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Intakes of Fats, Cholesterol, Fiber and Micronutrients as Risk Factors for Cardiovascular Disease in Jordan

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Abstract

The cardiovascular disease (CVD) is the leading cause of death in Jordan and many other countries. The etiology of CVD is multifactorial. Dietary factors play significant roles in the initiation, prevention and treatment of CVD diseases. The aim of this study is to estimate the daily intake of nutrients associated with developing CVD among Jordanians, based on the Department of Statistics household budget survey "JHEIS 2010", and to detect any changes in these intakes in comparison with the previous JHEIS survey. The data of the JHEIS 2010 were analyzed for the purpose of estimating the quantity of nutrient intakes in the different governorates of the country. The results showed that energy intake in the whole country (the Kingdom) was 3325 kcal/day. The daily intakes (as % of energy) of total, saturated, polyunsaturated, monounsaturated, trans, omega-3 and omega-6 fats were 26.6, 6.5, 8.5, 8, 0.2, 0.21 and 2.2%, respectively. The daily fiber intake was 7.2 g/1000 kcal. The daily intakes (mg/day) of cholesterol, sodium, potassium, calcium, and magnesium were 303, 6206, 3030, 627 and 305, respectively. There was a variation in the intakes of these nutrients and energy among governorates. It is concluded that the Jordanian estimated daily intakes of total fat, saturated, polyunsaturated and trans fats were within the recommendations expressed as percent of energy intake, in contrary to the intakes of monounsaturated, omega-3 and omega-6 fats and dietary fibers, which were lower than those of the recommendations. In addition, the daily intakes of potassium, calcium and magnesium were low and those of energy and sodium intakes were very high as compared with the recommendations.

Keywords: Jordan, Trans Fatty Acids, Saturated Fatty Acids, Cholesterol, Cardiovascular Disease, Hypertension, Sodium, Potassium, JHEIS 2010.

1. Introduction

The cardiovascular disease (CVD) is a major cause of disability and premature death throughout the world (WHO, 2007). Atherosclerotic risk factors, such as hypertension, smoking and alcohol, represent significant predictors for several CVDs (US Census Bureau, 2004a,b). In addition, there is a dramatic increase in the conditions that trigger heart disease and other chronic illnesses (Musaiger and Al-Hazzaa, 2012), particularly in low- and middle-income countries (WHO, 2012). Few studies have investigated the risk factors associated with lifestyle and family history of hypertension in Arab populations.

The health and nutritional status in the Arab Middle East countries has changed during the past four decades as a result of changes in dietary habits, socioeconomic situation and lifestyle. Coronary heart disease (CHD), diabetes, hypertension and cancer have become the main health problems in these countries (Fahed *et al.*, 2012; Musaiger, 2012). The burden of these non-communicable diseases is associated with an increased risk of CVD and increased health care costs (Brown *et al.*, 2009). The estimated mortality rate due to CVD and diabetes in the Eastern Mediterranean Region ranged from 179.8 to 765.2 per 100,000 population, with the highest rates in poor countries. Also, the prevalence of overweight and obesity (body mass index ≥25 kg/m2) has reached an alarming level in most countries of the region, ranging from 25% to 82%, with a higher prevalence among women (Musaiger and Hazzaa, 2012).

In Jordan, major causes of death and disability have shifted from nutritional deficiencies and infectious diseases to chronic diseases such as CVD, cancers and diabetes (Stovall *et. al.*, 2013; Madanat *et. al*., 2008). Therefore, the non-communicable diseases and obesity have become a public health concern. Al-Nsour *et al*. (2012) reported that 30% of adult Jordanians, older than 18 years of age, were overweight and 36% were obese. Hypertension was also found to be highly prevalent in Jordan, with 20.6% of the population reported to suffer from it (US Census Bureau, 2004a,b).

Jordan, like many other neighboring countries, has undergone a nutrition transition characterized by increased intakes of modern diets high in fat, cholesterol,

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sugar and salt, and by decreased intakes of the traditional diets that are high in fiber, whole grains, fruits and vegetables (Madanat *et al.*, 2008; Musaiger, 2002; Popkin, 2002). Some of the effects of the nutrition transition are the increasing incidence of obesity, diabetes and CVD such as atherosclerosis, hypertension and stroke (Popkin, 2002).

CVD is associated with the "Western" diet style, which characterized by a high consumption of energy, fat, cholesterol, sugar and salt. CVD mortality rates are twice as high among segments of societies that follow such a diet than among people who eat sensibly (Scarborough *et al*., 2011; Hu, 2008). Salt, sugar, saturated fat and trans fats are harmful when consumed in excess; conversely, fruits and vegetables (which are rich in potassium, antioxidants and fiber), polyunsaturated fats, monounsaturated fats, whole grains, pulses, nuts and fish have consistently shown a protective effect against CVD (Scarborough *et al*., 2011; Hu, 2008).

Of all dietary lipids, saturated fat has the strongest effect on blood cholesterol levels. A high intake of saturated fat, particularly when combined with a low intake of polyunsaturated fat, will lead to increased low density lipoprotein (LDL) (bad cholesterol) (Elmadfa and Kornsteiner, 2009). Replacing saturated fat with monounsaturated and polyunsaturated fats can generally lower LDL levels (Rolfes *et al*., 2012).

Trans fats are toxic; by raising serum LDL and reducing high density lipoprotein (HDL), they substantially increase the risk of CHD and stroke (Mozaffarian and Stampfer, 2010). The US Department of Agriculture Dietary Guidelines for Americans (USDA, 2010) recommends limiting intake of trans fatty acids and saturated fatty acids (SFAs) to as little as possible. Similarly, the UK Government recommends consuming <2% of total energy in the form of these fats (Mozaffarian and Stampfer, 2010).

Epidemiological and clinical studies suggest that the intake of omega-3 (n-3) fatty acids contributes to the reduction of cardiovascular mortality and has beneficial effects on lipid profile as well as blood pressure (Cabo *et al.*, 2012), whereas an imbalance between dietary n-3 and omega-6 (n-6) fatty acids contributes to a wide range of diseases (Wertz, 2009). It is noteworthy that the optimum n-6/n-3 ratio has been estimated to be within the range of 5:1 to 10:1 (Jones and Kubow, 2006). Since the typical Western diet is rich in linoleic acid (LA) (and arachidonic acid (AA), and relatively poor in EPA/DHA, it has been proposed that lowering the dietary n–6/n–3 ratio would provide an efficient means by which to reduce the risk of CVD (Simopoulos, 2008).

Results from many studies suggest an inverse association between dietary fiber intake and CHD risk in the general population (Erkkilä and Lichtenstein, 2006). According to the American Heart Association (AHA), Diet Recommendations for Cardiovascular Disease Risk Reduction, Therapeutic Lifestyle Change (TLC), and Dietary Approach to Stop Hypertension (DASH) dietary patterns emphasize the importance of a higher consumption of fruit, vegetables, legumes, and whole grains, as they contain adequate fiber to lower the LDL cholesterol (Raymond and Couch, 2012). In addition, many other factors have been incriminated in hypertension pathogenesis, including changes in intracellular concentrations of calcium, sodium, potassium, and magnesium. Observational studies have shown that a diet rich in potassium, magnesium, and calcium, present mainly in fruits and vegetables, is associated with lower incidence and mortality from CVD (He *et al.*, 2006).

The present average sodium intakes, approximately 3000 to 4500 mg/day in various industrialized populations, are very high, that is, 2- to 3-fold in comparison with the current DRI of 1500 mg. By contrast, the present average potassium, calcium, and magnesium intakes are remarkably lower than the DRI (Lichtenstein *et al.*, 2006). There is convincing evidence indicating that this imbalance, between the intake of sodium, on the one hand, and the intakes of potassium, calcium, and magnesium, on the other, produce and maintain elevated blood pressure in a big proportion of the population. Thus, it was suggested that decreasing the intake of sodium and increasing the intakes of potassium, calcium, and magnesium would help in its prevention and basic treatment (Cunha *et al*., 2012; Lichtenstein *et al*., 2006). The purpose of this study is therefore to estimate the daily intakes of nutrients associated with developing CVD among Jordanians, based on the Department of Statistics household budget survey "JHEIS 2010", and to detect any changes in these intakes in comparison with the previous JHEIS survey.

2. Methods

Data in this paper were based on a household budget survey, namely the Jordanian Household Expenditures and Income Survey (JHEIS), 2010, which aimed to collect detailed data on the household expenditures and income. The raw data collection of this survey was conducted during the period of April 1, 2010 to April 30, 2011 (DOS, 2012).

The annual per capita food intake data of a representative sample of all Jordanian households were calculated. The included 13866 households were proportionally distributed among the different governorates of the whole country (Kingdom) using two-stage cluster stratified sampling method. These households included 73490 individuals, by an average of 5.3 capita/ household. Males constituted 51.26% of the sample, 40.2% were children younger than 18 years and 3.8% were elderly (older than 65 years). Each participating household received a questionnaire that contained data of expenditure on different food and nonfood categories. The data on food items were analyzed using a nutrition analysis software program (Food Processor SQL nutrition and fitness software, 2008) which included details on the contents of energy and nutrients for each food item. In case a food item was not included in the database of the mentioned program, the nutrient makeup of this food was obtained from other food analysis sources such as Food Composition Tables for Use in the Middle East (Pellet and Shadarevian, 1970) and Food Composition Tables of the Gulf Region (Musaiger, 2006). Such foods and their analyses were

introduced to the Food Processor database. Then the daily intakes of total fats, n-3 and n-6 fatty acids, saturated, monounsaturated, polyunsaturated and trans fatty acids, cholesterol, dietary fibers, sodium, calcium, phosphorus and magnesium were calculated. The nutrient intake values, obtained for the different governorates and the Kingdom, were compared with the highest daily requirement intake (DRI) and other professional health recommendations to assure that needs were met for all age groups (IOM, 2010; 2002/2005).

To compare the estimated energy intake of the Kingdom of Jordan with a reference value, the estimated energy requirements (EER) values for low active individuals were calculated and used for the purpose of comparison. The EER values were, respectively, 2680 and 2105 kcal for the reference man and woman of the age 25 years (IOM, 2002/2005; IOM, 2001).

The DRI's of some minerals and n-3 and n-6 fatty acids for the age groups of 19-30 and 31-50 years were used for comparison (IOM, 2010; 2002/2005). The Acceptable Macronutrient Distribution Range (AMDR) for >19 years old, as a percent of total energy intake, were also used for comparison (IOM, 2002/2005).

3. Results and Discussion

The kingdom (whole country) per capita energy consumption was found to be 3325 kcal/day (Table 1). The daily energy per capita intake of the governorates ranged from 2753 kcal/day in Ajloun to 4334 kcal/day in Madaba. The present daily energy intake of the Kingdom was 24% and 56% higher than that of the EER reference man and woman, respectively. Also when compared with the daily energy intake obtained in a 2006/2007 survey, the present daily energy intake was 9.7% higher (Takruri *et. al*., 2011). It was found that the present daily energy intake of 8 out of the 12 governorates was higher than that obtained in the previous survey, ranging from 3% (in Aqaba) to 40.5% (in Jerash), whereas 3 governorates had a lower daily energy intake than that of the previous survey; only Ma'an had the same daily energy intake reported in the previous survey (DOS, 2008; Alkurd, 2011). On the long run, if this high daily energy consumption pattern continues, it is expected to cause overweight and obesity with the association of increased high body fat. Overweight and obesity are two of the main risk factors of CVD (Musaiger and Al-Hazzaa, 2012).

The share of the total daily fat intake as a percent of daily energy intake in the Kingdom was 27.1% (Tables 2 and 3).

The contribution of fat to total daily energy intake ranged from 17.8% (in Mafraq) to 29.3% (in Amman). All these percentages (except in Mafraq) fall within the range of the Acceptable Macronutrient Distribution Range (AMDR) of fat (20%-35%) (IOM, 2002/2005). This indicates that the Jordanian consumption of fat as a percentage of the total daily energy intake is generally acceptable.

Table 1. Estimated daily *per capita* intake of energy (kcal) in the whole country and governorates in Jordan: comparison between JHEIS 2010 and JHEIS 2006/2007[1]

Governorate	2010	2006/2007	% of change
Amman	3327	2940	+ 13.2
Balqa	2921	3079	- 5.1
Zarqa	3272	2893	+ 13.1
Madaba	4334	3328	+30.2
Irbid	3143	3320	- 5.3
Mafraq	3285	2876	+14.2
Jarash	4290	3054	+40.5
Ajloun	2753	3245	-15.2
Karak	3925	3107	+26.3
Tafilah	3235	2710	+19.4
Ma'an	3074	3075	0.0
Aqaba	2833	2750	+3.0
Whole country	3325	3031	+9.7

[1]References: DOS, 2012; DOS, 2008; Alkurd,2011

It has been shown that the daily per capita fat supplies showed an impressive increase in most of the Middle East Arab countries, ranging from 13.6% in Sudan to 143.3% in Saudi Arabia (Musaiger, 2002). Despite these apparently acceptable percentages, the total amounts of fat consumed are high when attributed to the reference EER. When these amounts are attributed to the 2680 kcal/day, the share of the Kingdom as a percentage of the total estimated daily energy intake was 33.6%, whereas Ma'an, with the highest governorate daily intake, attained 60.4% and Mafraq, with the lowest daily intake, attained 22% of the EER. It is clear that when the total daily energy intake is higher than the required, the amount of the consumed fat is more critical to health than its percentage of the total energy consumed per day. The present total fat daily intake of the Kingdom in the present survey is 14.9% higher than that of the 2006/2007 survey (Alkurd, 2011) (see Table 2). Compared to the previous survey, the change in the total fat for the governorates ranged from +127% (in Ma'an) to -35% (in Ajloun). It is worth noting that the daily energy intake of Ma'an was not different, whereas its fat daily intake was increased by 127% (from 79.4 to 180.0); this indicates that the increase in the daily fat intake was at the expense of carbohydrate and protein.

As indicated in Tables 2 and 3, the Kingdom's SFA daily intake was 24 g, which is 6.5% of the estimated total daily energy intake. The 2006/2007 percentage was 6.2 (Alkurd, 2011), which is slightly lower than the present daily intake. Despite that, the present percentage of SFA intake is within the healthy recommendations of <10% of the total energy intake.

Table 2. Daily *per capita* estimated intake of different fats in the whole country and governorates in Jordan based on JHEIS 2010 and JHEIS 2006/2007[1]

Governorate	Daily intake of fat types (g)													
	Total fat		SFA		MUFA		PUFA		Trans		n-3		n-6	
	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007
Amman	109.9	92.5	26.9	22.7	36.6	28.1	31.7	28.5	0.62	0.91	0.82	0.77	8.66	7.8
Balqa	70.9	89.4	17.7	22.2	20.2	23.8	21.9	28.9	0.63	0.80	0.66	0.59	7.02	6.8
Zarqa	102.9	85.3	25.6	20.8	34.0	25.4	29.7	26.7	1.03	1.08	0.75	0.65	8.16	6.9
Madaba	110.3	97.3	22.9	21.3	30.9	28.2	39.8	33.7	0.55	1.13	0.83	0.75	9.29	8.2
Irbid	97.0	111.4	23.6	26.3	30.2	37.3	27.5	32.2	0.82	1.32	0.78	0.84	7.92	9.2
Mafraq	65.4	79.2	17.9	20.2	21.5	25.6	13.8	22.9	0.70	1.81	0.71	0.59	7.49	7.4
Jarash	126.9	82.1	29.2	21.9	36.7	23.4	37.3	23.2	1.66	1.03	0.94	0.67	10.07	7.7
Ajloun	73.4	112.9	19.0	25.0	20.7	38.2	20.0	37.6	1.35	1.89	0.61	0.86	6.72	8.9
Karak	107.3	74.1	23.5	16.8	32.1	22.7	34.5	25.0	0.73	1.16	0.75	0.66	8.88	7.7
Tafilah	88.7	64.9	27.5	15.0	23.0	19.6	23.3	20.3	0.48	0.95	0.66	0.60	8.34	6.7
Ma'an	180.0	79.4	22.8	18.0	30.0	27.1	17.9	23. 5	0.32	1.97	0.40	0.57	4.81	7.3
Aqaba	85.3	75.3	19.9	21.7	28.4	26.1	25.2	18.5	0.59	0.89	0.55	0.61	6.45	7.0
Whole country	100.0	87.0	24.0	21.0	31.6	27.1	29.7	27.0	0.72	1.25	0.77	0.68	8.18	7.6
% of change (Kingdom from 2006/2007 to 2010)	+14.9		+14.3		+16.6		+10		-42.4		+13.2		+7.6	

[1]References: DOS, 2012; DOS, 2008; Alkurd, 2011

Table 3. The percentage share of fats out of total energy intake (TEE) in the whole country and governorates in Jordan based on JHEIS 2010 and JHEIS 2006/2007[1]

Governorate	fats % share of TEE													
	Total fat		SFA		MUFA		PUFA		*Trans*		n-3		n-6	
	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007
Amman	29.3	28.3	7.3	6.9	9.9	8.6	8.6	8.7	0.2	0.3	0.22	0.24	2.3	2.4
Balqa	21.5	25.9	5.4	6.4	6.2	6.9	6.8	8.4	0.2	0.2	0.20	0.17	2.2	2.0
Zarqa	27.5	26.4	7.1	6.4	9.4	7.9	8.2	8.3	0.3	0.3	0.21	0.20	2.2	2.1
Madaba	22.4	26.2	4.8	5.7	6.4	7.6	8.3	9.1	0.1	0.3	0.17	0.20	1.9	2.2
Irbid	27.4	30.0	6.8	7.1	8.7	10.1	7.9	8.7	0.2	0.4	0.22	0.23	2.3	2.5
Mafraq	17.8	24.7	4.9	6.3	5.9	8.0	3.8	7.2	0.2	0.6	0.19	0.18	2.1	2.3
Jarash	26.2	24.0	6.1	6.4	7.7	6.8	7.8	6.8	0.4	0.3	0.20	0.20	2.1	2.3
Ajloun	23.7	31.0	6.2	6.9	6.8	10.5	6.5	10.4	0.4	0.5	0.20	0.24	2.2	2.5
Karak	24.1	21.4	5.4	4.9	7.4	6.6	7.9	7.2	0.2	0.3	0.17	0.19	2.0	2.2
Tafilah	24.4	21.5	7.6	5.0	6.4	6.5	6.5	6.7	0.1	0.3	0.18	0.20	2.3	2.2
Ma'an	24.4	23.1	6.7	5.2	8.8	7.9	5.2	6.8	0.1	0.6	0.12	0.17	1.4	2.1
Aqaba	26.7	24.6	6.3	7.1	9.0	8.5	8.0	6.0	0.2	0.3	0.17	0.20	2.1	2.3
Whole country	**27.1**	25.6	6.5	6.2	8.5	8.0	8.0	7.9	0.2	0.4	0.21	0.20	2.2	2.3
% of change (Kingdom 2006/2007 to 2010)	+5.9		+4.8		+6.3		+1.3		-50		+5		-4.5	

[1]References: DOS 2012; DOS 2008; Alkurd, 2011

When these amounts are attributed to the EER of 2680 kcal, the Kingdom SFA intake constitutes 8% of this EER which is still within the recommendations for healthy people. The consumed saturated fat percentages of the governorates ranged from 4.8% in Madaba to 7.6% in Tafilah. Compared with the American Heart Association 2006 diet recommendations for CVD risk reduction that recommend limiting the daily intake of saturated fat to <7% of the total daily energy intake; it is clear that the present daily intake is higher than that mentioned in this recommendation (Lichtenstein *et. al*., 2006).

The Kingdom's daily intake of MUFA was 31.6 g which is 8.5% of the total daily energy intake. When this daily intake is referred to the 2680 kcal, it constitutes 10.6% of this energy, which is at the lower level of the healthy recommendations. Compared to the percentage obtained in the 2006/2007 survey, which was 8% (Alkurd, 2011), the present daily intake is slightly higher, but is still lower than the recommendations of 10-15% (Raymond and Couch, 2012).

The Kingdom's daily intake of PUFA was 29.7 g which is 8% of the total daily energy intake. The present percentage is similar to the percentage of the 2006/2007 survey of 7.9% (Alkurd, 2011). The present percentage is within the healthy recommendations (≤10%) of total daily energy intake.

Regarding the *trans* fats daily intake, it was found to be 0.7 g for the Kingdom, which is 0.2% of the total daily energy consumption. The percentages of daily intake of all governorates is <0.5. It's clear that these percentages are very low. The healthy recommendations of *trans* fats state that the daily intake should be as low as possible while consuming a nutritionally adequate diet (USDA, 2002/2005). The American Heart Association 2006 diet recommendations for CVD risk reduction state that the healthy daily intake should be <1% of the total daily energy intake; the present daily intake is consistent with this recommendation (Lichtenstein, 2006). The present percentage of *trans* fats is half that of the 2006/2007 daily intake (Alkurd, 2011). This is probably due to the relative decrease of daily ghee intake and the relative increase in oils.

The Kingdom's daily intake of omega-3 fats was 0.8 g which is 0.21% of the total daily energy intake. The percentages of the daily intake of the governorates ranged from 0.12 to 0.22. The Kingdom's percentage of the daily intake in 2006/2007 was 0.20 (Alkurd, 2011), which is similar to the value obtained in the present study. However the AMDR recommendation of 0.6-1.2% is much higher than the present daily intake for n-3 fats.

Regarding the daily intake of omega-6 fats, it was 8.2 g (2.2% of the total daily energy intake), with percentages of governorates daily intake, ranging from 1.4% in Ma'an to 2.3% in Amman. It is noteworthy that the 2006/2007 value of 2.3% (Alkurd, 2011) is similar to the present value. Again, like in omega-3 daily intake, the omega-6 AMDR recommendation (5-10%) is much higher.

When we look at the ratio of n-6:n-3 in the present survey, we find that it is 10:1, which is within the recommended ratio of these fatty acids, i.e., from 5:1 to 10:1 (Jones and Kubow, 2006). The ratio in the 2006/2007 survey was 12:1 (Alkurd, 2011), which means that the present consumption pattern of n-3 and n-6 fats has improved. High amounts of n-6 fats may exert adverse effects on the function of vascular endothelium or stimulate production of proinflammatory cytokines. Thus, a low ratio of n-6 to n-3 fats is recommended (Basu *et. al*., 2006; Kelly and Sabate, 2006; Gebauer *et. al*., 2006).

Table 4 shows the daily *per capita* estimated intakes of dietary fiber and cholesterol in the whole country and the governorates in Jordan. The *per capita* estimated cholesterol intake ranged from 180 mg (in Ma'an) to 345 mg (in Tafilah), whereas the Kingdom's intake was 303 mg. Only three governorates consumed more than 300 mg of cholesterol daily. The Kingdom's daily cholesterol intake in the 2006/2007 survey was 204 mg/day (Alkurd, 2011), which is lower than both the present daily intake and the upper healthy recommended daily intake of 300 mg/day.

Table 4. Daily *per capita* estimated intakes of dietary fiber and cholesterol in the whole country and governorates in Jordan based on JHEIS 2010 and JHEIS 2006/2007[1]

Governorate	Dietary fiber (g)		Dietary fiber g/ 1000 kcal consumed		Cholesterol (mg)	
	2010	**2006/ 2007**	**2010**	**2006/ 2007**	**2010**	**2006/ 2007**
Amman	24.3	24.0	7.3	8.2	326	241
Balqa	23.9	26.1	8.2	8.5	277	154
Zarqa	23.9	22.6	7.3	7.8	301	218
Madaba	35.3	25.2	8.1	7.6	294	232
Irbid	22.5	26.9	7.2	8.1	297	234
Mafraq	25.9	21.6	7.9	7.5	254	181
Jarash	31.3	28.0	7.3	9.2	343	207
Ajloun	19.1	25.1	6.9	7.7	258	228
Karak	29.3	21.6	7.5	7.0	279	194
Tafilah	20.5	20.1	6.3	7.4	345	200
Ma'an	21.1	25.4	6.9	8.3	180	175
Aqaba	21.8	21.0	7.7	7.6	224	181
Whole country	24.1	24.0	7.2	7.9	303	204
% of change (Kingdom from 2006/2007 to 2010)	+0.4		-9.7		+48.5	

[1]References: DOS 2012; DOS 2008; Alkurd, 2011

As for the dietary daily fiber intake of the Kingdom, it was 7.2 g/1000 kcal. This intake is nearly half of the recommended amount of 14 g/1000 kcal (USDA, 2010), with values in the governorates ranging from 6.3 g (in Tafilah) to 8.2 g (in Balqa). The 2006/2007 dietary fiber daily intake of the Kingdom was 7.9 g/1000kcal, which is higher than the present figure. This indicates that the daily fiber intake is low and needs to be doubled. The best and most practical way of increasing dietary fiber intake can be achieved through consuming more vegetables, fruits, and whole cereals and legumes. The low consumption of fiber-rich foods was also reported in other countries of the region (Musaiger, 2002).

Table 5 presents the estimated intakes of four mineral elements related to cardiovascular diseases, namely sodium, potassium, calcium and magnesium. The sodium's daily intake is 6478 mg for the Kingdom, which is more than 4 fold of the AI of sodium (1500 mg) (IOM.2002/2005). This intake is 15% lower than that of the 2006/2007 (7623 mg) (Alkurd, 2011). The present daily intake of the governorates ranged from 4589 mg in Balqa to 15614 mg in Jerash. This is in agreement with other reports indicating that the sodium content in the Arab Middle East diet is high (Musaiger, 2002).

However, it is noteworthy that around 54% of the sodium figure in the JHEIS survey came from the table salt daily intake of 3.11Kg/capita/year, which is equivalent to 3400 mg/capita/day. It is known that not all of the purchased sodium is ingested since part of it is discarded with brine water in many home processed foods, such as boiled white cheese, pickled olives and pickled vegetables. These home processing and preparation practices are common in Jordan. This might partly explain the odd high figure of the sodium daily intake calculated in this budget survey for Jerash

Table 5. Daily *per capita* estimated intake (mg) of some hypertension-related minerals in the whole country and governorates in Jordan based on JHEIS 2010 and JHEIS 2006/2007[1]

Governorate	Sodium		Potassium		Calcium		Magnesium	
	2010	2006/2007	2010	2006/2007	2010	2006/2007	2010	2006/2007
Amman	5926	7062	3162	3188	686	873	308	307
Balqa	4589	10877	2954	3058	552	909	285	297
Zarqa	7004	6767	3154	3018	629	824	326	295
Madaba	9865	8896	3679	3522	778	917	383	341
Irbid	5397	9155	3000	3672	740	949	306	359
Mafraq	6550	6556	2952	2740	546	753	304	267
Jarash	15614	8537	3868	3522	740	916	396	327
Ajloun	5480	9600	2523	3574	501	919	260	332
Karak	8022	4747	3301	2776	634	688	339	282
Tafilah	7637	6281	2610	2812	461	654	259	257
Ma'an	6632	7232	2502	3049	392	793	241	286
Aqaba	7356	5762	2600	2624	495	747	274	274
Whole country	6478	7623	3030	3130	627	829	305	302
% of change (Kingdom from2006/2007 to2010)	-17.7		-3.3		-32.2		+1.0	

[1]References: DOS 2012; DOS 2008; Alkurd, 2011

governorate, which is famous for dairy processing and vegetable pickling. The amount of the table salt given for Jerash in the present survey is 11.7 Kg/caput/year (in comparison with only 3.11Kg for the Kingdom) (Dos, 2012). In spite of this, we still find that the daily sodium intake by Jordanians is high, and more accurate methods of assessment of the sodium daily intake, such as 24-hr urine collection method, is suggested (Ji *et. al*., 2012).

The Kingdom's average daily intake of potassium is 3030 mg, which is 35.5% lower than the AI (4700 mg) (IOM, 2002/2005) and lower than the 2006/2007 daily intake (3130 mg) (Alkurd, 2011). There is a wide range in the potassium daily intake among the different governorates (from 2502 mg in Ma'an to 3868 mg in Jerash). This low daily potassium intake may be critical as an indicator of hypertension especially when the high daily sodium intake and the low calcium and magnesium daily intakes are taken into consideration (Ji *et. al*., 2012; Raymond and Couch, 2012). Since plant foods (fruits and vegetables) are rich sources of potassium and magnesium, it is important to encourage their consumption in the Jordanian diet in an attempt to decrease the incidence of cardiovascular diseases.

The Kingdom's calcium daily intake is 627 mg, which is 37% lower than the AI (1000 mg) (Table 5), with a wide range in the governorates (from 392 mg in Ma'an to 778 mg in Madaba). Also the Kingdom's daily intake of magnesium (305 mg) is lower than the AI for males (400-420 mg) and for females (310-320 mg) (IOM, 2002/2005). The intake of the governorates ranged from 241 mg in Ma'an to 396 mg in Jerash. It is noticed that even the highest daily intake was lower than the adult male recommendations. The magnesium's daily intake in this survey is similar to that of 2006/2007 intake (Alkurd, 2011).

4. Conclusion

In this study, the Kingdom's estimated daily intakes of total fat, saturated fat, polyunsaturated fat, *trans* fat and cholesterol were within the recommendations. However, the estimated daily intakes of energy and sodium were very high. On the other hand, the estimated daily intakes of monounsaturated, omega-3, omega-6 fats, dietary fiber, potassium, calcium and magnesium were lower than the recommendations. Thus, the present study highlights the unhealthy daily intakes of many dietary factors favorable to CVD, especially hypertension, such as energy, sodium, monounsaturated and omega-3 fats, dietary fiber, potassium, calcium and magnesium.

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