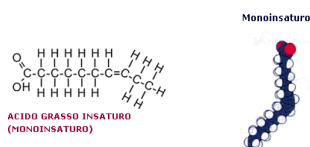


Grassi saturi: fonti vegetali



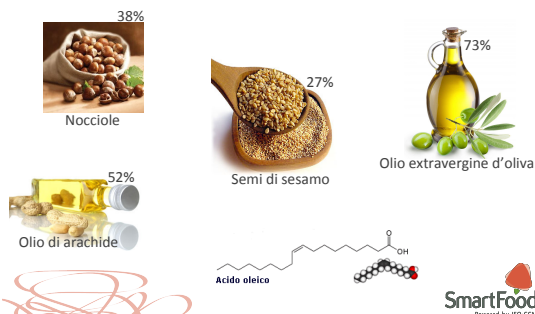
Grassi monoinsaturi

- hanno una struttura spezzata
- si aggregano meno facilmente
- questo li rende fluidi a temperatura ambiente



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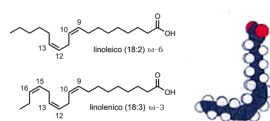
Grassi monoinsaturi: fonti



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Grassi polinsaturi

- hanno una struttura spezzata in più punti
- si aggregano molto meno facilmente
- questo li rende liquidi a temperatura ambiente



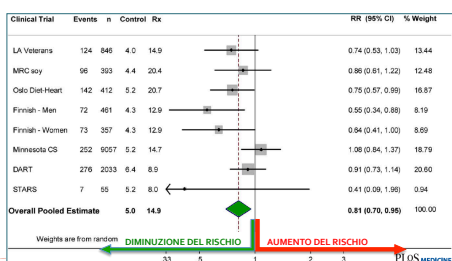
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Grassi polinsaturi: fonti



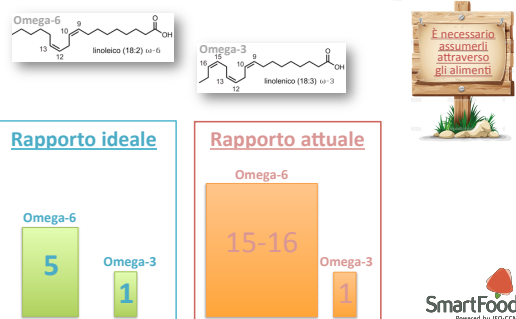
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RIMPIAZZARE I GRASSI SATURI DELLA DIETA CON GRASSI POLINSATURI ABBASSA IL RISCHIO DI EVENTI CARDIOVASCOLARI



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Grassi essenziali



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Acidi Grassi essenziali Omega-3



17 g



1,38 g



Fino a 3 g



Pesci azzurri



6,2 g

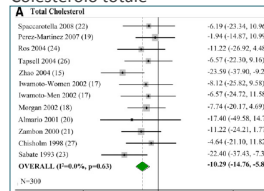
Noci

FABBISOGNO
GIORNALIERO:
Da 1 a 4 g al giorno

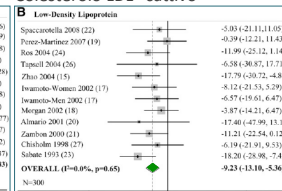


IL CONSUMO REGOLARE DI NOCI AIUTA A DIMINUIRE I LIVELLI DI COLESTEROLO TOTALE E COLESTEROLO LDL

Colesterolo totale



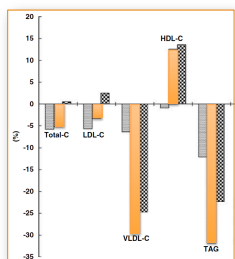
Colesterolo LDL "cattivo"



Effects of walnut consumption on blood lipids and other cardiovascular risk factors: a meta-analysis and systematic review¹⁻³
Ducrocq C, Baur and Poud R, 2016
The American Journal of Clinical Nutrition



IL CONSUMO REGOLARE DI NOCCIOLE AIUTA A MIGLIORARE IL PROFILO LIPIDICO EMATICO

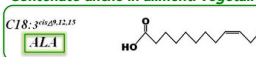


European Journal of Clinical Nutrition
Effects of hazelnut-enriched diet on plasma lipid profiles
SM Mecanigi et al

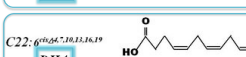
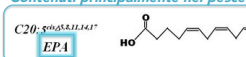


Acidi Grassi essenziali Omega-3 Diverse fonti

Contenuto anche in alimenti vegetali



Contenuti principalmente nel pesce



Il nostro organismo
è in grado di
trasformare parzialmente
gli ALA
in EPA e DHA



Vegetarian Dietary Patterns and Mortality in Adventist Health Study 2

In questo studio epidemiologico i ricercatori hanno analizzato le abitudini alimentari di più di 70.000 persone e le hanno seguite nel tempo registrando i casi di morte e le cause.

Characteristic	No. of People	Time, Person-years	Mean Time, y	Deaths	Death Rate, Deaths/1000 Person-years (95% CI) ^a
Vegetarian ^b	5548	32 810.3	5.92	197	5.40 (4.62-6.17)
Lacto-ovo	21 177	124 660.5	5.88	815	5.61 (5.21-6.01)
Pesco	7194	41 225.7	5.73	251	5.33 (4.61-6.05)
Semi	4031	23 714.6	5.86	160	6.16 (5.03-7.30)
Nonvegetarian	35 359	202 098.4	5.72	1147	6.61 (6.21-7.03)
All participants	73 308	424 509.4	5.79	2570	6.05 (5.82-6.28)

Le persone sono state divise, in base alle abitudini alimentari, in:

- Vegane
- Vegetariane
- Semi-vegetariane (mangiano pochissimo carne e pesce)
- Pesco-vegetariane (mangiano pesce ma non carne)
- Non vegetariane

Nelle persone con una dieta **pesco-vegetariana** è stato registrato il minor numero di morti per tutte le cause.



Vegetarian Dietary Patterns and Mortality in Adventist Health Study 2

Characteristic	All Cases	Ischemic Heart Disease	Cardiovascular Disease	Cancer	Other
All (N = 73 308), No. of deaths ^{a,b}	2560	972	967	706	867
Vegetarian	0.85 (0.73-1.00)	0.50 (0.40-1.33)	0.51 (0.71-1.10)	0.82 (0.68-1.24)	0.74 (0.56-0.99)
Lacto-ovo	0.91 (0.82-1.00)	0.82 (0.62-1.06)	0.80 (0.76-1.00)	0.90 (0.75-1.08)	0.91 (0.77-1.07)
Pesco	0.88 (0.69-0.94)	0.52 (0.43-1.07)	0.60 (0.62-1.00)	0.84 (0.72-1.22)	0.71 (0.56-0.90)
Semi	0.92 (0.75-1.13)	0.90 (0.59-1.33)	0.85 (0.63-1.16)	0.84 (0.66-1.35)	0.99 (0.72-1.38)
Nonvegetarian	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Women (n = 48 203), No. of deaths ^{a,b}	1529	203	197	433	496
Vegetarian	0.87 (0.78-1.20)	1.39 (0.87-2.24)	1.18 (0.88-1.60)	0.99 (0.69-1.46)	0.70 (0.47-1.03)
Lacto-ovo	0.96 (0.83-1.07)	0.86 (0.64-1.20)	0.89 (0.81-1.22)	0.85 (0.67-1.08)	0.90 (0.75-1.12)
Pesco	0.88 (0.72-1.07)	0.51 (0.36-0.99)	0.80 (0.66-1.23)	0.86 (0.61-1.21)	0.81 (0.58-1.13)
Semi	0.92 (0.70-1.22)	1.09 (0.67-1.80)	0.93 (0.64-1.34)	0.85 (0.66-1.30)	0.97 (0.64-1.47)
Nonvegetarian	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]

Andando ad approfondire le diverse cause di morte, il valore più significativo statisticamente emerge nelle morti causate da ischemia cardiaca.

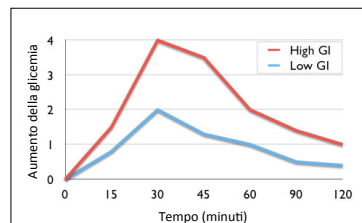
Questo studio potrebbe quindi indicare che gli acidi grassi omega-3 a lunga catena contenuti nel pesce possono essere protettivi per il cuore.



ALIMENTI POCO RAFFINATI E RICCHI DI FIBRA

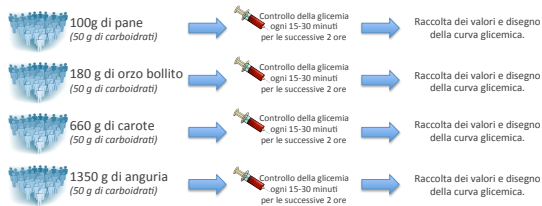
Indice glicemico

L'indice glicemico (IG) di un alimento è un valore che indica con quale velocità i carboidrati presenti al suo interno vengono digeriti e assorbiti dall'organismo e arrivano nel sangue sotto forma di zuccheri.



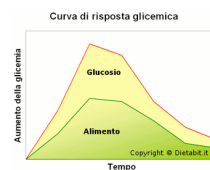
Indice glicemico

L'indice glicemico degli alimenti viene calcolato facendo consumare ad un gruppo di persone, in giorni diversi, cibi contenenti sempre la **stessa quantità di carboidrati**.



Indice glicemico

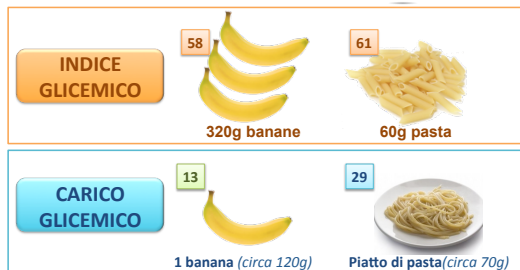
Il valore numerico dell'IG viene assegnato confrontando la curva glicemica del cibo di interesse con una curva di riferimento, che solitamente è la curva glicemica disegnata a seguito del consumo di 50g di glucosio.



Valutare gli alimenti soltanto attraverso il loro indice glicemico può essere riduttivo perché questo valore non tiene in considerazione la quantità di carboidrati presenti in una porzione di alimento.

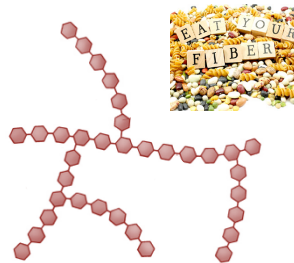
Per questo motivo è importante introdurre il concetto di **CARICO GLICEMICO**, che tiene conto anche della quantità di carboidrati presenti in un alimento.

Carico glicemico



<http://www.glycemicindex.com/>

Fibra alimentare

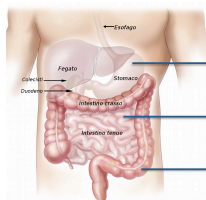


Il nostro organismo non possiede enzimi in grado di digerire la fibra alimentare

Fibra alimentare



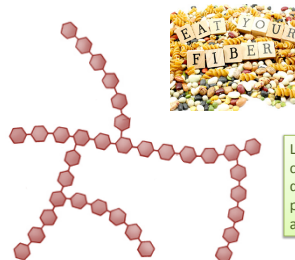
La fibra non può essere digerita dal nostro organismo quindi attraversa tutto il tratto gastrointestinale e raggiunge intatta il colon



- Rallenta lo svuotamento gastrico aumentando il senso di sazietà
- Rallenta e diminuisce l'assorbimento di zuccheri, grassi e colesterolo
- Viene fermentata dalla microflora acidificando l'ambiente intestinale



Fibra alimentare



La fibra alimentare abbassa il carico glicemico di un alimento o di un intero pasto rallentando il processo di digestione e assorbimento dei carboidrati.



Prodotti integrali

Stesso apporto calorico ma differente effetto sull'organismo grazie al contenuto di fibra che garantisce un carico glicemico minore



			
PASTA BIANCA	PASTA INTEGRALE	CRACKERS SALATI	CRACKERS INTEGRALI
356 kcal	324 kcal	428 kcal	408 kcal
			
RISO BRILLATO	RISO INTEGRALE	RISO BRILLATO	RISO INTEGRALE
362 kcal	357 kcal	362 kcal	357 kcal



COMPOSTI VEGETALI

Composti FITOCHIMICI



Flavanoli



IL CONSUMO DI CIOCCOLATO FONDENTE AL 70% IN DIVERSI STUDI SCIENTIFICI HA MOSTRATO EFFETTI BENEFICI PER IL SISTEMA VASCOLARE

Rull G. et al, Vascu. Pharmacol. 2015
Pereira T. et al, Cardiol Res Pract. 2014

- Minor pressione arteriosa
- Miglior funzione endoteliale
- Miglior elasticità dei vasi
- Minor aggregazione piastrinica

Ne bastano 2-3 quadretti al giorno!



Quercetina



Habitual intake of flavonoid subclasses and incident hypertension in adults^{1,2}

Michèle Comble, Ella J. O'Reilly, Colin Kuo, Laura Simpson, Mary Evans, JP Farnham, Gary Carlsen, and Eric B. Rimm

Dietary fat increases quercetin bioavailability in overweight adults

Yi Guo^{1,2}, Eunice Ma¹, Catherine G. Davis¹, Thiruvethilur, Mario G. Ferruzzi¹, Oik K. Chou¹, and Richard S. Bruns^{1,2}



Gli ASPARAGI contengono QUERCETINA

La quercetina è una molecola che appartiene alla famiglia dei polifenoli.



Consumare regolarmente alimenti ricchi di quercetina aiuta a mantenere in salute l'apparato cardiovascolare.



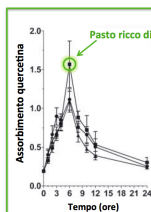
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Quercetina



Assorbimento della QUERCETINA

MDL Nutr Food Rev. 2013; 37: 886-905



Questo studio dimostra che l'assorbimento della quercetina viene migliorato dalla presenza di **grassi** all'interno del pasto.



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Antocianine



More, mirtillo, uva, fragole, arance rosse, melanzane, cavolo rosso, patate viola, mais blu



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Antocianine



Resistono bene al congelamento.



Sensibili alle alte temperature!



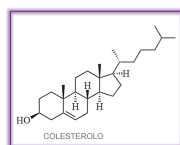
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Fitosteroli

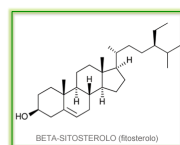


Steroli - Stanoli

Strutturalmente simili al colesterolo
Competono con l'assorbimento del colesterolo



COLESTEROLO



BETA-SITOSTEROLO (Fitosterolo)

IPOCOLESTEROLEMIZZANTI

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Carotenoidi



β-CAROTENE

• Zucca, carote, albicocche

LICOPENE

• Pomodoro, pompelmo rosa, anguria



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Carotenoidi

Composti liposolubili



COTTURA



Consigli pratici

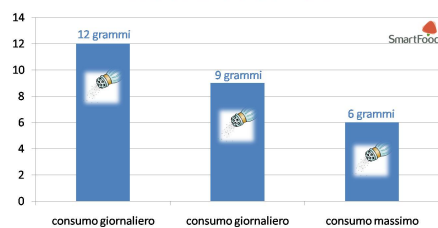


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**APPORTO MODERATO
DI SALE**

Quanto sale consumiamo?

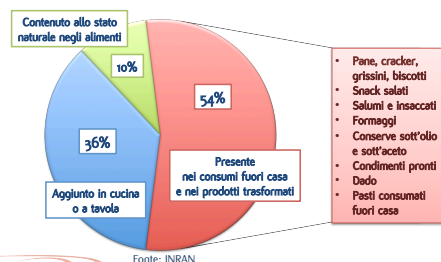
Dati sul consumo di sale in Italia



Fonte: <http://www.salute.gov.it>

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Apporto di sodio nella dieta



Fonte: INRAN

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Powered by IEO-CCM

“il sale nascosto”



VALORI PER 100grammi	
Energia	97 kcal
Proteine	19 g
Carboidrati	3.1 g
Grassi	1 g
Sale	2.2 g

1 porzione da 70 grammi: 1.5 g di sale!

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Sodio e sale



Valori medi per 1 burger da 100g	
Energia	161 kcal
Proteine	16 g
Carboidrati	6 g
Grassi	6.5 g
Fibra	7.1 g
Sodio	0.65 g

$$0.65 \times 2.5 = 1.6 \text{ g di sale}$$

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Sodio e sale



ALIMENTI	Peso dell'unità di misura	Contenuto per unità di misura	
	g	sodio (g)	sale (g)
Olive da tavola conservate	35 (5 olive)	0,46	1,1
Prosciutto crudo dolce	50 (3-4 fette medie)	1,29	3,2
Provolone	50 (1 porzione)	0,34	0,9
Formaggino	22 (1 unità)	0,22	0,6
Patatine in sacchetto	25 (1 confezione)	0,27	0,7
Salsa di soia	6 (1 cucchiaino)	0,34	0,9
Dado per brodo	3 (un quarto di dado)	0,50	1,2



Come consumare meno sale



Diminuire il consumo di alimenti comunemente ricchi di sale

- Salumi e formaggi
- Dado e altri insaporitori
- Cracker, grissini, crostini
- Patatine e altri snack salati

Leggere le etichette dei prodotti confezionati

- attenzione alla differenza tra "sodio" e "sale"

Diminuire l'aggiunta di sale alle preparazioni casalinghe con l'aiuto di:

- Erbe aromatiche
- Semi oleosi
- Spezie
- Marinature

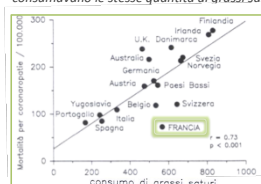


APPORTO MODERATO DI ALCOL

Il paradosso francese



Negli anni '90 alcuni ricercatori notarono che in Francia la mortalità per coronaropatie era inferiore se confrontata con altri paesi che consumavano le stesse quantità di grassi saturi.



Fra le varie ipotesi formulate si pensò che il grande consumo di vino rosso potesse avere un effetto protettivo. Questa ipotesi venne poi parzialmente smentita, in quanto si notò che i francesi avevano anche l'abitudine di consumare molte verdure crude prima del pasto. Inoltre non bisogna dimenticare che le malattie cardiovascolari sono multifattoriali, quindi non è corretto ricercare fattori di rischio e/o protettivi in un solo alimento.

Studi successivi individuarono nel vino diverse sostanze benefiche per il sistema cardiovascolare. Tuttavia è importante sottolineare che queste molecole sono presenti anche in frutta e verdura fresche, quindi non è necessario bere alcolici per assumerle.



"Consumo moderato" di alcol



Quindi se si vuole consumare bevande alcoliche, l'ideale è farlo con moderazione non superando queste dosi:

♂ 2 unità alcoliche al giorno.

♀ 1 unità alcolica al giorno.

Una Unità Alcolica (U.A.) corrisponde a circa 12 grammi di etanolo. Una tale quantità è contenuta in:



DOMANDE?



CANCRO: una sola parola per tante malattie



La parola "cancro" identifica un insieme di oltre 200 malattie, che colpiscono organi e tessuti diversi nell'organismo. Sono tutte caratterizzate dalla crescita incontrollata di cellule "anomale". Queste cellule, fuori controllo, generano masse che compromettono il funzionamento del tessuto o dell'organo in cui si trovano. Possono invadere i tessuti circostanti e, entrando nel flusso sanguigno e linfatico, diffondersi nell'intero organismo.

Tratto da:



CANCRO: malattia multifattoriale



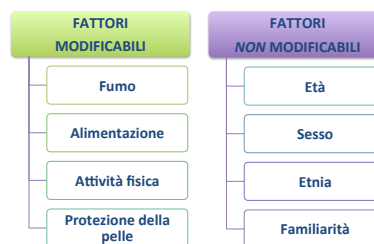
Il cancro è una malattia multifattoriale, causata dalla combinazione di molteplici fattori, sia *interni* sia *esterni*.

I primi sono propri dell'organismo in cui il cancro si sviluppa, come per esempio mutazioni genetiche ereditate dai propri genitori, determinate caratteristiche ormonali, o ancora, specifiche reazioni del sistema immunitario che favoriscono una proliferazione anomala.

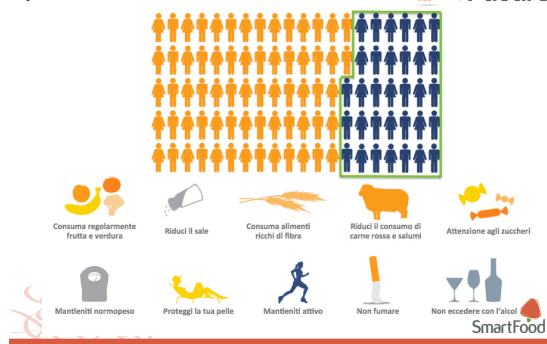
I fattori esterni, invece, sono legati sia all'ambiente in cui viviamo (pensiamo ad esempio alle sostanze chimiche dannose, alle radiazioni ultraviolette o ancora ad alcuni tipi di virus), sia al nostro stile di vita (ad esempio il fumo di sigaretta, un'alimentazione scorretta, la sedentarietà).



CANCRO: malattia multifattoriale



Con uno stile di vita sano è possibile prevenire circa un terzo dei tumori



Prevenzione oncologica



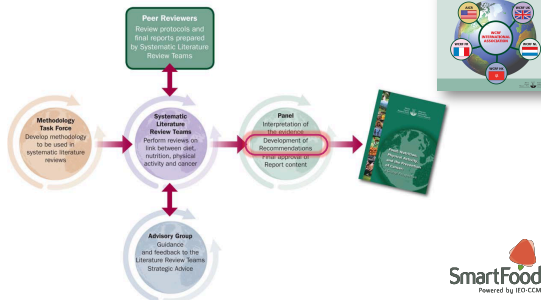
Tipo di tumore	Percentuale stimata di prevenzione con l'alimentazione	
	min	max
Bocca, faringe	33	50
Cervice uterina	10	20
Colon retto	66	75
Esofago	50	75
Fegato	33	66
Polmone	20	33
Prostata	10	20
Seno	33	50
Stomaco	66	75

Fonte: Food, Nutrition and Prevention of Cancer – American Institute for Cancer Research



ALIMENTAZIONE E CANCRO:

Un lungo e complesso procedimento di analisi degli studi scientifici per sviluppare le raccomandazioni per la prevenzione



→ Più di 7000 studi analizzati

→ Più di 150 tra ricercatori, epidemiologi e biologi coinvolti

→ Progetto di aggiornamento continuo



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10 RACCOMANDAZIONI



1. Mantieniti normopeso
2. Pratica uno stile di vita attivo
3. Evita le bevande zuccherate e gli alimenti ad alta densità energetica
4. Consuma più alimenti di origine vegetale
5. Limita il consumo di carne rossa ed evita le carni lavorate e conservate
6. Limita il consumo di alcol
7. Limita il consumo di sale
8. Soddisfa i fabbisogni nutrizionali attraverso la dieta
9. Allatta al seno per i primi sei mesi
10. Le raccomandazioni sono valide anche per chi ha già avuto un tumore

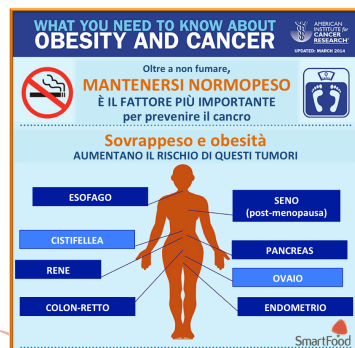
E OVVIAMENTE NON FUMARE!



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1. MANTIENTITI NORMOPESO

1. Mantieniti normopeso



- = Evidenze convincenti
- = Evidenze probabili

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1. Mantieniti normopeso



$$IMC = \frac{\text{Peso (kg)}}{\text{Altezza (m)}^2}$$

< 18.5	sottopeso
18.5-25	normopeso
25-30	sovrappeso
>30	obesità

CIRCONFERENZA VITA

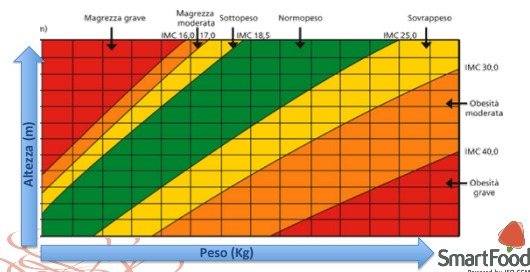
DONNA	UOMO
< 80 cm	< 94 cm
80-88 cm	94-102 cm
>88 cm	>102 cm



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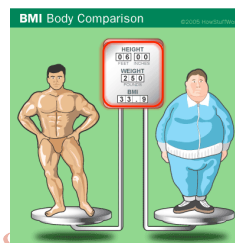
1. Mantieniti normopeso

Non esiste un peso preciso ideale ma un INTERVALLO DI PESO all'interno del quale si è in buono stato di salute



1. Mantieniti normopeso

L'IMC è un dato molto utile per grandi popolazioni. A livello di singolo individuo, è importante anche valutare la COMPOSIZIONE CORPOREA

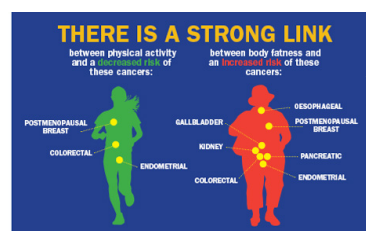


- ✓ Peso uguale
 - ✓ Altezza uguale
 - ✓ Stesso Indice di Massa Corporea
- MA.....
- ✓ Diversa % di massa magra e massa grassa



2. PRATICA UNO STILE DI VITA ATTIVO

2. Pratica uno stile di vita attivo



2. Pratica uno stile di vita attivo



2. Pratica uno stile di vita attivo



3. EVITA LE BEVANDE ZUCCHERATE E GLI ALIMENTI AD ALTA DENSITÀ ENERGETICA

3. Evita le bevande zuccherate e gli alimenti ad alta densità energetica



3. Evita le bevande zuccherate e gli alimenti ad alta densità energetica

INFORMAZIONI NUTRIZIONALI					
	Per 100 g	Per pezzo 35 g	(VALORI MEDI)	Per 100 g	Per pezzo 35 g
VALORE ENERGETICO	422 kcal	148	GRASSI di cui: SATURI	21,0 g	7,4 g
PROTEINE	6,5 g	2,3 g	FIBRA	2,0 g	0,7 g
CARBOIDRATI di cui: ZUCCHERI	50,8 g	17,8 g	SODIO	0,45 g	0,16 g

Farina di frumento, zucchero, uova 17,4%, cioccolato fondente 10,6% (pasta di cacao, zucchero, emulsionante: lecitina di soia), olio vegetale, yogurt all'albicocca 5,4% (yogurt, zucchero, purea di albicocca, aromi), grasso vegetale non idrogenato, amido di frumento, agenti lievitanti (difenilato disodico, carbonato acido di sodio, carbonato acido d'ammonio), proteine del latte, aromi, sale, glutine di frumento, emulsionanti: mono e digliceridi degli acidi grassi di origine vegetale.

Il 50% del prodotto è rappresentato da GRASSI e ZUCCHERI!

3. Evita le bevande zuccherate e gli alimenti ad alta densità energetica



INGREDIENTI PRINCIPALI: ACQUA e ZUCCHERO

Piccole percentuali di succo di frutta (quasi sempre da concentrato)

4. Consuma più alimenti di origine vegetale



4. CONSUMA PIÙ ALIMENTI DI ORIGINE VEGETALE

4. Consuma più alimenti di origine vegetale



Contengono molta acqua

Hanno una minor concentrazione calorica

Apportano fibra alimentare

Sono fonte di vitamine e sali minerali

Contengono fitocomposti



4. Consuma più alimenti di origine vegetale



Apporto ideale di fibra:
25-30 g al giorno

Protettivo nei confronti
del tumore del colon

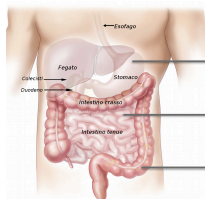
Con il solo consumo di 5 porzioni di frutta e verdura è impossibile raggiungere questo quantitativo di fibra. Risulta quindi fondamentale il consumo di cereali integrali e di legumi.



La fibra alimentare



La fibra non può essere digerita dal nostro organismo quindi attraversa tutto il tratto gastrointestinale e raggiunge intatta il colon



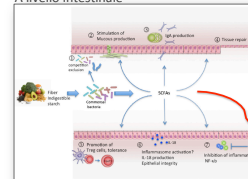
- Rallenta lo svuotamento gastrico aumentando il senso di sazietà
- Rallenta e diminuisce l'assorbimento di zuccheri, grassi e colesterolo
- Viene fermentata dalla microflora acidificando l'ambiente intestinale



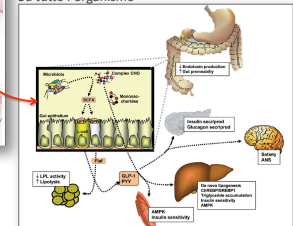
La fibra alimentare



A livello intestinale



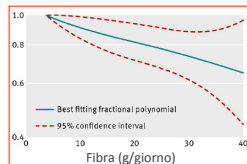
Su tutto l'organismo



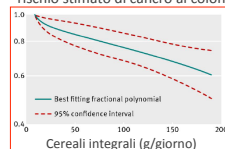
Revisione sistematica e meta-analisi di 25 studi



Consumo totale di fibra e rischio stimato di cancro al colon



Consumo di cereali integrali e rischio stimato di cancro al colon



BMJ 2011;343:d6617 doi: 10.1136/bmj.d6617

4. Consuma più alimenti di origine vegetale



4. Consuma più alimenti di origine vegetale



GLI ALIMENTI DI ORIGINE VEGETALE PROBABILMENTE RIDUCONO IL RISCHIO DI CANCRO	
Alimento	Sito del cancro
Verdure non amidacee	Bocca, laringe, faringe, esofago, stomaco
Frutta	Bocca, laringe, faringe, esofago, stomaco, polmone



4. Consuma più alimenti di origine vegetale



GLI ALIMENTI DI ORIGINE VEGETALE PROBABILMENTE RIDUCONO IL RISCHIO DI CANCRO	
Fonti alimentari	Sito del cancro
Alimenti contenenti composti solforati	Stomaco
Alimenti contenenti folati	Pancreas
Alimenti contenenti carotenoidi	Bocca, faringe, laringe, polmone
Alimenti contenenti vitamina C	Esofago
Alimenti contenenti selenio	Prostata



Carotenoidi



β-CAROTENE

- Zucca, carote, albicocche



LICOPENE

- Pomodoro, pompelmo rosa, anguria



Probabile ruolo nella **diminuzione del rischio di cancro** bocca, laringe, faringe, polmoni

Beta-carotene



Probabile ruolo nella **diminuzione del rischio di cancro all'esofago**



Composti solforati



GLUCOSINOLATI
cavoli, broccoli, verza,
ravanelli, senape



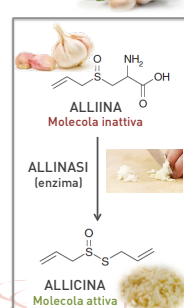
SOLFURI E TIOLI
aglio, cipolla, porri



Probabile ruolo nella **diminuzione del rischio di cancro allo stomaco.**



Aglio



Quando l'aglio viene **schacciato** o **tritato** si forma l'**ALLICINA**, uno dei composti che donano all'aglio il tipico odore pungente e lo arricchiscono di numerose proprietà benefiche.

Probabile ruolo nella **diminuzione del rischio di cancro al colon-retto.**



5. LIMITA IL CONSUMO DI CARNE ROSSA ED EVITA I SALUMI

5. Limita il consumo di carne rossa ed evita le carni lavorate e conservate

CARNE ROSSA
(manzo, maiale, agnello)

Meno di 500g
alla settimana!

CARNI LAVORATE e
CONSERVATE

Occasionalmente

IL CONSUMO DI CARNE ROSSA AUMENTA IL RISCHIO DI CANCRO

Evidenze **convincenti**

Carne rossa	Colon-retto
Carni processate	Colon-retto

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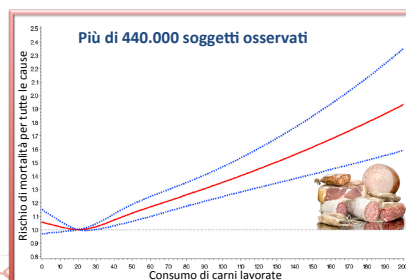
5. Limita il consumo di carne rossa ed evita le carni lavorate e conservate

Raggiungere i 500g alla settimana di carne rossa è più facile di quanto si creda!



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5. Limita il consumo di carne rossa ed evita le carni lavorate e conservate



Rohrmann et al. BMC Medicine 2013, 11:63

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6. LIMITA IL CONSUMO DI ALCOLICI

6. Limita il consumo di alcol

L'ABUSO DI ALCOL PUÒ AUMENTARE IL RISCHIO DI SVILUPPARE 7 DIVERSI TUMORI

Bocca
Laringe
Faringe
Esofago
Seno
Fegato
Intestino

1 unità alcolica al giorno

2 unità alcoliche al giorno

Più grande è il cerchio maggiori sono i casi di tumore legati all'abuso di alcol

Smart Food Istituto Europeo di Oncologia

Fonte:
CANCER RESEARCH UK

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6. Limita il consumo di alcol



Una Unità Alcolica (U.A.) corrisponde a circa 12 grammi di etanolo

Una tale quantità è contenuta in:



BIRRA

bicchiere da 330 ml

VINO

bicchiere da 125 ml

APERITIVO

bicchiere da 80 ml

SUPERALCOLICO

bicchiere da 40 ml

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7. LIMITA IL CONSUMO DI SALE

7. Limita il consumo di sale



“Un consumo eccessivo di sale può favorire l'instaurarsi dell'ipertensione arteriosa, soprattutto nelle persone predisposte. Elevati apporti di sodio aumentano il rischio per alcune malattie del cuore, dei vasi sanguigni e dei reni, sia attraverso l'aumento della pressione arteriosa che indipendentemente da questo meccanismo. Un elevato consumo di sodio è inoltre associato a un rischio più elevato di **tumori dello stomaco**, a maggiori perdite urinarie di calcio e quindi, probabilmente, a un maggiore rischio di osteoporosi.”

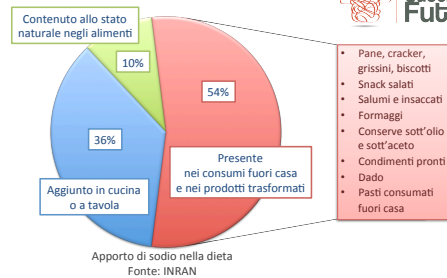
INRAN Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione

Il WCRF conferma che l'abuso di sale e di alimenti salati aumenta il rischio di cancro dello stomaco.

World Cancer Research Fund International

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7. Limita il consumo di sale



- Limitare il consumo di prodotti stagionati e conservati
- Evitare l'utilizzo di piatti pronti, salse, condimenti e insaporitori artificiali
- Preferire prodotti da forno artigianali

7. Limita il consumo di sale



CONDIMENTI DA PREFERIRE

OLIO EXTRAVERGINE DI OLIVA

FRUTTA SECCA (noci, mandorle, nocciole)

ERBE AROMATICHE (rosmarino, basilico, erba cipollina, origano, timo, aneto, santoreggia)

SEMI (papavero, girasole, sesamo, lino, zucca)

SPEZIE (curry, paprika, peperoncino, zenzero, noce moscata)



Tienile in vasetti dosatori comodi da utilizzare ed aggiungerli a tutti i tuoi piatti. Questo ti aiuterà a ridurre l'aggiunta di sale e a riscoprire i veri sapori dei cibi.

8. SODDISFA I FABBISOGNI NUTRIZIONALI ATTRAVERSO LA DIETA

8. Soddisfa i fabbisogni nutrizionali attraverso la dieta



Le vitamine, i sali minerali e gli altri composti vanno considerati come parte integrante degli alimenti che li contengono. Le evidenze scientifiche rafforzano questo concetto dichiarando che la migliore forma di nutrimento è rappresentata dagli alimenti e non dai supplementi.

Gli integratori alimentari non possono essere considerati sostituti degli alimenti, perché l'assunzione di un nutriente in alte dosi può avere un effetto completamente diverso sull'organismo rispetto all'effetto che avrebbe se consumato con gli alimenti.

Non vale la regola "di più è meglio".

Esistono tuttavia momenti della vita o particolari patologie in cui l'organismo necessita di un aiuto con supplementi ma è importante che, in qualsiasi caso, ci si rivolga a un medico.

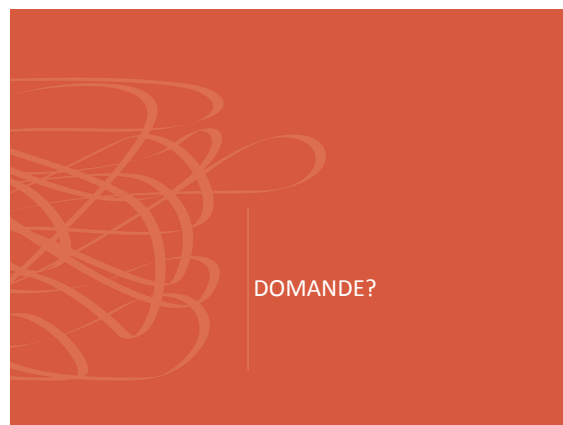
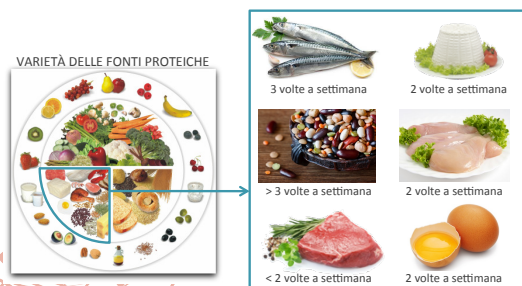


Fonte: WCRF
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8. Soddisfa i fabbisogni nutrizionali attraverso la dieta



8. Soddisfa i fabbisogni nutrizionali attraverso la dieta



SCIENTIA E NUTRIZIONE PER I
Cuochi del Futuro

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**SOSTENIBILITÀ AMBIENTALE
DEL CIBO**

Alimentazione sostenibile e salutare

SCIENTIA E NUTRIZIONE PER I
Cuochi del Futuro

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Alimentazione sostenibile e salutare

SCIENTIA E NUTRIZIONE PER I
Cuochi del Futuro

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Gli alimenti di origine vegetale sono protettivi per la salute e sostenibili per il pianeta

PERCHÉ SOSTENIBILI PER IL PIANETA?

Doppia piramide alimentare e ambientale

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Doppia piramide alimentare e ambientale

SCIENTIA E NUTRIZIONE PER I
Cuochi del Futuro

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Questa rappresentazione grafica permette di evidenziare il fatto che la base di un'alimentazione salutare dovrebbe essere costituita da alimenti di origine vegetale. Gli alimenti di origine animale sono previsti, rappresentando non più di un terzo dei cibi consumati.

Doppia piramide alimentare e ambientale

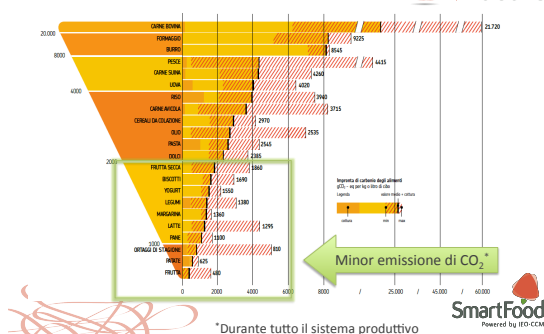
La parte ambientale della doppia piramide è stata pensata riclassificando i cibi rispetto al loro impatto sull'ambiente: utilizzando i dati di impatto per chilo di prodotto si ottiene una piramide capovolta, che vede gli alimenti a maggior impatto ambientale in alto e quelli a ridotto impatto in basso.



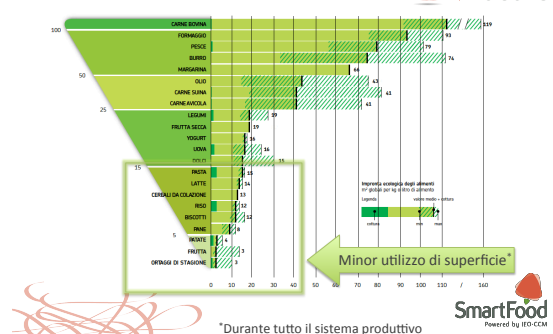
Valutare la sostenibilità Gli indicatori dell'impatto ambientale

INDICATORE	COSA MISURA	UNITÀ DI MISURA
Carbon Footprint	L'emissione dei gas serra responsabili dei cambiamenti climatici	Massa [kg] di CO ₂ equivalente
Ecological Footprint	Superficie di terra (o mare) biologicamente produttiva necessaria per fornire le risorse e assorbire le emissioni associate a un sistema produttivo	Superficie [m ² o ettari] globale
Water Footprint	I consumi e le modalità di utilizzo delle risorse idriche da parte del sistema produttivo	Volume [litri o m ³] di acqua

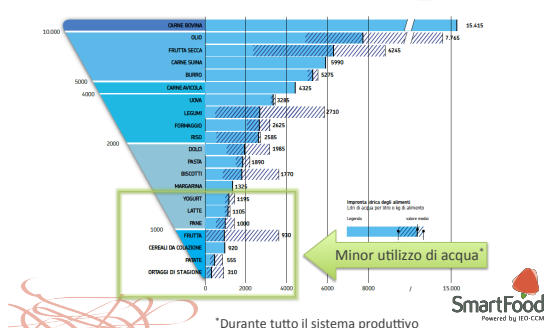
Carbon footprint



Ecological footprint



Water footprint



Valutare la sostenibilità di un menù giornaliero

		IMPATTO GIORNALIERO		
		Carbon Footprint [kg CO ₂ e]	Water Footprint [l]	Ecological Footprint [global m ²]
7 VOLTE	MENÙ CON CARNE	6.100	4.200	45
5 VOLTE	MENÙ VEGETARIANO	3.400	2.400	25
7 VOLTE	MENÙ VEGETARIANO	2.300	1.700	15

Valutare la sostenibilità di un menù settimanale



IMPATTO SETTIMANALE			
	Carbon Footprint (gCO ₂ eq)	Water Footprint (l)	Ecological Footprint (global m ²)
7 VOLTE MENU CON CARNE	42.700	28.300	300
5 VOLTE MENU VEGETARIANO + 2 VOLTE MENU CON CARNE	23.800	16.900	160
7 VOLTE MENU VEGETARIANO	16.300	11.900	110



Valutare la sostenibilità e il costo

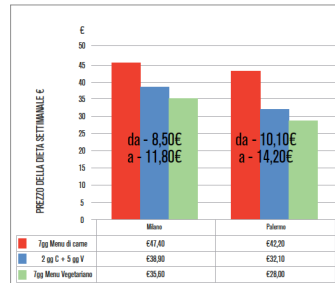
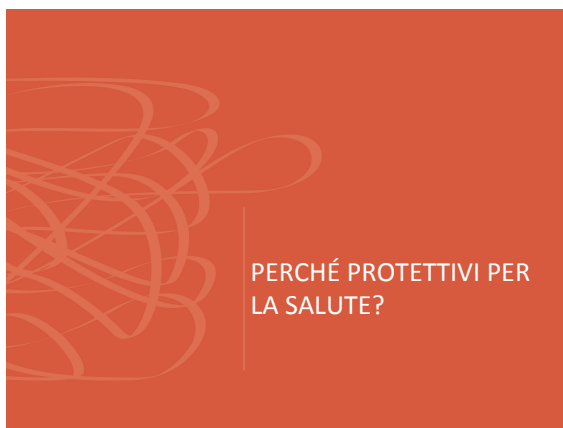
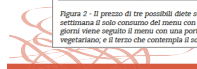


Figura 2 - Il prezzo di tre possibili diete settimanali: il primo calcolato supponendo per l'intera settimana il solo consumo del menu con una portata di carne, quello intermedio in cui per due giorni viene seguito il menu con una portata di carne e per cinque giorni viene seguito il menu vegetariano, e il terzo che contempla il solo consumo del Menu vegetariano.



Gli alimenti di origine vegetale:



Contengono molta acqua

Hanno una minor concentrazione calorica

Apportano fibra alimentare

Sono fonte di vitamine e sali minerali

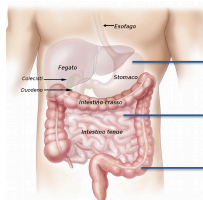
Contengono fitocomposti



Contengono fibra alimentare



La fibra non può essere digerita dal nostro organismo quindi attraversa tutto il tratto gastrointestinale e raggiunge intatta il colon



- Rallenta lo svuotamento gastrico aumentando il senso di sazietà
- Rallenta e diminuisce l'assorbimento di zuccheri, grassi e colesterolo
- Viene fermentata dalla microflora acidificando l'ambiente intestinale



LARN IV Revisione



Estratto dall'ultima revisione del 2014



"La ricerca scientifica ha individuato una grande varietà di sostanze (**quasi tutte di origine vegetale** da cui deriva il nome inglese di **phytochemicals**, cioè **fitocomposti**), comunemente assunte con la dieta, che possono influenzare positivamente la salute e quindi contribuire alla prevenzione di malattie."



Classificazione dei principali fitocomposti



QUALI SONO GLI
"ALIMENTI DI ORIGINE
VEGETALE"



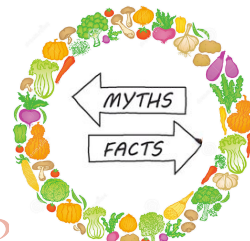
I MITI LEGATI AGLI
ALIMENTI DI ORIGINE
ANIMALE

Molto spesso si pensa che questi nutrienti siano presenti esclusivamente negli alimenti animali



Esistono invece numerose fonti vegetali di questi importanti nutrienti, più sostenibili per il pianeta e protettive per la salute.

Sfatiamo insieme qualche mito.....



IL CALCIO

Il calcio si trova solo nel latte e nei suoi derivati?



Età	Fabbisogno giornaliero (mg)
1-3 anni	700
4-10 anni	1000
11-17 anni	1300
18-59 anni	1000
>60 anni	1200
Gravidanza	1200
Allattamento	1000



100g di crescenza:
557mg di calcio



200ml di latte intero:
240mg di calcio

Effettivamente i latticini sono una buona fonte di calcio MA....



Quante porzioni di latte e derivati dovremmo consumare per raggiungere il fabbisogno giornaliero di calcio?



200 ml
latte



30g grana
(circa 4 cucchiaini)



1 vasetto di yogurt
(125g)



50g formaggio
semi-stagionato

Sono un po' troppe, INFATTI...



Cosa dicono le Linee Guida per una Sana Alimentazione



Consumo giornaliero di latte/yogurt



Formaggi: 2-3 volte a settimana

Le linee guida ci dicono di consumare il formaggio solo 2-3 volte a settimana, quindi è fondamentale introdurre il calcio anche da fonti vegetali.



Fonti alimentari di calcio



Consumando quantità eccessive di derivati del latte è facile eccedere in

grassi saturi -> derivati dal consumo di formaggi grassi

sale -> derivato dal consumo di formaggi stagionati

zuccheri -> derivati dal consumo di yogurt aromatizzati e bevande a base di latte



Fonti vegetali di calcio



975mg



Sesamo

257mg



Spia

160mg



Rucola

236mg



Mandorle

Per 100g
di alimento



Fonti vegetali di calcio: l'importanza della varietà



Broccoli: 72mg

Per 100g
di alimento



Noccioli: 150mg
Pistacchi: 135mg



Carciofi: 86mg



Fagioli: 137mg
Ceci: 117mg



Crescione: 170mg

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Erbe aromatiche

Utilizzando le erbe aromatiche in cucina è possibile insaporire naturalmente i piatti, diminuire l'utilizzo del sale e arricchire le ricette di calcio

ALIMENTO	CALCIO (mg)
Basilico, secco	2110
Timo, secco	1890
Salvia, secca	1650
Origano, secco	1580
Menta, secca	1370
Rosmarino, secco	1280
Cannella	1228
Prezzemolo, secco	1080



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Erbe aromatiche

Contenuto di calcio in un cucchiaino colmo di erbe secche

Un cucchiaino colmo di:	Contenuto di Calcio
Basilico secco	105 mg
Maggiorana secca	100 mg
Timo secco	95 mg
Salvia secca	85 mg
Origano secco	80 mg



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Erbe aromatiche come fonte di calcio

2 cucchiaini colmi di
basilico secco contengono
200 mg di CALCIO



1/5 del fabbisogno
giornaliero

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L'ACQUA COME FONTE DI CALCIO

L'acqua come fonte di calcio

- L'acqua contiene carbonato di calcio, chiamato comunemente "calcare"
- Nonostante il calcare sia il maggior responsabile dell'usura degli elettrodomestici, delle tubature e dei lavandini, non ci sono evidenze che correlano il calcare alla formazione di calcoli renali
- Inoltre il carbonato di calcio è altamente biodisponibile, quindi il nostro organismo è in grado di assorbirlo in maniera efficiente ed utilizzarlo per diverse funzioni biologiche, oltre che stoccarlo nelle ossa migliorandone la struttura.



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L'acqua come fonte di calcio



- Alcune acque arrivano a contenere fino a 300 mg di calcio per litro, quindi con 1,5-2 litri al giorno è possibile coprire metà del fabbisogno giornaliero di questo importante minerale
- Può essere utile scegliere queste acque, soprattutto per le persone che non riescono a coprire il fabbisogno di calcio attraverso gli alimenti per diversi motivi.



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L'acqua del rubinetto è più sostenibile



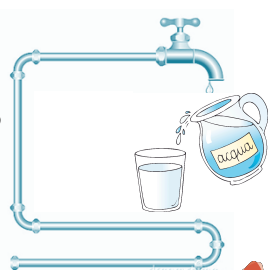
L'equilibrio idrico deve essere mantenuto bevendo essenzialmente acqua, tanto quella del rubinetto quanto quella imbottigliata, entrambe sicure e controllate.

-INRAN-

Per conoscere i parametri chimici e chimico-fisici dell'acqua puoi consultare il sito del tuo comune.



L'acqua del rubinetto è più sostenibile



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L'acqua del rubinetto è più sostenibile



Perché a volte l'acqua raccolta nel bicchiere è biancastra e caratterizzata dalla presenza di micro-bollicine?

La causa di questa opacità è l'elevata pressione dell'acqua determinata sia dagli impianti di pompaggio cittadini, sia dalle autoclavi condominiali.



Il calcare fa venire i calcoli?

L'Organizzazione mondiale della sanità chiarisce che l'acqua calcarea può incrostare gli elettrodomestici ma non è pericolosa per l'organismo e non è causa di calcoli renali.



Il cloro contenuto nell'acqua del rubinetto è pericoloso per la salute?

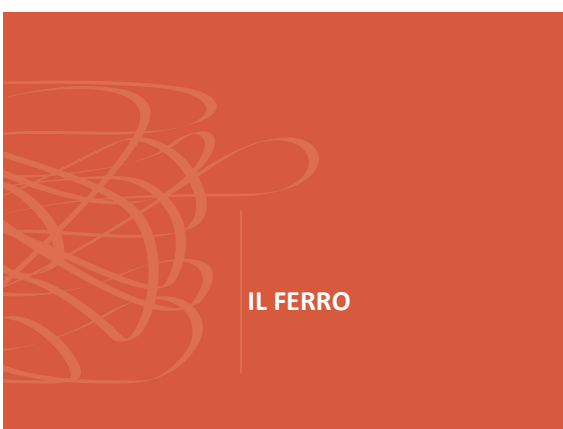
Bevendo due litri d'acqua al giorno, la scarsissima quantità di cloro presente nell'acqua del rubinetto non ha alcun effetto sulla salute. La soglia fissata dalla legge italiana per il residuo di cloro libero dopo la disinfezione è pari a 0,2 mg/L; a Milano la quantità di cloro presente nell'acqua dell'acquedotto è compresa tra 0,03 e 0,05 mg/L.



Può capitare che l'acqua abbia uno sgradevole odore di cloro.

Per eliminare questo inconveniente basterà raccogliere l'acqua in una brocca e lasciarla decantare per qualche minuto.

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Il fabbisogno giornaliero di ferro varia molto in base all'età, al sesso e alle diverse fasi della vita



Età	Fabbisogno giornaliero (mg)	Età	Fabbisogno giornaliero (mg)
1-3 anni	8	1-3 anni	8
4-6 anni	11	4-6 anni	11
7-10 anni	13	7-10 anni	13
11-14 anni	10-18	11-14 anni	10
15-17 anni	18	15-17 anni	13
18-29 anni	18	18-29 anni	10
30-59 anni	18-10	30-59 anni	10
60-74 anni	10	60-74 anni	10
>75 anni	10	>75 anni	10
Gravidanza	27		
Allattamento	11		

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Tenendo in considerazione che il fabbisogno di ferro può variare da 8 a 18 mg, facciamo qualche confronto



Fegato di bovino: 8.8 mg



Radicchio verde: 7.8 mg



Filetto di manzo: 1.9 mg

Per 100g di alimento



Pistacchi: 6.8 mg



Fonti vegetali di ferro

La varietà della dieta è fondamentale per assicurarsi un buon apporto di ferro



Un cucchiaino colmo di semi di lino: 1mg di ferro



100g di funghi gallinacci: 6.5mg di ferro



30 g di fichi secchi: 1mg di ferro



30g di anacardi: 2mg di ferro



20g di pomodori secchi: 2mg di ferro



I legumi come fonte di ferro



RIFERIMENTO
Filetto bovino: 1.9mg

Contenuto di ferro per 150g di legume fresco o 50g di legume secco



Ceci: 3mg



Fave: 2.7mg



Lenticchie: 2.6mg



Piselli: 2.7mg



Fagioli: 4.5mg



Erbe aromatiche come fonte di ferro



ALIMENTO	FERRO (mg)
Timo, secco	123.6
Maggiorana, secca	82.7
Origano, secco	44
Basilico, secco	42
Prezzemolo, secco	41.5

Per 100g di alimento



Erbe aromatiche come fonte di ferro



1 cucchiaino colmo di timo secco contiene 6 mg di FERRO



♂ metà del fabbisogno giornaliero
♀ 1/3 del fabbisogno giornaliero



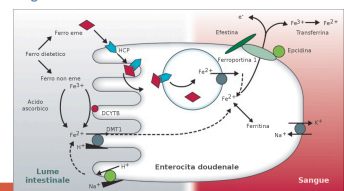
Il Ferro può essere presente negli alimenti come:



Più facilmente assorbito dall'organismo



Meno assorbito dall'organismo



Il Ferro negli alimenti:



Dal 50 all'80%: ferro EME
Dal 20 al 50%: ferro non eme



100%: ferro non eme

La cottura spinta può causare una perdita moderata di ferro "eme", mentre può migliorare l'assorbimento intestinale del ferro "non eme"



Come migliorare l'assorbimento di ferro non eme



Alimenti ricchi di vitamina C in grado di migliorare l'assorbimento del ferro



Succo di limone



Scorza di agrumi



Peperoni dolci e piccanti

Condire gli alimenti ricchi di ferro con scorza e succo di limone, e peperoncino, ricchi di vitamina C. Aggiungendo le erbe aromatiche si arricchisce ancora di ferro la ricetta. È importante ricordare che la vitamina C si degrada con il calore, quindi è meglio aggiungere questi condimenti freschi e alla fine della preparazione.



IL FOSFORO

Il fabbisogno giornaliero di fosforo è più alto durante l'infanzia e l'adolescenza ma non si differenzia per maschi e femmine



Età	Fabbisogno giornaliero (mg)
1-3 anni	460
4-6 anni	500
7-10 anni	875
11-14 anni	1250
15-17 anni	1250
18-29 anni	700
30-59 anni	700
60-74 anni	700
>75 anni	700
Gravidanza	700
Allattamento	700



La fonte "famosa" di fosforo: il pesce



100g filetto spigola:
1150mg di fosforo



100g sgombero:
264mg di fosforo



100g salmone:
280mg di fosforo



Fonti vegetali di fosforo, più sostenibili per il pianeta



30g di frutta secca mista:
Da 120 a 170 mg di fosforo



20g di semi misti:
Da 50 a 120 mg di fosforo



50g di legumi secchi misti:
Da 150 a 180 mg di fosforo



LE PROTEINE

Apporto proteico consigliato dalla SINU

LAVI PER LE PROTEINE							
		Peso corporeo	A01 Fabbisogno medio	75% Assicurazione raccomandata per la popolazione	EDT Obiettivo nutrizionale per la prevenzione		
		(kg)	(g/kg=de)	(g/kg=de)	(g/kg=de)	(g/kg=de)	(g/kg=de)
LATTANTI	0-12 mesi	8,6	1,11	9	1,32	11	
BAMBINI-ADOLESCENTI							
	1-3 anni	13,7	0,82	11	1,00	14	
	4-6 anni	20,6	0,78	16	0,94	19	
	7-10 anni	31,4	0,81	25	0,99	31	
Uomini	11-14 anni	48,7	0,79	39	0,97	48	
	15-17 anni	66,6	0,79	50	0,93	62	
Donne	11-14 anni	50,7	0,77	39	0,95	48	
	15-17 anni	56,7	0,72	40	0,90	50	
ADULTI							
Uomini	18-29 anni	70,0	0,71	50	0,90	63	
	30-39 anni	70,0	0,71	50	0,90	63	
	40-49 anni	70,0				1,1	77
	50-59 anni	70,0				1,1	77
Donne	18-29 anni	60,0	0,71	43	0,90	54	
	30-39 anni	60,0	0,71	43	0,90	54	
	40-49 anni	60,0				1,1	66
	50-59 anni	60,0				1,1	66

Le proteine sono presenti solo negli alimenti animali?

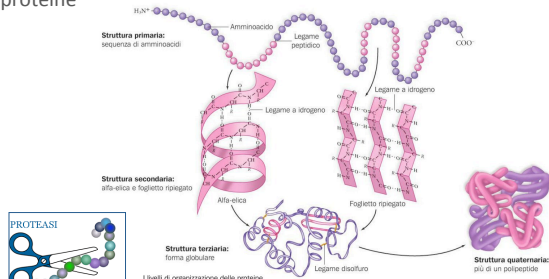


ALIMENTO/GRUPPI ALIMENTI	PORZIONI GIORNALIERE		
	1700 kcal ¹	2100 kcal ²	2600 kcal ³
CEREALI, TUBERI			
Pane	3	5	6
Prodotti da forno	1	1	2
Pasta/riso/Pasta all'uovo fresca	1	1	1-2
Pastate	1 (a settimana)	2 (a settimana)	2 (a settimana)
ORTAGGI E FRUTTA			
Ortaggi/Insalata	2	2	2
Frutta/Succo di frutta	3	3	4
CARNI, PESCE, UOVA E LEGUMI	1-2	2	2
LATTE E DERIVATI			
Latte/Yogurt	3	3	3
Formaggio fresco/ Formaggio stagionato	2 (a settimana)	3 (a settimana)	3 (a settimana)
GRASSI DA CONDIMENTO			
Olio/Burro/Margarina	3	3	4

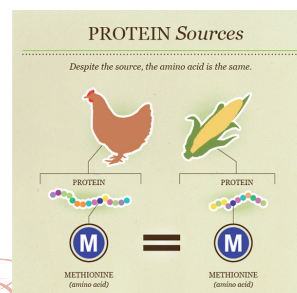
Fonti proteiche a confronto



Gli aminoacidi: l'unità strutturale delle proteine



Per questo motivo è importante non focalizzarsi soltanto sul contenuto proteico, ma anche sugli altri elementi contenuti in un alimento



Variare le fonti proteiche per un buon apporto di diverse vitamine, sali minerali e fitocomposti



Vitamina D
Grassi essenziali
Selenio



Fibra
Fitosteroli



Vitamina A
Calcio



Vitamina B5
Vitamina B12



CONCLUSIONI

Piatti unici a confronto



	Bistecca di manzo (100g) + patate (200g)	Orzo (80g) + lenticchie (50g)	Pasta integrale (80g) + ricotta fresca (100g)
Proteine	24 g	19 g	19.8 g
Carboidrati	31.6 g	83.4 g	56.5 g
Grassi	5 g	2 g	12.9 g
Fibra	2.8 g	13 g	9.2 g
Ferro	3.1 mg	2.9 mg	3.5 mg
Calcio	24 mg	67 mg	320 mg



Cosa abbiamo imparato?



- Sali minerali come ferro, calcio e fosforo, generalmente associati ad alimenti animali, sono presenti anche in numerose fonti vegetali
- È possibile quindi realizzare un pasto o addirittura un intero menù senza carne né pesce, ma allo stesso tempo ricco di nutrienti
- Intraprendere un'alimentazione sostenibile per il pianeta significa aumentare il consumo di alimenti vegetali e diminuire il consumo di alimenti animali
- Questo tipo di alimentazione risulta sicura e protettiva per la salute

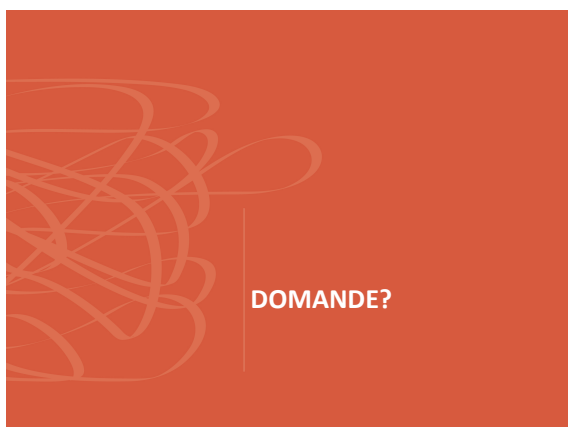


Esistono anche campagne a favore di un'alimentazione più sostenibile e salutare



Con diverse strategie di comunicazione







SCIENZA E NUTRIZIONE PER I
Cuochi del Futuro



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DIETA MEDITERRANEA: UNA STORIA DI EVIDENZE SCIENTIFICHE

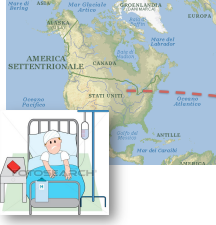


SCIENZA E NUTRIZIONE PER I
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ANCEL KEYS




ANCEL KEYS notò che in Italia pochissime persone si ammalavano di malattie cardiovascolari, a differenza degli USA dove ne erano colpite molte persone.



SCIENZA E NUTRIZIONE PER I
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ANCEL KEYS



Fino a quel momento la maggior parte dei medici era convinta che le malattie cardiovascolari fossero malattie legate all'invecchiamento e che non si potessero in alcun modo evitare o prevenire.

Il Dottor Keys iniziò a osservare diverse popolazioni per capire se qualcosa presente nell'ambiente potesse influenzare la frequenza delle malattie cardiovascolari.

Una delle prime cose che notò girando per il mondo fu che i Giapponesi in Giappone avevano una bassa incidenza di queste malattie, mentre i Giapponesi che si trasferivano in America avevano un'incidenza molto più elevata.



SCIENZA E NUTRIZIONE PER I
Cuochi del Futuro



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ANCEL KEYS




Tornò spesso anche in Italia e notò che la dieta degli italiani, soprattutto nel meridione, era poco calorica, ricca di alimenti vegetali e poco raffinati. Inoltre Keys notò un elemento fondamentale: il cibo in Italia era occasione di convivialità.





SCIENZA E NUTRIZIONE PER I
Cuochi del Futuro



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ANCEL KEYS



Il Dottor Keys si accorse che c'era una grande differenza nell'incidenza di malattie cardiovascolari anche tra i vari ceti sociali della popolazione italiana. Le persone con un lavoro maggiormente retribuito infatti, che vivevano in città, tendevano ad avere livelli di colesterolo più alto e di conseguenza più malattie cardiovascolari; chi abitava nelle campagne invece, con lavori manuali, uno stile di vita attivo e una dieta povera di "alimenti moderni" soffriva molto meno di queste malattie.



SCIENZA E NUTRIZIONE PER I
Cuochi del Futuro



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ANCEL KEYS




"we can believe that environmental influences are of major importance for most people and that it is reasonable, therefore, to hope that research can show how the development of the disease may be prevented or so influenced that, in effect, it can be controlled."

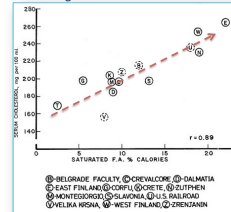


A questo punto Ancel Keys non ha più dubbi: è convinto che l'alimentazione della zona mediterranea sia la risposta ai suoi dubbi. Restava soltanto un problema: dimostrare questa sua teoria a livello scientifico per convincere tutti i medici, i cardiologi e i ricercatori.

RELAZIONE TRA DIETA E RISCHIO CARDIOVASCOLARE

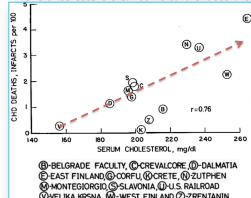


Consumo di grassi saturi & livello di colesterolo



I primi studi di Ancel Keys mostrano uno stretto legame tra il consumo di grassi saturi, i livelli di colesterolo e il rischio di malattie cardiovascolari.

Livello di colesterolo & rischio cardiovascolare



SEVEN COUNTRIES STUDY



7 nazioni



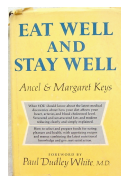
16 coorti



EAT WELL AND STAY WELL



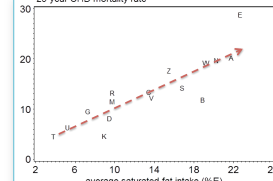
1. IF YOU ARE FAT, REDUCE.
2. RESTRICT USE OF FATS IN DAIRY PRODUCTS AND MEATS.
3. USE VEGETABLE OILS IN COOKERY, NOT AS MEDICINE.
4. AVOID HYDROGENATED PRODUCTS BUT IF YOU INSIST ON A SPREAD USE THE NEWER MARGARINES.
5. AVOID HEAVY USE OF SALT AND SUGARS.
6. FAVOUR FISH, POULTRY, FRESH VEGETABLES, FRUITS, NON-FAT MILK PRODUCTS.
7. DO NOT DEPEND ON THE DRUGSTORE OR VITAMIN PEDDLER FOR A GOOD DIET.
8. BE SENSIBLE ABOUT CIGARETTES, ALCOHOL, EXCITEMENT, BUSINESS STRAIN.
9. GET PLENTY OF EXERCISE, WITH RECREATION AND WORK OUT-OF-DOORS.
10. LEARN MORE ABOUT COOKERY AND HAVE FUN WITHOUT SATURATION.



RISULTATI DEL SEVEN COUNTRIES STUDY DOPO 25 ANNI

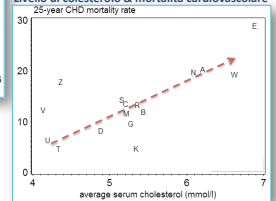


Consumo di grassi saturi & mortalità cardiovascolare



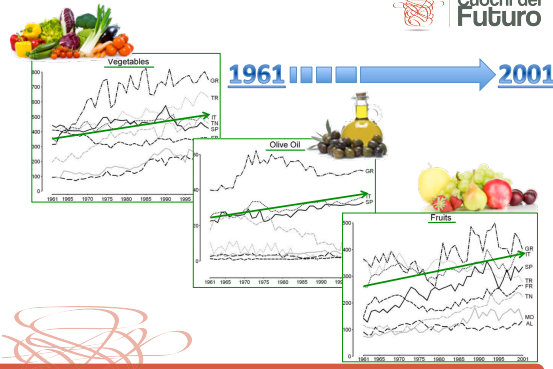
Ancel keys riesce ad ottenere una conferma di elevata importanza per tutta la comunità scientifica.

Livello di colesterolo & mortalità cardiovascolare

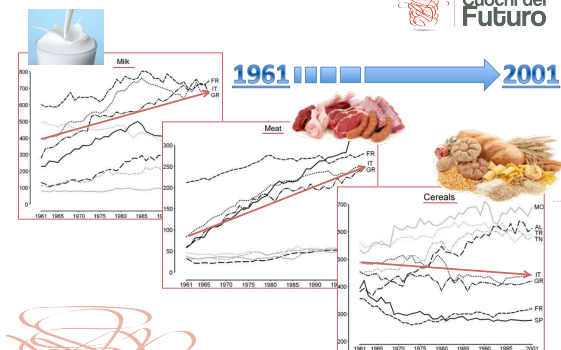


COSA È SUCCESSO NEL FRATTEMPO?

CONSUMI ALIMENTARI IN ITALIA

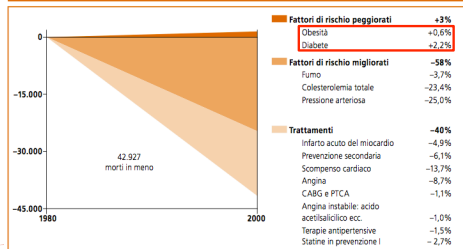


CONSUMI ALIMENTARI IN ITALIA

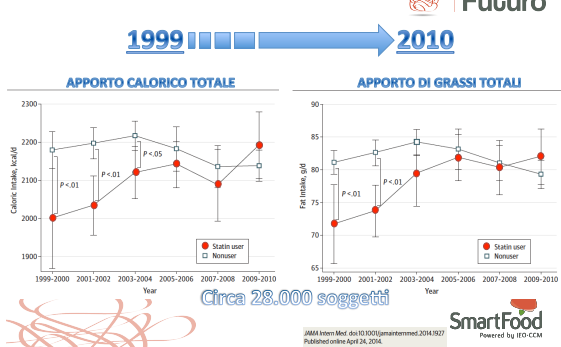


ANDAMENTO DEI FATTORI DI RISCHIO

Figura 2.1. Spiegazione della diminuzione di decessi per cardiopatia coronarica in Italia tra il 1980 e il 2000.

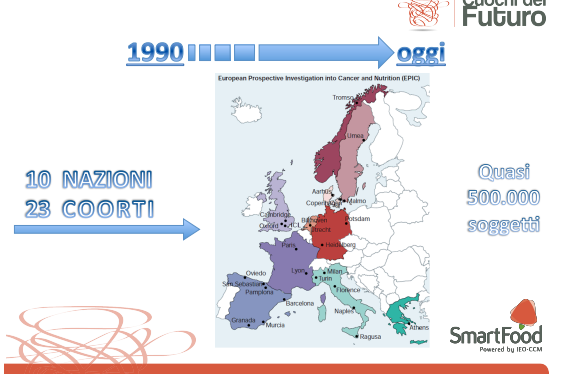


CHI UTILIZZA STATINE TENDE, NEL TEMPO, AD AUMENTARE L'INTROITO CALORICO E DI GRASSI



LA RICERCA CONTINUA....

PROGETTO EPIC



ADERENZA ALLA DIETA MEDITERRANEA E RISCHIO DI MORTALITÀ

Circa 22.000 soggetti

The NEW ENGLAND JOURNAL of MEDICINE

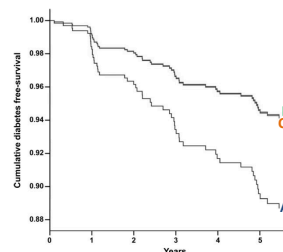
Table 4. Hazard Ratios for Death Associated with a Two-Point Increment in the Mediterranean-Diet Score.^a

Variable	No. of Deaths/ No. of Participants	Hazard Ratio for Death (95% CI)		
		Crude	Age- and Sex-Adjusted	Fully Adjusted
Death from any cause	275/22,043	0.74 (0.65–0.86)	0.79 (0.69–0.91)	0.75 (0.64–0.87)
Death from coronary heart disease	54/22,043	0.68 (0.50–0.94)	0.74 (0.54–1.02)	0.67 (0.47–0.94)
Death from cancer	97/22,043	0.81 (0.64–1.03)	0.85 (0.67–1.08)	0.76 (0.59–0.98)

N Engl J Med 2003;348:2599-608.

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CHI SEGUE LA DIETA MEDITERRANEA HA UN MINOR RISCHIO DI SVILUPPARE **DIABETE**



Circa 7.200 soggetti randomizzati in 3 gruppi di intervento

A: dieta a basso contenuto di grassi

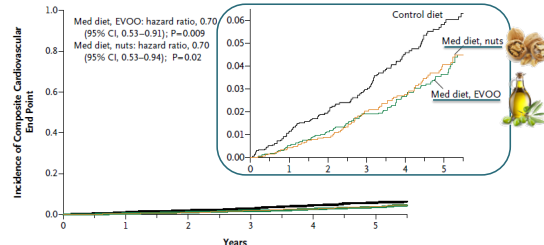
B: dieta mediterranea con olio extravergine d'oliva

C: dieta mediterranea con noci

Reduction in the Incidence of Type 2 Diabetes With the Mediterranean Diet
Results of the PREDIMED-Reus nutrition intervention randomized trial
Diabetes Care 34:14-19, 2011

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CHI SEGUE LA DIETA MEDITERRANEA HA UN MINOR RISCHIO DI **EVENTI CARDIOVASCOLARI**



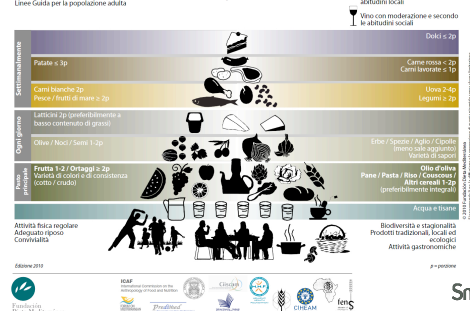
Primary Prevention of Cardiovascular Disease with a Mediterranean Diet

The NEW ENGLAND JOURNAL of MEDICINE
N Engl J Med 2013;
DOI: 10.1056/NEJMoa1200303

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PIRAMIDE DELLA DIETA MEDITERRANEA

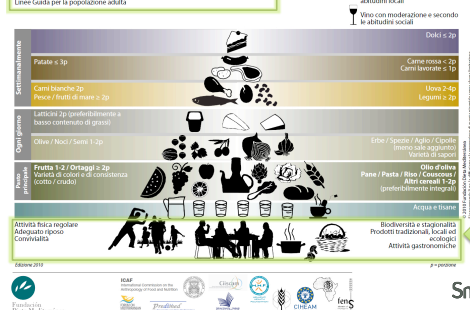
Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



LA DIETA MEDITERRANEA
NELLA CUCINA DEI NOSTRI
TEMPI

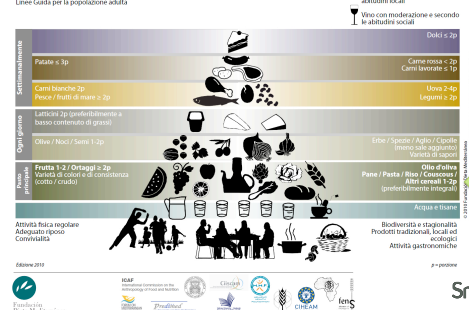
NON SOLO "DIETA" MA "STILE DI VITA"

Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



ALLA BASE DI OGNI PASTO

Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



ALLA BASE DI OGNI PASTO



Frutta, 1 porzione= 150g
Verdura, 1 porzione= 250g
Verdure a foglia, 1 porzione= 50g

↓
Per un totale di 5 porzioni
al giorno



Cereali integrali e loro derivati:
pane, pasta, cereali in chicco.

ALLA BASE DI OGNI PASTO



Olio extravergine d'oliva: il condimento per eccellenza

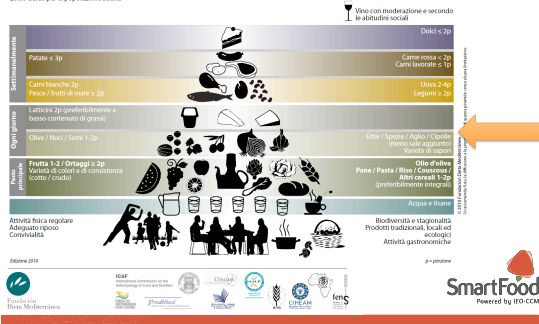


- ✓ Ricco di grassi monoinsaturi
- ✓ Elevato apporto di fitocomposti
- ✓ Ottima fonte di vitamina E

CONSUMO GIORNALIERO



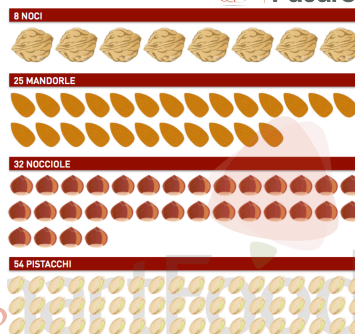
Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



FRUTTA SECCA



A QUANTO
EQUIVALE
UNA
PORZIONE
DI FRUTTA
SECCA?

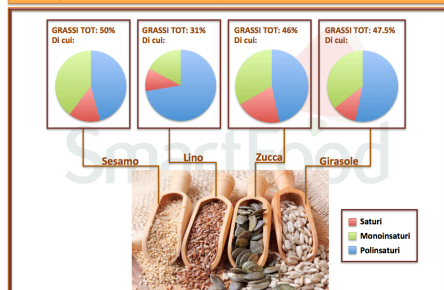


30 GRAMMI
IDEALE COME SPUNTINO

SEMI OLEOSI



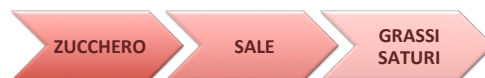
LA QUALITÀ DEI GRASSI NEI SEMI OLEOSI



LATTE E DERIVATI



È previsto un consumo giornaliero di latte o yogurt ma
ATTENZIONE A:



YOGURT: acquistare yogurt al naturale poiché quelli aromatizzati alla frutta o alla vaniglia, alla nocciola eccetera sono ricchi di zuccheri

FORMAGGI: preferire formaggi freschi e magri, poiché i formaggi stagionati sono generalmente più ricchi di sale e di grassi

YOGURT E ALTRE BEVANDE VEGETALI A BASE DI LATTE VACCINO O VEGETALE



Prova a leggere sull'etichetta di uno yogurt quanto zucchero è contenuto, vedrai che le quantità si aggira tra i 15-20 grammi, equivalenti a 3-4 cucchiaini di zucchero.

Ecco un esempio:

VALORI PER VASETTO	
Energia	97,5 kcal
Proteine	6,6 g
Carboidrati	17 g
Grassi	0,13 g

Per questo è importante acquistare questi prodotti "al naturale" o "bianchi" e poi arricchirli a casa con frutta fresca, secca, essiccata, cereali soffiati o cioccolato fondente.



FORMAGGI



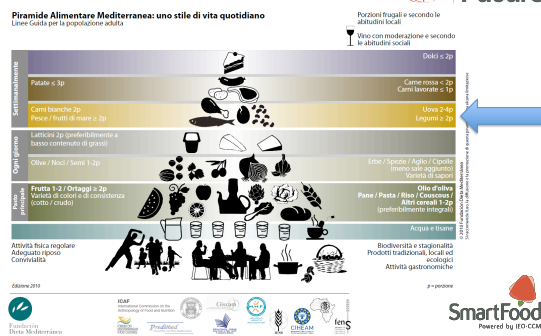
- I formaggi rappresentano un secondo piatto completo quindi non possono essere considerati un dessert
- Possono essere inseriti in un piano alimentare settimanale fino a 2/3 volte
- È preferibile consumare formaggi freschi e magri, poiché meno ricchi di grassi saturi e di sale



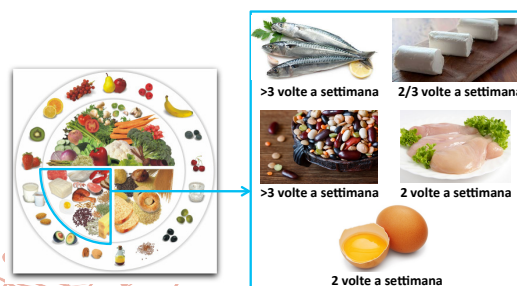
I SECONDI PIATTI



Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



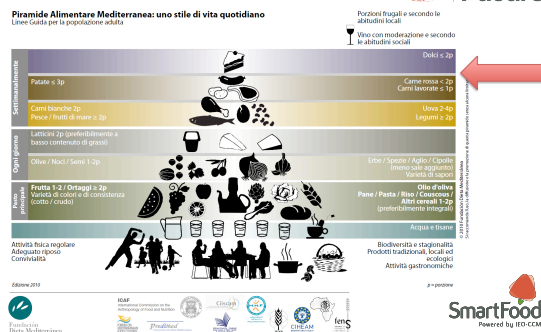
LA VARIETÀ DELLE FONTI PROTEICHE



CONSUMO OCCASIONALE



Piramide Alimentare Mediterranea: uno stile di vita quotidiano
Linee Guida per la popolazione adulta



CARNI ROSSE E SALUMI

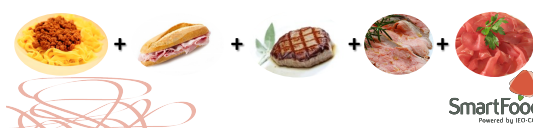


Carni rosse
(manzo, maiale, agnello)
< 2 volte alla settimana

Salumi
≤ 1 volta alla settimana



Superare i 500g alla settimana è più facile di quanto si pensi!



ALIMENTI AD ALTA DENSITÀ ENERGETICA

Sono alimenti che apportano molte calorie in un piccolo volume. In questi prodotti le calorie sono fornite principalmente da grassi e zuccheri, e non sono presenti composti utili per la salute.



INFORMAZIONI NUTRIZIONALI			
(VALORI MEDI)	Per 100 g	(VALORI MEDI)	Per 100 g
VALORE ENERGETICO	422 kJ 1767 kcal	GRASSI	21.0 g
		di cui SATURI	9.5 g
PROTEINE	6.5 g	FIBRA	2.0 g
CARBOIDRATI	50.8 g	SODIO	0.450 g
di cui ZUCCHERI	30.0 g		

Farina di frumento, zucchero, uova 17.4%, cioccolato fondente 10.0% (contiene di cacao, zucchero, emulsionante lecitina di soia, olio vegetale, yogurt all'albicocca 0.4% (yogurt, zucchero, panna di albicocca, aromi), grasso vegetale non idrogenato, aromi di frumento, agenti lievitanti (idrossido di sodio, carbonato di sodio, acido di frumento, emulsionanti: mono e digliceridi degli acidi grassi di origine vegetale).

Il 50% del prodotto è rappresentato da GRASSI e ZUCCHERI!



1 LATTINA DI TÈ FREDDO



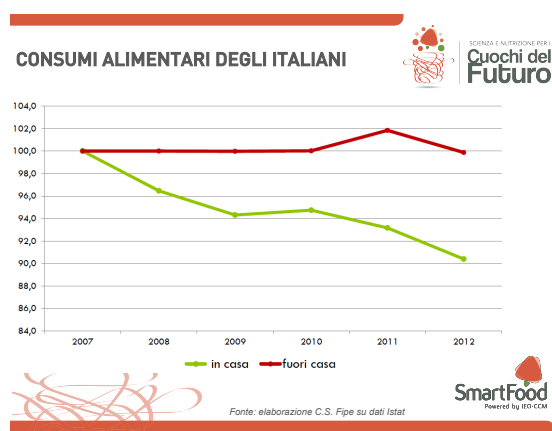
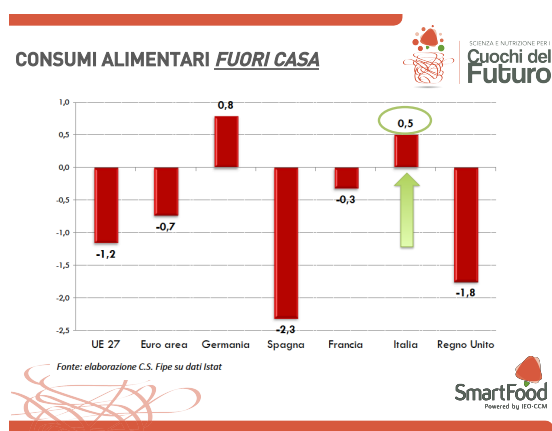
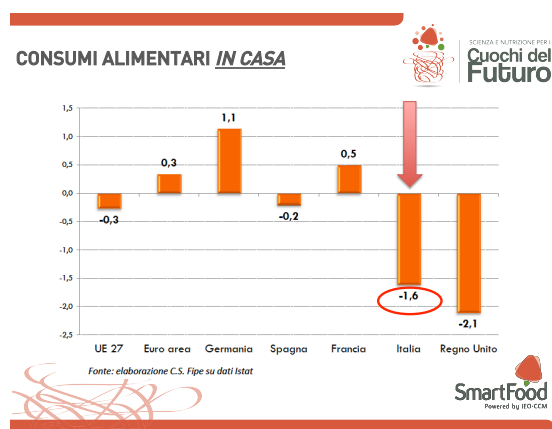
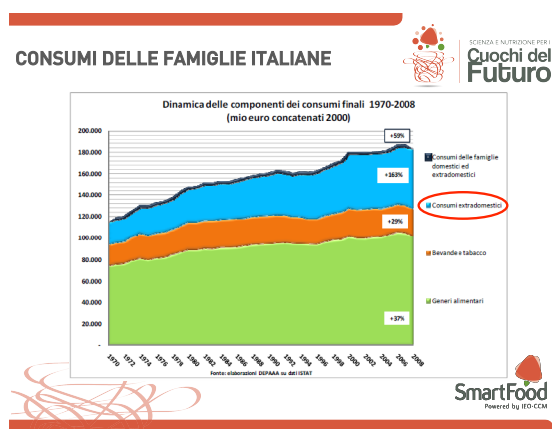
FINO A 30g DI ZUCCHERO

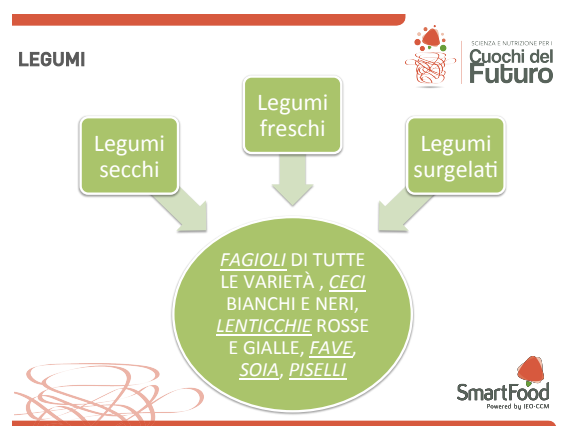
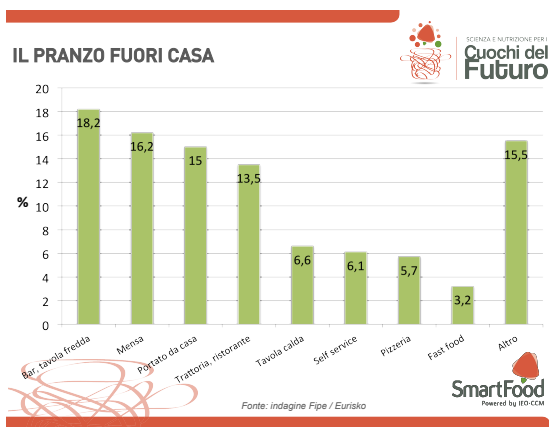
1 LATTINA DI BIBITA GASSATA



FINO A 40g DI ZUCCHERO

DOMANDE?





FRUTTA E VERDURA



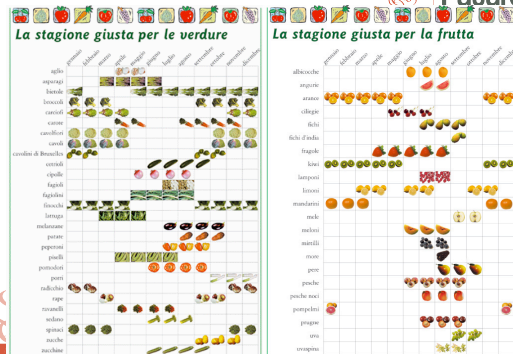
STAGIONALITÀ

VARIETÀ NEI COLORI

TERRITORIALITÀ



FRUTTA E VERDURA



FRUTTA SECCA, ESSICCATA E SEMI



FRUTTA SECCA (noci, nocciole, mandorle, arachidi, anacardi, noci brasiliane e pecan, pistacchi) e **CREME SENZA ZUCCHERI AGGIUNTI** (crema di nocciole, pistacchi, burro di arachidi)



FRUTTA ESSICCATA SENZA ZUCCHERI AGGIUNTI (albicocche, fichi, prugne, mele, uvetta, frutti rossi)



SEMI OLEOSI (sesamo, lino, zucca, girasole, canapa, papavero) e **CREME DERIVATE SENZA INGREDIENTI AGGIUNTI** (es. burro 100% sesamo)



PESCE AZZURRO



Pesce fresco

Pesce surgelato

PESCE DI PICCOLA-MEDIA TAGLIA RICCO DI OMEGA-3
(sgombero, sardie, alici, salmone, orata, branzino, spigola)



LATTICINI E BEVANDE VEGETALI



YOGURT BIANCO AL NATURALE, INTERO O MAGRO (non sono ammessi yogurt con zuccheri o altri ingredienti aggiunti)



RICOTTA VACCINA O DI PECORA O CAPRA (senza panna aggiunta)



BEVANDE VEGETALI (latte e yogurt vegetali di *soia, riso, avena, mandorla* senza zuccheri o altri ingredienti e aromi aggiunti)



CONDIMENTI SMART



INGREDIENTI UTILIZZABILI

Alimenti che, se consumati nelle dosi raccomandate, non rappresentano un rischio per la salute

ALCUNE TIPOLOGIE DI FARINE

Queste farine si possono utilizzare per impasti o lavorazioni in aggiunta alla farina integrale, che deve comunque essere presente in quantità maggiore.



Farina 0

Frumina, amido di mais



Fecola di patate

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LATTE, UOVA E FORMAGGI MAGRI

Latte vaccino, di capra

Uova

Formaggi magri, <25% di grassi
(caprino fresco, feta, quargirolo etc)

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MOLLUSCHI, CROSTACEI, PESCE CONSERVATO E CARNE BIANCA



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CONDIMENTI UTILIZZABILI IN QUANTITÀ MODERATE

PER LE
PREPARAZIONI
SALATE

- Salsa di soia
- Margarine con <16% di grassi saturi

PER LE
PREPARAZIONI
DOLCI

- Marmellata a ridotto tenore di zuccheri (<35% circa)
- Cioccolato fondente 70%
- Margarine con <16% di grassi saturi

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BEVANDE UTILIZZABILI

Può essere previsto **UN BICCHIERE DI VINO ROSSO** a pasto

L'eccesso di alcol, indipendentemente dal tipo di bevanda, è legato a un aumento del rischio di cancro: se ne raccomanda quindi un consumo decisamente moderato. Allo stesso tempo, però, esistono evidenze che un consumo moderato di un certo genere di bevande alcoliche, in particolare vino rosso, possa contribuire alla prevenzione del rischio di patologie cardiovascolari.

Per una buona prevenzione oncologica quindi la raccomandazione sarebbe di evitare il consumo di bevande alcoliche e consumarne piccole quantità solo occasionalmente. Tuttavia, se si vogliono consumare bevande alcoliche è bene preferire il vino rosso e non superare 1 unità alcolica al giorno per le donne e 2 unità al giorno per gli uomini. Possibilmente sempre durante i pasti.



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INGREDIENTI NON SMART

Alimenti il cui consumo eccessivo è legato ad un rischio per la salute



CARNI ROSSE FRESCHE, LAVORATE E CONSERVATE



CARNE ROSSA

- Manzo e vitello, maiale, agnello

SALUMI E INSACCATI

- Prosciutto crudo e cotto, bresaola, coppa, pancetta, lardo, speck
- Mortadella, salame

CARNI LAVORATE E CONSERVATE

- Salsicce, wurstel, carni essiccate, cotechino



FORMAGGI GRASSI E STAGIONATI



Formaggi >25% di grasso

Formaggi ricchi di sale

PECORINO, GORGONZOLA, FONTINA, BRIE, GRANA, ETC.



CONDIMENTI NON SMART



INSAPORITORI A BASE DI SALE (dado, brodi in polvere)

CONDIMENTI DI ORIGINE ANIMALE (panna, burro, strutto)

Oli di semi non spremuti a freddo

Margarine con >20% di grassi saturi



BEVANDE NON SMART



Bevande gassate e zuccherate, tè freddo

Succhi e nettari di frutta

Bevande a base di latte vegetale zuccherate o aromatizzate

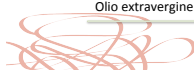


FOCUS: preparazioni dolci

INGREDIENTI CONSIGLIATI



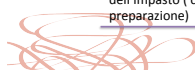
FARINE	Integrali, semintegrali	Frutta fresca
	Di mandorle, di nocciole	
	Di cocco, di castagne	
Oli di semi spremuti a freddo	Ricotta e yogurt bianco	Semi oleosi
	Cioccolato fondente 70%	
	Olio extravergine d'oliva	
		Cereali soffiati
		Bevande e yogurt vegetali



INGREDIENTI UTILIZZABILI



FARINE	Di tipo 0	Latte vaccino
	Fecola di patate	
	Amido di mais, frumina	
ZUCCHERI	Sono ammessi tutti i tipi di zuccheri (bianco, canna, miele, malto, etc)	Margarine <20% saturi
	La cosa importante è gli zuccheri non superino il 15% del peso totale dell'impasto (cioè 150g ogni kg di preparazione)	
		Marmellata <35% di zuccheri
		Max 2 uova per kg di preparazione



INGREDIENTI SCONSIGLIATI



FARINE	Di tipo 00	GRASSI	Di origine animale (burro, panna)
	Anche tutte le farine bianche raffinate (riso, orzo, farro, kamut)		Margarine ottenute con idrogenazione
			Margarine >20% saturi



FOCUS:
preparazioni salate

INGREDIENTI CONSIGLIATI



FARINE	Integrali, semintegrali	Spezie ed erbe aromatiche
	Di mandorle, di nocciole	
	Di cocco, di castagne, di ceci	
Oli di semi spremuti a freddo	Ricotta e yogurt bianco	Semi oleosi
	Olio extravergine d'oliva	
		Cereali soffiati
		Peperoncino
		Verdure e legumi



INGREDIENTI UTILIZZABILI



FARINE	Di tipo 0	Latte vaccino
	Fecola di patate	
	Amido di mais, frumina	
SALE	Il sale non deve superare lo 0,5%, quindi 1 cucchiaino per ogni kg di preparazione	Margarine <20% saturi
		Salsa di soia
		Max 2 uova per kg di preparazione
		Capperi, acciughe, olive, pomodori secchi etc



INGREDIENTI SCONSIGLIATI



FARINE Di tipo 00
Anche tutte le farine bianche raffinate (riso, orzo, farro, kamut)

GRASSI Di origine animale (burro, panna)
Margarine ottenute con idrogenazione
Margarine >20% saturi



COTTURE

CLASSIFICAZIONE DELLE COTTURE



Cotture SMART

- Al forno con poco condimento
- Gratinature con pangrattato integrale, farina di mais, di nocciole o altra frutta secca
- Al vapore

Cotture UTILIZZABILI

- Microonde senza grassi in cottura
- Bollitura in poca acqua
- Leggera scottatura sulla piastra

Cotture NON SMART

- Cottura prolungata sulla griglia
- Frittura di qualsiasi tipo
- Gratinatura con burro o formaggio



FOCUS: COTTURA DEGLI ALIMENTI VEGETALI

COTTURA DEI CEREALI



Consigli per migliorare il carico glicemico:

- Cottura al dente
- Cottura tipo risotto, valida per tutti i cereali in chicco
- Cottura per assorbimento di acqua, come per il cous cous



Altri consigli pratici:

- Riutilizzo dell'acqua di cottura delle verdure
- Utilizzo di acqua aromatizzata con curcuma



ALIMENTI CONTENENTI CAROTENOIDI



β-CAROTENE

- Zucca, carote, albicocche, erbe aromatiche

LICOPENE

- Pomodoro, pompelmo rosa, anguria



ALIMENTI CONTENENTI CAROTENOIDI

La biodisponibilità dei carotenoidi, cioè la capacità di passare dall'alimento al nostro organismo e poter espletare le loro funzioni, è facilitata dalla cottura e dalla presenza di sostanze grasse.



COTTURA



Esempi pratici



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ALIMENTI CONTENENTI COMPOSTI SOLFORATI



GLUCOSINOLATI
cavoli, broccoli, verza,
ravanelli, senape

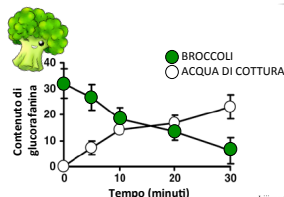


SOLFURI E TIOLI
aglio, cipolla, porri



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BROCCOLI, CAVOLFIORI, CAVOLETTI



Lijiang Song, Paul J. Thornalley
Food and Chemical Toxicology 49 (2011) 281-284

I composti solforati contenuti nelle crucifere tendono a disperdersi nell'acqua di cottura. Per minimizzarne la perdita, tagliare in cimette o in piccoli pezzi queste verdure e limitare il tempo di cottura al di sotto dei 10 minuti utilizzando poca acqua.

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CAVOLO CAPPUCCIO, VERZA

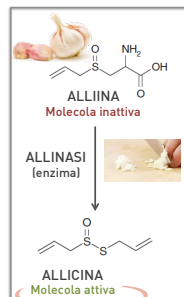


All'interno delle crucifere è presente un enzima, chiamato MIROSINASI. Quando si tritano queste verdure l'enzima viene a contatto con i glucosinolati e li trasforma in ISOTIACIANATI, molecole con numerose attività biologiche. La cottura però rende le mirosinasi meno attive, quindi tutto questo meccanismo funziona al meglio quando il prodotto viene tritato crudo.

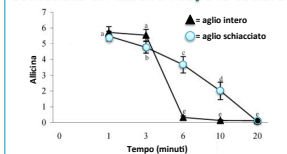
Consigli pratici:
Consumare questi alimenti crudi tritati, ad esempio in insalata, oppure saltati o sbollentati velocemente.

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AGLIO



Contenuto di ALLICINA dopo la cottura



La cottura dell'aglio tritato, piuttosto che intero, preserva maggiormente il contenuto di ALLICINA. Ancora meglio è il consumo di aglio crudo tritato, ad esempio nelle marinature oppure sfregato sul pane secco o sulle bruschette.

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DOMANDE?

LEZIONE SULLA SINDROME METABOLICA

- Utilizzo di ORZO e FIOCCHI D'AVENA, ricchi di beta-glucani
- Può essere utilizzato il PESCE nelle cotture previste dalle linee guida
- Utilizzo di marinature e condimenti alternativi per diminuire l'uso del sale
- Utilizzo della frutta secca, in particolare NOCCIOLE

ESEMPIO DI MENU

- Orzo cucinato freddo oppure in zuppa con verdure e/o legumi
- Salmone/tonno eccetera cucinato al forno con panatura di nocciole oppure con panatura di pangrattato integrale con erbe aromatiche e agrumi
- Insalata di pollo marinato agli agrumi/vino/aceto etc. con verdure
- Contorni di verdure cucinati e conditi con semi oleosi (lino, sesamo, girasole etc) tostati
- Dolce o biscotti realizzati con fiocchi d'avena, cioccolato fondente 70%, nocciole (farina, crema etc) farina integrale, frutta fresca

LEZIONE SU ALIMENTAZIONE E CANCRO

- Importante l'utilizzo di CEREALI INTEGRALI (pane, pasta, pizza con farine integrali)
- Legumi proposti in diverse ricette (CECI, FAGIOLI, FAVE, LENTICCHIE)
- Alimenti ricchi di carotenoidi (CAROTE, ZUCCA, ERBE AROMATICHE)
- AGLIO, CIPOLLA, PORRI, CAVOLI E VERZE

ESEMPIO DI MENU

- Pane integrale con hummus di ceci (con aglio)
- Pizza integrale con verdure
- Hamburger/polpette di legumi (ceci, lenticchie, fave, fagioli) e verdure (porri, cipolle)
- Crema di zucca o risotto alla zucca (con riso integrale)
- Broccoli/cavolfiori etc con condimenti alternativi
- Foglie di verza ripiene di patè di legumi
- Come dessert gelato con frutta fresca e zucchero in quantità moderate, oppure altri dolci sempre con farina integrale e molta frutta fresca

LEZIONE SU ALIMENTAZIONE E SOSTENIBILITÀ

- Menù interamente vegetariano (senza carne né pesce)
- Possono essere utilizzati dei formaggi freschi e magri (RICOTTA FRESCA, CAPRINO FRESCO, FETA, QUARTIROLO) e/o UOVA (nelle cotture previste dalle linee guida)
- Utilizzo di frutta secca, in particolare MANDORLE, FICHI SECCHI
- Condimento con PEPERONCINO FRESCO e SCORZA/SUCCO DI LIMONE ricchi di vitamina C

ESEMPIO DI MENU

- *Verdure grigliate/ripiene di ricotta aromatizzata con scorza di limone/herbe aromatiche*
- *Frittata o farinata di ceci ripiena di verdure e semi oleosi*
- *Primo piatto con cereali in chicco (es riso semintegrale o farro) condito con peperoncino fresco e legumi*
- *Oppure primo piatto integrale con pesto di rucola e mandorle e pomodori secchi*
- *Dolce realizzato con latte di mandorla non zuccherato e burro di sesamo, torta o biscotti con farina integrale e fichi secchi*

LEZIONE SULLA DIETA MEDITERRANEA DAGLI ANNI '50 AD OGGI

- Molte verdure a foglia verde (SPINACI, BIETE ETC)
- Piatto unico di CEREALI E LEGUMI
- Pesce azzurro (SGOMBRO, SARDE, ALICI)
- Cereali e derivati integrali

ESEMPIO DI MENU

- *Insalata di verdure a foglia, ad esempio spinaci novelli, condita con semi di girasole etc*
- *Insalata greca, con pomodori olive cipolle feta origano*
- *Polpette di pesce azzurro e legumi, senza esagerare con uova o altri prodotti animali*
- *Pane integrale*
- *Zuppa di legumi, ad esempio ribollita, oppure pasta integrale con crema di legumi (lenticchie, ceci, fagioli etc), oppure piatto unico di cereali e pesce azzurro*
- *Pesce azzurro gratinato con farina di nocciole, oppure bocconcini di pesce impanato con altre farine di frutta secca*
- *Torta salata con verdure a foglia verde*

Appendix 2.3

Questions and related answers (*right answers*)

Themes	Questions	Answers
<i>Nutritional science research (NR)</i>	Which types of research are necessary to confirm a scientific hypothesis?	A. In vitro and in human research B. Animal model research C. <i>In vitro, animal models and human studies</i> D. Food habits of different populations
	Which of these sources of information is less reliable?	A. Ministry of health B. World Cancer Research Fund C. Italian Society of Nutrition D. <i>Focus</i>
	What is the goal of the healthy nutrition guidelines?	A. To cure diseases B. <i>To prevent diseases</i> C. To be sure to not have diseases D. To promote local foods
<i>Metabolic syndrome (MS)</i>	Which are the macronutrients?	A. Carbohydrates, proteins, lipids, fats B. Carbohydrates, proteins, sugars C. Vitamins, minerals, phytochemicals D. <i>Carbohydrates, proteins, lipids</i>
	Which of these condiments are the richest in saturated fats?	A. Butter and cream B. Olive oil and seeds oil C. Palm oil and canola oil D. <i>Palm oil and butter</i>
	Choose the group of foods rich in omega-3 fatty acids:	A. <i>Fatty fish, walnuts, flaxseeds</i> B. Butter and cured meat C. Fresh fruit and pulses D. Potato flour
	What is the effect of the regular consumption of nuts?	A. Weight gain B. Increase of blood pressure C. <i>Cholesterol reduction</i> D. Constipation
	What does the glycemic index measure?	A. <i>The increase of glycemia produced by a food</i> B. The tendency of a person to develop diabetes C. The level of blood glucose D. The diabetic food list
	What does insulin control?	A. <i>Carbohydrates metabolism</i> B. Bone density C. Level of cholesterolemia D. Height growth
	Which is the condition that subjects with metabolic syndrome have altered?	A. Weight to height ratio B. Skinfold thickness C. Right thigh size D. <i>Waist circumference</i>

<i>Cancer prevention (CP)</i>	How many cases of cancer could be prevented with healthy lifestyle and nutrition?	A. All of them B. Half of them C. None of them D. One third
	What is the meaning of being in a “normal weight”?	A. Being thin B. Having a better body shape C. Having minor risk of developing diseases D. Eating less
	What is the maximum amount of red meat you can eat weekly to prevent certain types of cancer?	A. 300 grams B. 1.5 kilograms C. 50 grams D. 500 grams
	Which of these foods are the richest in dietary fiber?	A. Whole grains and pulses B. Fruit and vegetables C. Vegetables and pulses D. Fish and vegetables
	What is the ideal daily level of physical activity recommended?	A. At least 30-40 minutes B. At least 10 minutes C. At least 2 hours D. At least 4 hours
	How many portions of fruit and vegetables should be eaten?	A. At least 2 per week B. At least 1 per day C. At least 3 per day D. At least 5 per day
	Which are the risks related to high salt consumption?	A. Loss of bone density B. Increase of blood pressure C. Stomach cancer D. All the above
<i>Food sustainability (FS)</i>	What is the right ratio between animal and plant foods for a healthy diet?	A. Half plant and half animal foods B. 1/5 plant and 4/5 animal foods C. 2/3 plant and 1/3 animal foods D. Depends on the age
	What does the double pyramid show?	A. Link between food and health B. Nutritional value of two different foods C. Link between food and physical activity D. Link between food and sustainability
	Which of these foods are the richest in iron?	A. Liver, beans and herbs B. Meat, cured meats and cheese C. Liver, cured meats and spinach D. Meat, fish and eggs
	Which of these statements regarding milk is false?	A. Daily consumption is not harmful B. Lactose is the major sugar C. Is the only food that contains calcium D. Can cause both allergies and intolerances
	Which of these statements regarding tap water is false?	A. Is more sustainable than bottled water B. Contains limestone that can cause kidney stones C. Is under microbial control D. Is a source of minerals

<i>Mediterranean diet (MD)</i>	Who was the first that studied the so called "Mediterranean diet"?	A. Gregor Mendel B. Carlo Cracco C. Leonardo da Vinci D. Ancel Keys
	Which foods are present at the base of the Mediterranean diet pyramid?	A. Pasta, pizza and tomatoes B. Water, meat and olive oil C. Fish, vegetables and fruit D. Fruit, vegetables, cereals and olive oil
	What is the right frequency of consumption of the foods at the top of the Mediterranean diet pyramid?	A. Every day B. Occasionally C. 3-4 times per week D. Never
	Which are the protective food components contained in the Mediterranean diet?	A. Water and proteins B. Proteins and carbohydrates C. Fiber, phytochemicals and unsaturated fats D. Vitamins and minerals
	Which food components can increase the risk of cardiovascular diseases?	A. Water B. Polyunsaturated fats C. Proteins D. Saturated fats
<i>SmartFood guidelines (SG)</i>	Which of the following sweeteners is the healthiest?	A. Honey B. Sugar cane C. Barley malt syrup D. None of the above
	Which of the following options reflect a healthy balanced meal?	A. Pasta with pesto sauce+chicken salad+bread with Nutella B. Polenta+stew+fruit salad C. Pizza with vegetables+strawberry yoghurt D. Pasta with beans+spinach+fresh fruit
	What is the best cooking method to preserve the nutritional properties of plant foods?	A. Steaming B. Raw consumption C. Baking D. Depends on the type of food

Appendix 4.1

Supplement to: Ghelfi F, Tieri M, et al. Do cancer patients change their diet in the e-health information era? A review of the literature and a survey as a proposal for the Italian population.

The ECHO questionnaire consists of 32 structured questions assembled in three main sections: 'personal data', 'supplements and specific diets after diagnosis' and 'dietary changes after diagnosis'. For each question, a list of answers is provided; when indicated, patients can choose more than one answer.

This appendix provides additional information about the items investigated using the ECHO questionnaire. Please, note that this is not the full version of the questionnaire.

PERSONAL DATA	
Age Education On-going and completed treatments	
SUPPLEMENTS AND SPECIFIC DIETS AFTER DIAGNOSIS	
Use of supplements and products claimed for their anti-cancer properties <i>More than one answer possible</i>	
Vitamins	Phytoestrogens
Minerals	Omega-3
Plant extracts	Green tea
Probiotics	Aloe
Beginning of specific diets <i>More than one answer possible</i>	
Vegetarian	Macrobiotic
Vegan	Alkaline
Paleo	Fasting-mimicking diet
Reasons that guided these behaviours <i>More than one answer possible</i>	
Lose weight	
Fight cancer	
Dietary needs	
Sources of information that guided these behaviours <i>More than one answer possible</i>	
Internet/conferences	Pharmacist
General Practitioner	Homeopath
Oncologist	Relatives and friends
Nutritionist/Dietitian	Other cancer patients

If patients discussed about them with their own oncologist.	
DIETARY CHANGES AFTER DIAGNOSIS	
Wholemeal bread and pasta	Fish and shellfish, fresh and frozen
Refined bread and pasta	Preserved fish
Baked goods	Milk
Grains	Plant-based milk substitutes
Fruit	Dairy products
Nuts	Eggs
Vegetables	Vegetable oils
Pulses	Animal fats
Red meat	Alcoholic drinks
Poultry	Soft drinks
Processed meat	Hand-made sweet products
Plant-based meat substitutes	Sugar substitutes
Only one answer possible for each food item:	
Same consumption	Decreased
Started	Stopped
Increased	Never eaten
Sources of information that guided these dietary changes	
More than one answer possible	
Internet/conferences	Pharmacist
General practitioner	Homeopath
Oncologist	Relatives and friends
Nutritionist/Dietitian	Other cancer patients