



Report of the IUR Task Group “Radioecology in Arid Regions”

MODARIA Working Group 4

Food Consumption rates and habits, agricultural practices in arid and semi-arid countries

Review

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Contents

1. Introduction	3
2. Nutrition of Population of Arid Zones.....	3
3. Dietary habits of the people in the Arab world	4
4. Countries.....	7
4.1 KINGDOM OF BAHRAIN.....	7
4.2 EGYPT	9
4.3 THE HASHEMITE KINGDOM OF JORDAN.....	13
4.4 ROYAUME DU MAROC.....	16
4.5 SYRIAN ARAB REPUBLIC	18
4.6 RÉPUBLIQUE TUNISIENNE.....	20
4.7 STATE OF KUWAIT	22
4.8 PALESTINIAN WEST BANK	25
4.9 NOMADS	26
4.10 SUMMARY	28
4.11 ANNEX.....	29

1. Introduction

The knowledge of agricultural praxis and of consumption habits of the local population is one of the most important parameters when estimating radiation exposure by radioactive materials. Contamination of agricultural products leads to internal exposure through ingestion. Depending on the agricultural practices in the area of contamination and the stage of growing or harvest season at the time of the deposition, grains, root crops, other produce, and animal-derived food products may become contaminated directly or/and at a later stage. Food intake rates will determine internal radiation exposures essentially.

2. Nutrition of Population of Arid Zones

(From: Food of people, Andrej Koslov, Book, ISBN: 5-85099-155-7, 2005,
<https://www.livelib.ru/book/1000112572-pischa-lyudej-andrej-kozlov>)

The territory is defined as arid when the evaporation of moisture from its surface exceeds the amount of precipitation. There are various variants of arid biota: tropical and extratropical deserts, semi-deserts and steppes, arid savannahs. Each of them is characterized by a specific amount of precipitation, the ratio of dry and wet seasons, biomass, etc. The influence of high temperatures, increased ultraviolet irradiation, significant diurnal temperature changes, dry air, severe wind regime affects the peculiarities of the energy balance of the indigenous population.

A particular threat in the desert is the lack or scarcity of water. High dryness of air leads to rapid dehydration of the body. The average relative air humidity in the deserts is about 30% (in the tropical rain forest it reaches 80 - 100%). The effect on the body of dry air is exacerbated by constant winds. Desert winds are often combined with a significant increase in air temperature and, therefore, lead not only to additional loss of moisture, but also to overheating of the organism (a known expression - "the wind in the desert does not bring coolness"). Physiological adaptation to acute dehydration in humans is not produced, and the main way to combat the lack of moisture remains the choice of behavioural strategies and types of nutrition that allow to save water.

The predominantly carbohydrate diet reduces urination, hence, reduces moisture loss. Protein food, by contrast, increases thirst. This feeling can be dulled if the necessary amount of animal proteins and fats will come in the form of liquid food. One of the optimal products in this situation is the milk of domestic animals, which provides the body not only with water, but also with fats, carbohydrates and the most "high-grade" proteins.

Fats, in addition to performing the energy function, participate in the mechanisms of water exchange. In particular, during their oxidation, metabolic water is released, which partially satisfies the body's needs for liquid. Thus, fats are one of the most important components of nutrition in tropical desert conditions. However, the availability of concentrated animal fats in

the desert is low, and their digestibility in the gastrointestinal tract is somewhat reduced because of the heat.

Many species of desert animals "store" fats in their bodies (these are well-known sheepskin and jerboa, camel humpbacks, fatty fibre of the tail of lizards and lizards), spending them for obtaining metabolic water. Examples of such adaptation options are also known in man. The indigenous population of the deserts of South-West Africa (Bushmen) is characterized by a significant development of adipose tissue in the buttocks: in medicine, this phenomenon is called steatopygia.

3. Dietary habits of the people in the Arab world

Several factors have been found to determine the dietary habits of the people in the Arab world. Food consumption pattern has dramatically changed in some Arab countries as a result of sudden increase in income from oil revenue. It is believed that food subsidy policy has adversely affected the food habits in the Gulf states by encouraging the intake of fat, sugar, rice, wheat flour and meat. Socio-cultural factors such as religion, beliefs, food preferences, gender discrimination, education and women's' employment all have a noticeable influence on food consumption patterns in this region. Mass media, especially televised food advertisements, play an important role in modifying the dietary habits. The migration movement, particularly that which was carried out during the 70s has a great impact on the food practices in many Arab countries (A.O.Musaiger, 1993).

The Arab region covers 21 countries extending from the Gulf in the East to Morocco in the West. These countries are varied in geography, climate, population, economic and health status. Economically they can be divided into 3 categories, high per capita income group such as oil-producing countries (Gulf countries) which are also characterized by low infant mortality and higher health standards; and middle per capita income such as Iraq, Jordan, Syria, Tunisia and Lebanon and low per capita income group which include Egypt, Yemen, Somalia, Sudan, Djibouti and Mauritania.

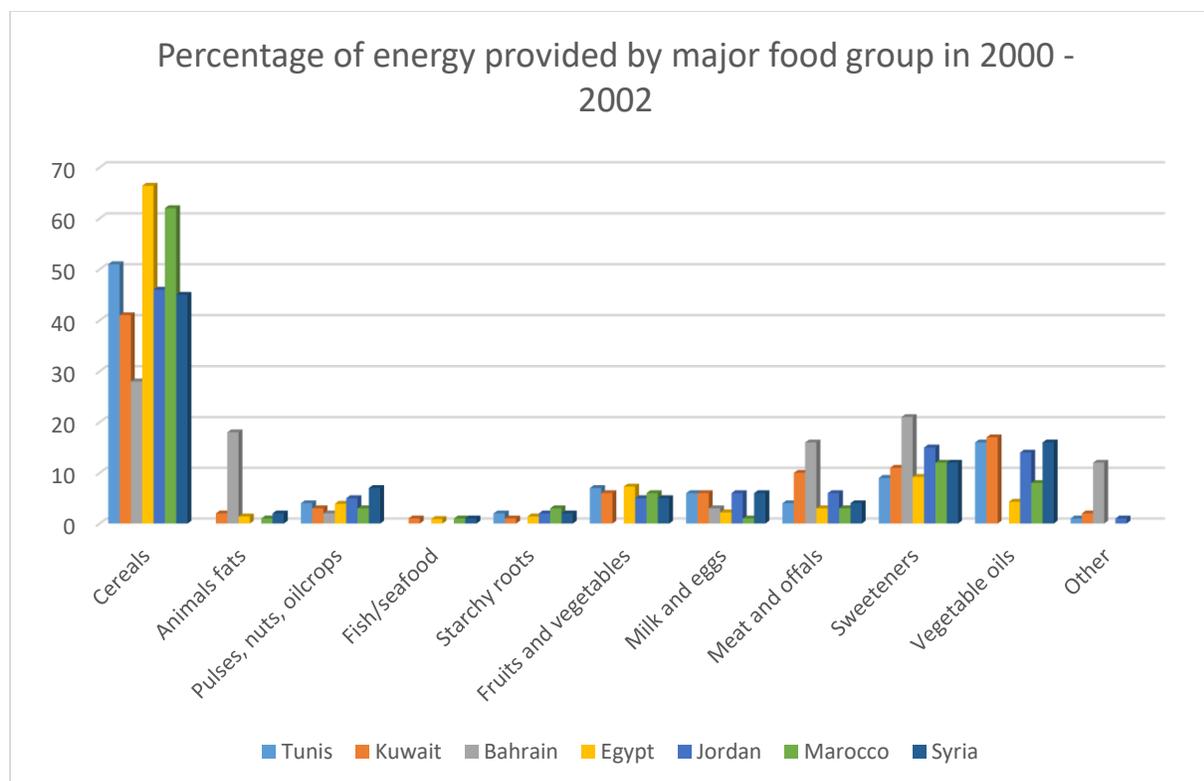
The high-income countries showed a marked rise in the consumption of meat, milk, eggs and cereals during 1976- 1980. The change in meat consumption exceeded 200% during this period. In Saudi Arabia, the change reached almost 500%. In other countries, the rise in meat consumption ranged from 12% in the North part of Yemen (formerly Yemen Peoples Democratic Republic) to 97 % in Jordan. Milk showed a similar trend, but the percentage change was lower than that of meat. The change in the consumption of milk in high-income countries ranged from 155% in Kuwait to 350% in Saudi Arabia whereas the average change in other countries ranged from 85 % in Jordan to 18% in Lebanon. Although the high-income countries had the highest growth rates in egg consumption, other countries, such as Syria and Tunisia, also experienced a

rapid growth of egg consumption, mainly due to the development of their poultry industries. The consumption of cereal was also highest in the high-income group [*Khalidi, 1984*].

At low-income levels, the cheap foods such as potatoes, bread, sugar and rice are the main source of energy. As incomes rise, people switch to more expensive foods such as meat, poultry, fruits and luxury foods (Tangerman, 1986). A recent study in Kuwait showed that, as household income increased, the availability of meat, fish, milk, eggs, fruits and vegetables increased (Kamel and Martinez, 1984). Analysis of the situation, however, is more complex because the income distribution within the population is unequal.

Unlike in urban areas, the food consumption patterns in rural areas are less varied and depend largely on food locally produced. The difference between the dietary habits of rural and urban populations can be seen in many parts of the region. In Egypt, for example, wheat bread is consumed mostly in urban areas, while bread made from a mixture of wheat and maize flours is consumed in rural areas (Ramadan, 1986). Fresh milk is consumed more frequently by urban families and fermented milk is used more by rural families (El-Nockrashy et al,1986). It was reported that 98% of the rural households in Lebanon made their own bread compared to only 10% of the urban ones. Most of the rural families ate meals together and all meals started earlier in the day as compared to those of urban dwellers (Al-Isi et al 1975). In Jordan, the consumption of milk and milk products, meat, fruit and sugar was found to be less among refugee families than other families living in cities (Patwardhan and Darby, 1972).

Religion has a greater impact on the food habits of the people than economic or other factors. Every religion in the world exhibits some food restrictions and preferences. The majority (more than 90%) of the people in the Arab countries are Muslim, the rest being Christian, Jewish, or members of African tribal cults (as in southern Sudan) (Moore, 1970). Islam forbids the consumption of pork which is rarely found in the region, and is not available in some countries, such as in Saudi Arabia and Kuwait. However, pork is marketed in the countries with native Christian populations such as Egypt, Lebanon and Tunisia, and, to some extent, Syria and Iraq.



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4. Countries

<http://www.fao.org/faostat/en/#data/FBS>

4.1 KINGDOM OF BAHRAIN

Agriculture

Despite the difficulties faced by agriculture in Bahrain because of infertile soils, scarcity of irrigation water, and a limited supply of skilled workers, production has increased due to growth of cultivated areas and irrigation. This growth occurred as the Ministry of Municipalities and Agricultural Affairs adopted different strategies such as providing farmers with mechanical equipment and seeds at low prices. The Directorate of Agriculture also provides training to farmers for better production, focusing mainly on overcoming problems related to water scarcity and soil quality. In order to develop the poultry industry, the Ministry also established a shareholding company which produces poultry and eggs. Many private sector farmers are working in this field (CIO, 2003). Nevertheless, the food production of Bahrain fulfils only a small fraction of the country's food needs.

Table 2: Land use and irrigation

Type of area	Estimate	Unit	Reference period	Source
Total Land Area	72	1000 Ha	2004	HID
Agricultural Area	14	%	2002	FAO
Arable lands & Permanent Crops	8	%	2002	FAO
Permanent Crops	6	%	2002	FAO
Permanent Pasture	6	%	2002	FAO
Forested land areas	n.a.	-	-	-
Irrigated agricultural land	6	%	2002	FAO
Arable & Permanent cropland	<1	Ha per agricultural inhabitant	2002	FAO

N.B. Percents are calculated on the total land area.

n.a.: not available

Main crops, agricultural calendar, seasonal food shortage

In 2002, the major food commodities produced in Bahrain were cow milk, dates, fresh fruits, tomatoes and eggs (FAO, Statistics Division). Tomato production increased from 2 048 tons in 2001/2002 to 3 067 in 2002/2003. Cabbage production increased in the same period from 677 to 842 tons. Similar increases were achieved in the production of lettuce, green onions, okra, cantaloupes and cow milk (CIO, 2003).

Crop Calendar

Foods are usually available all year around. However, for many locally produced vegetables, prices fluctuate throughout the year.

Livestock production and fishery

Industrial and non-industrial fisheries are the main source of local fish supply. This has allowed Bahrain to become self-sufficient in fishery products and to develop exports of sea products. The

Directorate of Fisheries provides fishermen with training and essential support such as low profit financial loans, suitable seaports, and safe shelter for boat keeping (CIO, 2003).

Table 3: Livestock and fishery statistics

Livestock production and fishery	Estimate	Unit	Reference period	Source
Cattle	11 000	number of heads	2003	FAO
Sheep and Goats	59 000	number of heads	2003	FAO
Poultry Birds	470	thousands	2003	FAO
Fish catch and aquaculture	13 641	tons	2003	FAO

Food consumption patterns

Traditional staple foods of the Bahraini diet are rice and other cereals accompanied by fish, meat and poultry. Large scale changes in foods patterns have occurred in the last 30 years. There has been a massive “westernization” of dietary patterns due to the recent economic development of the country. Consumption of rice and other cereals, as well as fish, appear to have decreased while the intake of red meat, chicken, eggs and milk has increased. These changes are due to income growth and improved standards of living as well as to the increasing urbanization and rapid development of the food processing industry. Processed foods are more available than before and snacking is becoming very common. Fast-food consumption has increased, even in families where a domestic helper is available. Also, eating out has become a common habit, particularly during week-ends and holidays, as it is a pleasant way of socializing. To a large extent, these changes are considered to be making food habits unhealthy. There is much discussion about the role played by fast food and take-away restaurants in changing food habits of Bahrainis. Food served in these restaurants, which are rapidly multiplying, is relatively cheap. However there hasn’t been any specific assessment of their contribution to overall energy and fat intakes in Bahrain. Soft drinks are also very cheap and are frequently considered as contributing to excess energy intake. Larger portions and loss of control over the composition of meals are other issues considered as potential contributing factors to increased fat and energy intake. There are no major differences in food habits between urban and rural areas. In addition, Bahrain has no food availability or food access problem and all types of food and international cooking are available. Bahrainis still enjoy sharing meals with the whole family. The average number of meals is 2-3 per day, with 2-3 additional unhealthy snacks (deep fried stuffed pastry, soft drinks, traditional sweets like *halwa*, *baklava*, dumplings, etc). Most families join their relatives for a weekly meal, which is longer and richer both in quantities and quality of food than regular everyday meals and therefore leads to an increased food intake. Adolescents are at high risk of overnutrition as their food habits are becoming unhealthy. Girls are more aware of their body image, and this can lead them to adopt risky dietary patterns, such as unbalanced restrictive diets (e.g. low carbohydrate/high protein diets, very low calorie diets) without medical supervision.

Supply of major food groups

No data are available on supply of major food groups at national level. Consequently, statistics regarding the per capita dietary energy supply are not available. At national level, energy requirements are estimated at 2230 kcal per capita per day¹.

Food imports and exports

In Bahrain, less than 10% of the food consumed by the population is locally produced and most of the food imports are under government control.

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4.2 EGYPT

Agricultural production, land use and food security

Agriculture remains one of Egypt's most important economic sectors. However, the sector's contribution to GDP shrank from 20% in 1986/87 to 17% in 1998/99. The number of Egyptians employed in the agricultural sector also fell from 50% of the total labour force to the current level of 32%. Despite productivity gains since the mid-1980s, Egypt remains one of the world's largest food importers (AAFC, 2001).

In Egypt, farming is confined to less than 4% of the total land area because the country falls within arid and hyper-arid zones. About 90% of the agricultural area is concentrated in the Nile delta and the rest is located within a narrow ribbon along the Nile between Aswan and Cairo (Upper Egypt) and a strip along the Mediterranean. In 2000, agricultural land represented 0.049 ha per person and 0.049 ha per person as arable and permanent cropland.

Cultivated lands in the desert and along the coast increased by 43% from 1986 to 1993, due to reclamation of desert and coastal lands. Nevertheless, the relative scarcity of arable land, coupled with, among other factors, high population growth, makes Egypt dependent on external sources for about half of its food supply (U.S. Department of State, 2000).

As part of a national land reclamation project, the government started one of the world's largest planned agricultural developments in Toshka in January 1997. The project aims to double the size of Egypt's arable land in fifteen years' time. The project's estimated cost is around \$86.5 billion over the coming 20 years until 2017 (U.S. Department of State, 2001).

By the end of the 1980's, the self-sufficiency ratio was only around 20% for wheat, lentils and edible oil. The major basic staple for which Egypt did not rely on external supply sources was rice. The country also produced most of its poultry and eggs requirements. On the whole, it imported more than one-half (65%) of the food consumed and food imports made up about one-quarter of total imports.

Egypt continues to espouse a policy of self-sufficiency in wheat production by encouraging the expansion of acreage and the use of newly developed high-yielding wheat varieties. The present status is much better, almost reaching 55% self-sufficiency. A contributing factor is mixing of corn (20%) with wheat for subsidized balady bread (Ministry of Supply 2001). Although total planted area did not increase in 1999, the production of wheat is estimated to be higher than 1998 (U.S. Department of State, 2001).

In recent years, Egypt's farmers have realized major increases in the exports of high value crops such as grapes, melons, strawberries and potatoes. USAID programs have supported specialization in the agricultural sector and export expansion through technological assistance, managerial training, and the dissemination of market information to farmers. These activities have contributed significantly to increased productivity, employment generation, rural income growth and poverty alleviation (USAID, 2001).

The food and nutrition situation

Dietary pattern

Different types of bread were consumed daily by almost 100% of the households. The most commonly used was the subsidized wheat bread, followed by wheat-maize home backed bread in rural areas. However, consumption of home-made bread decreased from 81% in 1981 to 29% in 2000 among rural families. Also, it decreased among urban families from 40% to 3% within 19 years' period (Aly et al., 1981).

Food items consumed daily by more than 50% of total households were: wheat bread (97% of households), tea (99%), ghee or butter (97%), sugar (91%), milk (58%), powdered milk (61%) and vegetables (52%).

Almost all families in both urban and rural areas consume 3 meals daily. Lunch was the main meal for the majority of urban households (88%) and for 57% of rural households. Table shows mean per caput daily intake of different food groups in the study governorates as obtained by the quantitative food frequency method (Hassany, 2000). Mean per caput daily intake of cereals in the total sample was 434.3 g, with higher intake among rural (488.3 g) areas. The highest intake of cereals was in Fayoum rural areas (513.1 g) and the lowest was in Cairo governorate (385.9 g). Mean per caput daily intake of roots and tubers was 215.4 g in the total sample. Also consumption of roots and tubers was higher in rural areas, compared to urban areas (227.5 g and 208.5 g) respectively. The lowest intake was in Cairo governorate (197.1 g) and it increased gradually in other governorates to reach 247.2 g in rural area of Souhag governorate. For pulses, the mean intake was 54.5g in total rural areas and 52.7 g in total urban areas. Variation in pulses consumption was minimal within different governorates and ranged from 50.6 g in Sharkia rural areas to 63.5 g in urban areas of Souhag governorate. Consumption of fruits and vegetables was higher in rural (142.0 g) than in urban areas (119.5 g), with a mean intake of 128.2 g for the whole of the sample. Mean fat and oils intake was 39.7 g for the total sample, with a slightly higher intake among urban than rural areas (40.5 g, 38.5 g) respectively. Mean meat intake was higher

among rural (102.9 g) areas, compared to urban areas (80.9 g). The mean intake was 89.4 g for the whole of the sample (Hassanyn, 2000).

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4.3 THE HASHEMITE KINGDOM OF JORDAN

Agricultural praxis

Observers expected food imports to remain necessary into the indefinite future. Much of Jordan's soil was not arable even if water were available; by several estimates, between 6 percent and 7 percent of Jordan's territory was arable, a figure that was being revised slowly upward as dry-land farming techniques became more sophisticated. In 1989 the scarcity of water, the lack of irrigation, and economic problems, rather than the lack of arable land set a ceiling on agricultural potential. Only about 20 percent of Jordan's geographic area received more than 200 millimetres of [rainfall](#) per year, the minimum required for rain-fed agriculture. Much of this land was otherwise unsuitable for agriculture. Moreover, rainfall varied greatly from year to year, so crops were prone to be ruined by periodic drought.

In 1986 only about 5.5 percent (about 500,000 hectares), of the [East Bank](#)'s 9.2 million hectares (230 million acres) were under cultivation. Fewer than 40,000 hectares (100,000 acres) were irrigated, almost all in the Jordan River valley.^[1] Because arable, rain-fed land was exploited extensively, future growth of agricultural production depended on increased irrigation. Estimates of the additional area that could be irrigated were Jordan to maximize its water resources ranged between 65,000 and 100,000 hectares (160,000 and 250,000 acres).

Most agricultural activity was concentrated in two areas. In rain-fed northern and central areas of higher elevation, [wheat](#), [barley](#), and other field crops such as tobacco, [lentils](#), [barley](#), and [chick peas](#) were cultivated; olives also were produced in these regions.^[1] Because of periodic drought and limited area, the rain-fed uplands did not support sufficient output of cereal crops to meet domestic demand.

In the more fertile Jordan River valley, fruits and vegetables including [cucumbers](#), [tomatoes](#), [eggplants](#), [melons](#), [bananas](#), and [citrus](#) crops often were produced in surplus amounts.^[1] The Jordan River Valley received little rain, and the main source of irrigation water was the [East Ghor Canal](#), which was built in 1963 with United States aid.

Jordan had about 35,000 head of cattle but more than 1 million [sheep](#) and 500,000 [goats](#), and the government planned to increase their numbers. In the late 1980s, annual production of red meat ranged between 10,000 and 15,000 metric tons, less than 33 percent of domestic consumption. A major impediment to increased livestock production was the high cost of imported feed. Jordan imported cereals at high cost for human consumption, but imported animal feed was a much lower priority. Likewise, the arid, rain-fed land that could have been used for grazing or for fodder production was set aside for wheat production. Jordan was self-sufficient, however, in poultry meat production (about 35,000 metric tons) and egg production (about 400,000 eggs), and exported these products to neighbouring countries.

(https://en.wikipedia.org/wiki/Agriculture_in_Jordan)

Characteristics of national food production

Jordan can be divided into four physiographic regions starting from the West and running from North to South: the Jordan Rift Valley which is the food bowl of Jordan for fruit and vegetables (Alqaisi et al., 2009), the Highlands where agriculture is mostly rainfed, the plains, and the Badia desert region in the east, which represents about 80% of the total country area (FAO, AQUASTAT, 2008). Jordan is one of the ten most water-poor countries in the world (IFAD, 2007). Only about 4% of the total land area is arable, mostly in the northwest and central areas; about 84% of this is rainfed and the rest is irrigated (UNDP, 2010a). The major share of local agricultural production consists of fruit and vegetables (tomatoes, cucumber, citrus fruits, bananas, etc.), which is the production that receives the most support from the Government. Potatoes and olives are also produced in rather large quantities. Local production of cereals has decreased considerably since the early 1960s while that of starchy roots, animal products and fruit/vegetables has increased substantially over the same period (FAO, FAOSTAT, 2011). Smallholder agriculture still suffers from poor market linkages and limited marketing facilities (IFAD, 2007).

Livestock-keeping (mainly sheep and goats) is an important activity in the rainfed, semi-desert areas (IFAD, 2007). However, production of meat is limited, though the production of poultry is active. Local production of milk is not sufficient to meet local demand (FAO, FAOSTAT, 2011). The marine fishing industry in Jordan is small and artisanal, while aquaculture production is expanding (FAO, Fisheries and Aquaculture Department, no date).

Jordan is dependent on food imports and thus particularly vulnerable to international food price shocks. The total food import bill has more than tripled between 1995 and 2008 (FAO, 2010).

Table A.1: Food consumption data

Survey name and date (Reference)	Region	Survey population: households/ individuals	Sample characteristics			Average food consumption									
			Age (years)	Sex	Sample size	Major food groups (g/person/day)									
						Cereals	Starchy roots	Pulses, nuts & oilcrops	Fruit & vegetables ¹	Oils & fats	Meat & offals	Fish & seafood	Milk, dairy products & eggs	Sugar & derived products	
Household Expenditure and Income Survey 2008 (Mar. 2008-Feb. 2009) (DoS, 2009)	Total	Households	All	M/F	12768	483	67	n.a.	412	40	150	11	n.a.	n.a.	
	Urban	Households	All	M/F	n.a.	471	65	n.a.	447	41	150	12	n.a.	n.a.	
	Rural	Households	All	M/F	n.a.	538	73	n.a.	368	34	151	8	n.a.	n.a.	
							Nutrient intake (per person/day)								
							Energy (kcal)	% from protein	% from lipid		Protein (g)	% protein from animal origin		Lipid (g)	% lipid from animal origin
							n.a.	n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
							Percentage of energy intake provided by								
							Cereals	Starchy roots	Pulses, nuts & oilcrops	Fruit & vegetables	Oils & fats	Meat & offals	Fish & seafood	Milk, dairy products & eggs	Sugar & derived products
							n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

n.a.: not available (methodological issues)

¹: Canned fruits, canned vegetables, lettuce and parsley mint are not taken into account in this food group as they were expressed in piece. Their quantity is however limited.

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4.4 ROYAUME DU MAROC

Agriculture praxis

Morocco is endowed with numerous exploitable resources. With approximately 33,000 square miles (85,000 square km) of arable land (one-seventh of which can be irrigated) and its generally temperate [Mediterranean climate](#), Morocco's agricultural potential is matched by few other Arab or African countries. It is one of the few Arab countries that has the potential to achieve self-sufficiency in food production. In a normal year Morocco produces two-thirds of the grains (chiefly wheat, barley, and corn [maize]) needed for domestic consumption. The country exports citrus fruits and early vegetables to the European market; its [wine industry](#) is developed, and production of commercial crops (cotton, sugarcane, sugar beets, and sunflowers) is expanding. Newer crops such as tea, tobacco, and soybeans have passed the experimental stage, the fertile Gharb plain being favourable for their cultivation. The country is actively developing its irrigation potential that ultimately will irrigate more than 2,500,000 acres (10,000 km²).

Agriculture in Morocco employs about 40% of the nation's workforce. Thus, it is the largest employer in the country. In the rainy sections of the northwest, [barley](#), [wheat](#), and other cereals can be raised without irrigation. On the Atlantic coast, where there are extensive plains, olives, citrus fruits, and wine grapes are grown, largely with water supplied by artesian wells. Morocco also produces a significant amount of illicit [hashish](#), much of which is shipped to [Western Europe](#). [Livestock](#) are raised and forests yield cork, cabinet wood, and building materials. Part of the maritime population fishes for its livelihood. [Agadir](#), [Essaouira](#), [El Jadida](#), and [Larache](#) are among the important fishing harbors.

Moroccan agricultural production also consists of orange, tomatoes, potatoes, olives, and olive oil. High quality agricultural products are usually exported to Europe. Morocco produces enough food for domestic consumption except for grains, sugar, coffee and tea. More than 40% of Morocco's consumption of grains and flour is imported from the [United States](#) and [France](#).

Agriculture industry in Morocco enjoyed a complete tax exemption until 2013. Many Moroccan critics said that rich farmers and large agricultural companies were taking too much benefit of not paying the taxes and that poor farmers were struggling with high costs and are receiving very poor support from the state. In 2014, as part of the Finance Law, it was decided that agricultural companies with a turnover of greater than MAD 5 million would pay progressive corporate income taxes.

Nevertheless, the danger of drought is ever present. Especially at risk are the cereal-growing lowlands, which are subject to considerable variation in annual precipitation. On average, drought occurs in Morocco every third year, creating a volatility in agricultural production that is the main constraint on expansion in the sector.

Droughts are most commonly the main concern for farmers in Morocco due to the major agricultural production that is a massive part of Morocco's economy.

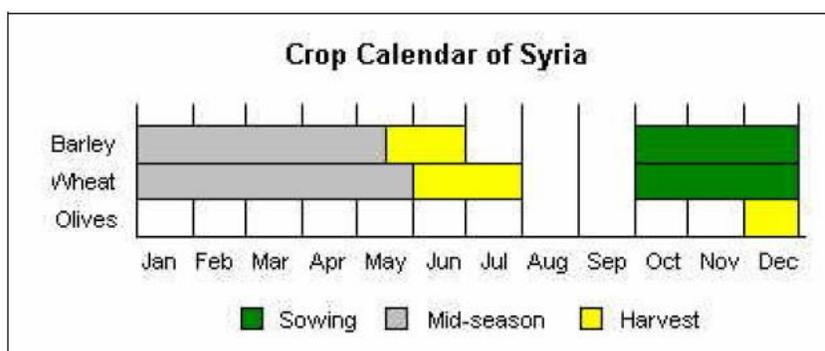
https://en.wikipedia.org/wiki/Agriculture_in_Morocco

4.5 SYRIAN ARAB REPUBLIC

Agriculture

In the past decades until the outbreak of the Syrian civil war, the agricultural sector has been the focus of the efforts of the Syrian government. Nearly one third of the country is cultivated, of which a third is irrigated (SCBS, 2004). The barren nature of much of the land and the scarcity of water resources, including low rainfall, hinder agricultural development (IFAD, 2004). Syria achieved self-sufficiency in the food sector in the early 1990s, and is now able to export fruit and vegetables. Another promising agricultural product is olive oil. In 2000, the olive crop showed a fourfold increase over the yield of 1991. In 2003, the production of cereals and dry legumes showed a four-fold increase over the yield of 1999 (SCBS, 2004). The government aims at expanding and diversifying food production and thus supports irrigated agriculture, in addition to encouraging the practice of double cropping. Syria's agro-business sector can benefit from an influx of modern farming technology and effective de-rocking techniques (IFAD, 2004).

The 5 major food and agricultural commodities produced by Syria in 2002 were wheat, sugar beets, cow milk, olives and barley (FAO, Statistics Division). Wheat and cow milk are mainly destined to local human consumption, sugar beets are used as animal feed and in the food industry. Olives are mainly destined to food industries, and barley is mainly used as animal feed (FAO, FAOSTAT Database).



Source: USDA, 2002.

Due to the diversification in food production, there is no food shortage throughout the year.

Agricultural development in Aleppo province, Syria (Ecology of food and Nutrition, V. 20, pp.197-210 (1985))

Crop	High rainfall Zone			Low rainfall Zone		
	N	Area (ha)	Yield (ton/ha)	N	Area (ha)	Yield (ton/ha)
Wheat	23	4.6	1.7	17	1.9	0.4
Barley	26	3.1	1.3	31	3.5	0.4
Lentils	25	1.9	0.7	-	-	-
Chickpeas	3	1.2	0.6	-	-	-
Faba beans	4	0.6	0.9	-	-	-

Livestock production and fishery

Syria has a large livestock production. Livestock is raised by both settled farmers and nomadic herders (IFAD, 2004). Dairy cattle represent the main share of livestock and are mainly kept close to towns where prices of dairy products are good and where water is available for forage production. Sheep, raised in the steppe, and goats, raised in the mountain ranges close to forested areas, are also an important part of the country's livestock resources (FAO, 2001).

Table 3: Livestock and fishery statistics

Livestock production and fishery	Estimate	Unit	Reference period	Source
Cattle	866 675	number of heads	2002	FAO
Sheep and Goats	14 429 367	number of heads	2002	FAO
Poultry Birds	28 969	thousands	2002	FAO
Fish catch and aquaculture	15 166	tons	2002	FAO

Food consumption

National level surveys Food consumption data are not available. Household income and expenditure surveys have been conducted in Syria but intake of food is not documented. According to the household income and expenditure survey of 1996/97, food expenditure represented 57% of total expenditures, with an equal share in urban and rural areas. Overall, high expenditures were for meat, fish and eggs (21%) followed by vegetables (17%) and cereals (16%). In urban areas, the highest expenditures were for meat, fish and eggs (23%) while in rural areas they were for cereals (19%) (SCBS, 1997).

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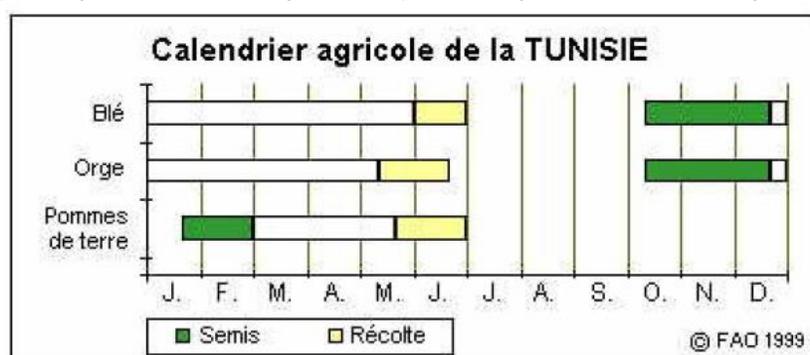
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4.6 RÉPUBLIQUE TUNISIENNE

Agricultural praxis

Tunisia produces mainly cereals (15% of total agricultural production), olive oil (10% of total agricultural production), citrus fruits and dates, mainly for export. The production of vegetables (mainly tomatoes and potatoes) is mainly for local consumption.



Source : SMIAR/FAO

Animal production and fishing

Approximately 71% of farmers use livestock in different forms: 55% practice sheep farming, 32% breed cattle and 29% goat farming. Self-sufficiency in milk and derivatives, chicken meat and eggs has been achieved, thanks in particular to efforts to control animal health and to improve the conservation of products.

Fish and livestock production is increasing to meet increased domestic demand. Export, processing and marketing of fish and seafood products is growing.

<http://www.fao.org/faostat/en/#data/FBS>

Food supply quantity (kg/capita/year)		
Wheat and products	2013	197.5
"Cereals	2013	0.78
Potatoes and products	2013	30.97
"Sweeteners	2013	0.68
Other and products"	2013	6.51
Nuts and products	2013	5.86
Olives (including preserved)	2013	2.35
Olive Oil	2013	3.15
"Vegetables	2013	154.64
"Fruits	2013	32.1
Mutton & Goat Meat	2013	5.34
Poultry Meat	2013	18.5
"Meat/offals	2013	2.3
"Butter Ghee"	2013	0.64
Animals fats	2013	0.5
Eggs	2013	7.67
Milk - Excluding Butter	2013	114.47

Tableau 13 : Données de consommation alimentaire

Nom et date de l'enquête (Références)	Région	Population déduite: ménages/individus	Effectif	Consommation alimentaire moyenne									
				Principaux groupes d'aliments (g/personne/jour)									
				Céréales	Tuber-cules	Légumi-neuses, noix & oléagineux	Fruits/ Légumes	Huiles/ Grasses	Viande & abats	Poisson & fruits de mer	Lait, produits laitiers & oeufs	Sucres et dérivés	
Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, 2000 (INS, 2004)	Total	Ménages	5 928	494	56	28	470	66	68	18	138	48	
	Urban	*	3 635	442	59	30	506	67	80	24	162	49	
	Rural	*	2 293	582	50	23	409	65	47	9	99	47	
	Grand Tunis	*	1 003	434	60	34	533	66	85	20	189	52	
	Nord Est	*	829	457	73	29	448	70	67	16	142	47	
	Nord Ouest	*	825	578	56	32	443	66	63	6	149	52	
	Centre Est	*	195	457	61	24	510	71	78	40	131	43	
	Centre Ouest	*	836	591	37	23	426	57	46	7	90	47	
	Sud Est	*	618	463	42	18	416	64	56	12	109	46	
	Sud Ouest	*	622	550	51	32	397	64	58	6	113	50	
	Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, 1990 (INS, 1993)	Total	Ménages	3 852	538	56	25	455	69	55	19	119	48
		Urban	*	2 219	465	65	22	494	72	67	27	142	49
Rural		*	1 633	646	42	28	404	64	36	8	87	46	
Grand Tunis		*	651	473	72	34	495	63	72	20	172	53	
Nord Est		*	493	510	71	23	492	74	54	17	132	46	
Nord Ouest		*	705	612	45	24	342	58	47	3	121	47	
Centre Est		*	704	478	60	21	505	87	59	48	59	43	
Centre Ouest		*	547	670	31	26	488	61	30	6	28	43	
Sud		*	752	523	50	16	390	67	56	12	65	53	
Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, 1980 (INS, 1983)		Total	Ménages	2 948	576	53	29	345	43	46	15	121	40
		Urban	*	1 304	490	60	31	381	44	62	24	135	39
		Rural	*	1 644	670	44	26	311	43	29	5	105	40
	Grand Tunis	*	445	480	58	31	390	44	66	15	180	42	
	Nord Est	*	410	566	74	35	345	45	49	12	128	42	
	Nord Ouest	*	599	648	39	26	286	34	38	2	149	41	
	Centre Est	*	580	538	77	32	354	56	49	41	74	31	
	Centre Ouest	*	481	686	28	22	352	38	28	3	110	35	
	Sud	*	441	571	45	24	352	39	44	9	70	42	

4.7 STATE OF KUWAIT

Agriculture

Due to soil infertility, water scarcity, unfavourable climate and lack of trained labour force, the agricultural sector plays a minor role in the Kuwaiti economy. Out of 17 818 km² of national territory, only 1 538 km² are used for pasture, trees and crops. With the exception of fishery products, Kuwait is totally dependent on imports for its food supply (MOP, 2004a).

The government has been carefully managing farms and experimenting hydroponic systems. However, most of the soil which was suitable for farming in south central Kuwait was heavily polluted during the 1991 Gulf war, when the destruction of oil wells in the area created vast "oil lakes".

The main food and agricultural commodities produced in Kuwait in 2002 were fresh vegetables, cow milk and poultry meat (FAO, Statistics Division). All these commodities were destined to local human consumption (FAO, FAOSTAT).

Winter, summer and semi-perennial crops include fruits, leafy vegetables, tubers and pulses. Vegetables such as tomatoes, cucumbers, lettuce, bell peppers, etc. and fruit such as strawberries are grown in green houses and in some cases exported to neighbouring countries. The food processing industry is well developed but the domestic production remains small in comparison with the volume of food imports (MOP, 2004a).

Livestock production and fishery

Livestock production is an important component of the agricultural sector and contributes about 67 percent to total agricultural GDP, as compared to 23 percent for plant production and 10 percent for fisheries.

The Persian Gulf is a rich fishing area. Kuwait uses the latest technologies for the development of this important resource. Fish and crustaceans are plentiful in territorial waters, and large-scale commercial fishing is undertaken locally and in the Indian Ocean (MOP, 2004a).

Food consumption

Community based surveys on dietary intake are urgently needed to provide valid estimates of energy and nutrient intake of the Kuwaiti population.

Due to the discovery of oil and gas resources, Kuwait showed rapid changes in the lifestyle and standard of living within the span of one generation. The changes in food patterns were due to increased family income, availability of various foods in local markets, food advertisements and lack of proper nutrition education and knowledge. Increase in the local production and imports of various foods from all over the world made available a great abundance and variety of foods in local markets at reasonable prices. According to a survey investigating food consumption patterns and dietary habits in Kuwait (Al-Awadi et al., 1997), illiterate mothers cook food themselves while graduate mothers depend on their parents and maids to cook for them. Fast foods - such as hamburgers, fried chicken and onion rings - are frequently consumed by educated families.

National level surveys

A Kuwait Nutrition survey has been approved by the Kuwait Institute for Advancement of Sciences and initiated in August 2006. It consists in a cross sectional survey including 1 600

households (10 000 Kuwaiti subjects). Food consumption data are collected using the 24 hour recall and a food frequency questionnaire. The objectives are to assess prevalence of micronutrient deficiencies (of iron, folate, iodine, vitamin A and vitamin D), to identify contributing factors to specific nutrition related health problems and to enable the government to develop policies and implement intervention programmes. Results have not yet been published.

Other surveys

A study based on a semi quantitative food frequency questionnaire was conducted in 2003-2004. It included 152 food items and the participants, aged between 18 and 65 years, reported their frequency of food intake over the past year. The reported average intake was 2.8 servings per day for fruits and 3.2 servings per day for vegetables. Participants reported eating cereals 5.3 times per day (Dehghan et al., 2005). Intake of fruit and vegetables are insufficient and need to be increased substantially to comply with recommendations (WHO/FAO, 2003).

Food	Consumption rates (g/person/day)
Cereals - Excluding Beer	395
Oil crops	11
Vegetable Oils	42
Vegetables	471
Starchy Roots	55
Treenuts	6
Pulses	19
Spices	8
Meat	227
Animal Fats	11
Offals	9
Eggs (Food Groups)	35
Milk - Excluding Butter	274
Fruits - Excluding Wine	151
Sugar & Sweeteners	98
Stimulants	11

<https://knoema.com/atlas/Kuwait/topics/Food-Security/Food-Consumption/Fish-Seafood>;
2007

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4.8 PALESTINIAN WEST BANK

(Below is the excerpt of a publication which summarizes the food consumption patterns in the Palestinian West Bank population)

Food consumption patterns in a Palestinian West Bank population

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Table 1 Mean (s.d.) household consumption of 25 selected foods, by wealth status^a

Food item	Mean (s.d.) (kg/consumption unit/y)			Test for trend ^b	Overall (n = 367)
	Poor (n = 95)	Middle (n = 224)	Wealthy (n = 48)		
Olive oil	17.4 (10.0)	18.6 (10.3)	19.3 (9.8)	<i>P</i> = 0.2	18.4 (10.1)
Vegetable oil	3.2 (5.7)	3.1 (4.9)	3.8 (6.6)	<i>P</i> = 0.9 ^c	3.2 (5.3)
Margarine	5.0 (3.2)	5.3 (4.0)	5.1 (5.1)	<i>P</i> = 0.7 ^c	5.2 (4.0)
Sum fats/oils	25.7 (11.2)	27.1 (11.3)	28.1 (13.4)	<i>P</i> = 0.2	26.9 (11.6)
Red meat	9.1 (8.6)	10.3 (8.6)	16.0 (13.6)	<i>P</i> < 0.001	10.8 (9.6)
Cold cuts	3.1 (4.0)	4.8 (4.6)	5.5 (5.6)	<i>P</i> = 0.002 ^c	4.4 (4.7)
Chicken	48.9 (33.2)	55.1 (29.5)	61.1 (27.1)	<i>P</i> = 0.02	54.3 (30.3)
Fish	5.8 (4.9)	6.8 (5.7)	7.3 (6.6)	<i>P</i> = 0.009	6.6 (5.6)
Eggs	15.2 (12.2)	15.1 (8.2)	17.0 (9.7)	<i>P</i> = 0.4	15.3 (9.5)
Sum	82.1 (44.5)	92.1 (37.1)	107.0 (37.6)	<i>P</i> < 0.001	91.5 (39.8)
Milk, fresh	6.4 (11.0)	8.6 (17.2)	7.7 (16.0)	<i>P</i> = 0.9 ^c	7.9 (15.6)
Dried milk	0.7 (2.0)	1.5 (3.5)	3.9 (10.5)	<i>P</i> = 0.06 ^c	1.6 (4.8)
Labaneh ^d	6.0 (7.1)	6.8 (7.0)	10.1 (8.3)	<i>P</i> < 0.001 ^c	7.1 (7.3)
Yoghurt	9.8 (11.8)	12.3 (10.9)	10.6 (10.2)	<i>P</i> = 0.4	11.4 (11.1)
White cheese	2.0 (2.9)	2.8 (4.1)	4.8 (9.0)	<i>P</i> < 0.001 ^c	2.8 (4.9)
Yellow cheese	0.9 (1.7)	1.3 (2.3)	2.5 (3.2)	<i>P</i> = 0.1	1.3 (2.3)
Sum dairy produce	25.8 (21.8)	33.4 (25.2)	39.6 (31.5)	<i>P</i> < 0.001	32.3 (25.6)
Lentils	4.2 (4.5)	2.9 (5.8)	2.0 (1.9)	<i>P</i> < 0.001 ^c	3.1 (5.1)
Chick peas	1.7 (2.4)	1.2 (2.0)	1.8 (2.7)	<i>P</i> = 0.2 ^c	1.4 (2.2)
Fava beans	1.8 (2.0)	2.2 (2.9)	2.4 (2.3)	<i>P</i> = 0.2 ^c	2.1 (2.6)
Peas	3.0 (3.6)	3.7 (4.4)	3.8 (4.8)	<i>P</i> = 0.5 ^c	3.5 (4.3)
Sum legumes	10.8 (8.4)	10.0 (8.7)	10.0 (7.2)	<i>P</i> = 0.5 ^c	10.2 (8.4)
White flour	67.9 (68.4)	69.9 (64.0)	54.3 (53.8)	<i>P</i> = 0.4 ^c	67.3 (64.0)
Brown flour	25.6 (31.6)	25.9 (28.9)	21.6 (24.9)	<i>P</i> = 0.7 ^c	25.2 (29.1)
Mixed flour	54.9 (74.9)	34.8 (61.4)	29.3 (52.8)	<i>P</i> = 0.05 ^c	39.3 (64.7)
Sum flours	148.4 (69.7)	130.6 (75.7)	105.2 (62.0)	<i>P</i> = 0.001	131.9 (73.5)
Rice	27.0 (13.6)	28.9 (15.7)	33.8 (19.3)	<i>P</i> = 0.02	29.1 (15.8)
Olives	2.6 (2.8)	2.7 (2.3)	3.3 (3.0)	<i>P</i> = 0.2	2.8 (2.5)
Sugar	37.3 (21.2)	38.1 (25.0)	37.4 (20.4)	<i>P</i> = 0.9	37.8 (23.5)
Salt	9.5 (6.5)	8.8 (4.8)	10.0 (10.2)	<i>P</i> = 0.9	9.1 (6.2)

^a Figures represent consumption (kg) per year per household member, with number of household members standardized as reference consumption units (expected energy expenditure for men aged 18–30 y).

^bFor variables where model assumption were violated, a Kruskal–Wallis non-parametric test was performed.

^c*P*-value for Kruskal–Wallis test.

^dPartially dehydrated yoghurt.

Objective: To describe the food consumption patterns in relation to wealth status and age groups in a Palestinian West Bank village population.

Design: Community-based cross-sectional survey of both households and individuals. A list recall method was used at the household level. At the individual level, a short food-frequency questionnaire was used in addition to a 24-h recall without estimates of portion sizes.

Setting: A Palestinian semi-rural village in the central West Bank.

Subjects: All households and all men and women aged 30–65 y in the study village were invited. All 368 households and 85% ($n = 500$) of eligible individuals participated.

Results: The mean energy consumption from 25 selected food items on household level was about 13.8 MJ (3300 kcal)/consumption unit/d (a consumption unit corresponds to the expected energy requirement for an adult male). The proportion of dietary energy from fat and the consumption of most animal products was highest among the wealthiest households, and the opposite trend was seen for the consumption of wheat flour and lentils. There seems to be an ongoing trend of increasing consumption of processed products rich in sugar among the younger age groups.

Conclusion: Shortage of dietary energy on the household level did not seem to be a problem in this population, even among the poorest. Differences in food consumption patterns between the poor and the wealthy, including a higher percentage of energy from fat among the wealthy, may be to the disadvantage of the wealthy with respect to some diet-related chronic diseases.

Sponsorship: The Norwegian Universities' Committee for Development Research (NUFU).

Descriptors: dietary survey; developing country; cross-sectional study; rural population; socio-economic factors

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<http://www.stockton-press.co.uk/ejcn>

4.9 NOMADS

Geographically, the Arabic countries region is characterized by desert, arable land and coastal areas which influence the dietary patterns of the residents. The desert area is inhabited by nomadic animal breeding tribes, who live mainly on cereal, dates, milk and milk products. The settled nomads consume cereal, pulses, some vegetables, and relatively less milk and fewer milk products. Meat is rarely consumed in the desert, being reserved particularly for occasions when guests have been invited or for feasts (Moore, 1970). However, the food consumption patterns may differ slightly from area to area based on the available food resources. In Iraq, nomads consume wheat bread, dates, ghee, milk and yoghurt. Rice is sometimes substituted for bread, and the only vegetable consumed is the onion (Al-ani, 1980). In arable areas, the inhabitants consume more vegetables and fruits, but the seasonal production has an impact on the type of food consumed. For example, in Egypt, the consumption of green vegetables, fruit and meat is higher in the Delta area than in oasis areas (Patwardhan and Darby, 1972). In coastal areas, fish plays an important role in the diet. The consumption of fish in Bahrain, Oman, Qatar, the United Arab Emirates and Southern part of Yemen is higher than in other countries in the region (Feidi, 1986). In contrast, fish consumption is almost negligible in countries which have limited coastal areas such as Syria (Alderman and vonBraun, 1986) and Jordan (Patwardhan and Darby, 1972) as well as in all desert areas.

Dietary habits of Nomads in Iraq are presented in publication of Majeed R. Al-Ani (Ecol. Of food and nutrition, 1980, v.9, 55-58).

Food	Amount consumed (g/day/capita)
Bread (markouk)	200
Wheat, whole	100
Dates, dried (Zahdi)	150
Date syrup (dibs)	50
Milk, camel	200
Yoghurt (Laban)	200
Ghee (Sann)	50

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Differences in food intake between adult Jews and Bedouins in Southern Israel

(Drora Fraser et al. Ethnicity & disease v.18, February 2008, 13-18)

The Negev region in southern Israel is the home of two subpopulations, Jews and Bedouins, each with its own culture, and socioeconomic and educational systems. The Jewish population in Negev is mostly urban and of lower socioeconomic status than Jews in Israel as a whole; a high percentage of the Jewish population are new immigrants from the former Soviet Union. The Bedouins are a Muslim population in transition from a nomadic to a settled lifestyle and are at the lowest socioeconomic level of all population groups in Israel. These residents, who account for <25% of the Negev population, are on average younger than Jewish residents in the region and in the country as a whole. The Negev Jewish population has a higher educational

level than does the Bedouin population, and Bedouins also have higher rates of unemployment and lower monthly incomes than do the Jewish population.

Age-adjusted intake of food groups per day per person in grams

Food group	Males			Females		
	Jews n=348	Bedouins n=56	P	Jews n=445	Bedouins n=113	P
Oils, butter, margarines	7.1 (.7)	6.1 (2.0)	.66	6.3 (.5)	3.9 (1.1)	.05
Alcohol	34.5 (7.3)	.0 (.0)	.10	9.6 (3.0)	.0 (.0)	.08
Legumes	38.3 (5.8)	59.3 (15.3)	.21	21.5 (3.2)	36.7 (6.4)	.04
Complex carbohydrates	289.3 (1.5)	481.5 (27.7)	<.001	209.9 (8.0)	330.2 (16.4)	<.001
Fruits	337.0 (23.4)	282.7 (62.0)	.42	301.8 (17.9)	340.3 (36.5)	.35
Vegetables	279.7 (13.7)	208.1 (36.2)	.07	247.6 (1.5)	208.6 (21.5)	.02
Meat	136.7 (8.1)	128.6 (21.4)	.73	93.4 (5.0)	106.1 (1.3)	.28
Milk & dairy products	206.7 (11.5)	112.3 (3.4)	.005	196.4 (8.6)	121.6 (17.5)	<.001
Fish	21.3 (3.5)	11.5 (9.2)	.33	17.8 (2.3)	8.3 (4.6)	.07
Eggs	22.8 (2.6)	34.0 (6.9)	.14	13.6 (1.6)	23.7 (3.4)	.008
Nuts	12.2 (1.7)	.5 (4.5)	.02	9.0 (1.2)	3.5 (2.5)	.05
Potatoes	58.3 (5.3)	23.5 (14.0)	.02	32.5 (3.2)	34.7 (6.6)	.77
Sweets	26.0 (1.5)	3.8 (3.9)	<.001	19.1 (1.2)	6.0 (2.4)	<.001
Soft drinks	153.8 (2.3)	41.1 (53.8)	.05	85.0 (13.8)	30.3 (28.2)	.09

Values are given as mean (standard error).

4.10 SUMMARY

Concerning agricultural practices and food consumption habits it is rather difficult if not impossible to recommend general food consumption baskets. As outlined above different cultural and environmental factors influence living conditions in arid regions and consequently require also rapid adaptation. Therefore for any estimation of contamination via food chains the optimal approach is to use consumption data and agricultural practise data from questionnaires reflecting the actual situation. This will also enable to identify the critical population groups and unusual pathways, which have to be considered in dose calculation models.

4.11 ANNEX

Philip Iddison, Arabian Traveller's Observations on Bedouin Food,

In *Food on the Move: Proceedings of the Oxford Symposium on Food and Cookery*, 1996. Devon England: Prospect books, Jan 1997; <http://www.enhg.org/alain/phil/bedouin/bedouin.htm>

badwiyyin - dwellers in the dessert

These characteristics of the land, reacting on the inhabitants, render them in great part of unsettled predatory habit, intensely individualistic, jealous of the secrets of water and pasture which barely make life possible, and proud of an exclusive liberty, which has never been long infringed. -- D.G. Hogarth (1904)^[1]

Arabia attracted a sparse number of adventurous travellers from the developing European countries from the sixteenth century to the middle of the present century. Their published accounts identify various attractions ranging through exploration, scientific studies, political or religious intrigue to early ethnographic studies. The latter often concentrated on the bedouin, a case of the traveller observing his fellow traveller. The accounts record a consistent view of the Arabian character and society, epitomised by the harsh realities of bedouin life and the more urbane life of towns and villages. There are passing references to the food of the local people and that introduced by the travellers but this is usually a subsidiary element of the account, subordinated to the traveller's tales of extreme hardship, the mercurial character of the bedouin and a fascination with their social customs. The latter were characterised by the two extremes of the rules of hospitality and the rules of raiding. Tales of the coffee hearth are common and this key element of bedouin life is remarkably consistent through the centuries of travel.

Practically every part of the Arabian peninsula, an area of some 3.2 million square kilometres, was occupied to some degree, from the well established trade and holy cities such as Jeddah, Mecca and Medina to the nomadic herdsmen of the vast sand deserts such as the Rub al Khali. However the bedouin seemed to dominate the Western perception of Arabia. This landmass included a variety of human habitations. Oasis villages and towns were scattered over the sand and stony deserts of the inland plateau. In the mountains on the southern and western fringes, altitude tempered heat, rain was more plentiful and a much more varied agriculture was possible. The Omani mountains sheltered groves of walnut and fruit trees and Yemeni valleys yielded sorghum and coffee. The long coastline had numerous trading ports and fishing villages where a rich haul of seafood was made ^[2].

Despite failing to conquer Arabia the Romans divided it into two provinces, *arabia felix* and *arabia deserta*. *Arabia felix* occupied the whole of the peninsula and effectively controlled the spice trade from the Indies in the period before reliable seaborne commerce

became established. It was also the only source of frankincense. *Arabia deserta* was the northern, Syrian desert [\[3\]](#).

From the start of the Islamic era in September 622, Arabia was practically inaccessible to non-Muslims. The few Westerners who did penetrate Arabia either posed as Muslims or travelled with trepidation as the population were frequently hostile to **kaffirs** (unbelievers).

The earliest account by a European traveller to the Arabian interior was by Ludovico di Varthema, a Bolognese adventurer who accompanied the **haj** caravan from Damascus in 1503 and who reached Yemen where he noted fair orchards, an abundance of vines, fat-tailed sheep and the spice trade.

The discovery of coffee in Yemen was to attract interest from all the main trading nations from the end of the sixteenth century, but trading houses and their European settlers remained in the coastal towns such as Jeddah, Aden and Mokha.

The first party with any aspirations to a scientific assessment of the interior was not mounted until 1762. Carsten Niebuhr was the only member of the party of six to return and his account was published in 1772. The party travelled in Yemen, only reaching as far inland as Sana but amongst many observations gave a detailed description of coffee cultivation which was then supplying the coffee houses of Europe.

The first crossing of Arabia was made by accident rather than by design and yielded little apart from confirmation of the stark terrain. Thereafter a number of travellers made significant journeys into the interior deserts and started to flesh out the lives of the bedouin. Charles Doughty (travelling 1876-8) provides a substantial amount of anecdotal information on the food culture of the bedouin. He travelled extensively in the Hejaz and Nejd, spending periods in oasis towns such as Hail and Kheybar as well as travelling with the bedouin. His observations establish a strong connection between the requirement of the bedouin to travel to find pasture for their flocks which were their economic wealth and sustenance and their frequent visits to the oasis towns which often extended into short periods of residence.

By the early twentieth century the only unexplored area of significance was the great sand desert called the Rub al Khali in the south-western portion of the peninsula and it was to yield little additional information on the food of the region when it was finally crossed in 1931 by Bertram Thomas.

With the advent of oil wealth, bedouin life changed dramatically from an austere existence in exacting terrain to nationality in new wealthy nations and a transition into the modern world in a single generation.

The Bedouin

Several travellers' reports of the bedouin culinary regime are influenced by the rules of hospitality. If the host were expansive or wanted to impress, the quality and quantity of food

offered would be lavish and hence create an unrealistic impression of routine consumption, not dissimilar to the situation in other cultures. However there would often be no backup supplies and playing host could seriously deprive the dependants of the host of their meagre rations or seriously deplete the host's flock. The dish of boiled mutton or camel calf served on rice or a "mess of wheat" ^[4], **mansaf**, would normally only be a festival or major family event dish for the bedouin ^[5]. Doughty, Thomas and Thesiger who travelled extensively with small parties of bedouin record a far more basic and monotonous diet. Commonly it was so ordinary that it did not warrant a mention in their journals.

Light breakfasts and occasional impromptu meals of game or for hospitality during the day are recounted but the main meal was usually taken at the end of the day, after the evening milking.

Bedouin culinary requirements ranged from the need to sustain a small group travelling independantly, probably with grazing flocks, to the provision for large tribal groups who might be settled in one area for several weeks. Access to fresh provisions might be close at hand in a nearby oasis or could be several days march away.

Thus bread, **'abud**, which was a staple, would be the simple mixing of flour with precious water from the waterskin (**girbeh**) to prepare dough to be cooked in the embers of the fire for wandering herdsmen. In a tribal encampment large quantities of **shirak** or **rukak** (thin unleavened bread) would be prepared and cooked on a **saj** (convex metal sheet), over a fire.

Small game was simply thrown on the fire to cook in its fur and was eaten in its entirety. On the other hand a butchered beast for a feast in a large camp would be cooked in a **jidda** or **qidr** (large stewpot) to be served with wheat or rice ^[6] and liberally drenched with rendered animal fat or molten butter (**samn**). Wheat is mentioned more in the nineteenth century accounts and seems to have been replaced by rice as the latter became more readily available through trade.

Cooking utensils were simple and robust. The **jidda**, made of tinned copper ^[7], came in a variety of sizes, large specimens were required to cook for feasts. It was accompanied by a shallow dish, **sahen**, for serving food. Wooden bowls and serving dishes were also used. Coffee making required its own utensils described below.

Much cooking was thus an improvised affair, three stones to make a tripod support and a search for dried plant roots in the desert sand or some dried camel dung, **jella**, for fuel.

With food resources at a premium there was little prospect of regular meals, one meal a day would be adequate and no meal was a common occurrence, perhaps a few dry dates and some camel milk sufficing. A bedouin herdsman could survive during the spring grazing, **rabia**, with the very barest of possessions. Doughty recounts meeting two young men several days from camp with their milch camels whose sole provisions were a cloak and stick each and one bowl between them so they could milk their camels for food and drink.

Hospitality

Bedouin hospitality made a great impact on Western travellers. The rules varied but the common version required that if anyone appeared at your camp who was not a sworn enemy, you were duty bound to provide at least a minimum of board and lodging for three and one third days. After that time your guest was required to leave and but was still under your guardianship for a further three days, the time it was believed to take for all the host's food to pass through the guest's body. Frequently a beast would be slaughtered for the first meal, as much to demonstrate the host's wealth and social standing and to uphold tribal honour which was on show on such occasions. Whilst this meal was being prepared, coffee or some other light refreshment such as dates and buttermilk would be served and the guest would be politely questioned to extract useful information. These gatherings were strictly male affairs, if women were in the encampment they would be segregated and would prepare the meal, although slaughter and butchery were men's work.

Meals were served on the ground to the guests first. Food was generally eaten speedily. Once you had taken your fill you would vacate your place at the food to allow someone of lower standing to have his turn. After rinsing your hands you would retire to wait for everyone to finish, after which more coffee would be served. After all the men had eaten any remaining food would be taken to the women and young children. A host would often abstain from eating, taking a supervisory role to ensure that the hospitality was worthy.

Staples

Bedouin food was dominated by a number of staple items. Apart from water these had to have certain characteristics. They had to be self mobile or at least economical to carry. They had to be readily preserved in the harsh climate which ranged from freezing ^[8] on the central uplands in winter to 55° Centigrade shade temperatures in the summer.

Apart from stock and their milk products the staple items were dates, wheat and rice, flour and **samn** (clarified butter).

Dates, **tamr**, were of prime importance to survival in the desert. They were ideal food, readily obtainable as they grew in all the oases, non-perishable, easy to consume, economical to transport, provided excellent nutrition as a balance to the other main dietary constituents and were relatively cheap. Thirty pounds of good dates cost 1 real (then equivalent to 4 shillings) in the 1870's whereas a goat cost 2 reals. Dates were also fodder for camels on a regular basis.

For a few months of the year during the date harvest, the fresh dates from the oases provided a welcome alternative to the the usual fare of dried dates.

*"the best stems, upon which hanged with the ripe, the half-ripe purple berries, which thus at the mellowing, and full of sappy sweetness, they call **belah**; the Arabs account them very wholesome and refreshing."* ^[9]

Ba-theeth, a preserve of parched flour, dried dates and **samn**, heated together and kneaded into a solid mass was prepared for use on journeys. It had excellent keeping qualities and did not require any further cooking.

Wheat was grown in Arabia in the marginal land where enough winter rain would fall or collect to grow the crop. There are references to **burghul** but it is not clear whether this is the true par-boiled grain or broken wheat boiled as a starch staple for meals. Wheat was cooked in a variety of ways including **harees**, a dish with the consistency of porridge but little of the appeal!

Rice has already been mentioned and there is an interesting aside by Doughty that one of his hosts begged enough water from his guest to cook the rice for the usual mutton meal.

Wheat was ground to flour for bread, hand querns were a possession of larger Bedouin groups. Barley meal is also mentioned as a bread ingredient and millet was grown in some oases although considered fit only for invalids. One dessert plant, **samhh**, yielded grain which could be used for bread, porridge or a version of **ba-theeth**.

Samn was a major commercial product of the bedouin herds which was sold in the villages and towns. Doughty travelled with a caravan from Aneyza to Medina taking the annual production of 30 tonnes ^[10] of **samn** in goatskin bags, each camel carrying about 170 kilos. The **samn** was prepared by churning either fresh goat or sheep's milk or yoghurt ^[11] in a skin which was inflated by blowing into it at regular intervals. The fresh butter (**zibdeh**) was heated with flour and occasionally coriander and cummin. Once the **samn** had been poured off into the storage skin (goatskin for commerce, **dubh** skin for personal use), the curds and flour were eaten and not wasted. A family with a modest herd could produce 250 kilos of **samn** during the winter season, worth £18 at Medina in the 1870's.

Yoghourt, **leban**, was also prepared and was drained and salted to make a sun-dried food for storage, **mereesy** or **jamid**. Initially like a cheese, which is mentioned by several travellers, the drained yoghurt eventually becomes rock hard and well deserves its description by Doughty as "*milk shards*". It was reconstituted by pounding in a mortar and mixing with water or sieving into hot water. As a travellers food it could be gnawed in its natural state.

Drinks

Water was a precious commodity. Throughout the interior it was only dependably found at some waterholes and at various springs associated with oases. There are no rivers in Arabia. On the rare occasions when a wadi was in spate due to heavy rain, the flow could be disastrous in its power and was likely to run for a day or two at most. With luck it would leave a few pools of water and would raise water levels in adjacent wells for a few months. There were only limited technical means of recovering ground water, the **haddaj** and **suany** or draw well driven by a camel or ox was the practical limit of mechanisation. Some permanent waterholes were 60 feet deep and required considerable effort to draw water with bucket and rope. If a large camel herd or caravan had to be watered the bedouin would work in relays for several hours, often with considerable fear of attack if there were **ghrazzu** (raiding parties) known to be in the vicinity.

The quality of the water was often poor. At frequently used waterholes several travellers noted the contamination of the water with urea percolating into the water source from the camel urine concentrated around the waterhole. Doughty comments on many sub-standard supplies "*brackish water ...thick well water full of old wafted camel droppings.....tasting like alum.....mawkish water causing illness in my companions.....salty bitter water.....water full of wriggling white vermin drunk through the lap of the kerchief.....muddy puddle water...*". Yet he claimed that he had never been ill from consumption of any of these doubtful sources.

Coffee, **kahwa**, was the prime social drink [\[12\]](#). The ring of coffee pestle on the mortar as the freshly roasted beans were crushed was the signal for men to gather at the coffee tent for the exchange of news and recounting of stories. Guests were received by the host who would frequently prepare the coffee himself.

"We sat down to drink coffee with the sheykh, Misshel, who would make it himself. This ruler of seven tribes roasted, pounded, boiled and served the cheerful mixture with his own hand. Misshel poured me out but one cup, and to his tribesmen two or three. Because this shrew's deed was in disgrace of my being a Nasrany, I exclaimed, "here is a great sheikh and a little kahwa!" Thus challenged, Misshel poured me out unwillingly, muttering some word of his fanatical humour".[\[13\]](#)

Coffee was always freshly roasted in a **mahmas** (roasting spoon) stirred with a **maqlab**. The roast beans would be cooled in a **mabradah**, a wooden tray. They were brayed in a **mihbash** or **nijirm** made of wood, iron or brass. In some bedouin families the coffee was brewed in a dedicated pot made of clay, **medlah**. It would be transferred to the classic beaked Arabian coffee pot of tinned copper or brass, **dalla** and served in small ceramic cups, **finjeyn**. It was often flavoured with cardamom.

Milk, **haleeb**, from camel, goat and sheep was consumed, although preference was for camel's milk. Of the three the camel's milk was drunk whole and the other two usually after the butter had been made. Doughty reports a hierarchy of bedouin views on the relative merits of the three milk sources:

*"Camel milk is the best of all sustenance, and the very best is that of the **bukkra**, the young camel with her first calf, as lightly purgative.*

*Ewe's milk is very sweet and fattest of all, it is unwholesome to drink whole, it kills people with colic ewe buttermilk should be let sour some while in the **semily** (butterskin) with other milk, until all are tempered together, and then it is fit to drink.*

Goat milk is sweet, it fattens more than strengthens the body."

These observations are borne out by modern analysis of the milk. An appended table compares the main characteristics with cow's milk from tropical breeds. Cattle were kept in the oases but are recorded as being of poor quality.

The dromedary cow has a gestation period of 370 to 375 days and only breeds every second year commencing at four years of age and continuing until 20 or so years of age. Calving is very seasonal coinciding with the winter rains and the presence of good feed stocks. The lactation period varies according to the camel's nutrition but is usually 18 months with yields of 1,000 to 3,000 litres per year and individual milkings up to 5 litres being common. The milk is rich in vitamin C which is of particular benefit to the bedouin who have little access to fresh fruit and vegetables. The milk diet was however not satisfying in some respects; bedouin complained to Doughty of the "*creeping hunger*" and begged him for "*Damascus kaak (biscuit), it is six weeks since I have chewed anything*".

Tea drinking was introduced at a relatively late stage but has become well established. Doughty may be held responsible in part for its introduction as he carried supplies for his own consumption and several times offered it to bedouin who had not tasted it before. They were generally unimpressed with the tea flavour, considering it insubstantial compared to coffee, but did enjoy the sugar ^[14].

Flocks

Bedouin existence depended on their herds and flocks. The camel was the supreme possession providing transport for man and his chattels, a mount for raids which would potentially add to his wealth, milk for food and drink, meat, hair and hides and dung for fuel. Camels were wealth and would rarely be slaughtered for meat. Any camel meat usually came from the slaughter of surplus bull calves or injured or sick beasts. Camels enabled man's penetration of the extensive desert areas as they are capable of sustained travel in search of pasture with only intermittent water supplies. After the winter rains, rich spring pastures provided enough moisture in the feed to enable camels to survive without access to water. Contrary to popular conceptions, camels do need regular feed to maintain satisfactory condition but this could be provided by meagre desert plants, some dates or even dried sardines traded up from the coast.

Where daily access to water could be assured, herds of goats and sheep were kept, primarily for milk and meat and also skins, hair and wool to make woven goods. There are references to fresh milk used for human consumption but apart from that dedicated to the rearing of young, **samn** production seems to have been the prime use. These herds were effectively tied to the permanent waterholes and oasis villages. Modern bedouin have overcome this handicap by using their four wheel drive vehicles to transport the water to the flocks. This is adding pressure to the limited amount of grazing.

The desert is remarkably fertile. Many plants are adapted to its demands, *halophyte* species are salt tolerant and *xerophytes* are drought resistant. Most of the seeds show remarkable long-term fertility ^[15]. A single thunderstorm can bring a flush of green plants which are established in a few days and will last for several months. A few days rain will trigger plant growth and revive dessicated shrubs that will be green for a year or two. The bedouin sought these rare storms in the deep deserts and would remember precisely where rain had fallen in recent months and hence there might be the chance of some pasture for their camels.

The bedouin were not recorded to consume desert plants on any regular basis. However they were aware of what was edible and would consume them on finding. Many plants were known to have medicinal or veterinary value and are mentioned. There are several plants which have water storage capabilities in the roots and these were known to the bedouin for emergency use. The dessert truffle, **faga**, was harvested and eaten.

Apart from the date palm which rarely produces useful fruit in the true wild state, some trees of the stoney and mountainous dessert produced edible fruit; **sidr** and **haybed** [\[16\]](#) are relatives of the jujube and produce significant quantities of edible fruit, **nabak** and **dom**. Another palm tree [\[17\]](#) has edible fruit, **mish**, that will keep for up to a year and are ground up to make a nutritious meal, eaten raw or cooked.

Game

Game formed an important element of bedouin food though it was not available on any regular basis and would at times be an item of last resort, such as the eating of carrion and the prohibited foods (**harram** rather than **halal**). The decimation of the game supply by hunting with high power rifles or automatic weapons from four wheel drive vehicles is a phenomenon of the last few decades and is slowly being reversed by a more enlightened view of the natural fauna.

Game was caught in a number of ways. Hunting **salukis** and several hawk species have been used for centuries and are a part of bedouin culture just about surviving to the present day. There are records of large traps in use since Chalcolithic times. They were constructed in the stoney deserts from converging drystone walls with a ditch behind. Gazelle were driven into the trap by beaters and in leaping over the wall some would be killed by the hunters or break limbs and be caught for slaughter. This illustrates a serious problem concerning game consumption for the strict Muslim, as all meat had to be slaughtered in a prescribed way and the carcass bled [\[18\]](#). The accounts show some laxity in this requirement, though given human nature it was usually ascribed to a neighbouring tribe with whom relations were not cordial or who were not considered to be true bedouin.

Matchlocks and rifles had become relatively common by the second half of the nineteenth century and were used for hunting. However their prime purpose was quite clearly for personal security or offensive action against fellow bedouin. Small game [\[19\]](#) such as jerboa and lizards could be dug out of burrows with a camel stick and some men were fleet enough of foot to run down the larger reptiles such as **dubh**, the spiny-tailed lizard which can grow to 60 cm long and whose tail is particularly good eating. Like most reptiles its flesh is likened to rabbit or chicken in taste and consistency. Sling shots and stones propelled from simple pop guns were also effective weapons in skilled hands.

Certain game had pre-eminent value to the bedouin, associated with the sporting element of the chase and kill. **Houbara** bustard was one such sought-after game-bird taken exclusively with hawks. The Arabian gazelle, **rim** and oryx were also esteemed [\[20\]](#). Conversely some game was not so welcome, gatta, sandgrouse were considered to be poor eating being dry-fleshed

birds. There are several references to the relish with which the bedouin would consume the cud from the stomach of ruminants such as gazelle.

Jarad (locusts) can probably best be considered as game. There are many references to the consumption of locusts; it seems to have been an item of horrible fascination for many of the European travellers.

"the children bring in gathered locusts, broached upon a twig, and the nomads toast them on the coals; then plucking the scorched members, they break away the head, and the insect body which remains is good meat." [\[21\]](#)

In the nineteenth century locust plagues were still a serious scourge for the Arabians. Doughty recounts passing a large locust swarm heading for the Teyma oasis from which he had departed with his Bedu companions a few days before. His companions accepted the destruction of the burgeoning date harvest with fatalism. Several had date gardens at the oasis and realised that they would have few or no dates that year and that they would have to rely on other resources such as their stock.

Whilst locusts were a curse for the farmer, they at least supplied some instant food. They were generally roasted or parched over the fire. If not consumed immediately the dried flesh could be ground up into meal and stored in a skin to be added to stews at a later date.

Oasis Life

If grazing was adequate near an oasis the bedouin would pitch camp and take a break from the nomadic life.

Many bedouin had land holdings in the oases where they would grow date palms to provide for their travels. At the date harvest in early autumn they would return to supervise their holdings which were frequently left in the hands of a slave farmer who would take half the crop for his sustenance. Beneath the date palms fodder could be grown for the flocks and vegetables and fruits cultivated. Fruits included pomegranate, citron, lime or lemon, grapes, plum, melons and watermelons. Vegetables included cucumbers, carrots, pumpkin, onions, garlic, okra, sorrel, thyme and other fresh green herbs.

The oasis village would have a **suq** or market. Apart from the basic foods such as **samn**, rice, wheat, flour and dates, some fresh vegetables and fruits would be on sale and there might be a butcher or someone who was offering cooked food.

Oasis rulers were expected to provide hospitality just as the sheikhs did in the desert. By the end of the nineteenth century these oasis rulers had started to develop political muscle through exacting taxes to pay for soldiers to enforce their new-found power. With the arrival of the internal combustion engine, the camel was soon displaced. The bedouin economy which was built upon the value of these beasts declined dramatically and many gave up their nomadic ways for good.

The bedouin recorded by Doughty and his fellow travellers in the nineteenth century no longer exist. Much of their culture has been handed down to their descendants and certainly elements of their food culture can still be identified in the Arabia currently on the threshold of the twenty-first century.

Appendix

Composition of Ruminants Milk

Constituent	Unit	DROMEDARY <i>Camelus dromedarius</i>	COW <i>Bos indicus</i>	SHEEP <i>Ovis aries</i>	GOAT <i>Capra hircus</i>
Fat	%	2.9-5.5	4-4.8	7	4.9-5
Protein	%	2.0-4.5	2.8-3.5	6	4-4.3
Lactose	%	3.4-5.4	4.5-4.6	4	4-4.1
Solids, non-fat	%	8.7-10.1	8.1	-	9.3
Total solids	%	12.9-14.4	13-13.5	18	14-14.2

Note: Values for sheep are temperate breeds due to lack of statistics on tropical sheep

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Endnotes

[1] Hogarth was summarising the explorations to date in Arabia and it is surprising what little of the peninsula had been comprehensively explored at the start of this century. His summary of the bedouin character is however concise and to the point.

[2] Some bedouin near the coastline split their activities between their flocks and fishing or pearl diving in the Arabian Gulf - Al-Fahim.

[3] Hogarth corrects the medieval error which assigned *arabia felix* to the south western provinces of the peninsula, but the error has become accepted in modern useage probably emphasised by our modern perception that these areas are more blessed in resources than the remainder.

[4] The "*mess of wheat*" or **harees** as described several times by Doughty was to be expected in Arabia where wheat was grown on the oasis fringes whereas rice, **temmn**, was generally imported by camel caravan from Iraq. The meat was boiled first and then the wheat cooked in the stock.

[5] Weir reports the slaughter of one camel and 86 sheep at one such feast in 1973 for the visit of a member of the Saudi royal family to a group of Jordanian bedouin. One dish contained 24 sheep on a mound of rice.

[6] The area bordering the southern Iraq marshes between the Tigris and Euphrates rivers was a major rice growing area up to the 1950's when Thesiger noted the importance of this crop to the Arabian economy.

[7] Copper has been replaced by aluminium. There is much evidence of prehistoric copper mining and refining on the peninsula.

[8] Snow was even recorded at high elevations every thirty or forty years.

[9] Doughty

[10] Valued at £2,000 by Doughty.

[11] Dyke and Weir respectively, **samn** is called **dibn** in the UAE.

[12] "*where there is not coffee, there is not merry company*": bedouin saying quoted by Doughty.

[13] Doughty

[14] And still do to this day, **shai** is invariably taken with a hefty sugar content.

[15] I have used dune sand in garden pot plants in the UAE and with regular watering have propagated seven different species from latent seed in the sand. One was *Portulaca oleracea*, purslane.

[16] *Zizyphus spina-christi* and *Zizyphus leucodermis* respectively.

[17] This palm, *Nannorrhops ritchieana*, also yields excellent strong rot-proof fibres for craft work.

[18] Unusual large game recorded included wolf, fox and hyena. Wolf flesh was considered to be medicinal, very good for aches in the shins.

[19] Small game included Cape hare, Ethiopian hedgehog, porcupine, and various rodents as well as many birds, some shot quite indiscriminately at hides. Snakes were not eaten but lizards were in extremis.

[20] Sadly they are still hunted, I saw a gazelle carcass from the small remaining population dangling from the back of a four wheel drive last winter.

[21] Doughty