Pakistan Journal of Nutrition 13 (4): 181-190, 2014
ISSN 1680-5194

Nutrition and Food Consumption Patterns in the Kingdom of Saudi Arabia

Ahmed Adam[1,2], Salih Osama[3] and Khan Ibrar Muhammad[4]
[1,3,4]Department of Community Health Sciences, College of Applied Medical Sciences,
King Saud University, P.O. Box 10219, Riyadh-11433, Saudi Arabia
[2]Department of Agricultural Economics, Faculty of Agriculture, University of Khartoum, Khartoum, Sudan

Abstract: The objective of the present study is to describe and examine nutrition and food consumption patterns in KSA, namely to analyze and assess: the trends of per capita supply of major food groups (g/capita/day) from 1961-2007 and dietary energy supply, distribution by macronutrient and diversity of the food supply. Only secondary data were used. Saudi Arabia annual food balance sheet for the period form 1961-2007 which produced by FAO were used to drive the average per capita micronutrients (Dietary Energy Supply, protein and fats). Descriptive statistics were used as analytical tools. The results revealed that the overall supply of the different food groups in KSA is in continuous rise from 881 g/capita/day in the period of 1961/70 to more than double (1735 g/capita/day) in the period of 1981/90. The supply of vegetables showed a sharp drop from over 400 g/capita/day in the year 1990 down to less than 250 g in the year 2000. Fruits supply was slightly better than vegetable during the same period (1990-2007). On the other hand, meat group showed steady, positive increasing supply pattern during the period from 1990 to 2007. During these two decades, meat supply increased from about 26 g/capita/day in 1990 up to 139 g/capita/day in 2007 with a percent increase of 435%. Macronutrients are essentially of vegetal origin, amounted to 92% for energy, 81% for protein to 67% for lipid during the period of 1961/70. In the subsequent years fats from vegetal origin was more or less stabilized at 67-68% while fats from animal origin was at 33%. The share of protein, in the dietary supply has remained stable from 1961/70 to 2001/07. While the share of lipids showed an increase trend from just 15% in 1961/70 up to 1981/90 and stabilized at 25% up to the 2001/07 period. However, the share of carbohydrates in the dietary supply has decreased from 75% in 1961/70 to 64% in 2001/07. In the last five decades the per capita consumption of Sugar and sweetener, meat, animal fat, offal, egg and milk has increased, contrary the consumption of fruits and vegetable have fluctuating trends, such trends will not be continued if Saudi to adopt more healthy lifestyle.

Key words: Nutrition, consumption pattern, Saudi Arabia

INTRODUCTION

Its well proven that dietary consumption patterns, diet composition and content of any population is influenced by many factors, these factors interact in a complex way to shape our patterns of dietary consumption. Some of the main factors that affect dietary consumption patterns include income, prices, individual preferences and beliefs, cultural traditions, as well as geographical, environmental, social and economic factors.

Saudi Arabia have witnessed major and dramatic changes in demographics and lifestyles during the last 3 decades since 80s, which highly impacting and influencing food choices and food intake of the entire population (Kuhnlein, 1989). Moreover, the pace of these changes seems to be accelerating, basically because of increased urbanization and its negative consequences with regards to dietary patterns and lifestyles of individuals (changes in diets, patterns of work and leisure) result in a typical situation often referred to as the "nutrition transition". Although, economic development is normally accompanied by improvements in a country's food supply and the gradual elimination of dietary deficiencies, thus improving the overall nutritional status of the country's population. Furthermore, it also brings about qualitative changes in the production, processing, distribution and marketing of food. Nevertheless, nutrition transition has adverse dietary changes include shifts in the structure of the diet towards a higher energy density diet with a greater role for fat and added sugars in foods, greater saturated fat intake (mostly from animal sources), reduced intakes of complex carbohydrates and dietary fiber and reduced fruit and vegetable intakes (Drewnowsk and Popkin, 1997).

While food plays an important role in satisfying individuals' basic needs, consuming food in excess to the body's needs may lead to undesirable health outcomes. The increasing prevalence of non-communicable diseases including obesity, type 2 diabetes mellitus, hypertension and different types of cancer in Saudi population, have highlighted the need to investigate factors that are associated with food intake.

Corresponding Author: Ahmed Adam, Department of Community Health Sciences, College of Applied Medical Sciences, King Saud University, P.O. Box 10219, Riyadh-11433, Saudi Arabia

The World Health Organization (WHO) emphasizes the importance of looking at social, cultural, political, physical and structural influences for effective prevention and management of overweight and obesity (WHO, 2000) and other non-communicable diseases (WHO, 2011).

However, the ability to evaluate food consumption trends and assess risks associated with NCDs is always limited by lack of data on current eating habits and consumer practices. FAO produces annual Food Balance Sheets which provide national data on food availability for each country. Food Balance Sheets give a complete picture of supply (including production, imports, stock changes and exports) and utilization (including final demand in the form of food use and industrial non-food use, intermediate demand such as animal feed and seed use and waste) by commodity. From these data, the average per capita supply of macronutrients (i.e. energy, protein, fats) can be derived for all food commodities.

The objective of the present paper are to describe and examine the food consumption patterns in KSA, namely to analyze and assess: the trends in Per capita supply of major food groups (g/capita/day) 1961-2007; Dietary energy supply distribution by macronutrient and diversity of the food supply and the share of the main food groups in fat and protein supply.

Population characteristics of Saudi Arabia: According to the 2010 census (Central Department of Statistics 2011) the total population in Saudi Arabia is 27 million; of this about 18.7 Million are Saudi citizens (2.21% growth rate). The national statistics pointed to the considerable rise in population size over the past three decades (7 millions in 1974; 16.9 m in 1992; 22.6 m in 2004 and 27 m in 2010). This rise was contributed to the high growth rate of the Saudi population which amounted to 3.8% for the period from 1974-1992; 2.5% for 1992-2004 and 32 for 2004-2010 and the influx of a large number of foreign workers. Moreover, this high growth rate is attributed to the high total fertility rate (TFR) of the women of child-bearing age (15-49 years), which averages about 4.8 live births per woman. Economical indicators for the year 2011, shows a per capita GDP of 76,229 (SAR), 6.77% GDP growth with 48.8% contribution from the private sector. In 2011 the export growth was up to 35.73% while the import was 1.45%, the contribution of the export to GDP was 61.6%. The unemployment rate according to 2009 records was 5.4% with the proportion of the working population to population of 32.1%. One of the most significant characteristics of the Saudi population is the age structure which indicates that, population below 15-years age group constituting 40.4% of total population. The median age is estimated at 17.3 years, which means that about one half of the population is at or below 17.3 years of age. The overall population density was 12 per sq km (30 per sq mi), but much of the population is concentrated on the coasts or internal oases; desert regions are largely uninhabited. The UN estimated that 86% of the population lived in urban areas in 2005 and that urban areas were growing at an annual rate of 2.95% (Worldmark Encyclopedia of Nations, 2007).

In addition, statistics also indicated a relatively large family size of 6 to 7 persons. These facts, has strong implications on the high consumption and, consequently, lower savings, with a negative impact on economic growth, as well as leading to higher demands on health, education and other services needed by the growing number of children.

Agriculture and animal wealth: Agriculture engages 10% of the economically active population and accounts for about 5% of Gross domestic Product (GDP). Only about 1.8% of Saudi Arabia's land area is cultivated, although 40% is suitable for grazing. About two-thirds of the cropped land is used for cereals and the remainder for vegetables and fruit. Dates remain the only major staple food crop with production sufficient to meet local demand and over 13% of the world's supply. However, the growing of dates has declined in favor of wheat, corn, sorghum, tomatoes, onions, grapes and a variety of other fruits and vegetables Saudi Arabia is 85% self-sufficient for vegetables and 66% for fruit. Production of wheat totaled 2,358,000 tons in 2004 however Agricultural irrigation accounts for 90% of total water needs, with wheat production alone using about one-third of the country's annual water supply.

As of 2005, Saudi Arabia had an estimated 7,000,000 sheep, 2,200,000 goats, 260,000 camels, 350,000 head of cattle. As imports of animal foodstuffs have increased and as greater varieties of agricultural products have been produced locally, camels have declined steadily in importance as a source of food. Sheep are found in all parts of Saudi Arabia where pasturage is available; they are raised for milk, as well as for meat and wool. Goats are kept for milk. Beef has not been a significant part of the Saudi diet and most beef and veal is consumed by expatriates, as traditional Saudis prefer camel meat. The output of poultry and eggs doubled during 1975-80 and in 2005, Saudi Arabia had an estimated 141 million poultry. Saudi Arabia is self-sufficient in milk production in 2005, 1,149,000 tons were produced.

Income: The US Central Intelligence Agency (CIA) reports that in 2005 Saudi Arabia's gross domestic product (GDP) was estimated at $340.5 billion. The CIA defines GDP as the value of all final goods and services produced within a nation in a given year and computed on the basis of purchasing power parity (PPP) rather than value as measured on the basis of the rate of exchange based on current dollars. The per capita GDP was estimated at $12,900. The annual growth rate of GDP was estimated at 6.4% and increased to 6.77 in 2011. The average inflation rate (Change in the index of

cost of living), in 2005 was 0.6% and reached 4.7 in 2011. It was estimated that agriculture accounted for 3.3% of GDP, industry 74.7% and services 21.9%.

The KSA statistical data for 2004 show that the per capita income stands at SR 56,100 (14960 US $), which was six times the average per capita income in the Middle East and North Africa and about three times the per capita income of upper-middle income countries. However in 2009, per capita income was 14486.08 US $ according to IMF and increased to 20327.7 US $ in 2011.

Undernutrition and hunger: "Globally there is enough food to feed the world, but it is not equally distributed and many people do not have the means to buy it," said Hartwig de Haen, FAO Assistant Director-General and head of its Economic and Social Department. "Even where food supplies are adequate at the national level, access to food is often a serious problem. Within countries and even within households, food is not always equally distributed. To ensure nutritional well-being, every individual must have access at all times to sufficient supplies of a variety of safe, good-quality foods."

According to World Food Programme figures, among developing country regions, the Arab countries have the lowest ratio of undernourished people to the total population (10%). Yet the Arab region is one of the two world regions in which the number of undernourished has risen since the beginning of the 1990s-from 19.8 million in 1990-1992 to 25.5 million in 2002-2004. The relatively low level in comparison with other regions is due to the relatively high income levels of oil countries, food purchasing power sustained by worker remittances and to the food supply policies implemented by some governments. It may be noted that even in wealthy countries such as Saudi Arabia, Kuwait and the UAE there are segments of the population that do not obtain sufficient nourishment. According to the Arab Human Development Report (2009), Egypt, Jordan, Lebanon, Morocco, Saudi Arabia and Yemen, recorded increases in both the absolute numbers and prevalence of undernourishment. On the other hand obesity is in an increasing trend, which is mainly attributed to over-consumption of high-fat foods and high sugar products combined with little physical activity however, it can also be a result of the cheap, low-grade and processed foods that starve children of absolutely crucial nutrients also make adults fat.

MATERIALS AND METHODS

The data used in the paper are primarily depend on the analysis of the food balance sheet that has been complied and analyzed by FAO in collaboration with Government of KSA for the period from 1961 till 2007. As well as the data from other local and international relevant sources such as Central department of Statistics, World Bank the analyzed data covers: Trends in Per capita supply of major food groups (g/capita/day) namely: Cereals, Starchy Roots, Sugar and Sweeteners, Pulses, Tree nuts, Oil crops, Vegetable Oils, Vegetables, Fruits, Stimulants, Milk, Meat, animal fat, offals, eggs, fish, spicy and other); dietary energy supply, distribution by macronutrient and diversity of the food supply; dietary energy supply, protein and fat by food group and vegetal/animal origin of macronutrients (DES, protein and fat).

RESULTS AND DISCUSSION

Qualitative aspects of the diet and food security in Saudi Arabia

Food consumption patterns: The people of Saudi Arabia are very traditional and eat the same foods they have eaten for centuries. The average meal of the Bedouin nomads who remain in Saudi Arabia is much simpler than that of the urban Saudis who make up the majority of Saudi Arabia's population today. However, the basic ingredients are the same: fava beans, wheat, rice, yoghurt, dates and chicken are staple foods for all Saudis. Saudi Arabia has over 18 million date palms that produce 600 million pounds of dates each year. Data available (FAO STAT) in addition to a very few local studies showed differences in food availability, climate, as well as regional food habits and traditions result in regional variation in food consumption patterns in KSA. However, the country is witnessing nutrition transition 3-4 decades ago were a substantial shifts to modern western diet and life style, urbanization is mostly pronounced in the country were 86% of the population are living in big cities compared to only 14% rural population.

Wheat and wheat-based dishes represent the majority of cereal grains consumption in the Kingdom. According to Khan and Al-Kanhal (1997), cereals contribute 41 and 40% of the total available food energy and protein in the Saudi diet respectively. Wheat is most commonly used for bread making, forms 64% of the total available cereals. The per caput availability of wheat increased over 56% in 1997, while other cereals like millet, sorghum, corn, decreased by 64% during a period of 1980/90. However, the average per caput consumption of bread per day has been reported by Al-Mohizea *et al*. (1995), to be 355 g. Based on this average consumption (355 g/head/day), wheat breads can meet 40-49% and 58-70% of energy and protein requirements respectively at national level per person per day. One study calculated that, a 100 g intake of Saudi breads would meet 7-10% vs 10-14% and 10-16% vs 12-19% of RDA for energy and protein for adult male vs female respectively. However, it should be noted that, these Recommended Daily Allowance RDAs was calculated based on the average daily per capita energy and protein requirements for Saudi population of 2100 Kcal and 53 g, respectively. It must be noted that, there are many conflicting reports with regard to the nutritive value of

Arabic bread; this may be due to different types of flour, yeast, methods of dough fermentation and time and temperature used in baking of breads. Rice consumption is very high being the main constituent of the traditional highly consumed Kapsah dish by almost 90% of the population. According to national nutrition survey (1995), the average per capita consumption of rice based products/dishes was 160 g/day. However, In 2010, the per capita rice consumption was estimated at 43 kg a year. It is served two times a day (for lunch and dinner) Kapsa, a preparation of chicken/lamb and rice, is the favorite rice dish in the country. Kapsa and other rice-based dishes are usually purchased from restaurants. There are about 8 different types of rice-based traditional dishes in Saudi Arabia, the most popular is Kabsah consumed on daily bases and served at all social functions. Kabsah is composed of rice, meat (chicken or mutton or beef or camel meat), onions, tomatoes, carrots, salt, spices and vegetable oil or animal fat. According to AI-Kanhal (1999), Kabsah contained cholesterol (2.9 mg/100 g) and provided 19% of the total calories a fat. Mutton and beef are favored over other types of meat. Consumption of fish is generally low. Most of the fish eaten is sea fish and is consumed along the Red Sea coast. Groundnuts and sesame are the main sources of local vegetable oils (MAF, 2001).

Supply of major food groups: As depicted in Table 1 all food groups showed an increasing trend in per capita supply/day during the last five decades (1961-2007).

Cereals, meat, vegetables and milk constitute the main food groups in terms of supply for human consumption. Milks supply increased from only 97 g/capita/day in 1961/70 to 241 g/capita/day in 2001/07. Increase in meat supply principally camel, goat and mutton, was noticeably significant. Meat supply/capita/day during the period of 2001/07 is more than five folds of that during 1961/70 as it increased from 26 g/capita/day in 1961/70 to 139 g in 2001/07. Fish supply showed increase pattern during the period from 11.45 g to 23.25 g/capita/day. Egg supply showed similar increase trend during the same periods from 2.2797 to 12.2597 g/capita/day.

Overall, the per capita supply of cereals (mainly wheat, rice and barley) has increased from 372 g/capita/day in 1961/70 to 449 g/capita/day in 2001/07 i.e., a 20% increase in cereal supply/capita/day during the last five decades. However, the supply has decreased in 1971/80 compared to the level of other years. Wheat is one of the most important staple grains in Saudi Arabia where most of it is consumed in the form of pita\flat bread and other types of European bread such as French baguettes, hamburger buns and toast. Total Saudi food wheat consumption in 2012/2013 is forecasted to increase by two percent to about 2.9 million compared to the consumption level in 2010/2011. Wheat production in 2012/2013 is anticipated to decline by 9 percent to one million metric tons (MT) compared to 2011/2012. The Saudi Grain Silos and Flour Mills Organization (GSFMO) is committed to implement the Saudi government's decree number 335 which has aimed at phasing out domestic wheat production by 12.5% reduction annually with the goal of terminating domestic wheat production by 2016. However, Saudi Arabia's total 2012/2013 wheat import is forecasted to reach 2.5 million metric tons of which 1.8 million metric tons is imported by GSFMO for human consumption.

Saudi rice import for 2012\2013 is forecast to reach about 1.1 million MT which is an increase of three percent compared to 2010\2011 import level. India has continued to dominate the Saudi rice market with an estimated 59 percent market share in 2010/2011. Over the past several years, India has benefited most from the shift in Saudi consumers' preferences for rice which have been shifted from long grain white basmati rice to long grain parboiled or sella or muzza basmati rice because of its ease to cook. Domestic barley

Table 1: Trends in Per capita supply of major food groups (g/capita/day) 1961-2007

	1961-1970	1971-1980	1981-1990	1991-2000	2001-2007
Cereals-excluding beer	372	338	389	440	449
Starchy roots	5	14	22	46	51
Sugar and sweeteners	32	52	86	78	86
Pulses	7	7	10	9	12
Tree nuts	0.3	1.0	2.2	2.1	3.5
Oil crops	4	7	9	6	5
Vegetable oils	9	16	38	38	43
Vegetables	152	301	388	326	278
Fruits-excluding wine	149	278	310	267	285
Stimulants	5.8	7.8	9.3	5.4	8.8
Milk-excluding butter	97	184	288	202	241
Meat	26	63	119	123	139
Animal fat	2.41	4.74	6.30	4.49	4.74
offals	3.59	5.01	8.16	9.62	10.02
Egg	2.27	8.25	17.40	13.10	12.25
Fish	11.45	15.59	21.67	16.79	23.25
Spices, other	1.34	3.21	5.15	4.33	6.26
Food supply (g/capita/day)	881	1309	1735	1594	1659

Source: FAO (2012)

consumption in 2012/2013 is forecasted to decline by 9% to 6.3 million MT compared to about 7 million ins 2011/2012 due to mainly the recent introduction of feed grade wheat that is being used as a barley substitute in the feed ration. Starchy roots, such as sweet potatoes and cassava, their supply increased steadily from 5 g/capita/day in 1961/70 to 51 g/capita/day in 2001/07. In 2000/07 the per capita consumption of sugar and sweeteners has increased by more than 2.5 folds of that in 1961/70. Sugars as sweeteners supply per capita/day increased sharply from 32 g in 1961/70 to 86 g in 1981/90 then declined to 78 g in 1991/2000 and back 86 g 2000/07.

Pulses showed slight supply increase 7g/capita/day in 1961/70 to 12 g/capita/day in 2001/02. According to Khan and Al-Kanhal (1998) an increasing trend in the per capita availability of food legumes has been reported to be 178% during the 90s decade. The national nutrition survey (KACST, 1995) showed that the average consumption of legume-based products and dishes in KSA is 63 g/head/day, contributing 2.6, 3.9, 8 and 34% of the total energy, protein, dietary fiber and iron intake respectively. It was estimated that, a 100g intake of Saudi legume-based dishes (*Foul Medammis*, *Flafil*, *Hummus*, *Belila*, *Shourbat addas*) can meet 3-15 and 8-19% of energy and protein requirements at national level per person per day respectively. Oil crops are grown and consumed mainly in the northern part of the country. Their per capita supply was about 34 g/day in 2000/02. The supply of offals in the other hand showed increasing pattern from 3.59 g/capita/day in 1961/70 to 10.02 g/capita/day in 2001/02.

Both fruit and vegetables supply were in increase pattern from 1961/70 to 1981/90, (from 149 and 152 g/capita/day to 310 and 383 g/capita/day, respectively) then, the supply started decreasing moderately and reached 285 g/capita/day in 2001/07 for fruits and 278 g/capita/day in 2001/07 for vegetables. Vegetable oil supply increased steadily and moderately from 9 g/capita/day in 1961/70 to 43 g/capita/day in 2001/07. Similarly, the supply of animal fat was on rise from 2.41 g/capita/day in 1961/70 to almost double (4.74 g/capita/day) in 2001/07 however, in the period of 1981/90, the rise in animal fat supply reached 6.3 g/capita/day. The overall supply of the different food groups in KSA is in continuous rise from 881 g/capita/day in the period of 1961/70 to more than double (1735 g/per capita/day) in the period of 1981/90. However, the total supply dropped to 1594 g/capita/day compared to the 80s level and started to increase again during the period of 2001/07 but not yet reaching the level of a1735 obtained during the 80s period.

The Saudi diet is essentially composed of cereals, milk, eggs, fruit and vegetables. Fruit and vegetables provide good sources of micronutrients, but the supply of meat and fish, which are other good sources of micronutrients, is limited.

Trend Supply of major food groups (Cereals, Vegetables, Fruits, Milk and Meat) during the period from 1990-2007: The supply of almost all food groups in KSA was least during the 60s and 70s periods, while the 80s decade witnessed the boom in the increase in the supply of most of the food groups compared to previous decades. However, during the period from 1990 up to 2007 (Fig. 1) a dramatic shift is observed in the supply of the major food groups in the Kingdom, for instant, the supply of vegetables showed a sharp drop from over 400 g/capita/day in the year 1990 down to less than 250 g in the year 2000. The vegetable supply then started to improve during the subsequent years (2001/04) reaching about 300g but, again showed a reduction pattern reaching 278 g/capita/day in 2007 (Fig. 2).

Fruits supply was slightly better than vegetable during the same period (1990-2007). Yet, showed a similar negative supply pattern as vegetable falling from its highest level (over 400 g) in 1990 down to the least level (267 g) in the year 2000, then started to gradually improve reaching just below 300 g but, again started to decrease during 2005/06 and reached 285 g/capita/day in the year 2007 (Fig. 2).

On the other hand, meat group showed steady, positive increasing supply pattern during the period from 1990 to 2007. During these two decades, meat supply increased from about 26 g/capita/day in 1990 up to 139 g/capita/day in 2007 with a percent increase of 435%.

Another increasing supply trend was observed for cereals during the same period (1990 to 2007). Cereals supply was just above 400 g/capita/day in 1990 and reached 450/capita/day in 2007, with a percent increase of 12.5%.

Cereals which constitute the main food group in terms of supply for human consumption in KSA showed a continuous increase in their per capita supply through these twenty year.

Dietary energy supply, distribution by macronutrient and diversity of the food supply: Table 2 Showed that in 2007, the dietary energy supply (DES) was 3078 kcal/capita/day, which exceed the level well meeting population energy requirements of 2100 kcal per capita/day. The share of protein, in the dietary supply has remained stable from 1961/70 to 2001/07. While the share of fats showed an increase trend from just 15% in 1961/70 up to 1981/90 and stabilized at 25% up to the 2001/07 period. However, the share of carbohydrates in the dietary supply has decreased from 75% in 1961/70 to 64% in 2001/07 (Fig. 3). Currently, the share of fat is adequate in comparison to recommendations (energy from lipids not exceeding 30%) (WHO, 2000).

The share of meat to macronutrient (protein and fats) supply in g/capita/day during the period from 1961 to 2007 was shown in Fig. 4. For both proteins and fats there was clear steady increase in supply particularly for

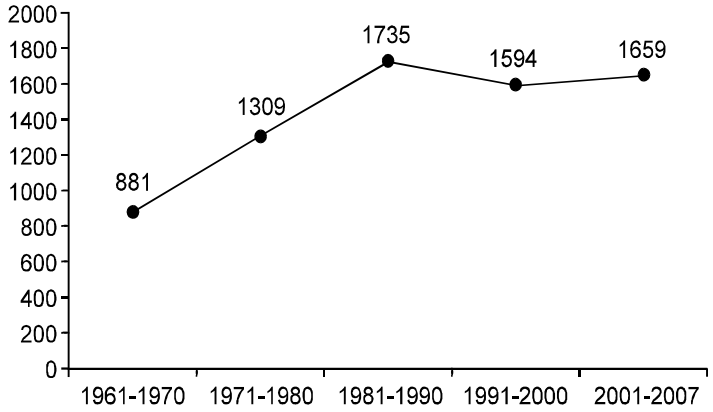

Fig. 1: Cumulative overall food supply (g/capita/day), trend in KSA in five decades (1961-2007)

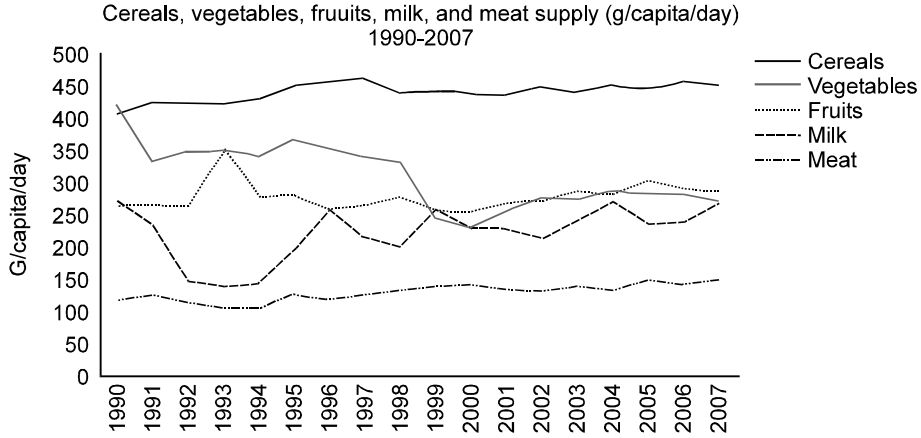

Fig. 2: Supply trend of the major food groups in KSA during the period from 1990-2007

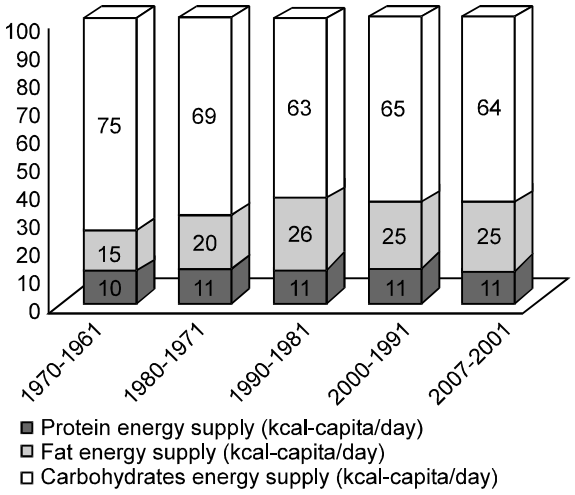

Fig. 3: Dietary energy supply (DES), trends and distribution by macronutrient

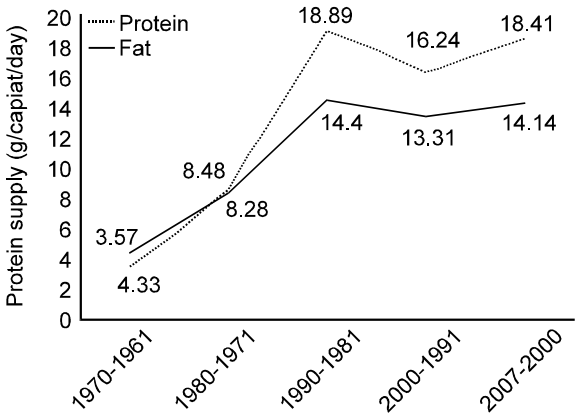

Fig. 4: Share of meat to micronutrients (protein and fat) supply (g/capita/day), 1961-2007

protein which increased from 3.57 to 18.41 g/capita/day. During the same period the share of meat to fats reached its maximum (14.4/capita/day) during the period from 1981-1990 then, start to drop during the period from 1991-2000. However during the period of 2001/07 the amount of fat contributed by meat started to increase and reaching 14.1 g/capita/day.

Table 2: Share of the food groups in Dietary Energy Supply (Kcal/capita/day), 1961-2007

	1961-1970		1971-1980		1981-1990		1991-2000		2001-2007	
Food groups	Amount	DES (%)	Amount	DES (%)	Amount	DES (%)	Amount	DES (%)	Amount	DES (%)
Cereals-excluding beer	1230	66.7	1110	52.6	1300	45.9	1466	50.6	1496	48.6
Starchy roots	4	0.2	10	0.5	16	0.6	33	1.1	36	1.2
Sugar crops	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sugar and sweeteners	115	6.2	184	8.7	305	10.8	279	9.6	306	10.0
Pulses	23	1.3	25	1.2	33	1.2	32	1.1	40	1.3
Tree nuts	1	0.1	3	0.1	6	0.2	6	0.2	8	0.3
Oil crops	21	1.1	23	1.1	19	0.7	16	0.6	15	0.5
Vegetable oils	79	4.3	144	6.8	335	11.8	339	11.7	380	12.4
Vegetables	31	1.7	63	3.0	87	3.1	88	3.0	70	2.3
Fruits-excluding wine	180	9.8	240	11.4	230	8.1	210	7.2	233	7.6
Stimulants	3	0.2	7	0.3	13	0.4	9	0.3	14	0.5
Alcoholic beverages	0	0.0	1	0.1	4	0.1	1	0.0	0	0.0
Milk-excluding butter	62	3.3	108	5.1	159	5.6	132	4.5	152	4.9
Aquatic products	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Meat	54	2.9	111	5.3	198	7.0	190	6.6	207	6.7
Animal fat	19	1.0	37	1.7	49	1.7	34	1.2	35	1.2
Offal	4	0.2	6	0.3	10	0.3	12	0.4	12	0.4
Egg	3	0.2	12	0.6	25	0.9	19	0.6	17	0.6
Fish	6	0.3	11	0.5	15	0.5	11	0.4	15	0.5
Spices, Other	5	0.3	12	0.5	19	0.7	16	0.6	23	0.7
Miscellaneous	3	0.1	7	0.3	13	0.5	8	0.3	17	0.6
DES (kcal/capita/day)	1843	100	2110	100	2834	100	2898	100	3078	100

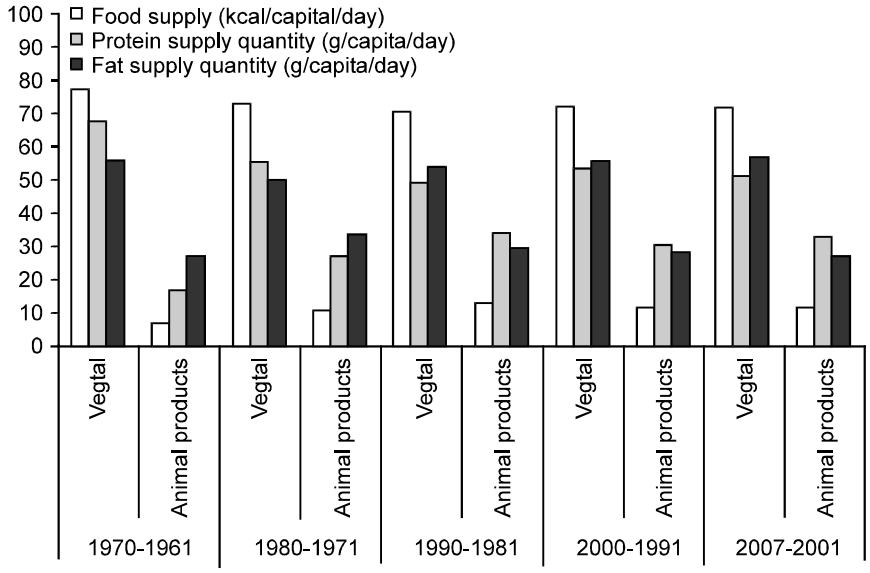

Fig. 5: Vegetable/animal origin of energy, protein and fats supplies (1961-2007)

Vegetal/animal origin of macronutrients: Macronutrients are essentially of vegetal origin, ranging from 92% for energy, 81% for protein to 67% for fat during the period of 1961/70. In the subsequent years fats from vegetal origin was more or less stabilized at 67-68% while fats from animal origin was at 33%. (Fig. 5).

Cereals provide almost half of the DES in KSA (49%) vegetables rank second (12%), sugar and sweeteners provide 10% of the DES. Thus, 71% of the energy supply comes from these 3 foods groups.

Share of the main food groups in the dietary energy supply (DES), trends: As depicted in Table 2, the share of cereals in the DES has decreased from 66.7% in 1961/70 to 48.6% in 2001/07, although the amount of cereals consumed during this period (from 1230 to 1496 g/capita/day) was slightly increased. There was a steady increase in the DES provided by starchy roots from 0.2% to 1.2% during the period from 1961/70 to 2001/07 with observed increase in g/capita/day (from 4 to 36). The part of non staple food groups in the DES can be classified into three categories, category number one, showed slight but steady increase in the DES during the

period from 1961/70 to 2001/07, provided by the member of this group including Sugar and Sweeteners (from 6.2 to 10%), vegetable oils (4.3 to 12.4%), Meat (2.9 to 6.7%), starchy roots (from 0.2 to 1.2%), stimulants (from 0.2 to 0.5%), offals (from 0.2 to 0.4%), Fish (from 0.3 to 0.5%), spices (from 0.3 to 0.7%) and miscellaneous (from 0.1 to 0.6%).

The second category showed fluctuation in its share to DES however, the general feature that link the members of this group that, they all reached their maximum contribution to DES during the period from 1981-1990. The members of this group include, milk group which, was 3.3 in the period of 1961/70; reached 5.6% in the period of 1981/90 then, started to decrease to 4.5% in 1991/02 and was 4.9% in 2001/07). Egg group was 0.2% in 1961/70; reached 0.9% in the period of 1981/90 then, started to decrease to 0.6% in 1991/02 and up to 2001/07. The group which include animal fat their share in DES was 1.0% during 1961/70 with amount reached 19 g/capita/day, the contribution to DES reached its maximum during the period of 1981/90 which was 1.7% (49 g/capita/day). However, the following periods up to 2007 the share to DES stabiles at 1.2% (35 g/capita/day). The third category includes vegetables which started sharing to DES at 1.7% during 1961/70 then stabilized at about 3% during the whole periods from 1971 to 2000 however, in the period of 2001/07 the share sharply decreased to 2.3%. Fruits are also included to this category as its share to DES started off at 9.8% during the period of 1961/70 and reaching 11.4% in the period of 1971/80. However, their share to Des started to decrease gradually reaching 7.6% in the year 2007. However, some food groups such as pulses, showed no changes in their DES contribution during the period from1961/70 to 2001/07(1.3%). The contribution of meat to the dietary energy supply has increased from 54 kcal/person/day during 1961-1970 to 207kcal/person/day in 2001-2007.

Share of the main food groups in the protein supply:

The main food groups contributing to protein supply in 2007 where cereals (48%), meat (22%), milk (10.4%), vegetables (3.5%), fruits (3%), pulses (3%), eggs and offal (4%) and fish (2.7%) (Table 3).

This result clearly indicates that, the major sources of protein supply were the plant sources (55.5%) including cereals, fruits and vegetables and pulses compared to about 40% for the animal-origin sources. The trend through the years 1961 to 2007 is indicating reduction in the percentage share of cereals from about 70% in the 60s to 48% in 2007. Pulses share was at 3% in the 60s then declined steadily up to 2.6% in 90s and to 3% in 2007 i.e., no significant observable change throughout these decades. As for fruits and vegetables, both showed an increase in the share in the year 1961 and reaching its maximum during the periods of the 80s then declined steadily up to the year 2007. The share of the meat was exceptional with regards to its continuous increase in their share throughout the decades where, in the 60s it was 7.4, 15% in the 70s, 20% in the 80s, 20.6% in the 90s and finally 22% in the year 2007.

The share of milk (excluding utter) was 7.3% in the 60s, reach its maximum (13.8%) during the 80s then, declined to 10.4% in the year 2007. Similar trend was

Table 3: Share of the main food groups in the protein supply

	Share of the food groups in protein Supply (g/capita/day), 1961-2007									
	1961-1970		1971-1980		1981-1990		1991-2000		2001-2007	
	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)
Cereals-excluding beer	33.26	69.3	29.71	52.1	34.81	44.63	39.71	50.27	40.33	48.01
Starchy roots	0.08	0.17	0.18	0.32	0.26	0.33	0.52	0.66	0.59	0.70
Sugar crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sugar and sweeteners	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulses	1.50	3.13	1.63	2.86	2.15	2.76	2.04	2.58	2.60	3.10
Tree nuts	0.00	0.00	0.07	0.12	0.19	0.24	0.19	0.24	0.23	0.27
Oil crops	0.67	1.40	0.66	1.16	0.49	0.63	0.60	0.76	0.56	0.66
Vegetable oils	0.04	0.08	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Vegetables	1.21	2.52	2.35	4.12	3.90	5.00	3.65	4.62	2.91	3.47
Fruits-excluding wine	1.81	3.77	2.54	4.46	2.54	3.26	2.34	2.96	2.59	3.08
Stimulants	0.46	0.96	0.59	1.04	0.67	0.86	0.41	0.52	0.64	0.77
Alcoholic beverages	0.00	0.00	0.00	0.00	0.03	0.04	0.00	0.00	0.00	0.00
Milk-excluding butter	3.50	7.29	6.84	12.00	10.73	13.76	7.57	9.58	8.70	10.36
Aquatic products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Meat	3.57	7.44	8.48	14.88	15.89	20.37	16.24	20.56	18.41	21.92
Animal fat	0.00	0.00	0.02	0.04	0.01	0.01	0.01	0.01	0.00	0.00
offals	0.61	1.27	0.85	1.49	1.40	1.79	1.65	2.09	1.71	2.04
Egg	0.23	0.48	0.87	1.53	1.87	2.40	1.41	1.78	1.33	1.58
Fish	1.12	2.33	1.56	2.74	2.21	2.83	1.64	2.08	2.30	2.74
Spices, Other	0.14	0.29	0.31	0.54	0.53	0.68	0.43	0.54	0.63	0.75
Miscellaneous	0.13	0.27	0.24	0.42	0.50	0.64	0.30	0.38	0.76	0.90
Protein supply (g/capita/day)	48	100	57	100	78	100	79	100	84	100

Table 4: Share of the Main Food Groups in fat Supply (g/capita/day), 1961-2007

	Share of the Main Food Groups in fat Supply (g/capita/day), 1961-2007									
	1961-1970		1971-1980		1981-1990		1991-2000		2001-2007	
	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)
Cereals-excluding beer	8.16	26.32	7.02	14.94	8.58	10.46	9.51	12.04	9.44	10.85
Starchy roots	0.00	0.00	0.00	0.00	0.03	0.04	0.10	0.13	0.10	0.11
Sugar crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sugar and sweeteners	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulses	0.15	0.48	0.17	0.36	0.21	0.26	0.22	0.28	0.29	0.33
Tree nuts	0.10	0.32	0.24	0.51	0.52	0.63	0.48	0.61	0.66	0.76
Oil crops	1.84	5.94	2.08	4.43	1.80	2.20	1.38	1.75	1.34	1.54
Vegetables oils	8.93	28.81	16.24	34.55	37.88	46.20	38.27	48.44	42.99	49.41
Vegetables	0.23	0.74	0.49	1.04	0.70	0.85	0.66	0.84	0.51	0.59
Fruits-excluding wine	0.53	1.71	0.81	1.72	0.88	1.07	0.82	1.04	0.86	0.99
Stimulants	0.06	0.19	0.33	0.70	0.84	1.02	0.61	0.77	1.01	1.17
Alcoholic beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Milk-excluding butter	3.13	10.10	4.94	10.51	6.61	8.06	7.02	8.89	7.87	9.05
Aquatic products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Meat	4.33	13.97	8.28	17.62	14.40	17.56	13.31	16.85	14.14	16.26
Animal fat	2.16	6.97	4.13	8.79	5.51	6.72	3.84	4.86	3.99	4.58
Offals	0.16	0.52	0.20	0.43	0.33	0.40	0.39	0.49	0.40	0.46
Egg	0.23	0.74	0.84	1.79	1.78	2.17	1.36	1.72	1.24	1.43
Fish	0.19	0.61	0.41	0.87	0.63	0.77	0.41	0.52	0.56	0.64
Spices, Other	0.23	0.74	0.54	1.15	0.85	1.04	0.68	0.86	0.96	1.10
Miscellaneous	0.16	0.52	0.15	0.32	0.24	0.29	0.15	0.19	0.56	0.64
Fat supply (g/Capita/day)	31	100	47	100	82	100	79	100	87	100

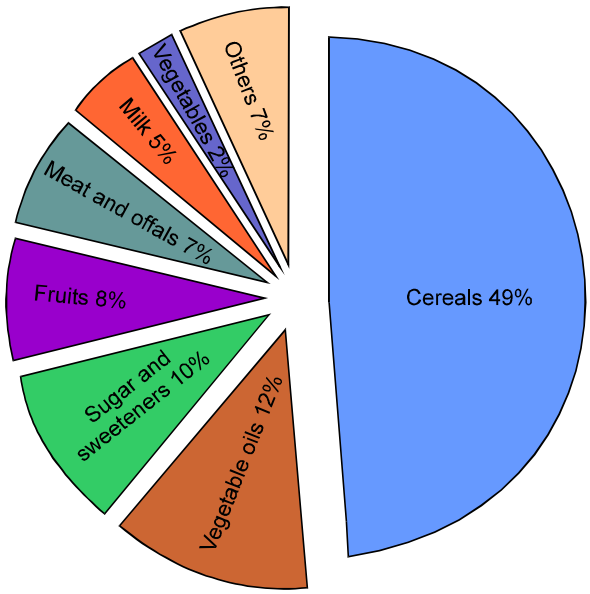

Fig. 6: % Contribution of major food groups to dietary energy supply (DES), Kcal/capita/day (2001-2007)

observed for eggs which were 0.5% in the 60s, reaching 2.4% in the 80s then declined to 1.8% in the 90s and 1.6% in 2007. The share of fish to protein in general was relatively low compared to other sources but particularly animal sources. However, the trend was similar to milk and eggs where in the 60s it was 2.3% reaching 2.8% in the 80s then 2.1% in the 90s and up to 2.7% in 2007.

Therefore, the most noticeable observation here is the increase in the share of meat throughout the period from 1961 to 2007 accompanied with consistent reduction in the share of cereals, fruits and vegetables.

Share of the main food groups in fat supply (g/capita/day), 1961-2007: The main food groups contributing to fat supply were vegetable oils (49.4%), cereals (10.9%), meat (16.3%), milk (9.1%) and animal fat (4.6%). The share of vegetable oils was on steady increase since 1961 (28.9%) up to 46% in the 80s and

to 49.4% in the year 2007. The share of meat on the other hand showed fluctuation, when it was 14% in the 60s then increased up to 17.6% during the 70s and 80s decades and then showed a decline pattern to reach 16.9% in the 90s and 16.3% in 2007. The share of milk (excluding butter) was more or less stable between 10% in the 60s and 70s then 8% in the 80s and 90s and up to 9.1% in 2007. The share of animal fat showed a general slight reduction from 7% in the 60s to 4.6% in the year 2007. The share of cereals to fat supply showed steady reduction from its highest share (26%) in the 60s to 15% in the 70s, 10.5% in the 80s, 12% in the 90s and 11% in 2007 (Table 4).

REFERENCES

Al-Kanhal, M.A., I.S. Al-Mohizea, A.I. Al-Othaimeen and M.A. Khan, 1999. Nutritive value of various rice based dishes in Saudi Arabia. Ecol. Food Nutr., 38: 223-235.

Al-Kanhal, M.A., I.S. Al-Mohizea, A.I. Al-Othaimeen and M.A. Khan, 1999. Nutritive value of various breads in Saudi Arabia. Int. J. Food Sci. Nutr., 50: 345-349.

Al-Mohizea, I.S., E.I. Mousa and M.A. Al-Kanhal, 1995. Bread consumption pattern in Riyadh area. Bull. Fac. Agri. Uni. Cairo., 46: 417-428.

Central Department of Statistics, 2011. Censuses statistics, Kingdom of Saudi Arabia.

Central Department of Statistics, 2011. GDP Growth rate. Kingdom of Saudi Arabia.

Drewnowski, A. and B.M. Popkin, 1997. The nutrition transition: new trends in the global diet. Nutr. Rev., 55: 31-43.

FAO, 2012 FAOSTAT, Food Balance Sheets Data, available online on FAO Website: http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368#ancor. Updated: 29 June 2012. Last access 17 February, 2014.

Hunger, 2009. Nutrition and human security. Arab human development report.

KACST, 1995. Evaluation of the nutritional status of the people of Saudi Arabia. Final report. King Abdulaziz city for science and technology, Riyadh.

Khan, M.A. and M.A. Al-Kanhal, 1997. Food availability and quality of diet in Saudi Arabia. Pak. J. Agri. Res. http://informahealthcare.com/doi/abs/10.1080/096374899101076?journalCode=ijf.

Khan, M.A. and M.A. Al-Kanhal, 1998. Dietary energy and protein requirements for Saudi Arabia. A methodological approach. EMHJ, 4: 68-75.

Kuhnlein, H.V., 1989. Culture and ecology in dietetics and nutrition. J. Am. Diet., 89: 1059-1060.

MAF, 2001. Production and consumption estimates for the period from 1992/93 to 1999/02. Ministry of Agriculture and forestry, department of planning and agricultural economics, food security section. Khartoum.

Saudi Arabia and Population, 2007. Worldmark encyclopedia of nations. Encyclopedia.com. (November 14, 2012).

WHO, 2000. Obesity: preventing and managing the global epidemic. WHO technical report series, No. 894). Report of a WHO consultation, WHO, Geneva (2000).

WHO, 2011. WHO global report, 2011. Non-communicable diseases country profiles.