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## Gender Differences in Food Choice and Dietary Intake in Modern Western Societies

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*"Sexual difference is probably the issue in our time  
which could be our 'salvation' if we thought it through."*  
Luce Irigaray

### 1. Introduction

A significant "male oriented" bias in science is a matter of fact (Marino et al., 2011), even though the number of women majoring in science has increased dramatically (Yokoo, 1996). Considering people graduated in mathematics, science and technology per 1,000 of population aged 20-29, since 1993 up to 2009 (EUROSTAT, 2011), proportion of women is 4.4% vs. 3.4% of men. Interestingly, 4 out of 5 authors of this paper are women. It is justifiable to ask the reason for this gender bias. We can advocate two "reasonable" reasons: the first one has mainly sociologic concern in that different aspects of the human society still present an odd distribution. Research is not an exception and even though the proportion of women within professionals involved in public and private research has reached and possibly overtaken the other gender, the target of scientific investigations is still to be actually considered somehow unbalanced in favour of one gender. The second one has an exquisitely pragmatic origin: in the majority of cases, and unless your research is not to be focused on events strictly connected to females (pregnancy, lactation, few organ specific disease), males are a simpler and cheaper experimental model than females. No needs to carefully evaluate risk factors bound to pregnancy and lactation, to consider hormonal cycle, no sharp changes of tissue functionality associated with ageing.

It is a matter of fact that in science, and nutritional science is not an exception, there is a widely accepted overlapping between the terms "human" and "male", while the term female (or woman in the case of the specie *H. Sapiens*) strictly refers to "not males". At the same time, the majority of us would agree in defending the evidence that both the biochemistry and the physiology significantly differ between genders, even independently on the most evident female physiological characteristics of presenting a specific and cyclic exposure to hormones flux. These differences are consistent with a gender-specific genetic set up, and result in a specific capacity to relate to and cope with the environmental challenge.

Recent literature (Marino et al., 2011) has highlighted that nutrition could differently influence the health of male and female individuals. It is widely accepted that nutrition is not only “just a fuel” but is the most significant part of the environment that we actually introduce into our body and eating patterns are a relevant component of the cultural reference models (Harris, 1985).

Driven by the above considerations this chapter will present and discuss available data emerging from an extensive literature review addressing differences and similarities between genders in food choice and food consumption patterns in modern western societies. An original elaboration of data on food consumption profiles according to gender will also be presented and critically evaluated under the perspective of nutrients intake and fulfilment of nutritional requirements at population level. In the preparation of this overview, we have undertaken a bibliographical search limited to social and scientific literature published in English. The search, informed by a strongly limited selection of words, included databases of peer-reviewed literature (SCOPUS) from 1995 to 2011. A ‘snowball procedure’ was employed whereby the references cited in each article were browsed for further relevant research. An original elaboration of data on food consumption profiles according to gender will also be presented and critically evaluated under the perspective of nutrients intake and fulfilment of nutritional requirements.

## **2. Key determinants in food choice: A gender perspective**

Food choices is an area in which research has revealed consistent behavioural gender differences. Food choice is dependent on a wide spectrum of factors, which affect human behaviour in different ways, resulting alternatively in the choice of some specific products and in the rejection of others. The study of food choice is mostly dealing with one question: “why do people eat the foods they eat?” Food plays an important part in all our lives in a variety of ways. The choices people make among foods determine which nutrients enter the body. However, in modern societies, food is more than mere sustenance. What people choose to eat is not solely based on their biological needs, their choice also addresses many psychological and/or emotional issues (Conner & Armitage, 2002). After all, a person does not necessarily have to be hungry to eat, does not always choose his/her most preferred food, and some of the influences in food choice might be unconscious. Generally speaking, food choice is a complex human behaviour and consequently is influenced by many interrelating factors ranging from biological mechanism and genetic profiles to social and cultural factors. Many studies have explored selected aspects of food choices from an ample variety of disciplines and perspectives (Axelson & Brinberg, 1989; Booth, 1994; Glanz et al., 1992; Mennell et al., 1992; Murcott, 1983; Shepherd, 1990, 2005; Thompson, 1988). Recent notions generally split the factors influencing food choice into those related to the food, to the person making the choice and to the external economic and social context in which the choice is made (Booth and Shepherd, 1988; Randall and Sanjur, 1981). There are chemical components and physical properties of the food which are likely to have an impact on choice, via sensory perception. However, perceiving a sensory attribute in a food does not necessarily means that a person will choose to consume that food. It is the person’s liking for that specific attribute in that food which influences choice. Psychological differences between people,

such as personality, may also influence food choice. In addition to factors associated with the person and the food, there are also other many factors in the context within which the choice is made that can be important in food choice. These include marketing and economic variables as well as social, cultural, religious or demographic variable. Food choices are made by individuals from alternatives available in a certain use situation. They are made repetitively, every day in various use situations: what to buy and take home for the family, what to eat at the canteen and which dishes to choose from a menu when eating out at a restaurant. Food choice may also be characterized by the context, a situation determined by the time, place, and company. In Western societies the abundance and variety of foods to choose is extensive. Anthropological and sociological work has emphasized the meaning of food and eating in self and cultural definition (Berbesque, 2009; Counihan, 1999; Murcott, 1983; Vartaniana et al., 2007). This literature indicates that, as mentioned above, the importance of food and eating extends well beyond a the need of covering “physiological needs”, playing a role in identity expression, communication, social interactions, as well as in delineating status and gender roles. Eating behaviour is therefore likely to be vulnerable to various social influences, including the desire to respond in a socially-desirable manner (Herman et al., 2003). Studies by Lindeman and colleagues (Lindeman & Sirelius, 2001; Lindeman & Stark, 1999, 2000) suggest that food choice is a means by which one expresses one’s own philosophy of life. In addition, the current emphasis on dieting and slimness in Western cultures promotes norms describing “what and when” one should eat, as well as what one should look like. Taken together, these considerations suggest that what one eats has important implications for social judgments. In addition, social changes such as the increased participation of women in the workforce lead to reduced time available for food selection and meal preparation, which further complicates food choice. Contemporary consumers have fears and conflicts involving food and health (Mennell et al., 1992; Rozin et al., 1999), and social norms about foods and meal composition, that guided previous generations, appear to be eroding, leaving people with a lack of structure related to food and eating behaviour (Fischler, 1980).

A body of literature has consistently found that many variables may influence eating behaviour, but their interrelations make their effect difficult to distinguish. In addition, the analysis of the effects of single or multiple factors is further complicated by the fact that eating behaviour is not a constant phenomenon, but will change with differing circumstances and experiences of the individual.

Studies conducted in modern western societies report consistent associations between gender and specific foods, where meat (especially red meat), alcohol, and hearty portion sizes are associated with masculinity, while vegetables, fruit, fish and sour dairy products (e.g., yogurt, cottage cheese) are associated with femininity (Jensen & Holm, 1999; Sobal, 2005). The results of a study conducted on the Hazda, a tribe of human foragers living in Tanzania, also showed a sex differences in food preferences, with males preferring meat more and females preferring berries more (Berbesque, 2009). Overall, the most relevant differences according to gender in food choices in modern western societies, emerging from our literature review, were in the relationship between eating habits and health consciousness, and between eating behaviour and weight control. Those topics will be discussed in the following sections.

## 2.1 Eating habits and health consciousness

In general, women have been frequently reported to engage in far more health-promoting behaviours than men and have healthier lifestyle patterns (Courtenay, 1998, 2000; Gough & Conner, 2006; Kandrack et al., 1991; Lonnquist et al., 1992; Roos et al., 2001).

Men usually talk about eating as habitual and routine, and as necessary activity to “fuel” their “fleshes”. Although they are aware of “healthy eating guidelines”, they often show skepticism and resistance to nutrition education messages, and frequently perceive healthy eating as monotonous and unsatisfying. Some men do express interest in food, cooking, and health, and indicate that they are reducing their consumption of red meat and increasing consumption of vegetables (Sobal, 2005). These alternative experiences with food are more commonly expressed by “high educational levels”, such as engineers, than by “blue-collar workers, such as carpenters or drivers, suggesting that social class may mediate associations between “masculinity” and food (Roos et al., 2001; Sobal, 2005).

With regard to eating habits, a large number of reports indicate that in general, women are more aware about diet and health-diet relationship implications and also embrace suggested dietary changes to a greater degree than men (Barker et al., 1995; Courtenay, 2000; Friel et al., 1999; Girois et al., 2001; Thiele & Weiss, 2003). Data on a representative survey in the Norwegian population (Fagerli & Wandel, 1999) shows that women considered health aspects and chose accordingly the foods they consider to be healthy, more often than men when selecting foods for an everyday dinner. Accordingly, their reported changes more often are in line and agree with dietary guidelines. The same study also reported consistent associations of healthier food behaviours with increased age, higher education, and female gender. These findings are similar to the observations resulting from the analyses from a population data set conducted in 114 worksites in the USA, overall employing 37,291 workers who were engaged in a variety of activities (Hunt et al., 1997). Also in this study, female gender was associated with food choices closest to the recommendations to increase fiber, fruits and vegetables and to reduce fat. A single exception was in found the adherence to follow the recommendation to increase consumption of beans and lentils for which male gender were associated with greater consumption. In a Pan-EU survey of 14331 subjects, female respondents perceived that “quality/freshness”, “price”, “trying to eat healthy” and “family preferences” were the most important influences affecting food choice, whereas “taste” was the most frequently selected factor affecting food choice of male respondents (Lennenäs et al., 1997). In a different study, females have been reported to be more likely than males to mention more vegetables or less fat or balance as a part of a healthy diet (Margetts et al., 1997).

Another factor contributing to food choices is the persuasion by others or by specific circumstances. More women than men reported that influence of other people can prevent them from eating healthier (Lappalainen et al., 1997). It has also been shown that men give lower priority to health compared to other considerations, such as taste and convenience, in making their food choices (Steptoe et al., 2002; Wardle and Griffith, 2001) and that they feel more ambivalent about healthy dietary choices (Povey et al., 2001; Sparks et al., 2001). Earlier studies have found significant gender differences in opinions and behaviour with regard to different health aspects. For instance they reported that men choose fewer high-fiber foods, eat fewer fruits and vegetables and low-fat foods, and consume more soft drink than women



(Beardsworth et al., 2002; Beer-Borst et al., 2000; Fulkerson et al., 2004; Li et al., 2000; Liebman et al., 2001; Pollard et al., 2002; Prättälä et al., 2007; Wardle et al., 2000). The International Health and Behaviour survey (IHBS) examined a range of health behaviours in a total of 19298 university students from 23 different countries utilizing a study approach based on a self-report questionnaire (Wardle et al., 2004). In almost all of the 23 countries a higher percentage of women reported to avoid high fat-foods, to eat fiber-rich foods, to eat fruit daily. Differences in salt intakes were less consistent but nevertheless a significant female advantages in 6 countries was observed. Similarly, in a study on 1024 UK adults, women reported to consume a larger number of portion of fruit and vegetables, than men (Baker & Wardle, 2003). A research carried out in the UK, the Netherlands and in Finland documents that women are more interested than men in eating healthily and natural products (Roininen et al., 2001). The food choice motivations of a representative sample of 9339 Polish respondents depended mostly on gender and age (Wadolowska et al., 2008). The study confirmed the findings of other authors about the role of females and its correlation with health-concerned attitudes, inclination to comply with dietary recommendations and readiness to gain new nutrition knowledge. In a nationally representative sample of Irish adults (n=1256), it has been observed that young lowest social class, primary level education males, were the subgroup most likely to have negative attitudes or motivation towards healthy eating (Kearney et al., 2001). Studied conducted in Ireland reported that women were generally more prone to make conscious efforts to try to eat a healthy diet 'most of the time', while men were three times more likely to 'hardly ever' make such conscious efforts to eat a healthy diet (Kearney et al., 2001; Hearty et al., 2007). Data from a representative sample of 98733 Canadians (Canadian Community Health Survey) indicates that gender plays an important role in determining food choices. Women are more likely than men to choose or avoid foods following to concerns about health and, accordingly, choose or avoid foods due to their contents (Ree et al., 2008).

In general, women have been shown to be more thoughtful about food and health issues and they seem to have more moral and ecological misgivings about eating certain foods than men, who are more confident and demonstrate a rather uncritical and traditional adherence to eating profiles and pattern (Beardsworth et al., 2002; Teratanavat & Hooker, 2006; Verbeke & Vackier, 2004). There has been a great deal of interest over recent years in the protective effect of fruit and vegetables against a number of diseases, and there is convincing evidence that high intakes of vegetables and fruit are associated with lower risk of chronic diseases (Colgan et al., 2004; Liu et al., 2000; Sargeant et al., 2001). International and national health organisations (NHMRC, 2002; WHO, 2003) have recommended to increase the consumption of vegetables and fruit as an important health and nutrition priority. In the Health Education Authority's Health and Lifestyle Survey of 1993 it was found that the main demographic characteristics that distinguished between low and high fruit and vegetable consumers were age, gender and smoking status (Thompson et al., 1999). These demographic characteristics perhaps result in the strongest variations in intakes of fruit and vegetables, with women reporting higher preference for eating vegetables than men (Thompson et al., 1999; Wardle et al., 2004). However, men reported to like fruit slightly more than women and there was no significant gender difference in attitudes towards fruit and vegetables, although women's attitudes were slightly more positive (Wardle et al., 2004).

One possible mechanism for the gender-specific patterns of healthy food choices might be related to nutritional knowledge. A number of studies have reported gender differences in the knowledge nutritional information (Crawford & Baghurst, 1990; Parmenter et al., 2000; Tate & Cade, 1990), supporting the hypothesis that differences in awareness could contribute to gender differences in intake. Gender, level of education and occupational social class were found to have significant independent effect on level of nutrition knowledge scores. In particular, women demonstrated superior knowledge regarding all the areas of nutrition, as confirmed by the majority of studies dealing with the evaluation of nutritional knowledge (Butriss, 1997; Parmenter et al., 2000). Food-related activities, such as shopping, cooking and eating are conventionally presented as female-centered (Caplan et al., 1998; Warde & Hetherington, 1994). Given women's traditional role in purchasing, preparing and providing food, it is not surprising that men know less about the health benefits of specific food items (Nutrition Forum, UK, 2003). The rise in the number of people living alone together with the decline in the number of traditional family units, where the husband earns and the wife is responsible for shopping and cooking, has raised new concerns. In fact, it appears that even though there is an increasing number of men cooking for themselves and fewer relying on women to make decisions about their diets, this novel activity is not accompanied by a significant increase in nutrition knowledge. However, the significance of nutrition knowledge as an determinant in food choices has been questioned in the light of evidence from research in the field of fat and fiber intake showing no more than small correlations between nutrition knowledge and dietary quality (Shepherd and Towler, 1992; Lappalainen et al., 1997). However, a recent study found substantial associations between knowledge and fruit and vegetable intake, possibly because, unlike the situation for fat intake, overall levels of public awareness are low (Wardle et al., 2000). Fewer men than women knew the current recommendations for fruit and vegetable intake, and fewer were aware of the links between fruit and vegetable consumption and disease prevention. The evidence that men have a lower knowledge about nutrition, or accord lower priority to nutrition in making their food choices, could result in lower intakes of fruit and vegetables. However, only in four member states (Austria, Belgium, Finland and Italy) within the Pan-Europe survey, more men than women reported lack of knowledge as a barrier towards healthy eating (Lappalainen et al., 1997).

Even though methodological differences in assessing food choices might have been in part generated slightly different results on gender-specific food choice, all the observations reported here are consistent in concluding that women generally make slightly healthier food choices. If women report healthier practices (or at least attempt to make healthier choices) all over the world, then this would suggest that any explanations for the differences are more likely to indicate underlying behavioural characteristics of men and women than local cultural effects.

## **2.2 Eating behaviour and weight control**

A factor that could contribute to gender differences in food choice is women's greater concern about weight control and their higher frequency of dieting. There is a consistent body of recent literature (Afifi et al., 2002; Johnson & Wardle, 2005; Kostanski et al., 2004; Liebman et al., 2001; Wardle et al., 2000; Wardle & Griffith, 2001) that clearly indicates that there are important gender differences in weight concern and body self-perception.

Weight control/body perception are known to influence food choice decisions, mainly in women (Glanz et al., 1998; Goode et al., 1995; Rozin et al., 1999). In many studies of attitudes to body weight or dieting, women reported more dissatisfaction with their weight and make more attempts to control weight than men (Beardsworth et al., 2002; Bellisle et al., 1995; Wardle & Griffith, 2001;). Numerous research on body image have shown that women are more likely than men to perceive themselves as overweight and to express discontentment with their body shape (McElhone et al., 1999; Neumark-Sztaine et al., 1999).

Concern with adhering to a slimming diet has been found to be significantly more widespread among women than men (Germov & Williams, 1996; Sobal et al., 1995). A Pan-EU survey on 15239 subjects (European Communities, 1999), reported a strong gender difference in the percentage of people who are content with their body weight. A consistent majority of males was comfortable with their current body weight compared with females. Conversely, a far higher proportion of females wished to be lighter or considerably lighter compared with males. The relative proportion choosing dieting as the strategy for losing weight compared with other methods was highest in the group wishing to be considerably lighter, especially among females (European Communities, 1999). On the other hand, it has been observed that men generally prefer to select physical exercise than dieting as a means for body weight control, while women were more inclined to select dieting, restrained eating and daily checking of body weight (Clark et al., 2009).

Moreover, in women, the frequency of dieting is often associated with difficulties in eating behaviour. Restrained eating behaviour, cognitive control and eating disorders are mainly seen as behavioural phenomena more common in women. Men, on the other hand, have fewer problems with their eating behaviour, and their attitude to food is generally uncomplicated and enjoyable, even though they are more frequently overweight and have higher risk of associated disease (Kiefer et al., 2005).

Problems with eating behaviour have a strong female prevalence emerging in childhood and adolescence (Afifi-Soweid et al., 2002). Girls often eat less and pay attention to calories, sugar and fat intake under the pressure of “feeling obliged” to be slim. Consequently, in part due to a specific social pressure, girls are more likely than boys to develop eating disorders (i.e., anorexia, bulimia, binge eating disorder). Women affected by certain eating disorders are likely to experience a constant internal conflict between the desire of being slim or slimmer, and the drive for certain “forbidden” food. Women are more often affected by the problem of craving (i.e., the strong willing for certain foods) than man, being more likely to be wishful for sweet foods. This attitude results in a difficulty in sticking to a weight reducing-slimming diet (Lafay, et al, 2001). Extensive research showed that women often experience the so called “carbohydrate craving” and there is an association between the wish for sugar- and fat-rich foods (like chocolate and other sweets) and menstrual cycle (Bruinsma and Taren, 1999, Rozin et al., 1991, Smith & Souter, 1969; Yen et al., 2010). Recent findings showed that the wish for sweet food regresses in women with increasing age (Kiefer et al., 2005).

In connection with the craving for particular foods, women more frequently report negative feelings, in contrast to men who describe positive feelings (Lafay et al., 2001). Women also eat more than usual in stressful situations more frequently than men (Kandiah et al., 2006).



A study dealing with the emotional triggers of “comfort” food consumption indicate that in women this eating behaviour was triggered by negative feelings, whereas in men was motivated by positive emotions (Dubè et al., 2005).

Differences in preference towards “comfort” foods across gender were investigated in a survey conducted in North America on 1416 people (Wansink et al., 2003). The findings of this study are consistent with other research showing that females preferred “comfort” foods within the category of snacks, such as chocolate, candy and ice cream. Indeed, one research on “chocolate addiction” reported that 70 of the 72 self-selected “addicts” were female (Tuomisto et al., 1999) and in another study the 92% of the surveyed sample self-identified as “chocolate addicts” were female (Hetherington & MacDiarmid, 1993). Wansink et al. (2003) reported that males preferred more substantial, warm, hearty- meal related comfort foods such as meat dishes, pizza or pasta, casserole and soup. On the other hand side it emerged that when women indulged in high-calories sweets like candy or ice cream often felt guilty afterwards – while men who chose foods other than sweets and snacks, didn’t (Wansink et al., 2003).

### 3. Gender differences in nutrients intake

In order to detect any gender-associated trend in nutrients intake, we have analysed the nutritional profiles estimated at population level within the context of nationwide individual dietary surveys. We considered the database of dietary intakes of 22 European Countries, partners of the European and Health Report (ENHR II), the most suitable source of data on the basis of the number of countries involved and the approach utilized to collect the indicators (Elmadfa, 2009). Data from this report have been therefore processed to highlight possible differences between males and females population groups concerning the percentage contribution to the average daily energy intake by carbohydrates, proteins, fats, fatty acids, and mean daily intake of minerals and vitamins. Data were then grouped by nutrients, by gender, country, and age-class and graphically plotted in order to detect similarities and differences associated to gender. Overall, no significant differences were observed in the percentage contributions of macronutrients to the daily energy intake. Minimum and maximum values (ranges) observed in average per-capita daily intakes in females per each country overlap those of males. These findings are in agreement with data obtained in previous studies (Flynn et al., 2009 ; Reynolds et al., 1999). In the European Health and Nutrition report (ENHR II, Elmadfa, 2009), solely for carbohydrates were found differences in the percentage of the average daily energy intake equal or higher than 5% among adults (10% in Estonia, and Lithuania; 9% in Czech Republic; 8% in Austria, Poland, Denmark, and Germany; 7% in Hungary, Portugal, and Finland; 5% in Latvia; less than 5% resulted in Greece, Sweden, France, Spain, The Netherlands, United Kingdom, Romania, Norway, and Italy), and elderly (10% United Kingdom and Denmark; 9% Germany; 7% in Hungary and Romania; 5% Poland and Greece; less than 5% France, Finland, The Netherlands, Sweden, Ireland, Spain, and Italy). The gap is due to the fact that the group of adult and elderly males tends to replace carbohydrates with alcohol. In two cases, differences higher than 10% were found for fats among adolescents in Norway (11% males vs. females) and Dutch (19% females vs. males). Percentage of energy from proteins did not show differences in absolute value higher than 1%.

Mineral	Gender	Age class											
		4-6 years		7-9 years		10-14 years		15-17 years		18-64 years		65+ years	
		min	max	min	max	min	max	min	max	min	Max	min	max
Sodium (g)	Male	1,8	3,4	2,2	4,2	2,3	5,0	2,9	6,5	2,6	7,3	2,3	7,0
	Female	1,7	3,4	1,9	3,7	2,2	4,8	2,2	4,5	1,7	5,6	1,8	6,0
	Δ%	6	0	16	14	5	4	32	44	53	30	28	17
Potassium (g)	Male	2,0	2,8	1,9	3,0	1,9	4,0	2,4	4,4	2,7	4,4	2,2	3,8
	Female	1,9	2,7	1,8	2,9	1,7	4,0	1,2	3,3	2,3	3,6	2,2	3,7
	Δ%	5	4	6	3	12	0	100	33	17	22	0	3
Calcium (mg)	Male	604	1103	732	1207	701	1381	806	1447	687	1171	627	1071
	Female	606	1024	631	1126	600	1238	645	1040	508	1047	533	959
	Δ%	0	8	16	7	17	12	25	39	35	12	18	12
Phosphorus (mg)	Male	882	1284	960	1455	964	1704	1413	1705	1264	1778	1059	1576
	Female	900	1183	851	1295	807	1636	962	1356	1017	1422	959	1404
	Δ%	-2	9	13	12	19	4	47	26	24	25	10	12
Magnesium (mg)	Male	171	267	204	303	200	503	260	467	256	465	221	403
	Female	166	267	166	301	181	429	186	369	197	372	179	348
	Δ%	3	0	23	1	10	17	40	27	30	25	23	16
Iron (mg)	Male	7,3	10,6	8,4	11,8	9,2	19,4	10,2	19	10,6	26,9	10	25,2
	Female	6,8	10,6	7,7	11,8	7,7	14,8	7,8	14	8,2	22,2	8,5	20,9
	Δ%	7	0	9	0	19	31	31	36	29	21	18	21
Zinc (mg)	Male	6,0	9,2	7,0	10,9	7,0	14,6	9,3	15,2	8,6	14,6	7,5	12,3
	Female	5,3	8,9	6,4	9,4	6,1	13,9	6,4	11,0	6,7	10,7	6,7	11,2
	Δ%	13	3	9	16	15	5	45	38	28	36	12	10
Iodine (mg)	Male	69	223	73	203	102	209	93	221	67	264	107	226
	Female	70	198	73	179	85	171	115	182	48	200	97	190
	Δ%	-1	13	0	13	20	22	-19	21	40	32	10	19
Copper (mg)	Male	0,7	2,2	0,9	2,8	0,9	2,9	1,2	3,4	1,1	2,3	1,1	1,9
	Female	0,7	2,0	0,8	2,6	0,7	2,8	0,8	2,1	0,1	2,2	0,9	1,9
	Δ%	0	10	13	8	29	4	50	62	1000	5	22	0
Manganese (mg)	Male	1,4	3,3	1,7	3,7	1,8	4,6	2,5	6,1	2,0	5,0	2,2	4,9
	Female	1,3	3,0	2,0	3,0	1,7	4,1	1,9	4,4	2,2	5,0	2,0	5,0
	Δ%	8	10	-15	23	6	12	32	39	-9	0	10	-2
Selenium (µg)	Male	23	61	27	41	29	110	39	59	36	73	39	62
	Female	24	61	20	50	28	104	30	38	31	54	34	55
	Δ%	-4	0	35	-18	4	6	30	55	16	35	15	13

Table 1. Minerals ranges of mean daily intake by age-class, and gender calculated starting from values observed in 22 European Countries (ENHR II partners).

		Age class											
Vitamin	Gender	4-6 years		7-9 years		10-14 years		15-17 years		18-64 years		65+ years	
		min	max	min	max	min	max	min	max	min	max	min	max
Vitamin A-(g)	Male	0,4	1,1	0,4	1,3	0,4	2,4	0,4	1,8	0,5	2,2	0,5	2,5
	Female	0,4	1,2	0,4	1,1	0,3	2,3	0,3	1,6	0,5	2,0	0,4	2,3
	Δ%	0	-8	0	18	33	4	33	13	0	10	25	9
β-carotene (g)	Male	1,2	3,8	1,6	4,1	1,1	4,8	1,2	4,7	1,4	5,3	1,3	4,8
	Female	1,1	3,4	1,6	4,0	1,1	5,2	1,0	4,7	1,4	5,6	1,3	5,0
	Δ%	9	12	0	2	0	-8	20	0	0	-5	0	-4
Vitamin D (μg)	Male	1,8	5,8	1,5	6,4	1,5	4,8	1,8	7,5	1,6	10,9	0,7	15,0
	Female	1,5	6,5	1,5	5,1	1,2	4,5	1,5	7,1	1,2	10,1	0,7	12,9
	Δ%	20	-11	0	25	25	7	20	6	33	8	0	16
Vitamin E (mg)	Male	5,3	9,8	6,3	11,2	5,9	14,5	6,8	20,8	3,3	17,4	6,3	13,7
	Female	5,1	9,8	5,9	13,3	5,6	18,1	6,0	15,5	4,2	16,1	6,7	13,7
	Δ%	4	0	7	-16	5	-20	13	34	-21	8	-6	0
Thiamin (mg)	Male	0,8	1,4	0,9	1,6	0,9	2,3	1,3	2,3	1,1	2,3	0,9	2,1
	Female	0,8	1,3	0,8	1,4	0,8	1,9	1,0	1,9	0,9	2,1	0,9	1,4
	Δ%	0	8	13	14	13	21	30	21	22	10	0	50
Riboflavin (mg)	Male	1,3	2,1	1,2	2,0	1,2	2,9	1,5	2,6	1,4	2,4	1,2	3,2
	Female	1,2	1,8	1,1	1,7	1,1	2,8	1,2	2,3	1,2	2,8	1,2	2,6
	Δ%	8	17	9	18	9	4	25	13	17	-14	0	23
Niacin (mg)	Male	15,7	24,9	18,7	29,9	8,7	40,4	12,2	43,3	9,2	41,3	8	37,9
	Female	14,4	24,6	16,2	26,3	6,9	32,5	7,3	30,5	6,4	30,6	6,7	31,9
	Δ%	9	1	15	14	26	24	67	42	44	35	19	19
Vitamin B6 (mg)	Male	1,3	1,8	1,2	2,5	1,2	2,8	1,5	3,1	1,6	3,5	1,2	3,0
	Female	1,0	1,9	1,1	1,9	1,1	2,7	1,2	2,5	1,3	2,1	1,2	2,9
	Δ%	30	-5	9	32	9	4	25	24	23	67	0	3
Folates (μg)	Male	150	256	144	290	149	428	190	365	203	494	139	343
	Female	109	199	133	264	140	360	154	298	131	392	121	335
	Δ%	38	29	8	10	6	19	23	22	55	26	15	2
Cobalamin (μg)	Male	2,7	5,3	3,6	5,5	3,2	11,8	4,9	7,5	1,9	9,3	3,1	8,2
	Female	2,6	5,0	2,2	5,3	2,2	11,1	3,5	5,2	1,0	8,8	2,5	7,5
	Δ%	4	6	64	4	45	6	40	44	90	6	24	9
Vitamin C (mg)	Male	60	170	63	172	73	197	71	201	64	153	59	142
	Female	61	157	57	172	77	222	67	205	62	153	60	160
	Δ%	-2	8	11	0	-5	-11	6	-2	3	0	-2	-11

Table 2. Vitamins ranges of mean daily intake by age-class, and gender calculated starting from values observed in 22 European Countries (ENHR II partners).

To complete the analysis ranges of average daily intake of minerals and vitamins intake across the 22 European countries were compared (table 1-2), confirming males having higher intakes in general, in almost all age-gender groups looking at both the minimum and the maximum value of intake observed in the 22 countries. Exceptions for minerals (Table 1): calcium and phosphorus (minimum in 4-6 years old), iodine (minimum in 4-6 and 15-17 years old), manganese (minimum 7-9 years old, 18-64 and maximum in 65+ years old), and selenium (minimum in 4-6 years old, maximum in 15-17 years old) (Elmadfa, 2009).

Vitamins intake showed higher variability than minerals intake (Table 2). Males had higher or equal per-capita average daily intakes both for minimum and maximum in all age-gender groups for niacin, folate, cobalamine, and thiamine only. In all other cases at least one age group showed either the minimum or the maximum value

The similarities in the percentage of energy provided by macronutrients and the overlapping of ranges for minerals and vitamins evidenced above indicate that the overall quality of diet does not differ substantially between males and females in all classes of ages and throughout Europe. A further remarks concerns dietary fibre, being highly associated with the mean energy intake, then increasing with the age (Elmadfa, 2009).

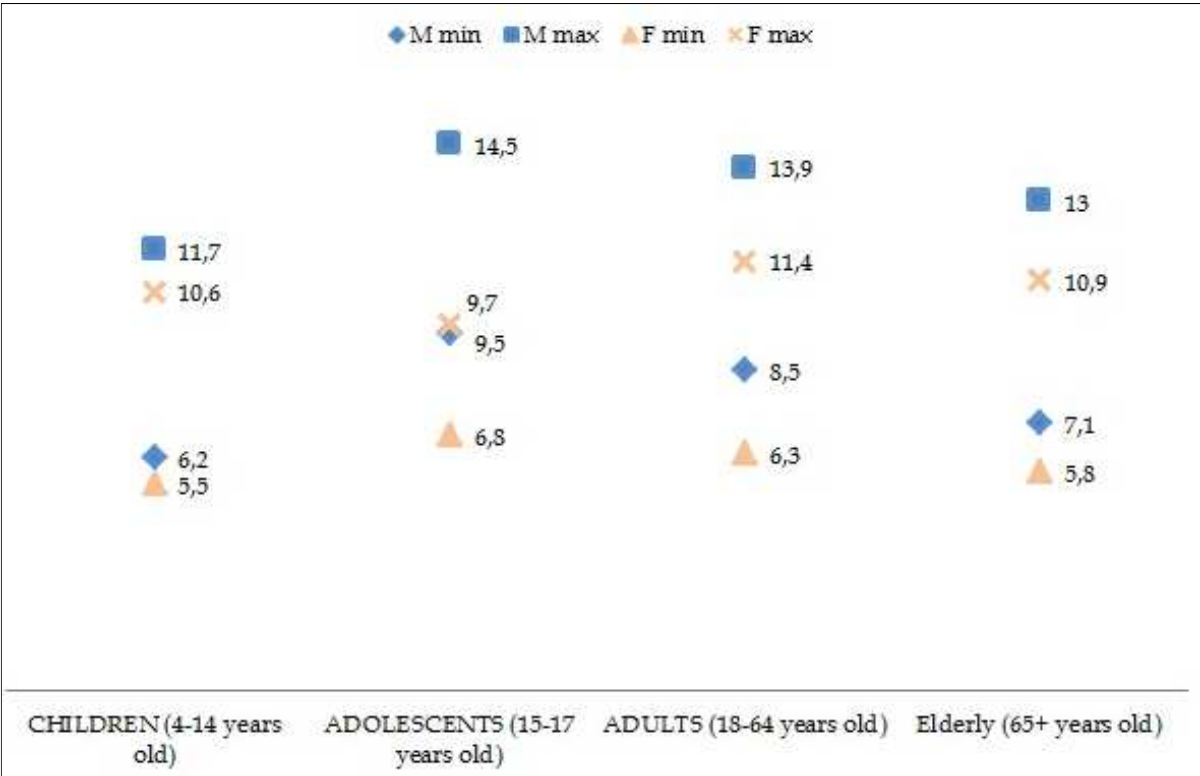


Fig. 1. Ranges of per-capita average daily intake (MJ) by age- class and gender

Overall, the level of energy intake was the main difference found when comparing the average per-capita dietary intakes of males vs. females (Elmadfa, 2009). As expected, men consume more energy than women (Figure 1), similarly to what is reported in other studies like a cross-country comparison (Flynn et al. 2009), or a cross-studies analysis (Reynolds et al. 1999). This difference occurs even though men and women show a similar food volume consumption (Marti-Henneberg et al. 1999).

In other words, the quantity of food does not seem the main component concurring to the energy intake. The combination of food categories characterizing the diet according to gender therefore plays a central role in determining the amount of energy consumed.

### 3.1 Dietary profiles and nutrient intakes

In order to explore more in depth the relation between food consumption and nutrients intake, we investigated the available literature reporting studies addressing gender specific dietary profiles. According to Kiefer and co-authors (Kiefer et al., 2005) children, adolescents and adults males consume more energy, fat, and cholesterol but less carbohydrates and fibre than females. Fibre intake was found higher in females also in most studies reported by Reynolds et al. (1999). Data from The National Health and Nutrition Examination Survey (NHANES II) on the US population from 1976-1980, indicate that males consume more calories and fats than females (Block et al., 1988).

A research conducted in the US (Courtenay, 2000) showed that males of all ages consume more saturated fat and dietary cholesterol than females. Cholesterol intake of males was substantially higher than recommended levels, while dietary cholesterol of most females of all ages fell within the recommended range for classes of age (Courtenay, 2000).

One study (Wardle et al., 2004) showed that gender differences in food consumption do not always reflect differences in the proportion of energy consumed as fats or fibre intake, but this might be due to gender difference in alcohol consumption, which is likely to add a substantial amount of energy as “drink calories”. Once adjusted for energy intake, the dietary micronutrients profile of women tend to be higher than in men. In general, the diets of females were more nutrient-dense, with the exception of milk-derived calcium, and also higher in dietary fibre, phytochemicals, and various micronutrients (Liebman et al., 2003).

Among school children, girls were found to consume much less energy than boys and also have a reduced micronutrient intakes. Pre-school children did not show significant gender differences in dietary profiles (Backstrand et al., 1997). These observations corroborate the importance of differences associated to gender in food choices in determining the quality of the diet, at individual level.

According to Chung & Hoerr (2005), women seem more predisposed to meet the minimum recommended number of servings of fruit. Moreover, men have been shown to consume less carotenoid-rich foods, such as carrots, spinach, broccoli and other greens than women (Courtenay, 2000).

In agreement with the study by Chung & Hoerr (2005) and Wardle and co-workers (2004) showed that women eat more fruit than men. Several studies have reported that in various western countries women eat more fruits, vegetables, cereals, cereal products, milk, dairy products and whole grain products than men. On the other hand, the consumption of red meat, eggs, alcohol, soft drinks, high sucrose food, as well as various high starch foods such as potatoes and bread is higher in men (Beer-Borst et al., 2000; Fraser et al., 2000; Kiefer, 2005; Prättälä et al., 2007; Wardle, 2004).

The differences associated with gender were similar in all countries, throughout age and educational groups, and in rural and urban areas (Prättälä et al., 2007). A study on gender



differences in food intake conducted on 1556 older people living in Britain (Fraser et al., 2000), also indicated that women eat more butter, full-fat milk and certain beverages, cakes, apples, pears and bananas, whereas men consume more eggs, sugar and meat products. Men also consume more alcoholic drinks, more frequently and in higher amounts than women (Bates et al., 1999; Fraser et al., 2000; Liebman et al., 2003). Similar trends have been found in two British national surveys, the Health and Lifestyle Survey (Cox et al., 1993), and the National Dietary and Nutritional Survey (Gregory et al., 1990). These observations are also in agreement with data obtained in studies conducted in the United States (Wirfalt & Jeffrey, 1997) and Australia (Baghurst et al., 1994). On the whole, the studies reported here strongly suggest that a higher intake of fruit and vegetables is one of the elements characterizing women's dietary profiles.

The results of the present analysis on gender differences in nutrients and foods intake lead to figure out that fruit and vegetables consumption is a suitable indicator for dietary characterization. This remark suggests to include this relatively novel quantitative variable in future population studies as a tool to analyse gender specific eating behaviour. Moreover, a composite methodological design linking food choice and dietary intake approaches could help to deepen the knowledge of eating behaviour in the population.

Gender is usually considered in the Nutritional recommendations published by European countries (Pavlovic et al., 2007), even though a conceptual bias, might occur when scientific evidences are collected on males and then extrapolated to women (Tarnopolsky, 2003). Nutritional recommendations at international level are developed by gender and age when addressing specific nutrient requirements (World Health Organization [WHO] 2010a, thereafter (WHO, 2010a) whereas this does not occur in the formulation of nutritional goals for the general population (WHO 2010a, 2010b, 2010c). Further investigations should be carried out to analyse the appropriateness of including gender specific statements in international nutrition policy guidelines.

#### 4. Conclusions

All reported data are consistent with the view that in modern Western Societies women generally show a tendency to perform healthier food choices and are much more concerned about the importance of food choice and eating behaviour to stay in a good physical shape than men. This attitude is also reflected by dietary profiles in terms food intake pattern, showed consistent trends according to gender.

In conclusion, the "take home message" extrapolated from this systematic review, in strong accordance with other recent studies (Berbesque, 2009; Marino et al., 2011), is to stress the importance of considering a gender specific approach, both in terms of behaviour and of physiology, when addressing nutrition issues in research and in policy making. As a matter of fact, a more detailed informative basis would help the formulation of suitable monitoring programs in the research side, and an increasing effectiveness of policy interventions in respect of different population groups.

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Human behavior accounts for the majority of morbidity and premature mortality throughout the world. This book explores several areas of human behavior including physical activity, nutrition and food, addictive substances, gun violence, sexual transmitted diseases and more. Several cutting edge methods are also examined including empowering nurses, community based participatory research and nature therapy. Less well known public health topics including human trafficking, tuberculosis control in prisons and public health issues in the deaf community are also covered. The authors come from around the world to describe issues that are both of local and worldwide importance to protect and preserve the health of populations. This book demonstrates the scope and some of the solutions to addressing today's most pressing public health issues.

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