Mediterranean Journal of Nutrition and Metabolism 9 (2016) 171–181
DOI:10.3233/MNM-16111
IOS Press

Changes in Mediterranean dietary patterns in Italy from 1961 to 2011

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Received 4 July 2016
Accepted 20 October 2016

Abstract.
BACKGROUND: In recent years, dietary pattern analysis has emerged as an alternative and complementary approach to examining the relationship between diet and risk of chronic diseases. Obesity and non-communicable diseases (NCDs), such as Metabolic Syndrome (MetS), diabetes mellitus, hypertension, cardiovascular disease, stroke and some cancers have become a more frequent cause of disability and premature death in both developed and developing countries.
OBJECTIVE: Evaluate food availability and the evolution of dietary patterns in Italy between 1961 and 2011 to identify possible contributing factors to the rise in NCDs such obesity and MetS.
METHODOLOGY: An ecological study was conducted on the basis of Food Balance Sheet (FBS) (kcal per capita per day), of the Food and Agriculture Organization (FAO). With this data cluster analysis (hierarchical and K-means) was performed to identify dietary patterns. By analysis of variance ANOVA and *post hoc* analysis by the Kruskal-Wallis test intercluster were analysed each food.
RESULTS: Three periods were identified. The availability of kcal/person/day increased slightly, but showed important changes in dietary patterns composition and they showed clearly changes, it moved away of the Mediterranean diet and its composition was found more in line with the so-called nutritional or dietary transition.
CONCLUSIONS: Considering the rise in NCDs as MetS and its components during this time, the observed changes in eating habits may have contributed to deleterious effects on metabolic heath. Thus, dietary modifications may be warranted.

Keywords: Dietary patterns, metabolic syndrome, risk factors

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ISSN 1973-798X/16/$35.00

1. Introduction

Dietary modifications along with a decrease of energy expenditure due to a sedentary life, have given rise to the so-called nutritional transition, characterized by changes in both; the quantity and type of food consumed. These changes correspond to diets with higher energy density, more added fat and sugar in foods, increased intake of saturated fats (mostly animal) accompanying a decreased consumption of complex carbohydrates and fiber, and reduced consumption of fruits and vegetables [1]. By contrast, developing countries and the poorest areas of the countries continue suffering from food shortages and a lack of nutrients [2–7]. The transition from a traditional to a "Westernized" dietary pattern is among the main responsible for the increased trends of obesity and metabolic-related diseases in most of the nations of the world [3], This transition is particularly evident among the younger generations and in urban population. High socioeconomic and cultural status, older and more educated people were areas associated with a higher adherence to Mediterranean diet [8].

In recent years, dietary pattern analysis has emerged as an alternative and complementary approach to examining the relationship between diet and risk of chronic diseases. Instead of looking at individual nutrients or foods, the pattern analysis examines the effects of overall diet; they may thus be more predictive of disease risk than individual foods or nutrients.

Several studies conducted in Mediterranean countries have been suggested that the Mediterranean diet has a protective effect against non-communicable diseases, including metabolic and cardiovascular risk factors [9–12]. By instance, in Sicily the prevalence rates of NCD are high, greater adherence to the Mediterranean dietary pattern is still associated with a better health status [12].

Cohort studies and randomized controlled trials indicate that adherence to the Mediterranean diet is associated with a reduction of coronary heart disease (CHD) risk and mortality [13–15].

In a meta-analysis to explore the association in prospective studies and randomized control trials between Mediterranean diet adherence and CVD incidence and mortality, Grosso et al, found that individuals with the highest adherence to the diet had lower incidence and mortality from CVD compared to those least adherent. A significant reduction of risk was found also for coronary heart disease, myocardial infarction, and stroke incidence [16].

In another meta-analysis, Sofi et al., found that greater adherence to a Mediterranean diet is associated with a significant reduction in overall mortality (9%), mortality from cardiovascular diseases (9%), incidence of or mortality from cancer (6%), and incidence of Parkinson's disease and Alzheimer's disease (13%) [17].

Enzzati et al. [18] showed that consumption of that the animals fats and foods high in fat calories have increased in the Mediterranean countries and have declined in the Nordic countries, which could explain, at least in part, why cholesterol levels are lower in Sweden and Finland than in Italy. Montonen et al. [20] in a cohort study found that the risk of developing diabetes is higher in individuals whose diet is based on potatoes, butter and whole milk, while this is lower in those who consume mainly fruits and vegetables [19]. Indeed, diets based on fruits, vegetables, whole grains, nuts, seafood have been associated with reduced the risk of obesity, hypertension and diabetes.

Non-communicable diseases represent the main, causes of disability and premature death in both; developing and newly developed countries, especially among the poor's [21]. The burden of chronic diseases is increasing rapidly worldwide. In 2012, it accounted for the 67.8% of total deaths (including malignant neoplasm, diabetes mellitus and cardiovascular, autoimmune, endocrine, haematological, mental disorders, neurological conditions) [22]. It has been estimated that by 2020, chronic diseases will account for nearly three quarters of the total deaths; ischemic heart disease, stroke and diabetes [23]. Burden of chronic disease of 2012 was 55.1% for a total of 1 512 578 000 life years lost due to disability [21].

Metabolic syndrome (MetS) is considered a cluster of cardiovascular risk factors including obesity and blood pressure, blood lipids, and blood glucose alterations [24].

Prevalence of MetS varies depending on the classification criteria. According to the ATP III, Miccoli et al [25] reported in 2005, 18% in women and 15% in men. Application of this estimated prevalence data to the

Italian adult population suggests that 3.6 million women and 3 million men may suffer from MetS. Grundy in 2008 reported prevalence of 24% for men, 23% for women 45–64 years old and 30% and 55.2% for men and women of 65–84 years respectively (NCP). And using the WHO criteria, prevalence for men and women 40 to 79 years was 34% [26]. The 3rd Atlas of cardiovascular disease in Italy, reports than between 2008 and 2012 the prevalence of MetS was 23% for men and 18% for women, aged between 35 and 74 years [27].

Study conducted in South Italy showed slightly lower rates, with a prevalence between12% and 23% of MetS [25, 28, 29].

Overall, prevalence rates are high; recognition of the MetS as a major challenges for the implementation of health policies and requires immediate strategies to reduce the level of individual metabolic risks. Age, sex and genetic predisposition are not modifiable elements, however, much of the risks associated with these features, such as; dyslipidaemia, hypertension, obesity and hyperinsulinemia, are biological factors that may be modified or reduced by implementing public policies addressing the social determinants of health. It is not enough to treat the established risk factors, rather it is necessary to improve the conditions in which people born, live and die [30–32].

The rise in metabolic disease in recent years may be due, in part, to changes in Mediterranean eating habits. Thus, the purpose of this study was to assess food availability and eating patterns changes in Italy between 1961 and 2011 to identify dietary components that may contribute to the MetS risk.

2. Material and methods

An ecological study was conducted on the basis of Food Balance Sheet (FBS), published annually for the Food and Agriculture Organization (FAO) [33].

Using the availability of kcal for person in a day (kcal/person/day), a hierarchical cluster analysis was performed to define dietary patterns. Years were categorized according to the food there was a larger apparent consumption of kcal/person/day throughout the study period (1961–2011). Subsequently, based on dendrogram and the results obtained, that suggested a classification for three clusters, we executed a K-means cluster analysis by case iteration grouping method. Then, we analysed the iteration historical for K-means, the displacement of the centre or centroid of each component and the distribution of each cluster years, and calculated the proportions of kcal/person/day each food brought to the average of each dietary pattern.

FBS, that the FAO produces annually, allow estimating the availability of food in a country (also called apparent consumption) show estimates of the quantities and the main groups of food for human consumption in several countries per year. This information does not provide data about of effective consumption of food, and it does not show differences by population groups: age, sex, and location. However, since the FBS they are produced each year, enable comparisons between countries and draw the food consumption trends in a country over time. For instance Garcia-Closas et al., conducted a study to describe geographical differences and time trends in the supply of the most important food components of the traditional Mediterranean diet, used food supply data collected from national food balance sheets for the period 1961–2001 [34]. Ezzati and Riboli, using the same FBS analysed food availability in many countries as a risk factor for no communicable diseases [18]. Chen and Vidalo assess the trends in food availability in Portugal, France, Italy, Greece and Spain from 1966 to 2003 [35]. Finally, by analysis of variance ANOVA and *post hoc* analysis by the Kruskal-Wallis test intercluster were analysed each food.

3. Results

The availability of kcal/person/day increased slightly, from 3128 to 3539, between 1961 and 2011. Using cluster analysis, we built three different eating patterns. The distribution of cases in the cluster by both methods

Table 1
Dietary patterns. Kcal/person/day. Italy 1961-2011

Dietary patterns	I 1961–1969		II 1970–1981		III 1982–2011	
Foods	kcal/per/day	%	kcal/per/day	%	kcal/per/day	%
Wheat and products	1197	38.1	1216	35.0	1052	29.6
Sugar (raw equivalent)	264	8.4	313	9.0	281	7.9
Olive Oil	233	7.4	268	7.7	294	8.3
Wine	207	6.6	190	5.5	104	2.9
Milk (without butter)	192	6.1	244	7.0	276	7.8
Beef	112	3.6	142	4.1	142	4.0
Potatoes	87	2.8	72	2.1	71	2.0
Other Fruit	68	2.2	58	1.7	57	1.6
Other Vegetables	62	2.0	67	1.9	67	1.9
Rice	47	1.5	44	1.3	53	1.5
Pork	42	1.3	86	2.5	157	4.4
Soybean Oil.	37	1.2	109	3.1	109	3.1
Animal Fat	37	1.2	64	1.8	92	2.6
Eggs	37	1.2	44	1.3	46	1.3
Butter	35	1.1	42	1.2	49	1.4
Apples and products	32	1.0	26	0.7	27	0.8
Poultry	30	1.0	53	1.5	62	1.7
Other Legumes	27	0.9	15	0.4	22	0.6
Grapes and products (without wine)	25	0.8	23	0.7	23	0.6
Sunflower Oil	24	0.8	21	0.6	81	2.3
Beans	23	0.7	20	0.6	15	0.4
Tomatoes and products	19	0.6	21	0.6	29	0.8
Oranges and Mandarins	18	0.6	25	0.7	35	1.0
Beer	13	0.4	20	0.6	34	1.0
Fish and sea products	23	0.7	25	0.7	42	1.2
Total /%	3153	93.7	3493	95.8	3582	91.0

Source: Constructed by the authors from the Food Balance Sheets FAO. United Nations for Food and Agriculture. Statistical Databases. URL:http://faoestat.fao.org 1961–2011.

(hierarchical and k-means) grouped the first nine years of the period studied (1961–1969) in eating pattern I with 3,152 kcal/person/day on average. The pattern II for twelve years (1970–1981) had an average of 3493 kcal/person/day. Pattern III (1982–2011) had an average of 3582 kcal/person/day, respecting the chronological order (Table 1). There were statistically significant differences between the patterns in all food except sugar (Table 2).

Foods found in greater proportion in the three dietary patterns were: wheat, sugar, olive oil, wine, milk and beef, although the order varied among patterns. The wheat ranked first in three patterns, but its availability fell 10% in the studied period. Sugar ranked second in the three eating patterns although their availability decreased.5% from the pattern I and III, and was surpassed by olive oil in the third period. Olive oil increased almost 1% its apparent consumption over the period studied, it was placed in third place in the patterns I and II and second in the pattern III. Wine took fourth place in the first two patterns, however their availability decreased 4% in the pattern III. Milk increased nearly 2% over the period, took the 5th place in the pattern I, the 4th in the II and III, which exceeded the availability of wine. The total contribution of kcal/person/day of this food group was 70.2%.

Table 2
ANOVA Test of Cluster Analyses and Kruskal-Wallis Tests. 1961–2011

Food Groups	ANOVA Test of Cluster Analyses		Kruskal-Wallis Tests
	F	Sig	Sig
Grand Total	104.883	0.000	000
Cereals – Excluding Beer	46.452	0.000	0.000
Sugar & Sweeteners	26.589	0.000	0.449
Vegetable Oils	247.274	0.000	0.000
Vegetables	19.479	0.000	0.000
Fruits – Excluding Wine	12.406	0.000	0.002
Meat	185.063	0.000	0.000
Animal fats	139.024	0.000	0.000
Milk – Excluding Butter	64.096	0.000	0.000
Eggs	101.322	0.000	0.000
Fish Seafood	138.837	0.000	0.000

Source: Analysed by the authors from the Food Balance Sheets FAO. United Nations for Food and Agriculture. Statistical Databases. URL:http://faoestat.fao.org 1961–2011.

The following food group, whose contribution was lower, among meats we observed beef took place 6o with a minimum increase. Animal foods (pork and poultry) showed significant increase in the pattern I and III. Pork increased in more than four times its availability, fish and sea products showed increased availability especially in dietary pattern III (Table 1).

Vegetable oils, particularly olive oil, contributed a significant number of kcal/person/day to the diet of Italians. However, from the second pattern soybean oil shows significantly increased availability of 37 to 109 kcal/person/day, and sunflower oil increased from 0.8% to 2.3% (Table 1). Fruits and vegetables contributed to kcal/person/day between 2% and 2.8% (Table 1). Apparent consumption of fruit in the same period showed no significant differences, however, it shows great variability, as reflected in the category of "other" that accounts for 50% of the apparent consumption of fruits. Apples showed greater availability, followed by grapes and oranges. Vegetables have remained virtually unchanged over the period; the most consumed were tomatoes. But nevertheless, from the category "other" we can interpret there is great diversity in this food group. Among tubers, potatoes have shown a slight increase in availability. Legumes also show a slight decline. The largest contribution comes from beans, another group with great diversity, as we can conclude from an important availability under "other". Beer, showed an important increase in its availability (Table 1).

According to the above, in Table 3 it is clear that dietary patterns have changed in composition at the expense mainly of the increase in apparent consumption of vegetable oils and fats and animal foods, which showed an increase of 7% between the pattern I and III, and by the decrease in the consumption of cereals, roots and tubers and fruits and vegetables. While cereals accounted for the main source of energy, like in the rest world, its apparent consumption has decreased mainly due to the decline in wheat consumption. It is noteworthy that sugar consumption declined from the early 80 s. Vegetable oils significantly outperformed animal fats (17.2 vs. 4.4). The availability of vegetable oils as a whole showed a significant increase of 5%. Within animal foods, milk was the top contributor in kcal/person/day to eating patterns. A striking finding was the availability reduction of alcoholic beverages. Wine provided the greatest contribution, however, it showed a decrease of almost four-fold, while beer increased almost three-fold its apparent consumption.

Table 3
Dietary patterns according to the general food groups in kcal/person/day. Italy 1961–2011

Food groups/Dietary paterns	I 1961–1969		II 1970–1981		III 1982–2011	
	kcal/per/day	%	kcal/per/day	%	kcal/per/day	%
Cereals	1301	41.4	1304	37.5	1138	32.0
Animal fats and vegetable oil	458	14.6	605	17.4	768	21.6
Animal fat	75	2.4	110	3.2	158	4.4
Vegetable oils	383	12.2	495	14.2	610	17.2
Food of animal origin	449	14.3	614	17.7	751	21.1
Meat	197	6.3	301	8.7	387	10.9
Milk – excluding butter	192	6.1	244	7.0	276	7.8
Eggs	37	1.2	44	1.3	46	1.3
Fish and sea products	23	0.7	25	0.7	42	1.2
Sugar and sweeteners	268	8.5	321	9.2	291	8.2
Fruits and vegetables	241	7.7	242	7.0	267	7.5
Fruits – excluding wine	152	4.8	146	4.2	164	4.6
Vegetables	89	2.8	96	2.8	103	2.9
Roots and tubers Potatoes	89	2.8	73	2.1	72	2.0
Legumes	53	1.7	39	1.1	47	1.3
Alcoholic beverages	232	7.4	225	6.5	147	4.1
Nuts	30	1.0	28	0.8	37	1.0
Total	3153	100	3493	100	3582	100

Source: Constructed by the authors from the Food Balance Sheets FAO. United Nations for Food and Agriculture. Statistical Databases. URL:http://faoestat.fao.org 1961-2011.

4. Discussion

In the explanation of the increased prevalence of MetS, the genetic component and other biological factors such as aging and body fat distribution, together with the change of lifestyle in terms of the adoption of a high-energy diet and a sedentary life come together mediated the socioeconomic context in which people live [3]. For several years it has been documented that the main trigger of this cluster of metabolic factors and atherogenic, prothrombotic, proinflammatory is obesity and more specifically the accumulation of abdominal fat or at central level [36]. In The Third Atlas of Cardiovascular Disease, the prevalence of overweight and obesity in Italy is recorded as moving from 61.7% in the years 1998–2002, to 64.3% in the years 2008–2012 [27]. Due to the increase of obesity and MetS that are registered in Italy, it is important to know whether changes in eating patterns might contribute to the explanation of the increase.

The Italian population has been characterized by its Mediterranean diet, which have been associated with good health, generally involves intake of large amounts of plant foods, such as; cereals, fruits, vegetables, legumes, tubers, roots and oilseeds. Olive oil is the main source of edible fat. The intake of red meat and processed foods is limited, and the consumption of wine, dairy, poultry and eggs is moderate [37, 38]. A slow but concrete moving away from traditional patterns has been observed specially in younger and low educated people [39].

Bonaccio et al. and Grosso [40, 41] had founded a higher income and education are independently associated with a greater adherence to MD-like eating patterns and a lower prevalence of obesity.

In this study we founded that in Italy, in the period 1961–2011 increased in kcal/per/day was only from 3153 to 3582 and we could say that the traditional (Mediterranean) diet was preserved relatively; olive oil is the principal source of fat and its availability increased slightly in the study period. Fruits and vegetables have

remained virtually unchanged over the period; however, FBS data suggests diversity in availability in this food groups (Table 1). Its range is a favourable factor because they provide a large number of essential micronutrients as minerals, antioxidant vitamins, phytochemicals and dietary fibre which are related to lower risk for the development certain types of cancer, cardiovascular diseases, type 2 diabetes, obesity [42–44].

Different epidemiological studies and some intervention trials suggest that the Mediterranean diet is a protective factor against chronic diseases such as MetS, cardiovascular disease, diabetes and hypertension, as it includes high consumption of olive oil and nuts, foods containing mono and polyunsaturated fatty acids, dietary fibre and bioactive polyphenols from olive oil [45]. Liyanage et al. [46], in a systematic review and Meta-analysis, founded that the Mediterranean diet may protect against vascular disease. Nevertheless, the available evidence is limited and variable.

Simopoulos [44] mentioned that dietary pattern contains various protective substances, such as selenium, glutathione, a balanced ratio of (n-6):(n-3) essential fatty acids (EFA), high amounts of fibre, antioxidants, vitamins E and C, some of which have been shown to be associated with lower risk of cancer, including cancer of the breast.

Panagiotakos et al. [47] founded that Mediterranean dietary patterns were associated with low levels of metabolic syndrome, while consumption of red meat and sugary drinks showed otherwise. Similarly, Deshmukh-Taskary al. as part of the Bogalusa study, founded association between eating patterns, lifestyle and sociodemographic aspects with the metabolic syndrome [50, 51]. Some authors have agreed to the above studies in Italy [29], Portugal [35], Spain [50] and other Mediterranean countries [34].

Diet has evolved over time due to the influence of many factors and complex interactions among them. Variables as income, prices, individual preferences, beliefs and cultural traditions, as well as geographical, environmental, social and economic characteristics interact and shape the pattern of food consumption. With economic development, availability and diversity of food has spread in almost all the countries and there has been a gradual decrease of the food shortages with a consequent improvement of the nutritional condition in the world. However, there have been differences in the pace of this trend across countries with low, medium and high income and among population groups within each country. Since the 50's of the twentieth century, the world has undergone changes that have affected the diet, first in the industrialized regions and later in the developing countries. For instance, fruit and vegetables availability declined between 1990 and 1998 in most regions of the world. The increase of urbanization around the world will alienate people from primary food production, and at the same time, it will hinder access to varied and nutritious diets with enough fruits and vegetables, especially for the urban poor [51].

Thereafter, traditional diets based largely on vegetables, complex carbohydrates and fibre, have been replaced by diets composed of foods of high energy content; added sugar, saturated fat and animal foods. Changes in eating patterns and ways of life due to modernity, understood as increasing industrialization, urbanization, economic development and globalization of markets, have accelerated over the past four decades. With urbanization, qualitative changes were induced in the production, processing, distribution and marketing of food [52].

The food market has become food products manufactured and marketed worldwide, and consequently have altered eating habits and lifestyles, not all of them favourable. There have also been negative impacts on food patterns, which have had consequences on health and nutritional status of populations, not only in developing countries, but also in the developed world [52–56].

Analyses of FAOSTAT data showed that energy contents of food measured in kcal/per/day have been increasing steadily worldwide since the mid-sixties until 2011. In developing countries the increased was of more than 900 kcal/per/day. In Italy availability in kcal/per/day had increased only 400 kcal/per/day, but dietary patterns showed changes in its composition mainly in the pattern III, i.e. in the early 80 s. Pattern I was comprised wheat, sugar, olive oil, wine, milk, and beef. In the pattern II, milk exceeded wine and the apparent consumption of pork, soybean oil, animal fat and poultry increased. It is observed that animal foods and vegetable oils others than olive oil, begun to form part of the food pattern. Pattern III showed clearly changes, it moved away of the Mediterranean diet and its composition was found more in line with the so-called nutritional or dietary transition mentioned

by Popkin [2]. Particularly, the availability of animal foods almost doubled, meat has shown an increase in its apparent consumption of 5% for food of animal origin as a whole (Tables 1 and 3). As diets become richer and diverse, high-value protein and a major source of a wide range of essential micronutrients, especially minerals such as iron and zinc and vitamins such as vitamin A, which provides the livestock, improves nutrition of the people. However, excessive consumption of animal products can lead to excessive fat intake, with consequent effects on health [57].

According to Popkin, the increase of the amount of fat consumed is an important feature of the nutritional transition [1]. The lowest consumption is recorded in Africa, and the highest is observed in North America and Europe. The apparent availability per capita of fat of animal origin has increased in 20 and 40 grams per capita in developing and industrialized countries, respectively. The percentage of energy from fats in the diet exceeds 30% in the industrialized regions [15]. In Italy has increased significantly from 14.3% in the decade of the 60's to over 20% from the eighties (Table 3), however, it is within the accepted values. Consumption of edible oils also changed in the world as a result of the increasing use of margarines (rich in trans fatty acids) that do not require refrigeration. Olive oil is the main and most important edible oil consumed in most Mediterranean region and certainly in Italy, even showed a slight increase, but soybean and sunflower oils substantial increase (Tables 1 and 3). Cereals decreased their apparent consumption, globally; the proportion of food energy provided by cereals has decreased slightly over time even though it represents less than 50% of the availability of food energy [57]. In Italy a decrease of 10% in the period studied was observed (Table 3). Another feature of the nutritional transition was the change in the proportion of energy supplied by sugar, its apparent consumption in Italy has not increased significantly (Table 1), in fact, it has remained apparent consumption below maximum limits recommended by WHO (10%) [57]. Finally, regarding wine, the availability has decreased mainly from the 80 s and a gradual substitution of wine with beer has occurred (Table 1).

The results of this study should be considered in light of some limitations. The FAO data are based on agricultural production and trade statistics, thus do not capture food waste or subsistence production, nor do they account for food processing. Moreover, these data do not include specific information about consumption of refined flour versus whole grains, sugar-sweetened beverages, and partially hydrogenated vegetables oils (and hence trans-fat consumption), all of which are important dietary risk factors.

5. Conclusions

We identified a number of changes in the composition of eating patterns from 1961 to 2011 in Italy. Considering the rise in MetS components during this time, the observed changes in eating habits may be contributing deleterious effects to metabolic heath. It is necessary to take action to prevent the food pattern to continue changing and prevalence of metabolic diseases continue to rise. Nevertheless, the change in eating patterns or increased kcal/person/day alone cannot account for the unique responsible for the increase of MetS, thus intervention programs should involve as target also increased engagement in physical activity. Promoting balanced diets and healthy lifestyles to reduce the global burden of non-communicable diseases require a multi-sectorial approach with the participation of the different sectors of the society. While this multi-sectorial approach is essential, the intervention of the State, with a holistic view of the problem, can coordinate efforts from different sectors so they can have a real impact on food production, distribution, commercialization, etc. The regulation of advertising, the nutritional quality of the products offered, the labelling on the features offered are just some of the actions that, along with education and promotion of physical activity, can contend with the complexity of the problem. The agricultural and food sectors are key components in the promotion of healthy diets for individuals and populations. The nourishment strategies must be directed to guarantee food security for all, as well as promote the consumption of appropriate quantities of healthy foods [58].

Funding

Laura Moreno-Altamirano has received research grants from DGAPA-PASPA. National Autonomous University of Mexico.

Acknowledgments

To DGAPA-PASPA. National Autonomous University of Mexico for research grant Ing. David Limón for his technical advise.

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