

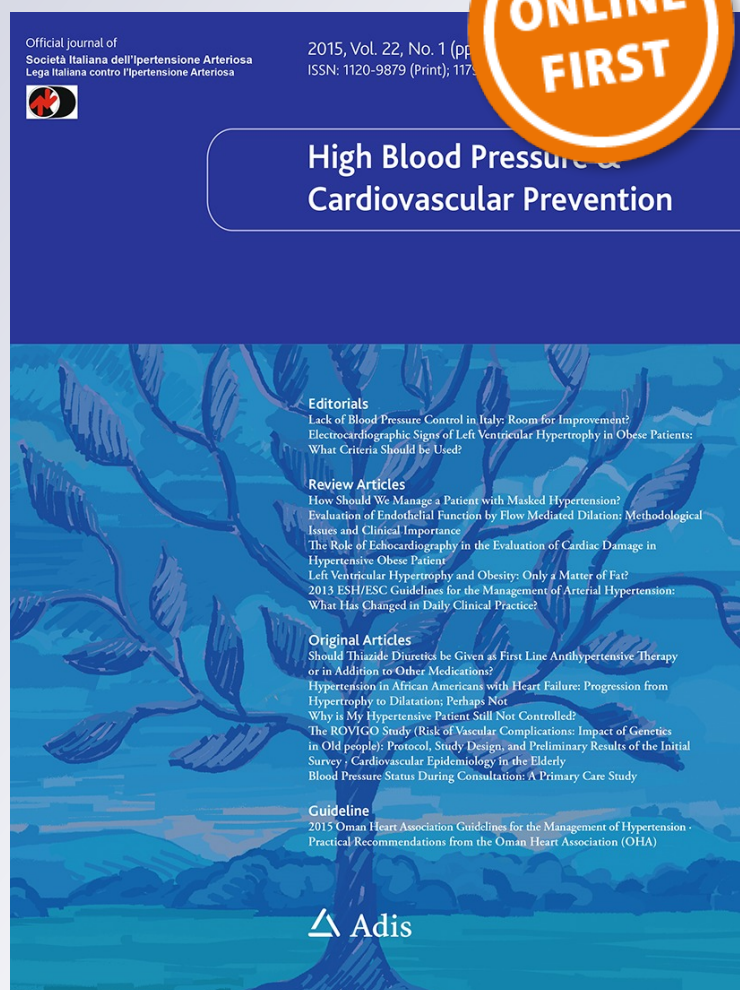
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Healthy fats for healthy nutrition. An educational approach in the workplace to regulate food choices and improve prevention of non-communicable diseases

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Abstract

Introduction An educational activity, aimed at highlighting the benefits of Mediterranean Diet, compared to less healthy eating patterns, can encourage the adoption and maintenance of a mindful approach to food choice. This is especially important when a progressive shift towards a non-Mediterranean dietary pattern can be observed, even in Mediterranean countries.

Aim To test a protocol aimed at increasing knowledge and motivation to embrace healthy eating habits and, engendering conscientious food choices, improve the prevention of non-communicable diseases.

Methods Employees were involved in educational activities focusing on a healthy Mediterranean diet and on the role played by extra-virgin olive oil, one of its key components. Food questionnaires were completed both before and after the educational and information activities, in order to assess changes in personal knowledge of and attitudes towards fat consumption.

Results Answers on dietary guidelines and fat properties were more accurate after the seminars. The results showed increased understanding of the properties of extra-virgin olive oil versus seed oil and a stronger tendency towards healthy food choices.

Conclusions Implementing preventive information and training strategies and tools in the workplace, can motivate a more mindful approach to food choice with the long-term goal of contribute to reducing non-communicable diseases.

Keywords Mediterranean diet · Extra-virgin olive oil · Workplace medicine · Educational training · Prevention of non-communicable diseases

1 Introduction

Unhealthy diet is a risk factor for cardiovascular disease and a major contributor to the development of cardiovascular risk factors. It also may increase the incidence of other non-communicable-diseases such as osteoporosis, neurodegenerative diseases and some types of cancer [1]. On the contrary, a well-balanced diet is a cornerstone of good health. Healthy people who follow a Mediterranean diet have a lower risk of developing type 2 diabetes, cardiovascular disease and cancer, Parkinson's disease and Alzheimer's disease and have a longer telomere length, which is biomarker of aging [2–5]. Nevertheless, healthy eating habits are a choice determined by various factors including individual preferences and social environment, and can be encouraged by providing clear information on the long-term benefits and actual taste satisfaction.

Extra virgin olive oil (EVOO) is an ideal, tasty, healthful product, providing both recognized nutritional properties and intense hedonic experiences, positively correlated to product quality. Olive oil is the primary source of fat in the Mediterranean diet, and has been considered unhealthy because of its energy-dense

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composition [6], notwithstanding the fact that a healthy diet is qualified by the quality rather than the quantity of its fat content. Unsaturated fatty acids, given their documented effects on health and wellness, must be the fats of preferential choice [2, 7]. EVOO is rich in monounsaturated fats, has few polyunsaturated fats, with an optimal linoleic acid/alpha-inolenic acid ratio. In particular, oleic acid (18:1n-9) ranges from 55 to 83 % of the total fatty acid content, while linoleic acid (18:2n-6)—the major essential fatty acid and the most abundant polyunsaturate in our diet—is present in concentrations between 3.5 and 21 % [8]. It also contains minor but important components as vitamin A, vitamin E, phytosterols and polyphenols. While phytosterols concur to reduce cholesterol absorption, oleic acid-enriched low density lipoproteins (LDLs) are more resistant to oxidative modifications, and vitamin E and polyphenols have anti-oxidant properties that reduce the oxidative damage of LDLs [9]. These antioxidant activities play a relevant role in the prevention or attenuation of pathologies associated with redox imbalance, such as atherosclerosis and other chronic degenerative diseases. They also constitute an important nutritional factor in cardiovascular and cancer prevention, and are one of the factors which determine the longevity of the Mediterranean population [9–11].

Nutrition knowledge is significantly associated with a higher adherence to a Mediterranean dietary pattern and with a lower prevalence of obesity in Southern Italy independently of education level and other socioeconomic factors [12] and improved adherence increases benefits [13]. These potentialities are clinically relevant in terms of public health, particularly in reducing the risk of premature death amongst the general population. Moreover, well-informed parents can transmit the importance of healthy eating to their children [14]. By so doing, they contribute to inverting the “diabesity” trend in the younger generation (and help preserve culinary tradition). However, despite policies which disseminate knowledge on healthy fats, informative tools, effective in orienting food choices are still needed. A worldwide promotion of the Mediterranean diet is being counteracted by a progressive shift to a non-Mediterranean dietary pattern, even in Mediterranean countries. In Italy, this trend is strongly mirrored in an increase in the prevalence of obesity especially in adolescents [15], but also in adults [16]. This leads us to discussing food education in terms of fostering the efficacy of recommended guidelines [17]. Directing consumers towards the consumption of healthy products is a primary aim, pursued through educational tools. However, it is not sufficient to support habitual consumption of such foods. i.e., when their hedonic appeal is insufficient [18] or their sensory appeal and healthy properties are not fully appreciated. Since work places, schools and other collective

sites, are the best places in which to address people's food habits [19, 20], the current research has been carried out in the workplace.

2 Aim

The aim of our study was to assess lipid consumption habits and consumers' basic knowledge of the nutritional properties of fats, both before and after specific educational activities, by providing them with correct, simple and clear scientific information. Extra virgin olive oil (EVOO), was taken as the archetype for a “must-be-well-known” healthy food, which provides hedonic rewards and enjoys social consideration. The short-term goal was to increase knowledge and motivation to embrace healthy eating habits. The long-term goal was to engender conscientious food choices, which would improve the prevention of non-communicable diseases.

3 Materials and Methods

3.1 Participants and Experimental Design

Volunteers, recruited among Italian National Research Council (CNR) employees in Rome and Bologna (Italy), were requested to participate in the project on food education entitled, “Olive oil in the prevention of major degenerative diseases. Intervention model training and dissemination in the workplace”. The project is part of the programmes for health promotion in the workplace, coordinated by the Health and Safety Department of CNR, Rome (Promozione e tutela della Salute, so called “PRO.SA. Project”) in the field of cardiovascular health [21]. The experimental design aimed to compare participants' knowledge of edible fats, before (a) and after (c) a specific educational activity (b). The first phase consisted of participants completing an online survey on their fat consumption and their knowledge of the nutritional and healthful properties of several substances present in food, including those typical of olive oil (a). The second phase (b) was educational, with experts holding information workshops. The final phase evaluated the educational impact of the exercise, by comparing the questionnaires filled in before (a) and after (c) the workshops. A total of 182 people participated in the initial survey (a). The sample population consisted of 56% women and 44 % men, between 25 and 72 years of age (50 % 40–56). Approximately two-thirds had a university degree, while the others had completed secondary education. Sixty-eight of them also completed the questionnaire after the workshops (c).

3.2 Characteristics of the Questionnaire

Participants were requested to complete the same online survey before (phase a) and after (phase c) the educational activity. The comparison between the amount of fat contained in a tablespoonful of olive oil and of seed oils (Table 4), was the most significant finding. In phase (a), participants responded that olive oil contained more fat than seed oils, while their awareness that the two types of oil have the same fat content increased by more than 30 % after the seminars.

Participants provided socio-demographic data and were requested to indicate the condiments used when eating at home and in the workplace. Individual knowledge on the role fats play in health and nutrition was assessed through three multiple choice questions, and two ratings: the questions were as follows: (1) What is the recommended percentage of daily calorie intake coming from fats in a balanced diet? (2) How many minutes do you need to walk on average to burn the calories contained in a tablespoonful of oil; (3) How does the fat content of olive oil compare to that of seed oil; (4) Rate (low–9 high) the following condiments of animal or vegetal origin in terms of their capacity to raise blood cholesterol level and (5) Rate the following substances according to their healthfulness. The last questions focused on the properties of EVOO: identify substances present in the product, rate selected sensory markers, according to their significance in indicating the presence of antioxidants.

3.3 Data Management and Statistical Analysis

The data collected was processed anonymously and used strictly for scientific purposes. Statistical analysis was performed by SAS 9.3 (SAS Institute Inc., Cary, NC, USA). A one-way analysis of variance (ANOVA), using Fisher's Least Significant Difference (LSD) test, was applied to ascertain if the average scores differed significantly ($p \leq 0.05$) before and after the information workshops. The percentage of answers provided per question before and after the workshops was analysed using the Chi-square test.

4 Results

In terms of their eating habits, participants declared that in general, they ate at home at least once a day. EVOO was the most frequently used condiment (Table 1). When eating out, a 30 % decrease in the consumption of EVOO was recorded, paralleling a 32 % increase of common olive oil. About a quarter of the participants confirmed they used butter at home, while only 1 % said they consumed it when

Table 1 Condiments more frequently used by consumers at home or out of home

Condiment	% at home	% out of home
Seed oil	11	1
EVOO*	96	66
Butter*	25	1
Spreadable margarine	1	0
Olive oil*	8	41
Solid margarine	2	0
Prepared dressing	1	5

* Indicates a significant difference ($p \leq 0.05$)

eating out. Only one percent said they used ready-prepared dressings when eating at home, a slightly higher percentage was recorded when eating out. About 60 % of participants declared they eat lunch regularly at the workplace cafeteria, and that they were only partially satisfied (38 %) or not at all satisfied (34 %) with the fat dressings available. The improvements participants envisaged were an increased use of local, organic products, with nutritional guarantees (data not shown). Answers on dietary guidelines and fat properties were more accurate after the seminars. Before the educational activities the majority of participants affirmed that, to the best of their knowledge, in a balanced diet should 15–20 % of average daily calories should be in the form of fats. After the seminars, there was only a slight increase in the number of people who provided the correct answer (25–35 % of calories from fats) (Table 2).

Even before specific information was provided, more than two-thirds of the participants correctly indicated that a person of an average build/weight (70 kg) should walk briskly (at a speed of about 5 km/h) for about 20 min to burn off a tablespoon of oil. This percentage increased to 79 % after educational training (Table 2).

The impact of the information provided on the relative fat content of olive oil and seed oil was significant. Participants' awareness that the fat content is the same for both kinds of oil increased by more than 30 % once correct information had been provided. In terms of the capacity of different condiments to raise blood cholesterol levels, a basic knowledge was recorded even before the seminar. Animal fats (lard, butter and cream) received the highest scores. Industrial vegetable fats (margarine) yielded intermediate scores. Vegetable oils (from seeds or olive) obtained the lowest scores in both phases. EVOO scored a 10 % decrease after educational training, seed oil, surprisingly, the opposite (Table 3).

Nearly all the substances proposed to participants for their potential health benefits, received a relatively high score. Only chlorophyll had a score below 5. After the seminar, in which their role was underlined, phytosterols

Table 2 Percentage of consumers indicating advisable daily calorie intake deriving from fats in a balanced diet; time necessary to burn off a tablespoon of oil (person of about 70 kg, speed about 5 km/h) and prevalence of fat content in olive vs. seed oil, before and after educational activity

	% before seminar	% after seminar	% variation
Daily calorie intake			
15–20 %	63	61	–2
25–30 %	35	39	+4
35–40 %	2	0	–2
Time to burn off			
20 min*	68	79	+11
40 min*	28	13	–15
60 min	4	0	–4
Amount of fat			
Olive oil > seed oil*	43	19	–24
Olive oil = seed oil*	43	74	+31
Olive oil < seed oil	14	6	–8

* Indicates a significant difference ($p \leq 0.05$)

Table 3 Average score (range 1–9, 1 lowest–9 highest) provided by consumers before and after seminar when asked about the capacity of various condiments to raise the cholesterol level in the blood

Condiment	Score before seminar	Score after seminar
Lard	8.5	8.3
Butter	7.8	8.0
Cream	7.6	7.6
Solid vegetable margarine	5.8	6.1
Spreadable vegetable margarine	5.9	6.1
Seed oil	4.4	4.8
Extra virgin olive oil	3.0	2.7

Table 4 Average score provided by consumers (range 1–9, 1 lowest–9 highest) about selected substances capacity to carry out health benefits function (beneficial effect) and percentage of consumers acknowledging the presence of the selected substances in extra virgin olive oil, before and after seminar

Substances	Beneficial effect		Presence in olive oil	
	Score before seminar	Score after seminar	% before seminar	% after seminar
Vitamin A	6.7	7.2	39*	70*
Vitamin C	7.2	7.2	14	16
Vitamin E*	7.2	7.7	58*	90*
Antioxidant	8.1	8.3	91	98
Polyphenols*	7.0	7.9	66*	93*
Phytosterols*	5.8	7.0	34*	62*
Chlorophyll	4.3	4.5	42	43
Fibre	6.7	6.5	7	11

* Indicates a significant difference ($p \leq 0.05$)

and polyphenols received higher scores (20 and 12 % respectively) (Table 4). Regarding the substances contained in EVOO, antioxidants and polyphenols were those most cited before the educational training. A significant increase in specific knowledge was recorded after the seminars, especially an understanding of the presence of vitamin A, polyphenols and phytosterols increased (Table 5). The information about the sensory markers of EVOO as an indication of its antioxidant capacity, was effective in increasing the scores attributed to the smell of grass (+39 %) and, to an even greater extent, to its pungent (+52 %) and bitter traits (+75 %). At the same time, a decrease in the

importance of its visual aspects, such as color and clarity, was also recorded (Table 5).

5 Discussion

Knowledge of food nutrition is a recognized driver for improving eating habits [22, 23], and simple, clear information is one tool to facilitate, motivate and support healthier food choices. Diets in which olive oil is the main source of fat could be a useful tool to reduce risk factors for cardiovascular disease and other non-communicable

Table 5 Sensory characteristics (1 not important–9 extremely important) indicating an high antioxidants presence in EVOO as scored before and after seminars before and after seminar

Characteristic	Score before seminar	Score after seminar	% variation
Green in color*	6.3	3.9	–38.1
Yellow in color*	4.0	2.9	–27.5
Transparency	3.5	3.4	–2.9
Odor of grass*	4.1	5.7	39.0
Odorless	2.3	2.5	8.7
Viscosity	4.3	3.7	–14.0
Pungent*	5.0	7.6	52.0
Bitter*	4.4	7.7	75.0

* Indicates a significant difference ($p \leq 0.05$)

diseases [2, 9–11]. Therefore, the advice of using healthy dressings could be a primary prevention strategy, when attempting to generate consistent changes in their food choices in their daily lives. The analysis of the questionnaires filled before and after an educational seminar, focused on the role of fats in nutrition, health, and prevention of cardiovascular disease and other non-communicable diseases, indicates that such educational initiatives, by bringing information into the workplace, can be very useful in educating consumers. A further step would be to re-submit the questionnaire to participants after a longer period of time and to ascertain if the knowledge gained has been retained.

Answers on food choices reveal that a Italian sample population is quite careful about the quality of condiments used at home and proposed when eating out. The customary use of EVOO recorded is in line with Mediterranean eating habits. More remarkably EVOO is used predominantly at home, and not commonly found when eating out. Butter is more frequently used at home, probably as an ingredient in cooking, while it is not utilized as a condiment, the same declaration was recorded for seed oil. Participants demonstrated an appropriate basic knowledge about the differences between animal and vegetable fats in terms of cholesterol, with margarine presumably perceived as artificial. This findings suggest specific care in meal preparation at home, with participants choosing condiments on the basis of their cooking habits, generic information and taste expectations. There is potential for introducing educational initiatives in this food-caring scenario. When specifically focusing on the quality and properties of a high quality product like EVOO, educational training increased participants' knowledge of some key health components such as vitamin A, polyphenols and phytosterols and about sensory markers as indicators quality. This indicates that despite the declared frequent use of EVOO as a condiment, consumers appear not to be fully aware of its properties and traits, since their major source of information is possibly commercial advertising. Consumer perception must be educated to interpret bitterness and pungency as a sensory clue of the presence of

polyphenols [24]. These attributes, typical of high quality EVOO, are not always appreciated by consumers [25]. Consumer education can thus help in training about how to drive healthy food choices. On the contrary, there is no clear link between some of the traits emphasized by commercial advertising (e.g. colour and acidity) as proof of quality, and the product's healthful properties.

The approach followed, based on simple and clear practical tools to help participants make healthy food choices in their daily lives, was effective in increasing their understanding of the importance of mindful food choices: an increase in knowledge of fat dressings, nutritional implications, health and eating habits, together with an increased interest in products providing enhanced quality traits, were recorded. This result is important considering that an individual's health is linked to key domains, such as genetics, social circumstances, environmental exposure, health care, and behavioral patterns. Changing an individual's unhealthy dietary behavioral patterns is a great opportunity to improve health and reduce mortality [26]. However, the difficulty in changing food habits is well known, and often the declared willingness to improve individual behavior patterns, is not fulfilled as expected [27, 28]. For example, Americans were believed to be highly aware of the role of functional foods and to be ready to incorporate them into their diets [29]. Moreover, low rates of healthy food consumption, despite great intentions and aspirations to eat healthily, are reported [30].

Even in a Mediterranean country such as Italy, where olive oil is an established dietary component, the awareness of its nutritional properties and how to go about choosing a high quality product, still leaves room for improvement.

6 Conclusions

In conclusion, the experience we report here may be seen as a simple, practical and effective means of assisting consumers in making the choice to follow a healthy diet, and gives some indications about the concrete possibility of putting in place preventive strategies to improve overall

dietary patterns, even in workplaces. Such improved dissemination of information and knowledge, if widely adopted, could effectively amplify the long-term goal of reducing cardiovascular disease and other non-communicable diseases.

These results indicate how, even for relatively simple concepts, the need for correct information is still necessary to engender informed choices in the type of oil to consume and, more general terms, informed food choices.

Reinforce individuals' knowledge through specific actions, through educational or practical actions (e.g. informing them of the availability of healthier foods, offering guided taste experiences) may reinforce individuals' awareness and their ability to translate nutritional recommendations for healthy eating habits into a real introduction of healthy foods as part of their daily diets. Moreover, the dissemination of information can also be amplified towards families and friends, to increase the global awareness of healthy foods.

Unfortunately, despite the worldwide promotion of the Mediterranean diet in recent years, a progressive shift to a non-Mediterranean dietary patterns, even in Mediterranean countries, has emerged. In Italy, this trend is strongly reflected in the cited increase in the prevalence of obesity, especially amongst the adolescents [15], and in adults [16]. While it is true that policy change, including the introduction of legislation and regulations, can play a role in changing consumers' eating habits, it is equally true that individuals need assistance, education, and tools to support their personal decision to safeguard their health by adopting a more mindful approach to food choice.

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References

1. Arnold M, Pandeya N, Byrnes G, Renehan AG, Stevens GA, Ezzati M, et al. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *Lancet Oncol* Nov 26. 2014. doi:10.1016/S1470-2045(14)71123-4.
2. Sofi F, Vecchio S, Giuliani G, Martinelli F, Marcucci R, Gori AM, et al. Dietary habits, lifestyle and cardiovascular risk factors in a clinically healthy Italian population: the "Florence" diet is not Mediterranean. *Eur J Clin Nutr*. 2005;59:584–91.
3. Estruch R, Ros E, Salas-Salvado J, Covas MI, Corella D, Aros F, et al. Primary prevention of cardiovascular disease with Mediterranean diet. *N Engl J Med*. 2013. doi:10.1056/NEJMoa1200303.
4. Crous-Bou M, Fung TT, Prescott J, Julin B, Du M, Sun Q, et al. Mediterranean diet and telomere length in Nurses' Health Study: population based cohort study. *Br Med J*. 2014;349:g6674.
5. Gu Y, Hong LS, Schupf N, et al. Mediterranean diet and leukocyte telomere length in a multi-ethnic elderly population. *Age* (Dordrecht, Netherlands). 2015;37:9758 (Epub 8 March 2015).
6. Food Standards Agency. Traffic light labelling. 2009. <http://www.eatwell.gov.uk/foodlabels/trafficlights/>. Accessed 6 June 2009.
7. Micha R, Mozaffarian D. Saturated fat and cardiometabolic risk factors, coronary heart disease, stroke, and diabetes: A fresh look at the evidence. *Lipids*. 2010;45:893–905.
8. COI/T.15/NC No 3/Rev. 8 February 2015. Trade standard applying to olive oils and pomace oils.
9. Covas MI, Konstantinidou V, Fitó M. Olive oil and cardiovascular health. *J Cardiovasc Pharmacol*. 2009;54:477–82.
10. Buckland G, Mayén AL, Agudo A, Travier N, Navarro C, Huerta JM, et al. Olive oil intake and mortality within the Spanish population (EPIC-Spain). *Am J Clin Nutr*. 2012;96:142–9. doi:10.3945/ajcn.111.024216 (Epub 30 May 2012).
11. Couto E, Boffetta P, Lagiou P, Ferrari P, Buckland G, Overvad K, et al. Mediterranean dietary pattern and cancer risk in the EPIC cohort. *Br J Cancer*. 2011;26(104):1493–9. doi:10.1038/bjc.2011.106 (Epub 5 Apr 2011).
12. Bonaccio M, Di Castelnuovo A, Costanzo S, De Lucia F, Olivieri M, Donati MB. Nutrition knowledge is associated with higher adherence to Mediterranean diet and lower prevalence of obesity. Results from the Moli-sani study. *Appetite*. 2013;68:139–46. doi:10.1016/j.appet.2013.04.026.
13. Sofi F, Abbate R, Gensini GF, Casini A. Accruing evidence about benefits of adherence to Mediterranean diet on health: an updated systematic review with meta-analysis. *Am J Clin Nutr*. 2010;92:1189–96.
14. Azais-Braesco V, Brighenti F, Paoletti R, Peracino A, Scarborough P, Visioli F, Vogale C. Healthy food and healthy choices: a new European profile approach. *Atherosclerosis*. 2009;Suppl 10:1–11.
15. Celi F, Bini V, De Giorgi G, Molinari D, Faraoni F, Di Stefano G, et al. Epidemiology of overweight and obesity among school children and adolescents in three provinces of Central Italy, 1993–2001: study of potential influencing variables. *Eur J Clin Nutr*. 2003;57:1045–51.
16. Giampaoli S, Vannuzzo D, Gruppo di Ricerca del Progetto osservatorio epidemiologico cardiovascolare/health examination survey. La salute cardiovascolare degli italiani. Terzo Atlante Italiano delle Malattie Cardiovascolari. *G Ital Cardiol*. 2014;15(Suppl 1):7S–31S.
17. Bertin M, Lafay L, Calamassi-Tran G, Volatier J-L, Dubuisson C. School meals in French secondary state schools: do national recommendations lead to healthier nutrition on offer? *Br J Nutr*. 2012;107:416–27.
18. Civille GV, Oftedal KN. Sensory evaluation techniques—Make "good for you" taste "good". *Physiol Behav*. 2010;107:598–605.
19. Geaney F, Kelly C, Greiner BA, Harrington JM, Perry IJ, Beirne P. The effectiveness of workplace dietary modification interventions: a systematic review. *Prev Med*. 2013;57:438–47. doi:10.1016/j.ypmed.2013.06.032.
20. Maes L, Van Cauwenberghe E, Van Lippevelde W, Spittaels H, De Pauw E, Oppert JM. Effectiveness of workplace interventions in Europe promoting healthy eating: a systematic review. *Eur J Pub Health*. 2012;22:677–83.
21. Volpe R, Sotis G, Gavita R, et al. Healthy diet to prevent cardiovascular diseases and osteoporosis. The experience of the "Pro.Sa". project. *High Blood Press Cardiovasc*. 2012;19:65–71.
22. Grosso G, Mistretta A, Turconi G, Cena H, Roggi C, Galvano F. Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy. *Public Health Nutr*. 2013;16:1827–36.

23. Ludolph R, Schulz PJ. Does regulatory fit lead to more effective health communication? A systematic review. *Soc Sci Med.* 2015;128:142–50 (**Epub 14 Jan 2015**).
24. Andrewes P, Busch JLHC, de Joode T, Groenwegen A, Alexandre H. Sensory properties of virgin olive oil polyphenols: identification of deacetoxy-ligstroside aglycon as a key contributor to pungency. *J Agr Food Chem.* 2003;51:1415–20.
25. Caporale G, Policastro S, Carlucci A, Monteleone E. Consumer expectations for sensory properties in virgin olive oils. *Food Qual Prefer.* 2006;17:116–25.
26. Schroeder SA. Shattuck lecture: we can do better-improving the health of the American people. *N Eng J Med.* 2007;357(pp1221):1228.
27. Weijzen PLG, De Graaf C, Dijksterhuis G. Predictors of the consistency between healthy snack choice intentions and actual behaviour. *Food Qual Prefer.* 2006;20:110–9.
28. De Bruijn GJ. Understanding college students' fruit consumption. Integrating habit strength in the theory of planned behaviour. *Appetite.* 2010;54:16–22.
29. IFIC, International Food Information Council Foundation. Food & health survey: consumer attitudes toward food safety, nutrition & health. 2014. <http://www.foodinsight.org/surveys/2014-food-and-health-survey>.
30. Gilbert L. The functional food trend: what's next and what Americans think about eggs. *J Am Coll Nutr.* 2000;19(S):507S–512S.