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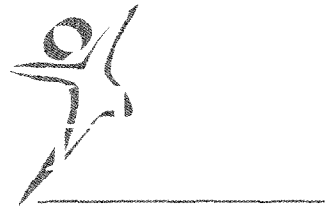
Toward a Virtuous Circle

A Nutrition Review of the Middle East and North Africa

Atsuko Aoyama



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A Nutrition Review of the Middle East and North Africa

Atsuko Aoyama

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FOREWORD

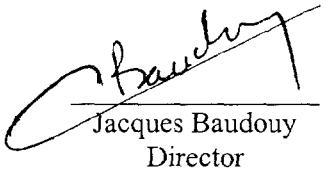
The countries of the Middle East and North Africa (MENA) region face unprecedented challenges. The pace of change in the global economy has never been faster, prompting the need for new strategies to promote economic and social development. Economic development and rising incomes signal a new prosperity and governments in the region are struggling to sustain the improvements in the quality of life of their citizens, which they have worked hard to bring about.

Good nutrition is key to maintain or improve health, and people's ability to secure an adequate diet is fundamental to achieving social and economic advances. Since nutrition is a multi-sectoral issue, development and improvement in other sectors can greatly affect nutritional status. Nutrition disorders in turn impede the economic development of a country through decreasing educational attainment and economic productivity, and increasing health care costs. Therefore, nutritional status is one of the best proxies to measure poverty and social development. In spite of this critical role, nutrition disorders frequently escape notice. Particularly in developing countries, the groups most vulnerable to poor nutrition are women and children, especially if they are rural.

This nutrition review of the MENA region is to develop a base of knowledge and a sector strategy, and to help fulfill the World Bank's mandate for poverty reduction. This is the first comprehensive overview of nutritional issues in the region, putting together the problems in an overall economic development context. The review focuses on the health implications of nutritional issues, and supplements a regional study of food subsidy programs and the regional health, nutrition and population sector strategy paper.

The findings of this review are sometimes troubling, and often surprising. Although the nutritional status of most people in MENA countries has improved over the last two decades, undernutrition and micronutrient deficiencies remain a serious threat to public health. Even though nutritional deficiencies are strongly linked to poverty, economic progress does not always improve nutritional status. Thus, even in well performing economies, progress has been uneven, leaving pockets of poverty in its wake, especially among rural populations. This also suggests that not only income but the status of women, their educational attainment, cultural factors, food and agriculture policies, and access to various social services including health care and clean water are critical factors affecting nutrition and nutritional disorders.

I hope this review will help stimulate country discussions in the context of economic and social development among various stakeholders and result in effective policies and strategies for improving nutrition in the region.



Jacques Baudouy
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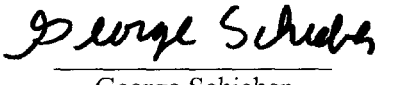

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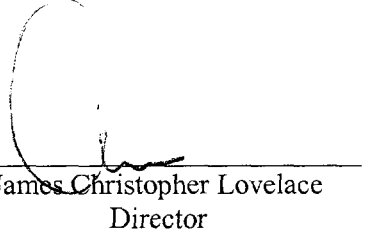

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PREFACE

Countries which comprise the World Bank's Middle East and North Africa region (MENA) vary widely in their economic development, politics, geographic and environmental conditions, their health status and other social factors. Until now, World Bank activities in the health, nutrition, and population (HNP) sector in MENA have focused mainly on health and population, and although the Bank completed some nutrition sector work in Morocco in 1994, and a case study on food subsidy reform in Tunisia in 1996, a comprehensive assessment of nutritional issues in the region has never been done.

The World Bank HNP sector board approved this nutrition review in the MENA region to develop a base of knowledge and a sector strategy, and to help fulfill its mandate for regional knowledge management. The review assesses nutritional status, focusing on the health implications of nutritional issues, but the review's scope do not include the assessment of existing nutrition programs. The review proceeds concurrently with a regional study of food subsidy programs, both of which supplement the regional HNP sector strategy paper. The review aims to:

- assess the region's nutritional status;
- analyze the causes and consequences of nutritional problems and their implications for health;
- suggest a strategy to improve the nutrition and health of the people in the region;
- develop a database from available sources and literature.

ABSTRACT

Good nutrition is key to maintain or improve health, and people's ability to secure an adequate diet is fundamental to achieving social and economic advances. Improving people's nutritional status is linked to economic progress, and economic progress often helps people improve their nutritional status, creating a virtuous circle.

This nutrition review in the Middle East and North Africa (MENA) is to develop a base of knowledge and a sector strategy. The review aims to put the problems in an overall economic development context, while focusing on the health implications of nutrition disorders.

MENA countries have largely achieved food security and the nutritional status of most people has improved over the last two decades. Despite these achievements, undernutrition and micronutrient deficiencies, such as iron, iodine, and vitamin D, remain a serious threat to public health. In addition, changes in the diet have escalated the incidence of obesity and diet-related non-communicable diseases.

Even though nutritional deficiencies are strongly linked to poverty, economic progress does not always improve nutritional status. Improving female education and access to other social services also contributes to lowered childhood malnutrition over the long term. Required actions for three types of nutrition disorders among MENA countries and strategic options for the World Bank are suggested.

ACKNOWLEDGMENTS

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ABBREVIATIONS

ACC/SCN	United Nations Administrative Committee on Coordination, Sub-Committee on Nutrition
BMI	Body mass index
CAS	Country assistance strategy
CBC	Communication for behavior change
EMRO	World Health Organization Regional Office for the Eastern Mediterranean
ESCWA	United Nations Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization
G6PD	Glucose-6-phosphate dehydrogenase
GDP	Gross domestic product
GNP/c	Gross national product per capita
Hb	Hemoglobin
HDL	High-density lipoproteins
HNP	Health, nutrition and population
IDD	Iodine deficiency disorders
IMCI	Integrated Management of Childhood Illness
IMR	Infant mortality rate
IQ	Intelligence quotient
IUGR	Intrauterine growth retardation
LDL	Low-density lipoproteins
MENA	Middle East and North Africa
MMR	Maternal mortality ratio
NCHS	National Center for Health Statistics
NGOs	Non-governmental organizations
OECD	Organisation for Economic Co-operation and Development
25-OHD	25-hydroxy vitamin D
PA	Palestinian National Authority
RDA	Recommended dietary allowance
RNE	Food and Agriculture Organization Regional Office of the Near East
SD	Standard deviation
T_3	Triiodothyronine
T_4	Thyroxine
TFR	Total fertility rate
TGR	Total goiter rate
TSH	Thyroid stimulating hormone
TV	Television
U5MR	Under five year child mortality rate
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
US	United States of America
USAID	United States Agency for International Development
VAD	Vitamin A deficiency
WFP	World Food Programme
WBG	West Bank and Gaza
WHO	World Health Organization

Executive Summary

Good Nutrition and Economic Progress: A Virtuous Circle

Good health is a crucial element in the quality of life, a prerequisite for better educational attainment and essential to national economic productivity. In all nations, improving people's nutritional status is linked to economic progress, and economic progress often helps people improve their nutritional status, creating a virtuous circle. Good nutrition is key to maintain or improve health, and people's ability to secure an adequate diet is fundamental to achieving social and economic advances.

In spite of the critical role of nutrition in development, malnutrition so frequently escapes notice that it is referred to as "the silent disaster." Globally, the world is producing enough food, but inequitable access and allocation prevents many people from getting an adequate diet and therefore their health is at risk. In 1992, the United Nations Food and Agricultural Organization (FAO) estimated that about 841 million people or about one fifth of the world's population were food energy deficient.

Countries in the Middle East and North Africa (MENA) region have largely achieved national level food security in terms of dietary energy intake, except for Yemen and Iraq. Clinical vitamin A deficiency is largely under control in the region. The nutritional status of most people has improved over the last two decades. Economic development and rising incomes signal a new prosperity and governments in the region are struggling to sustain the improvements they have worked hard to bring about for their citizens in the quality of life. Despite these achievements, undernutrition and micronutrient deficiencies remain a serious threat to public health. Recently, the prevalence of stunting has increased in several countries—the result of chronic undernutrition. Anemia is widespread among women and children; and there is a high incidence of iodine deficiency disorders and vitamin D deficiency. Changes in the diet brought about in part by new found prosperity have escalated the incidence of obesity and diet-related non-communicable diseases such as heart disease and diabetes mellitus.

The numbers are alarming. In MENA countries, it is estimated that over 10 million children suffer from stunted growth, about 90 million people are anemic, and about 85 million people are at risk for iodine deficiency disorders. Even though nutritional deficiencies are strongly linked to poverty, economic progress does not always improve nutritional status. For instance, in Egypt and Tunisia, the number of stunted children *increased* despite the rise in GNP per capita. This appears to indicate that even in well performing economies, progress has been uneven, leaving pockets of poverty in its wake, especially among rural populations. The economic costs of nutrition disorders are staggering. Undernourished or anemic adults are less productive and childhood stunting leads to an estimated six to eight percent loss in labor productivity in adulthood. Assuming annual wages of $1,000 per person, stunting of one million children creates a direct income loss of $60 to 80 million per year, plus accompanying health care costs related to the condition.

In seven countries in the region, stunting affects over 20 percent of children under five years of age, and in nine countries, wasting is prevalent in over five percent—indicating medium to high levels of childhood malnutrition. This condition is the most serious in Yemen, the poorest country in the region, but also stunting prevalence recently increased in Algeria, Egypt, Oman, and Tunisia. Stunting appears to affect boys and girls equally but rural areas are much worse off than urban, and the gap between rural and urban is widening in Egypt, Morocco, and Tunisia,

more evidence that childhood undernutrition is not necessarily linked to lower levels of economic development.

An improvement in maternal health care could elevate the nutritional status and health of entire nations. In five MENA countries, low birth weight is a problem for over 10 percent of babies, indicating the poor health and nutritional status of many pregnant women. The increase in the incidence of low birth weight correlates with the increase of infant mortality and stunting. But the problem does not end there—low birth weight babies grow into adults who are likely to be more susceptible to chronic diseases such as hypertension and diabetes mellitus. Countries lose three times over—first because low birth weight babies are more likely to have repeated episodes of illness, or die in infancy; second because those who do survive childhood have a reduced ability to lead productive lives; and third because the expense of treating chronic diseases can cut deeply into the national health budget.

Anemia, which is caused mainly by iron deficiency, is highly prevalent among women and children even in wealthier countries in the region, and is likely linked to the higher rate of maternal mortality and low birth weight. In MENA countries the major source of iron is cereals, but the diet also contains many substances which inhibit iron absorption, leading to widespread anemia. In addition to nutritional education to diversify diets and increase the bioavailability of iron, other control measures could include iron supplementation, iron fortification of staple foods, and public health interventions such as parasitic disease control programs and birth spacing.

Iodine deficiency disorders (IDD) are still high in Syria, Iran, Yemen, and a part of Egypt. Although many MENA countries have already started universal salt iodization programs, further technical inputs and multi-sectoral commitment may be required to achieve sufficient coverage of iodized salt.

Vitamin D deficiency has been reported among small children and women in Iran, Kuwait, Libya, Morocco, Saudi Arabia, West Bank and Gaza, and Yemen. Infants whose mothers have low vitamin D levels are more likely to develop vitamin D deficiency symptoms. While vitamin D fortification and supplementation programs are required, communication for behavior change (CBC) programs have to be started urgently. One of the most commonly available *sources* of vitamin D is sunshine—humans can produce vitamin D if their skin is exposed to sunlight but cultural practices—such as women being heavily veiled, and infants being constantly wrapped—prevent it from being synthesized.

Nutrition disorders are caused by nutrient deficiencies but also by unbalanced intakes. Economic development has brought a nutrition transition to many MENA countries. People's nutritional intake patterns change from diets based on cereal and vegetables with a relatively low intake of dietary energy, to a diet with an higher dietary energy intake and higher intake of animal fat and protein. As a result, obesity is becoming more common, especially in high income countries and urban areas. Obesity is more prevalent among adult women than men, in part due to cultural prohibitions which restrict women's movements. Obesity and excess fat intakes lead to increase of diet related non-communicable diseases such as coronary heart diseases and diabetes mellitus in 10 to 20 years.

Creating the Virtuous Circle: What Can Countries Do?

Good nutrition and health create a virtuous circle—bad nutrition and disease create a vicious circle. Nutritional disorders damage health *directly* by causing disease, but also *indirectly* by increasing susceptibility to disease. In turn, diseases cause nutritional disorders by creating nutrient loss, reducing the body's ability to absorb nutrients, or increasing the body's nutrient

consumption. Children and women are most vulnerable to nutrition disorders because of their higher requirements for nutrients for growth and reproduction, their lower status in society and the family, and other cultural factors. Mothers' health status directly affects that of their children, so the poor nutritional status of women and children also forms an *intergenerational* vicious circle. Therefore, national improvement in nutritional status should target this critical group—children aged 6 to 24 months and pregnant women. This also suggests that improving female education and other social services contribute to lowered childhood malnutrition over the long term. For example, increased female secondary school enrolment rates in MENA countries correlate with a decrease in the numbers of stunted and underweight children.

Many questions remain to be answered. Many national policies, not just those in the social sector, affect nutritional outcomes, but these linkages have been inadequately explored. Food and agricultural policies have a major impact on nutrition, but the nature and extent of these are not yet known because the policies have never been evaluated alongside anthropometric data and other poverty indicators. Neither have the reasons for the poor correlation between economic development and nutrition status been fully analyzed. Growing income differentials, unequal access to social services and other exclusionary mechanisms might explain some of this polarized development, but it requires proper and in depth analyses. The peri-urban poor are an emerging phenomenon which has not been fully studied. Feasibility studies or sector work is needed to design nutrition interventions such as micronutrient fortification programs. Impacts of existing nutrition programs should be reviewed. Many avenues need to be followed because quantity and quality of data are insufficient to design interventions. Policy makers can select among specific interventions or comprehensive programs, targeted or universal approaches, but institutional and technical capacity building is a prerequisite for sustainable implementation.

Some possible interventions are:

- Comprehensive public health programs targeting children under two years of age and pregnant and lactating women, particularly among rural population.
- Food and micronutrients supplementation including iron, iodine, and vitamin D targeted to pregnant and lactating women, adolescent girls, under five year and school age children.
- Micronutrient fortification, such as salt iodization, iron fortification of wheat flour, and vitamin D fortification to edible oil and milk.
- CBC programs delivered through health service channels, schools, community organizations, and mass media which aim to prevent nutrition disorders and promote health activities.

MENA countries' nutrition typology. Possible combinations of nutrition interventions for each type are as follows:

- *Type 1*: high malnutrition and micronutrient deficiency; low economic and social indicators; e.g. Yemen, Iraq. Specific nutrition interventions and comprehensive health and social programs are required urgently. Decreasing malnutrition of small children and pregnant women should be the first priority. International support will be essential.
- *Type 2*: relatively large population of undernutrition with large urban/rural gaps and high micronutrient deficiency; relatively well-performing middle income economy with a significant number of poor; e.g. Iran, Tunisia. Specific nutrition interventions and comprehensive health and social programs should be targeted to the rural population, urban

poor, women and small children. Food policies should be carefully assessed for their effectiveness and real nutrition impacts on the vulnerable groups.

- ***Type 3***: high obesity and micronutrient deficiency; relatively high income with pockets of poverty and social indicators that are low in comparison with similar level economies in other regions; e.g. Saudi Arabia, Bahrain. CBC programs for obesity and micronutrient deficiencies prevention and micronutrient fortification programs, plus nutrition and social programs targeted to the vulnerable groups. International agencies may need to provide technical assistance.

To assist MENA countries in improving nutrition, the World Bank may explore strategic options:

- Stimulating country discussions.
  Disseminate this regional nutrition review among stakeholders in the social and economic sectors in each country to stimulate discussions. Organize a regional conference.

- Put nutrition back on the policy agenda.
  Nutritional status is one of the best proxies to measure poverty and social development. Nutritional issues should be included in the country assistance strategy (CAS) and be discussed with the government in the context of economic and social development.

- Support specific programs.
  The Bank's health sector operations may put more emphasis on nutrition improvement. Current national public health programs can be strengthened with more nutrition activities after carefully estimating program costs to prepare feasible and sustainable financing plans.

- Partner and facilitate technical assistance.
  To meet international standards, most MENA countries may need technical support for planning, implementing, and monitoring their nutrition programs. The Bank may facilitate technical assistance in partnership with other organizations such as WHO, UNICEF, FAO, and NGOs.

- Coordinate and monitor other sector programs.
  Poverty reduction programs should use nutrition indicators to assess and adjust the impacts of interventions. Other sector operations including water and sanitation, agriculture, education, and industry, can be designed and monitored to produce positive impacts on nutrition.

Improving the nutritional status of people in the MENA countries is a priority—for the well being of citizens, and for continued economic development and growth. Unfortunately, development strategies to date have fallen short of the nutritional goals expected in any caring and equitable society. In the longer term, it is costly and unsustainable to overlook the needs of underprivileged populations, particularly women, children, and rural inhabitants. Targeted interventions are urgent and essential.

Policymakers must act immediately to put nutrition on the country's priority agenda. Strong political commitment at the highest level is indispensable to implement and sustain effective nutrition interventions. The World Bank will work together with the governments to achieve the sustainable, equitable, economic, social and human development.

1. Introduction - Good Nutrition and Economic Progress: A Virtuous Circle

Good health is a crucial element in the quality of life, a prerequisite for better educational attainment and essential to national economic productivity. In all nations, improving people's nutritional status is linked to economic progress, and economic progress often helps people improve their nutritional status, creating a virtuous circle. Good nutrition is key to maintain or improve health, and people's ability to secure an adequate diet is fundamental to achieving social and economic advances.

In spite of the critical role of nutrition in development, malnutrition so frequently escapes notice that it is referred to as "the silent disaster."(207) Globally, the world is producing enough food, but inequitable access and allocation prevents many people from getting an adequate diet and therefore their health is at risk. In 1992, the United Nations Food and Agricultural Organization (FAO) estimated that about 841 million people or about one fifth of the world's population were food energy deficient.(70)

The Middle East and North Africa region (MENA)[1] has largely achieved food security, except for Yemen and Iraq. Clinical vitamin A deficiency is, for the most part, under control in the region. People's nutritional status has improved in the last two decades. Despite these achievements, several nutritional deficiency disorders remain serious public health problems which need to be addressed by all of the countries: stunting, anemia among women and children, iodine deficiency disorders (IDD), and vitamin D deficiency. Economic development and rising incomes in the region signal prosperity and have also brought about changes in the diet, but this nutrition transition has been accompanied by an increased incidence of obesity and diet-related non-communicable diseases.

And there is worse news. In MENA countries, it is estimated that over 10 million children suffer from stunted growth, about 90 million people are anemic, and about 85 million people are at risk for iodine deficiency disorders. Although nutritional deficiencies are strongly linked to poverty, economic progress does not always improve nutritional status. For example, the number of stunted children *increased* in Egypt and Tunisia despite the rise in GNP per capita, and in the high-income Gulf states, anemia and vitamin D deficiency are common.

The economic costs of nutrition disorders are staggering. Undernourished or anemic adults are less productive (Annex 2) and childhood stunting leads to an estimated six to eight percent loss in labor productivity in adulthood.(108) Assuming annual wages of $1,000 per person, stunting of one million children creates a direct income loss of $60 to 80 million per year, plus accompanying health care costs related to the condition.

Despite overall economic development, gaps in income levels occur and may grow wider. This appears to indicate that economic progress is uneven, that rural populations have been excluded, and that pockets of poverty are present even in the well performing economies. This polarized economic development is not only socially unjust, but also unsustainable. Even a robust economy can collapse under the pressures arising from an inequitable society—particularly where something as basic as food is concerned.

The factors affecting people's ability to secure and maintain adequate nutrition are complex and linked; they include population growth rates, human migration, the state of

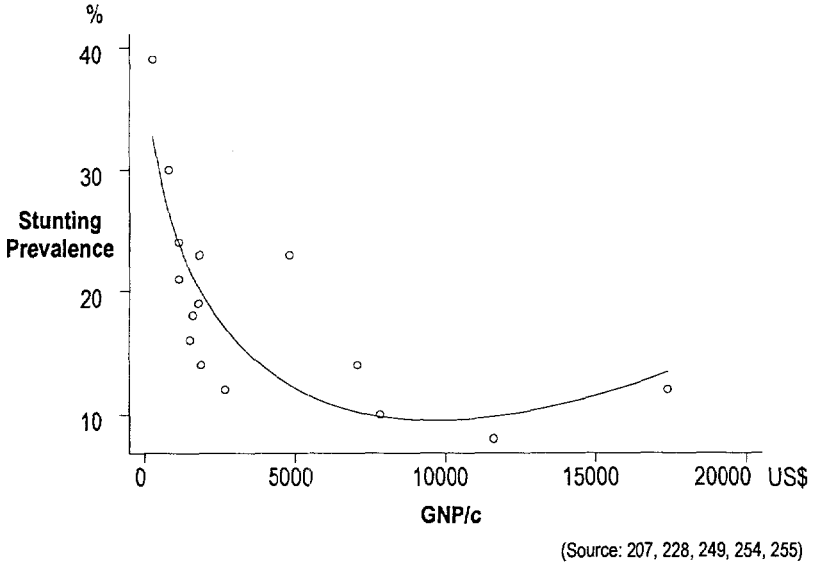
[1] Countries in the MENA region in this paper indicate: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates (UAE), West Bank and Gaza (WBG), and Yemen.

agriculture, transportation and trade, among others. People's access to health care, education, clean water and sanitation, as well as status of women, affects their nutritional status and their ability to use their food resources wisely. Health problems associated with poor nutrition are widely observed in low income countries but surprisingly are also found among vulnerable populations in middle and high income countries. The issues affecting these groups need to be identified and addressed to achieve adequate nutrition globally.

Particularly in developing countries, the groups most vulnerable to poor nutrition are women and children, especially if they are rural. They have lower social and economic status in the family and society, and higher nutritional needs for growth and reproduction. In 1995, the World Health Organization (WHO) estimated that about 200 million or over 30 percent of children under five years old were malnourished.[223] Although many children in developing countries sicken and die from communicable diseases such as diarrhea, respiratory infection, and measles, malnutrition underlies 56 percent of under five year deaths.[256] It not only increases their susceptibility to diseases but also delays their recovery from illness. Furthermore, repeated and prolonged illnesses hinder nutritional intake; thus malnutrition and diseases form a vicious circle.

Nutrition disorders exist even in high income countries in the MENA region. There is no significant correlation between prevalence of wasting, underweight and low birth weight and GNP/c in MENA countries (Annex 4). Even though malnutrition is generally associated with poverty, economic development has decreased child malnutrition to only a limited extent. The stunting prevalence in MENA countries drops significantly when the GNP/c increases in the range of low and lower-middle income levels, but the correlation is less significant in the range of upper-middle income and higher levels (Figure 1). This indicates that although stunting, the most constant indicator of chronic child malnutrition, is associated with poverty, general economic development alone will not be able to eliminate stunting. Since GNP/c indicates only the average income level, it may conceal the size and status of underprivileged groups where higher prevalence of child malnutrition may be found.

Figure 1: Stunting Prevalence and GNP/c in MENA Countries

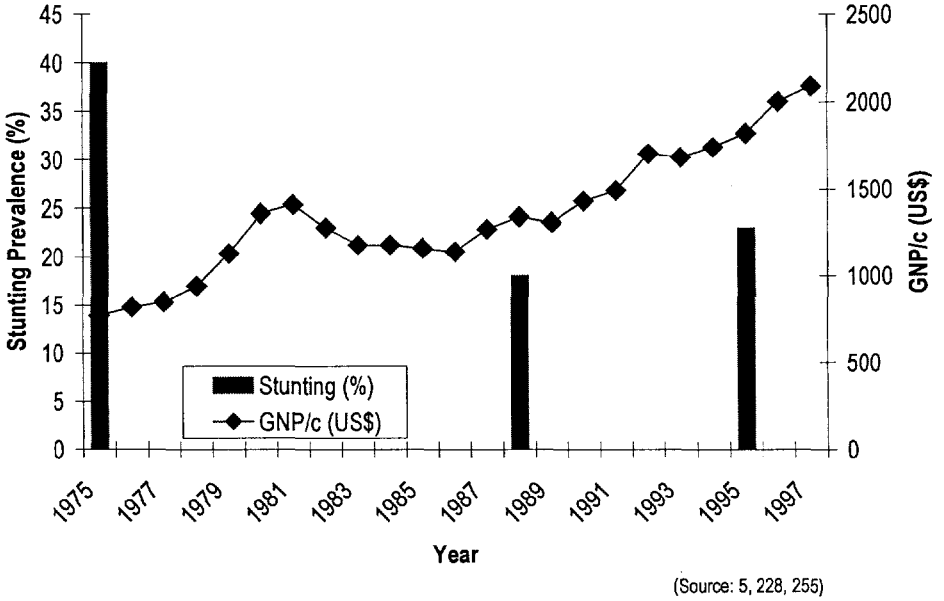


(Source: 207, 228, 249, 254, 255)

Nutritional status in rural areas is much worse than in urban areas in most MENA countries (Table 2, Figure 5, 15; Annex 4). That is because overall economic development may have brought fewer benefits to rural areas, or because investments may not have been well targeted or evenly distributed. When industrialization is concentrated in urban areas it may erode traditional agricultural production by absorbing labor from the rural areas. In addition when rural people produce more market oriented crops it may reduce their own consumption of agricultural products.[158] Unless overall economic development is supplemented with targeted social and rural development, the changes that result may damage the nutritional status of rural people.

Tunisia[2] exemplifies a country where economic development has not diminished child malnutrition (Figure 2). From 1988 to 1995, GNP/c in Tunisia grew steadily, but the incidence of malnutrition caused stunting prevalence to increase from 17.9 percent to 22.5 percent—as high as 32.6 percent in rural areas, and 14.5 percent in urban areas (Table 2). The gap between urban and rural widened as the national stunting prevalence rose (Figure 5; Annex 4).

Figure 2: Stunting Prevalence and GNP/c in Tunisia



(Source: 5, 228, 255)

Malnutrition commonly refers to a protein-energy deficiency, but another type of nutritional deficiency results from inadequate intake of micronutrients such as iron, iodine, and vitamin A, among others. This type of nutritional deficiency is referred to as "silent hunger" and can occur even when protein-energy intake is sufficient. Micronutrient deficiency impedes physical and mental development, increases morbidity and mortality, and decreases educational attainment and economic productivity. If widespread, it can significantly retard social and economic progress.

Most developing countries are undergoing a nutrition transition. This transition occurs when people's food intake patterns change from a cereal and vegetable based diet with a

[2] Preliminary results of 1996/98 survey conducted by the National Institute for Nutrition indicated a significant decrease of child undernutrition in Tunisia (stunting prevalence: total 9.5 percent, urban 7.6 percent, rural 11.6 percent; wasting prevalence 1.3 percent).[field interviews]

relatively low intake of dietary energy, to one with a higher dietary energy intake and an increased portion of animal fat and protein. The transition is accompanied by a reduction in energy expenditure because of more sedentary occupations, motorized transport, and availability of amenities. The nutrition transition is common in high-income countries and is also increasingly seen in urban areas and among relatively affluent populations in low and middle income countries. The nutrition transition signals a higher standard of living which is a welcome development, but it also leads to over-consumption of dietary energy, particularly animal fat, which increases the incidence of obesity and the risk for diet-related non-communicable diseases such as cardiovascular disorders and diabetes mellitus. Preventing these diseases through nutritional education is inexpensive but unless immediate action is taken, MENA countries will have to face the high cost of treating these diseases later.

A variety of nutrition issues are observed in MENA countries, but to date, the Bank's activities in the health, nutrition, and population (HNP) sector in the region have focused mainly on health and population. Although the Bank completed some nutrition sector work in Morocco in 1994,[243] and a case study on food subsidy reform in Tunisia in 1996,[190] there has not been a comprehensive assessment of nutritional issues in the region.

The World Bank HNP sector board approved this nutrition review in the MENA region to develop a base of knowledge and a sector strategy and to help fulfill its mandate for regional knowledge management. The review assesses nutritional status, focusing on the health implications of nutritional issues, but the review's scope do not include assessments of existing nutrition programs and food policies. The review proceeds concurrently with a regional study of food subsidy programs,[258] both of which supplement the regional HNP sector strategy paper.[253] The review aims to:

- assess the region's nutritional status;
- analyze the causes and consequences of nutritional problems and their implications for health;
- suggest a strategy to improve the nutrition and health of the people in the region;
- develop a database from available sources and literature.

2. Nutrition in MENA Countries - Current Situation and Trends

Protein-Energy Disorders

Undernutrition

Child undernutrition is common in many MENA countries (Table 1). The main indicators of child undernutrition are stunting, a condition where attaining normal height for age is hindered by chronic malnutrition, and wasting, below normal weight for height where the body is emaciated mainly due to acute malnutrition (Annex 1). In seven of the countries in the region, over 20 percent of children under five years old are stunted. In nine of the countries, wasting is observed in more than five percent of the under five year olds. By international standards, this is considered medium to high levels of undernutrition. Additionally, underweight shows a similar distribution pattern although it is generally lower than the figures for stunting. There is no evidence of absolute shortages of food, but despite this, certain children are chronically undernourished. Child malnutrition is the most serious in Yemen, the poorest countries in the region, but overall, child undernutrition is not clearly linked to the level of economic development among the MENA countries.

Table 1: Health and Nutrition Indicators in MENA Countries

(Most Recent Data between 1980-1997)

	GNP per capita (US$)	Total Population (million)	Population Annual Growth Rate (%)	Infant Mortality Rate (per 1000 live births)	Stunting (Under 5) (%)	Wasting (Under 5) (%)	Underweight (Under 5) (%)	Low Birth Weight (%)	Anemia (Women) (%)	Total Goiter Rate (%)
Low Income*										
Yemen	260	15.7	3.7	93	39	13	39	19	5 - 36	32
Lower-middle Income*										
Egypt	790	63.3	1.8	57	30	5	12	10	17 - 79	5.2
Iraq	-	20.6	2.1	161	28	9	25	21	18	7.3
Morocco	1,110	27.0	2.0	64	24	2	9	9	20 - 40	20
Syria	1,120	14.6	2.9	28	27	9	13	11	30 - 52	73
Jordan	1,510	5.6	4.2	21	16	2	9	7	4 - 46	-
Algeria	1,600	28.8	2.0	34	18	9	13	9	19 - 42	8.5
Iran	1,780	70.0	2.5	33	19	7	16	9	20 - 50	30
Tunisia	1,820	9.2	1.6	28	23	4	9	8	41	4.3
West Bank and Gaza	1,870	2.3	3.7	28	14	6	15	-	23 - 56	-
Lebanon	2,660	3.1	1.9	33	12	3	3	10	27 - 49	15
Upper-middle Income*										
Oman	4,820	2.3	4.7	15	23	13	23	8	15 - 54	10
Libya	-	5.6	3.6	50	15	3	5	5	6	6.3
Saudi Arabia	7,040	18.8	3.4	25	14	3	14	7	5 - 57	-
Bahrain	7,840	0.6	3.6	18	10	6	7	6	40 - 49	-
High Income*										
Qatar	11,600	0.6	5.3	17	8	2	6	5	30	-
Israel	15,920	5.7	2.6	8	-	-	-	7	18 - 61	-
Kuwait	17,390	1.7	2.7	13	12	3	6	7	31 - 42	-
United Arab Emirates	17,400	2.5	3.1	15	-	-	-	6	22 - 62	-

* The definitions of income groups are: low income as GNP/c $765 or less; lower-middle income as $766-$3,035; upper-middle income as $3,036-$9,385; and high income as $9,386 or more.

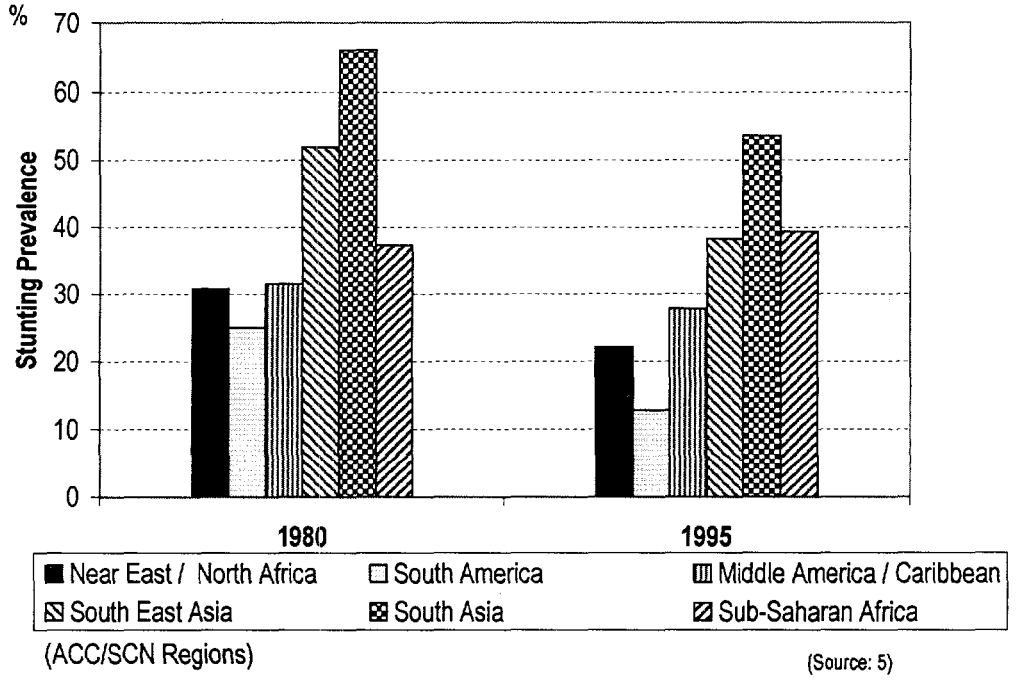
(Source: 55, 148, 151, 206, 207, 216, 220, 221, 226, 228, 247, 248, 249, 254, 255)

Stunting

Childhood stunting, or chronic undernutrition, is largely due to inappropriate feeding, repeated bouts of childhood illnesses such as diarrhea that reduce the intake and absorption of nutrients, plus improper care of sick children. Trends in stunting are mixed among children in MENA countries. Figure 3 indicates that stunting in the Near East/North Africa region[3] has been the second lowest among the six regions in the developing world between 1980 and 1995. However, the decline during that period was only about 0.6 percent per year for the region.[5] Among MENA countries that conducted multiple national surveys on stunting, there is a disturbing trend. Since 1990, stunting has increased in Algeria, Egypt, Oman and Tunisia. (Figure 4)

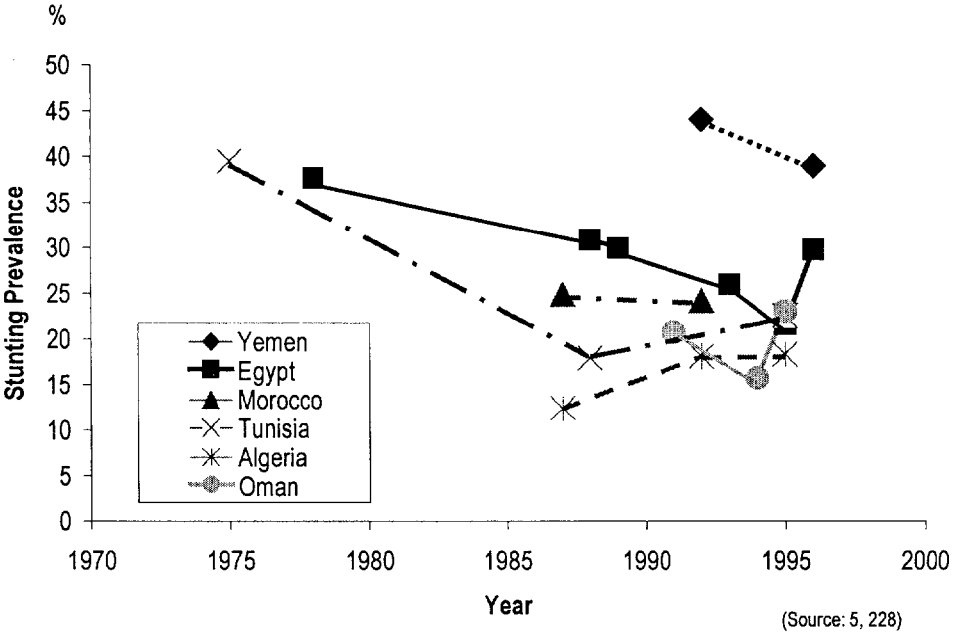
Stunting prevalence can be analyzed by looking at children's gender and place of residence. Table 2 shows that among girls, stunting is equal to or even lower than that among boys, and reports from Tunisia and Morocco indicate that there is no significant difference in the treatment of boys and girls in the duration or intensity of breastfeeding.[156] There are significant differences between urban and rural populations. In most MENA countries, children from rural areas are more likely to be stunted than children from urban areas. In fact, rural children in Iran, Morocco, Saudi Arabia, and Tunisia are twice as likely to suffer from stunting. The stunting prevalence in urban/rural areas has been surveyed more than one time in Egypt, Morocco and Tunisia. For the three countries represented, the urban/rural gap is widening, leaving rural children more vulnerable to stunting (Figure 5).

Figure 3: Estimated Stunting Prevalence by Region



[3] Near East/North Africa region of ACC/SCN includes Cyprus and Turkey.

Figure 4: Trend of National Stunting Prevalence



(Source: 5, 228)

Table 2: Stunting Prevalence in Children Under 5 Years

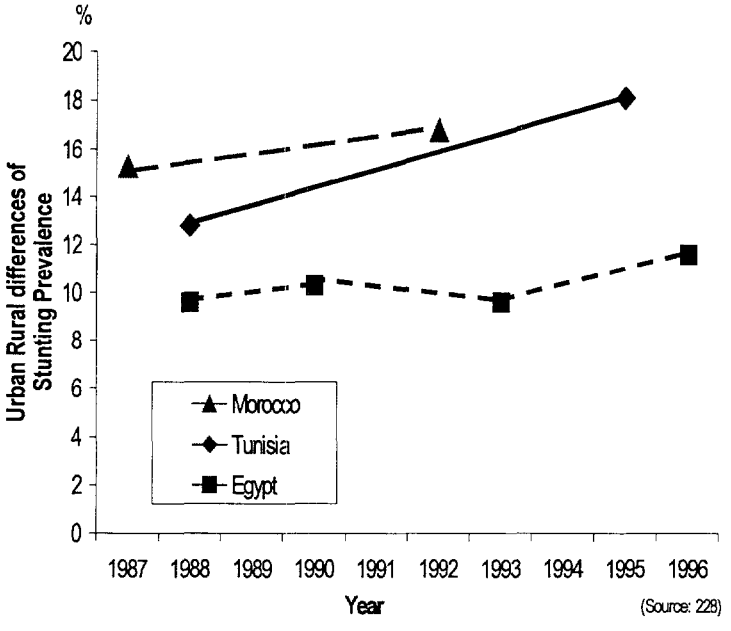
(Most Recent Data between 1980-1997)

	Total (%)	Male (%)	Female (%)	Urban (%)	Rural (%)
Low Income					
Yemen	39.0	41.5	36.1	29.0	44.4
Lower-middle Income					
Egypt	29.8	31.0	28.4	22.8	34.4
Iraq	27.5	-	-	-	-
Morocco	24.2	24.2	24.2	13.2	30.0
Syria	26.6	27.8	25.8	26.0	27.6
Jordan	15.8	16.2	15.5	15.8	27.3
Algeria	18.3	18.3	18.2	18.0	18.5
Iran	18.9	19.5	18.4	12.2	24.8
Tunisia	22.5	22.3	22.6	14.5	32.6
West Bank and Gaza	14.2	13.8	14.6	-	-
Lebanon	12.2	12.6	11.8	-	-
Upper-middle Income					
Oman	23.0	23.1	22.9	21.2	25.6
Libya	15.1	16.4	13.8	13.9	18.1
Saudi Arabia	-	-	-	14.0	41.0
Bahrain	9.9	10.3	9.6	12.1	7.8
High Income					
Qatar	8.1	8.3	8.4	-	-
Kuwait	12.2	-	-	5.1*	17.3**

* High socioeconomic group; ** Low socioeconomic group (Source: 228)

- : data not available

Figure 5: Stunting Prevalence Higher in Rural Areas



In MENA countries, children under five years old are more likely to suffer from stunting than school age children. Figure 6 shows a small decrease in stunting in three MENA countries by the age of four, while Figure 7 shows the result of cohort studies by the age of ten among Bedouin children in Israel. It is unclear whether these data imply that children can recover growth lost earlier to stunting once they have passed through the years of high susceptibility to childhood illnesses and are old enough to have more control over their own food intake, or whether they mean that severely malnourished and stunted children die during early childhood.

Figure 6: Stunting Prevalence by Age

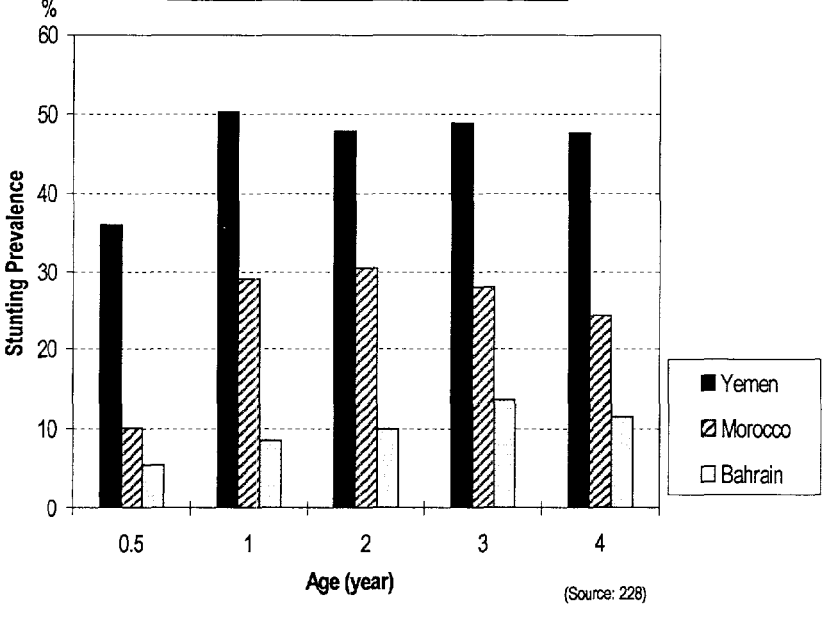


Figure 7: Cohort Study of Stunting Prevalence among Bedouin Children

Low birth weight

Low birth weight, the proximity of intrauterine growth retardation (IUGR), is a sign of fetal malnutrition, a condition that is mainly due to the poor health and nutrition of the mother during pregnancy. The incidence of low birth weight is higher if mothers are of short stature, undernourished, or anemic. Infants born with low birth weights die more frequently during infancy, and if they survive, they are more likely to become stunted children (Annex 4). Also, fetal malnutrition increases an individual's susceptibility later in life to chronic diseases such as hypertension and diabetes mellitus.[5, 174]

Over 10 percent of babies in Egypt, Iraq, Lebanon, Syria, and Yemen are estimated to have low birth weight (Table 1). However, the data on low birth weight may not be robust because weighing newborns is not common practice in many developing countries. Available statistics show that although 86 percent of babies in Jordan are weighed at birth, in Morocco the figure is only 22 percent, and only 6 percent in Yemen.[45]

Child malnutrition in several MENA countries

Yemen, Iran, and Iraq present unique cases in the study of child malnutrition in MENA countries because there are widespread child nutrition problems which have resulted from the unique political, social, and economic context. Yemen is the lowest income country in the region and has the highest incidence of child malnutrition. Iran has the largest population and although most of its social indicators are comparable to other lower-middle income states in the region, the prevalence of stunting is twice as high in rural areas as it is in the urban areas. In Iraq, war and international sanctions have diminished the health and nutritional status of its citizens.

Yemen, the lowest income country

In Yemen child health and nutrition problems are more severe than in the region overall. About 20 percent of the population lives below the poverty line,[246] and most social indicators are also poor—life expectancy at birth is 57 years; the female adult literacy rate is only 26 percent; infant mortality rate (IMR) is 93 per 1,000 live births; and the maternal mortality ratio (MMR) is 1,000 per 100,000 live births (Table 1, Annex 3). In 1995, Yemen's rate of immunization coverage was only 49 percent,[4] compared with over 80 percent for most MENA countries. Low immunization coverage leads to high child morbidity, one of the major causes of chronic childhood malnutrition. Unpublished Yemeni government data from 1996 show that 45 percent of children were stunted, 16 percent suffered from wasting, and 38 percent were underweight.[210]

Nutritional habits and cultural practices in Yemen appear to exacerbate undernutrition caused by poverty and poor health. Breastfeeding is nearly universal in the first three months of life and 80 percent of mothers continue to breastfeed infants up to five months, but only about 40 percent of infants are breastfed exclusively. The majority are given sugar water, boiled water, honey, butter-fat or cow's milk cream in the first few hours after delivery. People also believe that if the mother is fearful, angry or sick, breast milk is unsuitable for feeding. Complementary foods such as biscuits and wheat porridge are introduced at the age of three to six months. The Yemeni habit of chewing qat, especially by pregnant women and teenage children, reduces their nutritional intake (Box 1). In this environment, nutritional intervention is essential but as of October 1998, there were only seven trained nutrition specialists in the Ministry of Public Health.[field interviews] They have backgrounds in medicine, agriculture, and some of them have attended a regional training course in nutrition.

Box 1: Nutrition Implications of Qat Chewing in Yemen

Most of the adults in Yemen chew the leaves of the qat plant as an afternoon social activity, usually taking place over a three- to five-hour period. This habit is recently spreading among rich and poor, men and women throughout Yemen.

Qat contains an amphetamine-like mild stimulant which causes loss of appetite and insomnia. Since the active ingredients of qat are secreted in breast milk, it may interfere with the appetite of breastfeeding infants. The incidence of low birth weight is 20 percent higher among women who chewed qat during pregnancy. Also, poor households spend an estimated 10 to 12 percent of their income on qat, likely displacing some of the resources which could be spend for nutritious food and health care.

Although qat is chewed only in Yemen and a limited part of Africa, it provides an interesting example of the nutritional implications of substance abuse, including tobacco, alcohol, and narcotic drugs.[248]

Iran, rural people are much worse off

The 1995 joint survey by the Iranian government and the United Nations Children's Fund (UNICEF) shows that the incidence of stunting is almost twice as high in rural areas as it is in

[4] The Ministry of Public Health reported that the immunization coverage in Yemen increased up to 68 percent by August, 1998.[Field interviews]

cities. Between the ages of 12 and 23 months, 34 percent of rural children and 18 percent of urban children were stunted.[137] In the countryside this situation is probably caused by poverty, lack of education and cultural practices.[113, 168] The diet in agricultural areas is based on unleavened bread, and there is little nutritional diversity. There are poor sanitary conditions, high child morbidity including diarrhea and intestinal parasites, lack of knowledge about child feeding, and a high maternal workload. There are also food taboos, for example, cheese is believed to impair intellectual development, and eggs are thought to delay speech and cause stammering. Local habits such as geophagia (eating clay) and using sedative drugs on children are hazards that likely contribute to nutritional problems and poor health.

Iraq, trade sanctions increase malnutrition

Figure 8: Child Malnutrition in Iraq

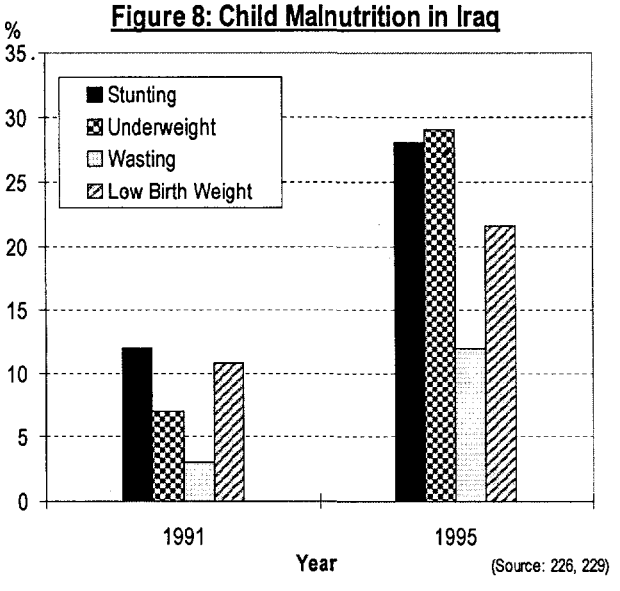
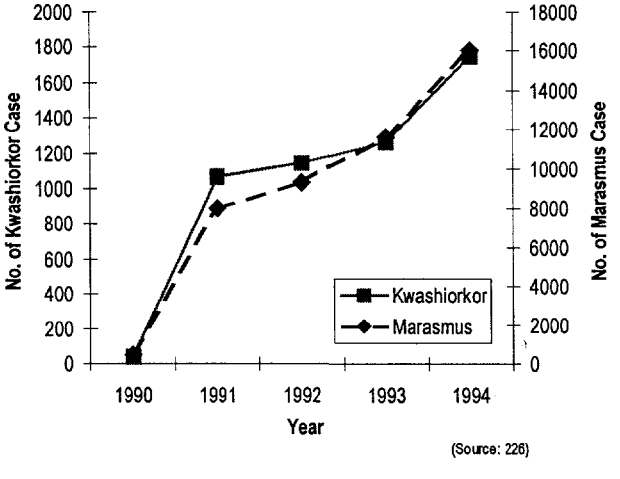


Figure 9: Severe Child Malnutrition in Iraq (Monthly Average)



The state of health and nutrition in Iraq continues to deteriorate since the United Nations (UN) imposed trade sanctions in August 1990; children are affected most.[71, 226] Figure 8 shows that childhood malnutrition increased dramatically between 1991 and 1995. The incidence of stunting and low birth weight doubled; underweight and wasting quadrupled. Severe forms of child malnutrition, marasmus and kwashiorkor, rarely observed before 1990, are increasing rapidly (Figure 9).

Obesity and Diet Related Diseases

Higher incomes increase average food consumption

Table 3: Average Food Consumption (1989)

	Energy (kcal/day/capita)	Protein (g/day/capita)	Fat (g/day/capita)
Low Income			
Yemen	2,142	60.0	33.5
Lower-middle Income			
Egypt	3,336	83.5	78.4
Iraq	2,887	71.8	75.3
Morocco	3,020	81.3	55.6
Syria	3,003	78.6	82.7
Jordan	2,634	71.4	62.0
Algeria	2,866	76.6	61.2
Iran	3,181	84.1	62.2
Tunisia	3,119	83.3	85.7
Lebanon	3,274	86.2	97.1
Upper-middle Income			
Libya	3,324	80.5	108.3
Saudi Arabia Emirates	2,874	86.5	82.5
High Income			
Kuwait	3,195	95.3	104.9
United Arab Emirates	3,309	101.6	111.5

(Source: 150)

Obesity is increasing throughout the world, and the MENA region is no exception to this trend. Obesity and diet-related non-communicable diseases are a public health issue in most MENA countries. Table 3 shows average per capita intake of dietary energy, protein and fat. Average intakes[5] of dietary energy and protein in most MENA countries are higher than the Recommended Dietary Allowance (RDA) (Annex 1). In high income countries, average dietary energy consumption exceeds 3,000 kcal/day and consumption of animal products is also increasing. Sugar consumption is increasing in most MENA countries.[75, 76] People eat more sugar and fat even during the month of fasting, Ramadan (Box 2).

[5] Average intakes of total population do not necessarily reflect the presence of undernourished group of population or the size of the undernourished or overnourished group of population.

Box 2: Nutrition Impacts of Ramadan

Ramadan is one of the five pillars of Islam. Throughout the ninth lunar month, Ramadan, all healthy adult Muslims are obliged to fast from dawn to sunset. Although children, people in ill-health or traveling, women who are pregnant, lactating or menstruating are permitted to break their fast, it is known that children as young as nine years old or pregnant women often opt for fasting. Instead of the usual three meals a day, Muslims eat at home with family members—one large meal after sunset, and if they need it, a second meal before dawn.

People eat more sugar and fat during Ramadan, plus they work fewer hours and decrease their physical activities. Some studies showed significant weight gain during Ramadan, while other studies showed decreased dietary energy intake for about 500 kcal/day and decreased body weight. Body weight loss could also be largely attributable to negative fluid balance. Most studies indicated increased blood LDL-cholesterol levels, decreased blood HDL-cholesterol levels, decreased blood triglycerides levels, significant increase in blood glucose levels, and significant increase in blood uric acid levels during Ramadan.

Ramadan fasting does not harm well-nourished healthy people, and it has positive psychological effects. There can be minor complications such as headache and dyspepsia, and a few serious renal or gastrointestinal complications are reported. Several studies showed that pregnant women's Ramadan fasting had no effect on the mean birth weight.

However, it will be necessary to evaluate and monitor the fasting and the food consumption at night on the middle aged and elderly more carefully, since the blood biochemical change increases risks of developing or worsening chronic non-communicable diseases. Women usually cannot decrease household workload during daytime, therefore, the effects of fasting on women, pregnant or non-pregnant, need to be evaluated further. Children and adolescents also need careful evaluation.[79, 85, 93, 105, 142, 155]

Obesity incidence is on the rise

While the problems of undernutrition are well known in MENA countries, health problems associated with being overweight are increasing as parts of these countries become more affluent and urbanized. Obesity is more commonly associated with life in wealthier, developed countries, but is also found in areas where there has been a nutrition transition—that is, when a cereal-based diet is replaced by a diet high in calories and animal fat and low in fiber—combined with a sedentary lifestyle. Obesity is more prevalent among women than men (Figure 10). A comparison of Table 4 and Figure 10 shows that the incidence of obesity is higher in high income MENA countries than it is in OECD countries. Around 44 percent of the women in Kuwait and 38 percent in United Arab Emirates are obese, compared to 25 percent of women in United States and less than three percent in Japan. Also, Figure 11 shows an increase in the incidence of overweight among young children in Egypt and Morocco, which may indicate a trend that also exists in other countries in the region.

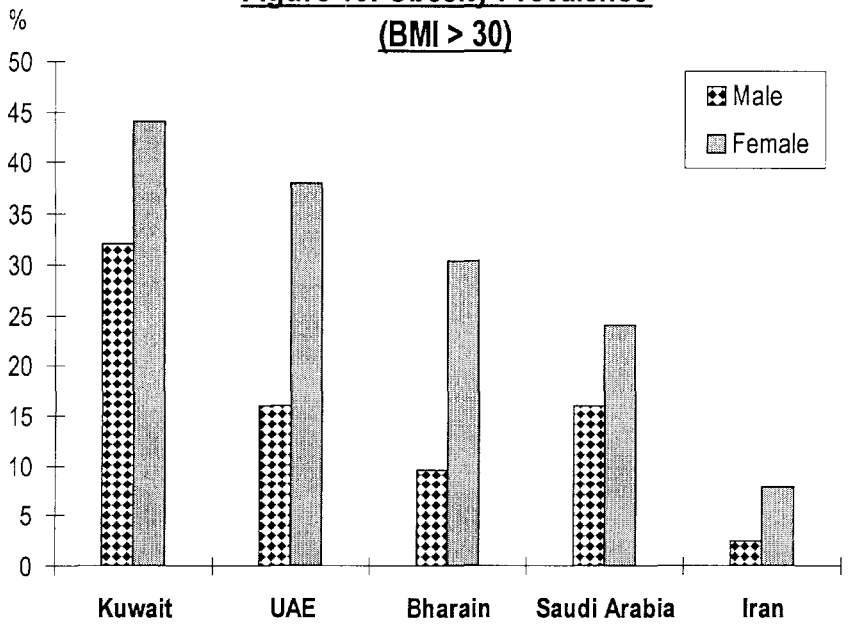
Table 4: Obesity Prevalence in Selected OECD Countries

(Most Recent Data between 1993-1996)

	Obesity Prevalence (%)	
	Male	Female
U.S.	19.7	24.7
England	15.0	16.5
Netherlands	8.4	8.3
Japan	1.8	2.6

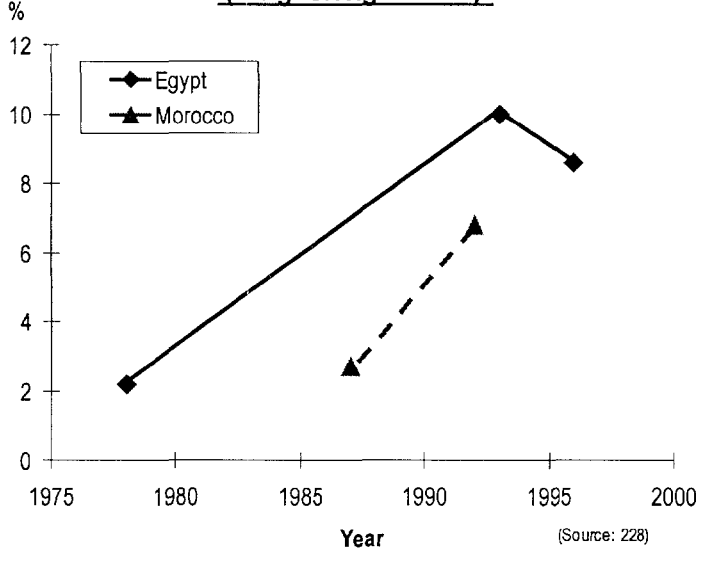
(Source: 230)

Figure 10: Obesity Prevalence (BMI > 30)



(Source: 230)

Figure 11: Overweight Prevalence in Children Under 5 Years (Weight/Height +2SD)



(Source: 228)

Faulty diet causes many health problems

MENA countries are likely to face much higher health care costs in the decades to come because of diet-related non-communicable diseases. Among women, obesity increases the risk of complications in pregnancy and delivery. Obesity, high intake of animal fat, and low intake of dietary fiber are risk factors for chronic non-communicable diseases such as coronary heart diseases, diabetes mellitus, colon and breast cancer.[82] Figure 12 shows that circulatory system diseases are already a major cause of adult deaths in most MENA countries. The prevalence of diabetes mellitus is high in several MENA countries (Figure 13).

It takes 15 to 20 years before the increase in body weight is followed by the onset of diabetes, and another 5 to 15 years before diabetes causes more serious complications such as renal failure, blindness and amputations.[46] This means that MENA countries are likely to face much higher costs of health care in 10 to 20 years, unless nutrition interventions to prevent diet-related non-communicable diseases are begun immediately. In the United States where the incidence of obesity has doubled since 1980, the direct and indirect health care costs associated with the disease are estimated to be more than $70 billion annually.[186, 238]

Figure 12: Death Due to Circulatory System Diseases (% of Total Death)

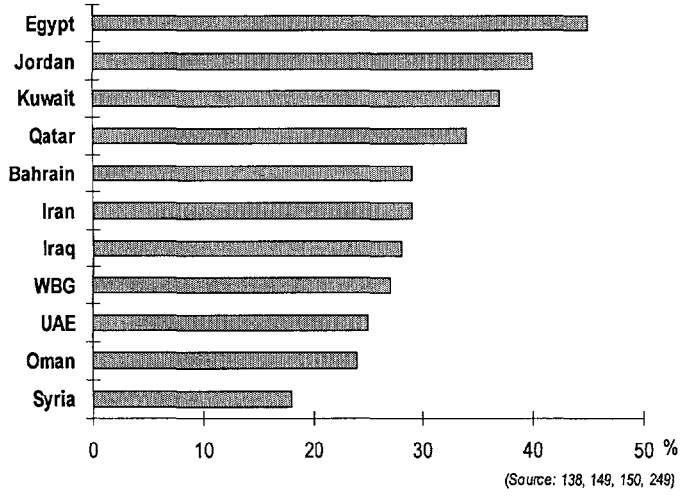
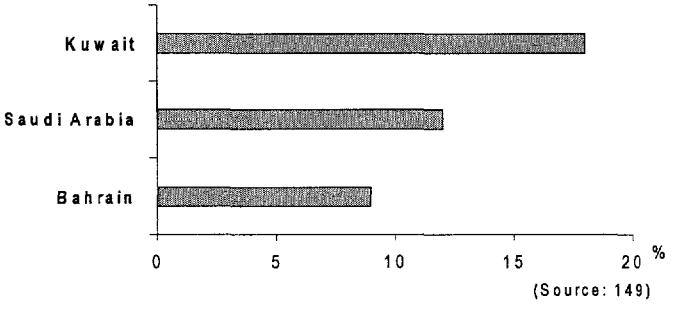


Figure 13: Prevalence of Diabetes Mellitus



Micronutrient Disorders

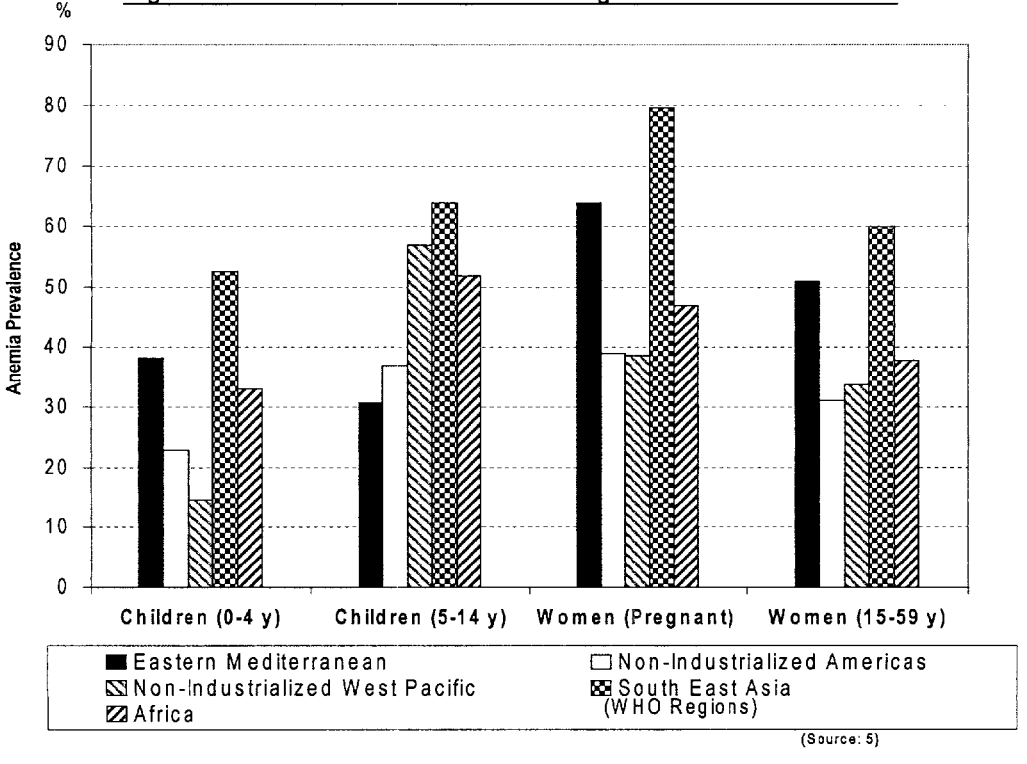
Iron

Nutritional Anemia

Nutritional anemia is usually due to iron deficiency and is a common problem throughout the world, particularly among children and women of reproductive age. Anemia is most critical in children under 24 months of age, because they are at the greatest risk of being deficient and most likely to suffer damage. Compared to other regions, anemia in MENA countries is less prevalent among school-age children, but relatively more widespread among younger children and women[6] (Figure 14). Anemia is common among women and children throughout the MENA region regardless of income level; the incidence in Kuwait is similar to that in Egypt and West Bank and Gaza (Table 5).

There are significant gaps between urban and rural and between males and females in children's anemia in Bahrain (Figure 15). Anemia is more prevalent in preschool boys, but decreases considerably when they reach secondary school. The number of anemic girls increases in intermediate school and, for rural girls, continues to increase into secondary school. Adolescent girls become more susceptible to anemia following menarche, but the number of urban girls with anemia decreases in secondary school revealing that anemia was prevented for some.

Figure 14: Anemia Prevalence among Women and Children



(Source: 5)

[6] The Eastern Mediterranean Region of WHO includes Afghanistan, Cyprus, Djibouti, Pakistan, Somalia, and Sudan, but does not include Algeria and Israel.

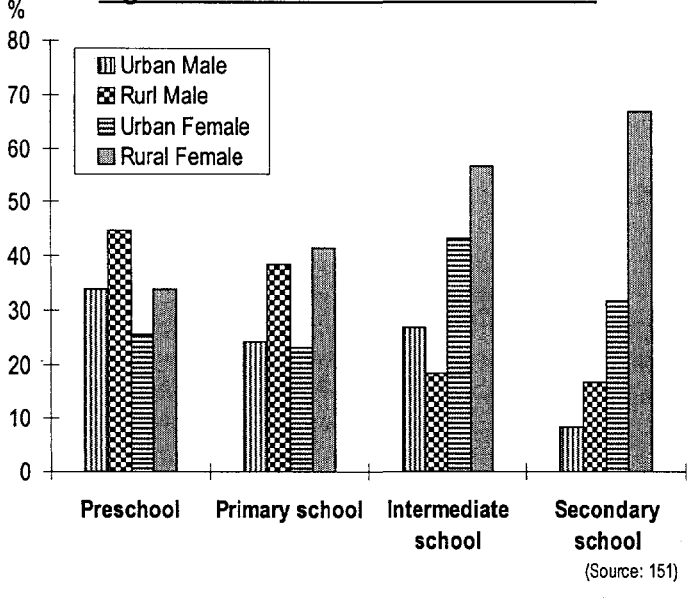
Table 5: Anemia Prevalence

(Data from Various Subnational Surveys between 1980-1996)

	Children		Women		Men
	Under 5 Years (%)	School Age (%)	Pregnant (%)	Reproductive Age (%)	(%)
Low Income					
Yemen	17~66	-	-	5~36	-
Lower-middle Income					
Egypt	23~90	22~45	21~79	17~71	-
Iraq	-	-	-	18	-
Morocco	27~47	-	20~40	-	-
Syria	53	-	49~52	30	-
Jordan	34	-	25~46	4~23	-
Algeria	-	-	42	19~42	-
Iran	>30	-	20~50	-	-
Tunisia	30	-	41	-	-
West Bank and Gaza	58~76	40~67	23~56	28~44	-
Lebanon	-	-	49	27	-
Upper-middle Income					
Oman	40~67	31~78	49~54	15~48	3~24
Libya	-	-	-	6	-
Saudi Arabia	36~37	26~55	5~57	-	30~56
Bahrain	30~39	21~42	-	40~49	20
High Income					
Qatar	26	-	30	-	-
Israel	44~71	-	10~32	18~61	-
Kuwait	-	13~26	40	42	34
United Arab Emirates	28~76	8~95	22~62	-	-

(Source: 114, 148, 151, 216, 220)

Figure 15: Anemia Prevalence in Bahrain



(Source: 151)

Anemia risk factors

The major dietary source of iron in MENA countries is cereals. Unlike heme iron in animal products, the bioavailability of nonheme iron in cereals is low. Absorption of iron is further reduced by the consumption of tannin, phytate, and dietary fiber. People in the region drink a lot of tea, which contains tannin, and eat unleavened bread, or bread baked with high extraction rate flour which is high in phytate and dietary fiber. Vitamin C in fruits and vegetables can increase absorption of nonheme iron, but the amount of fruits and vegetables people eat varies depending on seasonal availability and cost. Much of the anemia in MENA countries can be prevented by more diversified diets that include animal products, fruits, and leavened bread. Furthermore, tea should not be consumed with meals and should not be given to small children. Iron fortification of staple food should be also needed.

Anemia among children under five years of age is caused by poor feeding practices, childhood illnesses such as diarrhea, and mothers' anemia during pregnancy and lactation. Feeding sweet tea and unleavened bread to infants and toddlers increases their chances of developing anemia. Intestinal parasites, especially hookworm, may also cause anemia although the prevalence of parasites has not been accurately measured. Schistosomiasis is endemic in Egypt, causing hematuria and anemia. In many developing countries, malaria is a major cause of childhood anemia when repeated bouts occur at short intervals, but it is endemic only in Yemen in the MENA region and it is resurfacing in Iraq.

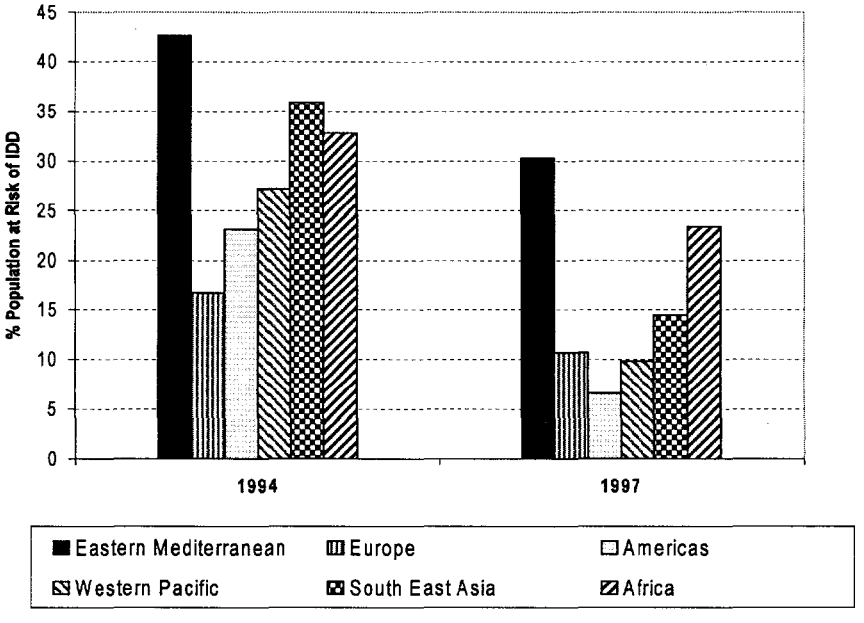
Regardless of income level, women in MENA countries are at high risk for anemia due to high fertility, short birth intervals, poor maternal health care, and lack of nutrition education. However, lower income can increase the risk of anemia because there is less money for a balanced diet. Women with lower incomes in rural areas are the highest risk group because they have less diversified diets and lack access to regular health care. This group requires more urgent attention and specific interventions for their own health and the health of their children. Women who do receive antenatal care, may avoid taking iron supplements because they can cause stomach discomfort, plus some women believe that the iron pills cause abortion or excess enlargement of the fetus.

Consanguineous marriage is common practice and is an important factor contributing to hereditary diseases endemic in MENA countries which cause disorders similar to nutrient deficiency (Annex 1). For example, G6PD deficiency and thalassemias cause hemolytic anemia. Premarital genetic counseling would help, but cultural sensitivity must be taken in account.

Iodine

Iodine deficiency disorders (IDD) are a problem in the region because many of the countries have areas with little iodine in the soil, *e.g.,* the mountainous areas of Iran, Iraq, Lebanon, Morocco, Syria, Tunisia, and Yemen, and also the oases in the deserts of Egypt and Libya.[232] The effects of iodine deficiency are even seen in coastal areas, because not all people eat seafood due to dietary habits or prohibitively high prices. Previously in the MENA region, goiter was believed to be merely a cosmetic issue, and in some communities, a symbol of adulthood, *i.e.* girls starting to develop goiter were considered to be eligible to marry. In 1989, the WHO Eastern Mediterranean Regional Office (EMRO) established a Working Group for control of IDD to reduce total goiter rate (TGR) to 10 percent or less by the year 2000.[233] The strategy included national surveys followed by salt iodization and iodized oil supplementation programs.

Figure 16: Proportion of Total Population at Risk of IDD



(WHO Regions)

(Source: 5)

Table 6: Iodine Deficiency Disorders (IDD)

	Total Goiter Rate (6-11 year old) (Data between 1981-1994) %	Goiter Prevalence Based on Various Subnational Surveys %	Households Consuming Iodized Salt (Data between 1992-1996) %
Low Income			
Yemen	32	-	21
Lower-middle Income			
Egypt Egypt (New Valley)	5.2	12 - 43 52 - 82	0
Iraq	7.3	30 - 80	50
Morocco	20	18 - 80	-
Syria	73	69 - 77	36
Jordan	-	6 - 16	75
Algeria	8.5	23 - 71	-
Iran	30	-	82
Tunisia	4.3	15 - 51	98
Lebanon	15	12 - 70	92
Upper-middle Income			
Oman	10	10	35
Libya	6.3	20 - 55	90
Saudi Arabia	-	8 - 30	-
High Income			
United Arab Emirates	-	46 - 66	-

(Source: 148, 151, 207, 221)

The most visible result of iodine deficiency is goiter, the enlargement of the thyroid gland visible as a swelling in the front of the neck. Other iodine deficiency disorders include impaired physical and mental development, congenital anomalies, and cretinism (Annex 1). IDD is a major public health problem in many developing countries. Figure 16 shows the Eastern Mediterranean Region[7] has the highest proportion of people at risk for IDD. In other regions the incidence of IDD has decreased rapidly during the past three years due to effective interventions, but in MENA, salt iodization has begun only recently.

IDD surveillance and control is at different stages in MENA countries (Table 6). In 1989, Iran identified 14 out of 24 provinces as IDD endemic areas and designed control programs for them. They built 22 salt iodization plants, and by 1995, 76 percent of rural households and 87 percent of urban households consumed iodized salt. Iodized oil was also distributed to the hyperendemic areas. In 1990, Syria identified a high total goiter rate of 77 percent in rural areas and 69 percent in urban areas. The single salt producer, the Ministry of Industry, began to iodize salt in 1992, but it reaches only an estimated 36 percent households. The government has distributed iodized oil to children under two years and pregnant women. While no nationwide data are available, a 1991 survey in Yemen indicated that 78 percent of girls and 60 percent of boys in Sana'a had goiter, and that there were hyperendemic rural areas where 95 percent or more of the population had goiter.(210) In 1995, the Ministry of Public Health launched a control program in collaboration with UNICEF which aimed to achieve universal salt iodization. By the end of 1998, about 70 percent of salt consumed in urban areas in Yemen are iodized.(field interviews)

In West Bank and Gaza, neonatal screening for thyroid stimulating hormone (TSH) is carried out on all newborns at the public hospitals and clinics since TSH increases in reaction to low level of thyroid hormones. This screening found 10 positive cases out of 27,000 tested in 1994 and 81 positive cases out of 45,000 tested; higher than the incidence in European countries which is around 0.2 per 1000 births.(21, 218) Endemic hypothyroidism is observed in Khan Younis area in Gaza at about 15 percent goiter prevalence. All salt used in West Bank and Gaza is imported from Israel, but the salt is not iodized and Israeli authorities do not allow production or distribution of iodized salt within West Bank and Gaza.(218, field interviews)

Vitamin A

Clinical vitamin A deficiency (VAD) is largely under control in the MENA region, in fact, it is the only region in the developing world expected to eliminate clinical VAD before the year 2000[8] (Figure 17). Diets in the MENA countries include generous amounts of leafy green vegetables rich in carotene that are a good source of vitamin A (Annex 1).

A 1992 subnational survey in Yemen observed clinical VAD in around two percent of the sample group, the highest prevalence —three percent—occurred among five and six year old children.(222) Clinical VAD was seen more frequently in boys than girls. Subclinical prevalence of VAD among one to five year old children was around 62 percent. Subsequently, a one-time vitamin A supplement program was implemented. A pilot program of universal vitamin A distribution is underway in conjunction with National Immunization Day.

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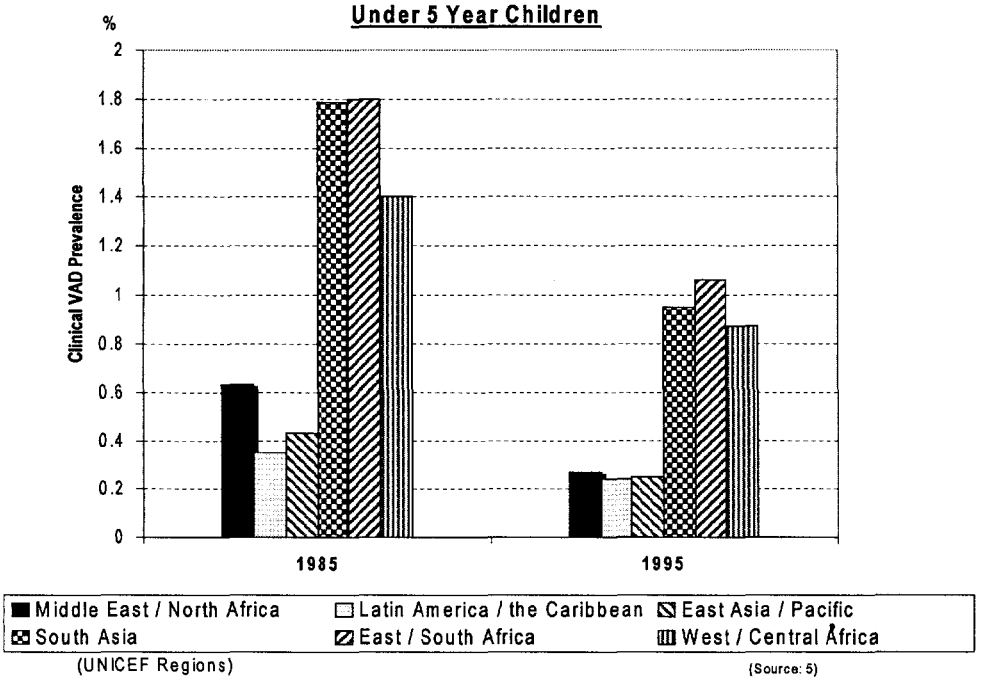
[7] Moderate to severe levels of IDD are seen in Afghanistan, Pakistan and Sudan, which are not included in MENA region.

[8] The Middle East and North Africa Region of UNICEF includes Djibouti and Sudan, but does not include Israel.

In Iraq, where the trade embargo has created a health and nutrition crisis among vulnerable groups, a 1994 survey reported that VAD is increasing. But in general, MENA countries are making progress in reducing the incidence of VAD—Oman found no cases of clinical VAD in children under two in 1991. However, in Egypt and Morocco, significant numbers of young children tested have low serum retinol or low levels of vitamin A in their systems, so subclinical VAD still needs to be addressed (Annex 4).

Figure 17: Estimated Clinical VAD Prevalence for Under 5 Year Children



Vitamin D

Vitamin D deficiency causes rickets in children, and osteomalacia (bone softening) and, in the extreme, bone fractures in adults. Vitamin D is found in animal foods, and it is also synthesized by the skin if people are exposed to a sufficient amount of sunlight. The vitamin D deficiency observed in MENA countries is due to the low dietary intake of vitamin D, plus lifestyles that avoid sunlight. Throughout the region, people live in dark houses, infants are wrapped for long periods of time, and many women wear thick, dark veils. In Saudi Arabia, the airborne dust particles may block ultraviolet light. Women of reproductive age and children are the most vulnerable to vitamin D deficiency. Rickets occurs most commonly by the age of one and disappears by the fifth year. Although it is treatable by exposure to sunlight, bone development may be irreversibly damaged. Especially in girls, an underdeveloped pelvis can lead to obstetric complications later.

Studies in several MENA countries show a relationship between vitamin D deficiency and people's clothing and living conditions. In 1995, a hospital-based study in Kuwait reported significantly lower vitamin D levels as measured by low serum 25-OHD levels in veiled women.[63] The study suggests that young, unmarried women are particularly at risk because they

cover themselves more thoroughly than the older, married women. Young, otherwise healthy women suffer bone fractures due to vitamin D deficiency. In Saudi Arabia, surveys in 1992 showed lower serum 25-OHD levels in urban areas than in rural areas, lower levels among occupants of mud or brick houses than tents, and lowest levels in female adolescents and preschool children.[148] Another study revealed that women in higher income households had higher levels of serum 25-OHD because they had more animal origin food in their diet, lived in better housing, and attended antenatal care more regularly where they received vitamin D supplements.[176]

Babies born to mothers with low vitamin D levels are at higher risk for rickets. Studies in Saudi Arabia and Libya report that mothers of infants with rickets had low serum 25-OHD levels.[60, 67] These infants begin life with low levels of vitamin D and prolonged breastfeeding by mothers with low vitamin D put the infants at higher risk, because breast milk is their main source of vitamin D. Infants with rickets have weak muscles and poor suck, have trouble with breast milk intake, and are often malnourished. In Yemen, a 1972 survey in six villages in the northern part of Yemen reported that 16.5 percent of children aged six months to four years had rickets, and a 1987 survey in a village in northern Yemen reported an overall prevalence of rickets as high as 27 percent among children under five.[210] During the last three years in Gaza, the 400 cases of rickets found in children under two years of age were treated successfully by introducing sufficient sunbathing.[field interviews]

Zinc

Cases of zinc deficiency were recorded in Egypt and Iran for the first time in the early 1960s.[166, 167, 171] Diets in both countries were based on pulses and unleavened bread made from wheat flour. In fact, diets in these and other MENA countries are low in bioavailable zinc and high in factors that inhibit its absorption. The incidence of zinc deficiency is probably similar to that of nutritional iron deficiency because both are caused by the same dietary pattern. A zinc deficiency may cause low birth weight, severe anemia, or it may retard growth or sexual maturation. Zinc deficiency can be controlled by modifying the diet to include improved varieties (*e.g.*, animal products and milk) and by reducing phytate through bread leavening and fermentation (Annex 4).

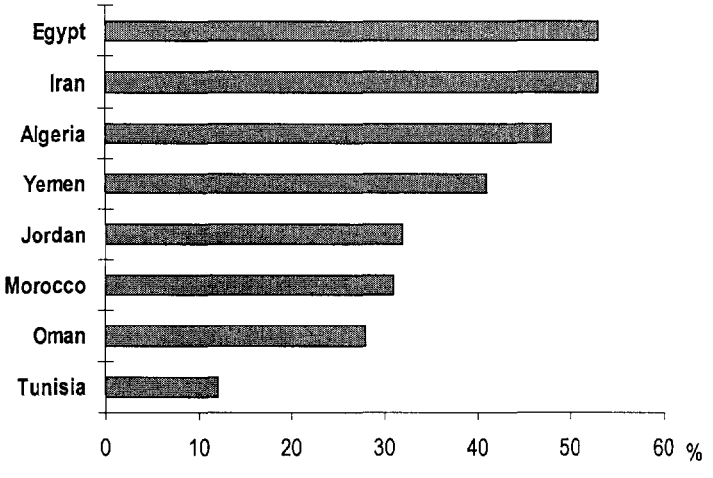
3. Causes, Consequences and Determinants of Nutrition Disorders

Breastfeeding and Complementary Feeding

Inappropriate feeding practices are major causes of child undernutrition. Three important issues of child feeding are: exclusive breastfeeding in early life; duration of breastfeeding; and complementary feeding. International experts recommend exclusive breastfeeding of infants for about six months and breastfeeding with good quality complementary foods up to two years.[231, 234] Significantly in a region with a large Muslim population, the Koran recommends breastfeeding for up to two years. Figure 18 shows that only about half of mothers or fewer in MENA countries exclusively breastfeed their infants for up to three months. Therefore, over half of the infants under three months of age are fed complementary foods or breast milk substitutes. The duration of breastfeeding is gradually declining in most countries, especially in urban areas. A study in urban Riyadh, in Saudi Arabia, showed that only 31 percent of non-employed mothers and 12 percent of employed mothers breastfed their infants; the highest income mothers were the least likely to breastfeed.[9]

As a result, inappropriate complementary feeding and weaning practices are major causes of child undernutrition, which is highest in the age group between six months and two years. These hazardous practices include abrupt weaning, mixed breast and bottle feeding as early as the first month, and the premature introduction of complementary food—all of which are commonly found in MENA countries. Complementary foods include tea, sugar water, rice, wheat, milk, vegetables, and breast milk substitutes, often prepared in unsanitary conditions—infant formula diluted with unsafe water in an non-sterile bottle. There are also numerous traditional beliefs and values that undermine good breastfeeding practices which can leave children undernourished and vulnerable to disease at a very early stage in life. For example, some mothers believe colostrum is harmful to newborns, so they do not start breastfeeding until two days after birth.

Figure 18: Exclusive Breastfeeding up to 3 Months



(Source: 207, 210)

Gender

The poor nutrition and health status of women and female children form an *inter-generational* vicious circle. Low birth weight infants are more likely to be stunted. Stunted girls grow up to be short-height women. Short-height women more frequently suffer from obstetric complications which may endanger their own lives, plus that of the fetus and infants. The incidence of low birth weight is higher among mothers who are short, undernourished, or anemic.[55] To break this vicious circle, it is critical to reach females aged 6 to 24 months, as well as pregnant women.

A young girl's anemia worsens after adolescence due to increased iron requirement, and if she becomes pregnant, her baby will have low birth weight and anemia, plus her own health will deteriorate. Anemia in pregnancy increases the risk of maternal deaths, since it lowers the tolerance to blood loss and resistance to infection. Although 25 percent of maternal deaths are directly due to bleeding and 15 percent are due to infection, anemia is a strong contributing factor—depending on the country, anywhere from a quarter to almost all of maternal deaths are linked to anemia.[220, 227] Frequent pregnancies and short intervals between births impede the recovery from worsened nutritional status during pregnancy and lactation.

The prevalence of malnutrition is similar among girls and boys, although gender gaps in the region are large compared with other regions.[191] This may require further in-depth study to disaggregate the data in relation to other factors such as age, area of residence, socio-economic status, birth order, and so forth, even though no significant differences appeared in the aggregated average data.[202]

Cultural norms in the MENA countries may require that, adolescent girls and young unmarried women receive particular attention. Early marriage can result in pregnancy while the mother is still physically growing: this causes extra nutritional burdens. Young women's lower status in the family may deny them nutritious food rich in iron and protein. Unmarried females may develop vitamin D deficiency because they are more heavily veiled and tend to remain indoors. Nutrition disorders including anemia and IDD should be treated before pregnancy, however, unmarried females are less likely to contact health professionals than married women who are pregnant or mothers of small children.

Obesity prevalence among women is much higher than that among men. Obesity and diet-related non-communicable diseases increase risks of complications of pregnancy and delivery and therefore increase maternal and perinatal morbidity and mortality. Sedentary life styles of obese people, particularly those who are urban and affluent increase the risk. High obesity prevalence among women may be partially due to cultural prohibitions to women's physical exercise.

Education and Cultural Background

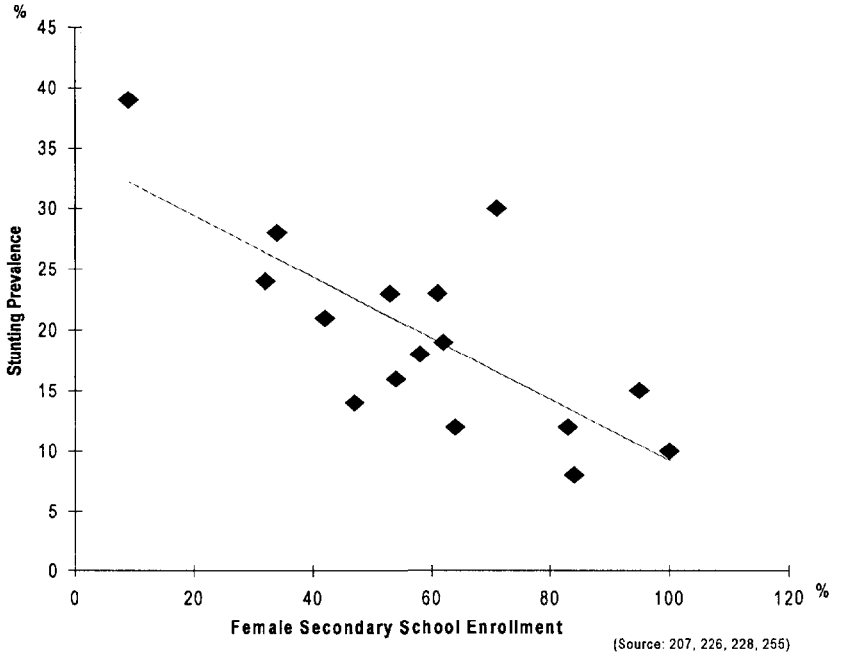
Education

Childhood malnutrition is often caused by improper child feeding and caring practices, therefore, the knowledge and values of caretakers, especially mothers, are very important. Women with secondary and higher education tend to have fewer children which can enable them to provide better care, plus improve their own health and nutritional status. In addition, women living in countries that provide them with the opportunity for secondary and higher education are more likely to have access to additional health and social services.

In MENA countries the incidence of stunting drops significantly with the increase of female secondary school enrollment rates (Figure 19). (Stunting also drops with the increase of male secondary school enrollment rates but the correlation is not statistically significant—Annex 4.) Since stunting is the most constant indicator of chronic child malnutrition, higher female education level, and overall social development as reflected by the female education level, seem to contribute over time to a decrease in child malnutrition.

Education levels influence nutritional status; nutritional status affects children's educational attainment. Children who are undernourished or anemic can be retarded in their cognitive ability development. Likewise, iodine deficiency disorders (IDD) are a major cause of mental retardation and impaired physical development in endemic areas. Even moderate forms of IDD lead to the loss of 10 to 15 IQ points.[187] Additionally, intrauterine growth retardation and low birth weight impede children's cognitive and physical development. Thus, nutritional disorders cause lower school attainment, and consequently, decrease people's long-term economic productivity.

Figure 19: Stunting Prevalence and Female Secondary School Enrollment in MENA Countries



(Source: 207, 226, 228, 255)

Box 3: Delivering Nutrition Messages to the Public

Delivering proper dietary information to the general public, especially children and their caretakers, is very important to improve nutritional status. In the early 1970s, all households in Kuwait had at least one television set, and in 1991, 87 percent of urban households and 41 percent of rural households in Yemen had televisions. The mass media has remarkable impacts on food beliefs and practices. After the Tunisian government used TV spots to encourage people to eat lentils, demand increased to the point where the government had to import lentils. Another example is a survey in Bahrain that showed that 42 percent of housewives bought a newly advertised beverage, and 59 percent of children always requested food items advertised on TV. Some mass media advertisements encourage over consumption of nutritionally unbalanced food such as snacks and soft drinks.

Messages which may lead to nutritionally unbalanced diets can be found not only in mass media campaigns but also in school textbooks. The UN Food and Agricultural Organization Regional Office of the Near East (FAO/RNE) is advising governments about the nutrition implication of messages on the dietary habits of children. FAO/RNE screened English textbooks used in the Gulf states which contained phrases such as "I like Pepsi, I like tea. -- I don't like milk."

But, the food industry can also be a strong ally for delivering nutrition information to the general public. FAO/RNE has prepared nutrition education materials financed by a multinational company that produces fortified cereals. There are no specific advertisements in the education materials, however, the company expects that people who have become more nutritionally conscious are willing to choose the company's fortified products. This innovative partnership between the public and private sectors suggests a direction of the better communication strategy.[49, 150, field interviews]

Cultural background

Equity in food distribution is important not only at the national level, but the household level among family members. Households living a traditional lifestyle may allocate insufficient quality and quantity of foods to women and children, even though the total household's nutrition intakes are sufficient and balanced.[108] Moreover, undernutrition and obesity may coexist in a same household: for example, mothers of undernourished children are sometimes obese.

Information and communication technology has increased people's access to outside information. Commercial messages on television and mass media nutrition campaigns can strongly influence attitudes and behaviors (Box 3). Unless consumers are educated and protected, they may receive messages with harmful nutritional implications, such as commercial messages that encourage over-consumption of soft drinks and snacks. The behavior of people is as important as education and culture and can actually compensate for deficits in education.

Demographic Changes and Conflicts

Demographic changes

The MENA region has high natural population growth rates and significant migration—caused by workers who seek employment in the oil-producing countries and by political unrest and conflict in some countries (Box 4). These demographic issues create pressure on food supply and often increase imports (Annex 3). Migrant workers usually earn enough to feed themselves plus send money home to their families. But refugees can strain local resources, and in many cases they require international assistance to ensure that they are adequately nourished (Annex 2).

Box 4: Displaced Population in Southern Iraq

People from the marshlands of southern Iraq have had their environment and livelihood destroyed and now malnutrition is widespread. Many of those who could escape have become refugees in Iran.

In early 1991, civil war broke out following the Shiite revolt after the Gulf War. Many people fled into the marshlands between the Tigris and Euphrates rivers. An intensified military campaign and blockade by the Iraqi government continued during 1993 conducted a forced removal of Shiites in and around the marshes. Extensive army and civil engineering projects began to divert water from the marshes and the resulting environmental destruction depleted local food sources to the point where the remaining inhabitants are no longer able to feed themselves; neither can they purchase food due to the blockade. Originally about half a million people lived in the region but by mid-1994, as many as 200,000 had fled their homes and were in hiding in the marshes and up to 50,000 were living in camps in Iran.

While many civil conflicts devastate the economy, in this instance the destruction especially affects the food chain and lack of food and potable water are among the major reasons for displacement.[2]

Conflicts and economic sanctions - the case of Iraq

Before the Gulf War in 1990, Iraq was an oil-rich country that imported two thirds of its food supply. Since the UN sanctions were imposed, Iraq's revenues have plummeted; it is unable to import sufficient food and medicine, or pesticides to control malaria, or materials to rebuild infrastructure destroyed by the war. Scarcity of food and medicine plus damage to water treatment and sanitation systems are seriously undermining the health and nutritional status of the population. Although massive starvation has been avoided through an efficient rationing system, sanctions have cut people's diets drastically (Table 7).

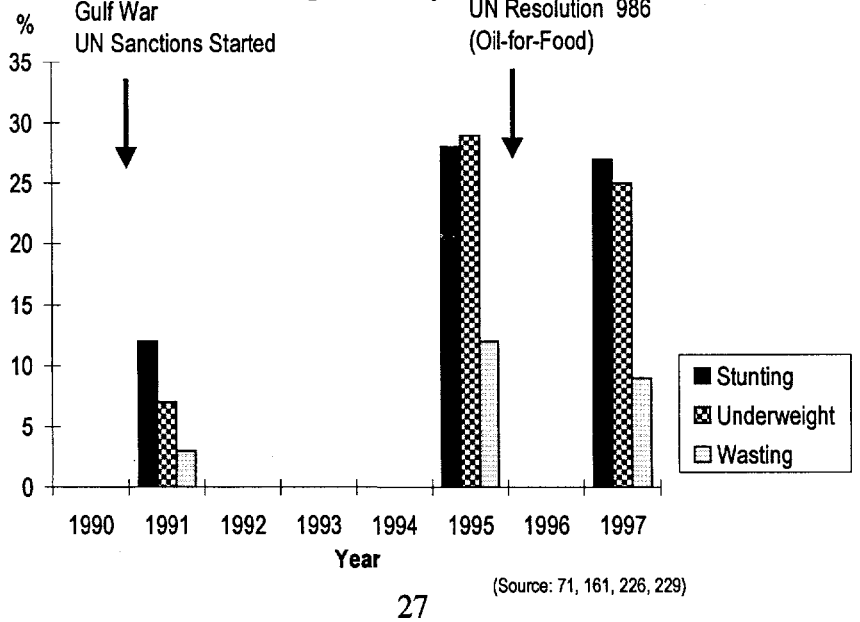
Figure 20 shows the dramatic effect the embargo has had on children—malnutrition has increased, and many children are more susceptible to disease because they lack medicine and basic sanitation. In 1995, the UN Security Council instituted the "oil for food" program to help alleviate the widespread malnutrition caused by sanctions. Since then, the nutritional status of Iraqi children has improved slightly. Until sanctions end and reconstruction begins it will be difficult for the nutritional status and basic health of the population to recover.

Table 7: Total Dietary Energy Intake in Iraq before and after the Gulf War

Year	Total Energy	Rations
	Kcal/cap/day	
1984-89	3,372	
1990	3,150	
1991-95	2,250	1,295
1997	2,424	2,030

(Source: 71)

Figure 20: Nutrition Impacts of International Sanctions against Iraq



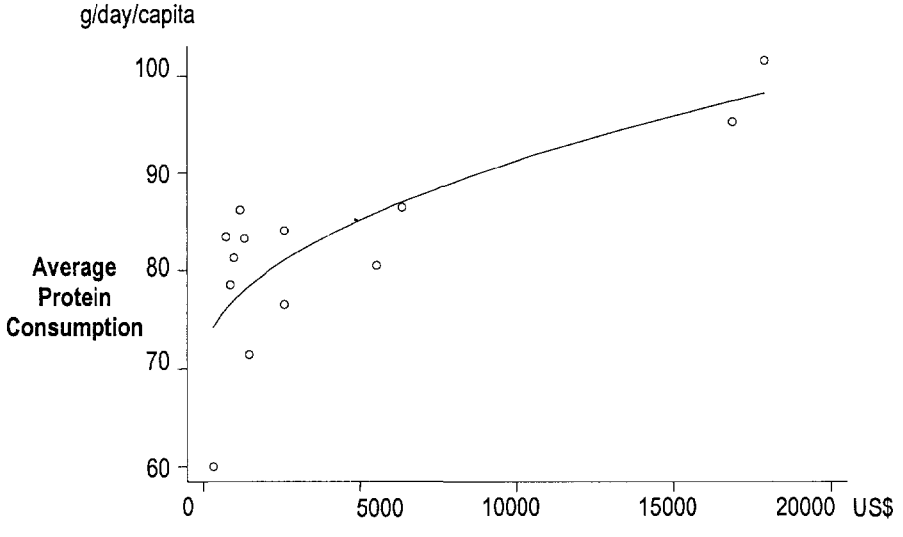
(Source: 71, 161, 226, 229)

Economic Development

Income and nutrition

Poverty and malnutrition are usually strongly linked. Yemen, the only low income country in the region, has the lowest average dietary energy consumption, or food availability, and the highest prevalence of childhood malnutrition. Industry, markets and social infrastructure such as schools and clinics, water and sanitation, tend to grow in cities, so rural development lags overall economic development and there is a higher incidence of malnutrition in rural areas. But low dietary energy intake does not necessarily correlate with poverty because even poor countries have public welfare programs, including food subsidies and international assistance, that enable some underprivileged people to secure adequate dietary energy. Countries must identify the people most at risk for undernutrition and design programs to reach them effectively—poor people generally and the rural poor specifically must be monitored carefully because they are the most susceptible to nutrition problems.

Figure 21: Protein Consumption and GNP/c in MENA Copuntries



(Source: 150, 255)

At lower income levels, nutrition problems are related more to the balance and quality of food in the diet than to dietary energy intake. Many nutrition disorders result from an inadequate dietary balance because the poor often cannot afford the variety of foods that maintain good health. People in the higher income countries in the MENA region tend to consume more protein daily (Figure 21), particularly animal-based protein. These foods are good providers of protein, iron, zinc, vitamin A and D; their consumption actually increases the bioavailability of iron and zinc. Higher income is also linked to higher levels of family education and competency, and adequate housing and health care. Thus, positive relationships emerge between eating meat and animal products and health, especially in developing countries. People who cannot regularly afford meat and animal products in their diet need good nutritional education to make wise food choices, plus regular health care to monitor growth and signs of micronutrient disorders. Decreased household income often results in decreased variety of foodstuff because it reduces

purchases of more expensive meat and fruits, even though total dietary energy intake remains the same (Box 5).

Box 5: Influence of Border Closures in Gaza

The borders of Gaza Strip and West Bank towns are controlled by Israeli authorities even after the Palestinian National Authority (PA) took over the administrative responsibilities. It is not unusual for the borders to be closed for unspecified periods due to Israeli security concerns. This restricts the movement of people and goods which curtails the income of many Palestinians, particularly in Gaza Strip, who depend on labor and trade inside Israel.

In 1996, following a prolonged border closure in February and March, an NGO active in nutrition programs in Gaza Strip conducted a rapid household survey on food security. The results showed that the mean monthly income decreased by 32 percent; on average, the consumption of meat fell by 30 percent from 5.3 kg to 3.7 kg/month/household; eggs by 22 percent from 105 to 82/month/household; and less than 50 percent of households could still buy fruits and milk during the closure. However, the meals per day did not decrease, and more than 90 percent of households could still buy flour and rice; flour consumption remained stable.

This survey illustrates how political instability can affect people's nutritional status. Dietary quality and diversity are most affected, while total dietary energy intake can be stabilized, even during the prolonged border closure. However, nutritional education, for example advising people about the high nutritional value of many cheap foods, such as vegetable sources of protein and micronutrients, would be useful in this situation.[107, 249]

Dissociation of nutrition status and economic development

The stunting prevalence in Egypt[9] declined until 1995, although the rate of decline did not directly correlate to the increase of GNP/c (Figure 22). Stunting prevalence actually *increased* from 22 percent to 30 percent during the rapid economic growth between 1995 and 1996. The urban/rural gap remained constant during the decline in stunting prevalence, but increased when the national stunting prevalence increased (Figure 5; Annex 4).

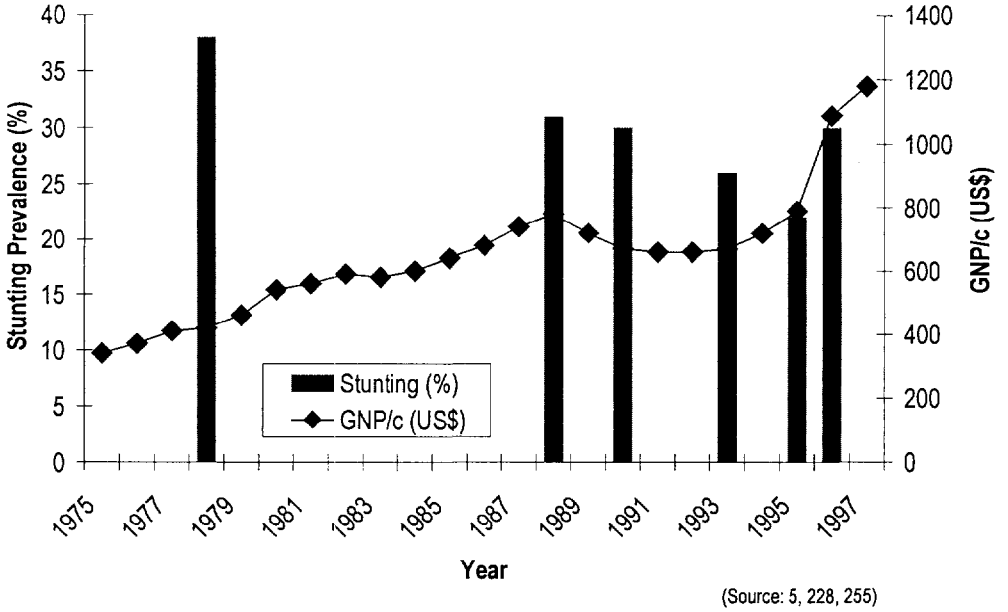
Egypt has the highest average dietary energy consumption in the region despite its income level and stunting prevalence being the second lowest (Table 1, 3). This is due to the heavy food subsidy schemes[10] which have increased food availability per capita to levels comparable to industrialized countries.[74, 150] The food subsidy scheme covered 20 food items and in 1981, accounted for almost 20 percent of total government expenditures. But since the late 1980s, as part of economic structural reform, the Egyptian government gradually decreased the subsidies so that by 1995, they included only bread, wheat flour, sugar, and edible oil, and accounted for only 5.5 percent of total government expenditure.[8, 11, 258] In that year, bread and wheat flour accounted for 42 percent of total daily energy consumption in urban households and 23 percent in rural households, thus they are the largest sources of dietary energy in the Egyptian diet.

[9] The 1997 interim Egypt Demographic and Health Survey reported a decrease of stunting prevalence and a decrease in the urban/rural gap, but an increase of wasting prevalence (stunting prevalence: total 24.9 percent, urban 20.0 percent, rural 28.2 percent; wasting prevalence: 6.1 percent).[66]

[10] Food subsidy issues are analyzed in the regional study on consumer food subsidies.[258]

Nutritional status is affected by food subsidies, but how they are linked is not yet clear—there was a major food subsidy reform which was completed by 1992, and the stunting prevalence declined steadily until 1995. The rice subsidy was canceled in 1992, and bread is more heavily subsidized than wheat flour.[11] This policy may have hurt rural households, since they consume more rice and wheat flour and prepare their own bread at home rather than purchase it. The persistence of child malnutrition in Egypt is related more to child caring practices and infectious diseases, such as diarrhea and intestinal parasite infection, than to food availability.[4]

Figure 22: Stunting Prevalence and GNP/c in Egypt



(Source: 5, 228, 255)

4. Improving Nutrition in MENA Countries

Major Nutrition Issues in MENA Countries

In spite of improvement in income and health status, stunting, or chronic undernutrition among children under five years of age, is still prevalent in some countries, especially in rural areas (Table 8). The urban/rural gap is widening: income differences are growing, inequity in access to social services exists, and there are other exclusionary factors which explain this polarized development. But it requires further analyses. Nutrition improvements have lagged economic development in Egypt and Tunisia as reflected in their data on stunting prevalence. Morocco, while not as obvious, might also be in the same situation.

Table 8 also illustrates the status of micronutrient deficiencies in MENA countries. Certain deficiencies, particularly iron, are prevalent even in high-income countries. Women and

[11] Consumer price of bread is about one third of actual production cost.[11]

children are most vulnerable to these deficiencies, which might also explain the relatively high maternal mortality and low birth weight incidences in the region. Iodine deficiency disorders (IDD) also remain a serious public health issue, however, many MENA countries have already started universal salt iodization programs which can eliminate it as a public health issue.

Obesity and excess fat intake are problems in the region, particularly in high income countries, in urban areas, and among women. High obesity prevalence increases risks of diet-related non-communicable diseases, such as coronary heart disease and diabetes mellitus, in the years following the change of diet and weight gain. These conditions will result in soaring health care costs in 10 to 20 years, unless intensive preventive campaigns are undertaken.

Table 8: Major Nutrition Issues in MENA Countries

	Stunting	Wasting	Low Birth Weight	Anemia	IDD	VAD	Vitamin D Deficiency	Obesity	Diet-Related Non-communicable Diseases
Low Income									
Yemen	++	++	++	++	++	+	+		
Lower-middle Income									
Egypt	++	++	+	++	+	+		+	++
Iraq	++	++	++	++	+	+			+
Morocco	++	+		++	++		+		
Syria	++	++	+	++	++				+
Jordan	+	+		++				+	++
Algeria	+	++		++	+				
Iran	+	++		++	++		+	+	+
Tunisia	++	+		++				+	
West Bank and Gaza	+	++		++			+		++
Lebanon	+	+	+	++	+				
Upper-middle Income									
Oman	++	++		++	+				++
Libya	+	+		+	+		+		
Saudi Arabia	+	+		++			+	++	++
Bahrain	+	++		++				++	++
High Income									
Qatar		+		++					++
Israel				++					++
Kuwait	+	+		++			+	++	++
United Arab Emirates				++				++	++

++: high/moderate; +: mild/unknown extent; blank: low/no data

Possible Strategies and Actions

Creating a policy framework

Each country should develop a specific operational strategy. Initially, policy makers need to recognize nutritional issues and their causes, prioritize the problems, identify the vulnerable groups in their population, and assess impacts of existing programs and institutional capacity. Next, they must design short-, medium-, and long-term strategies to solve nutritional problems; and to coordinate the efforts of all concerned agencies. They need to choose between specific interventions and comprehensive programs, between targeted or universal approaches. During

implementation, progress and impact have to be carefully monitored. As nutrition affects health most directly, Ministries of Health should take leading roles in coordinating among sectors, drafting strategies, and implementing interventions.

Since nutrition is a multi-sectoral issue, development and improvement in other sectors can greatly affect nutritional status. Therefore, the design and preparation of programs in other sectors should always be assessed for their nutrition implications, and during implementation they should also be monitored for impact on nutrition. Policy changes in agricultural and trade sectors should be monitored for their effect on local food availability and prices. Even within the health sector, it would be more effective to address risk factors for all nutrition disorders simultaneously.

For instance, Integrated Management of Childhood Illness (IMCI) by WHO and UNICEF is expected to reduce chronic child undernutrition through a comprehensive approach to address the health and nutrition problems of small children.[182] IMCI is a comprehensive primary health care program including case management of diarrhea, respiratory infection, and malaria, nutrition counseling and management, and drug management. Although IMCI has been implemented in various developing countries in the world, only a few MENA countries, such as Egypt and Morocco, started to introduce this approach.

In depth analyses necessary for each country

The real impact of food and agricultural reforms on nutritional status are not completely understood. Despite the fact that nutritional status is one of the best indicators of poverty, people responsible for economic policies and for nutritional assessment do not coordinate policy. Country economic data and nutritional indicators should be analyzed together to figure out why there are discrepancies between the economic development and nutritional improvement. Priority issues in each country can be identified only after conducting in depth studies on nutritional issues and assessments of existing nutrition programs. Before designing interventions, such as micronutrient fortification programs, feasibility studies or sector work should be conducted.

Various factors, such as household income, status of women, their educational attainment and other cultural factors, critically affect nutrition and nutritional disorders, however, these factors are likely to carry different weights in determining the pattern of nutritional disorders.[12] Clarifying a link between the underlying causal factors and the patterns of nutritional disorders would lead to more specificity and a prioritization of policy intervention for each nutrition disorder pattern, and also contribute to stronger policy recommendations at the country level.

Capacity building

Strong institutions and technical capacity are a prerequisite for implementing successful and sustainable nutrition interventions. Many countries have a shortage of qualified nutritionists, plus they are poorly distributed to address nutrition problems. In Egypt, nutritionists are mainly hospital based in large urban areas,[24] but most of the countries' nutrition problems are in rural communities and prevention of nutritional disorders does not take place in hospitals. To achieve a critical mass of qualified technical personnel, regional collaboration should be more encouraged. The WHO/EMRO and the Nutrition Institute in Cairo are conducting regional training courses on nutrition for example.[236]

[12] For example, a study in Jamaica indicated that increased child height correlated to increased education of women in a household, marginally correlated to household income, but did not correlate to father's education.[97]

Communication for behavior change (CBC)

Many nutritional disorders are not expensive to solve, or they can be avoided if people understand the risks and change their behaviors. People need to know the elements of good child feeding practices and how to maintain a balanced diet, regardless of their incomes. Nutrition awareness is essential among the general public, and especially among mothers and caretakers of small children.

Communication for behavior change (CBC) programs should be carefully designed, monitored and evaluated to achieve maximum impacts. CBC programs can be delivered through many channels: schools, clinics, communities, youth groups and mass media. For example, health professionals can counsel mothers about breastfeeding and appropriate complementary feeding techniques at clinics or by home visit; school health programs can include nutrition education for children and provide supplemental nutrition. Information with nutrition implications in the newspapers, on television, and elsewhere has to be carefully monitored to avoid spreading misleading information and to protect consumers.

Possible interventions to each nutrition disorder

Possible interventions for nutritional issues are summarized below. The disorders and their possible interventions are illustrated in Table 9. Examples of nutrition programs in other countries, their costs and cost/benefit analyses of long term diet-related benefits of nutritional supplements on labor productivity relative to the costs of intervention measures are described in Annex 2. For example, iron supplementation to rubber plantation workers in Indonesia lead 15 to 25 percent increase of productivity (benefit-cost ratio of 260:1); and iron fortification of bread in Lebanon is estimated to avert lifetime income loss of $15,000 (benefit-cost ratio of 7,500 to 1).

- Child malnutrition
  Comprehensive public health and nutrition programs targeted to children under two years of age and their care takers, particularly among the rural population, should include growth promotion, IMCI, diarrhea control, and nutritional education regarding breastfeeding and appropriate complementary feeding techniques.

- Low birth weight
  Comprehensive maternal health services: *e.g.,* food and iron supplementation and nutrition monitoring of pregnant women at the antenatal check-up. CBC programs for pregnant women and decision makers in the family including husbands and the elders.

- Obesity and diet-related non-communicable diseases
  CBC programs to address obesity and diet-related non-communicable diseases. Health promotion activities including physical exercises and nutrition counseling. Experience in industrialized countries shows that there are no single universally accepted solution to control obesity epidemic, thus innovative and multidirectional approach will be required.

- Anemia
  Iron and folic acid supplementation to pregnant and lactating women, children particularly under 24 months of age, and adolescent girls through health service channels, schools and communities. CBC programs to promote proper complementary feeding, diet diversification and modification to increase iron intake and absorption. Iron fortification of staple foods. Parasitic disease control programs. Premarital genetic counseling to decrease hereditary anemic diseases.

- Iodine deficiency disorders (IDD)
  Universal salt iodization. Iodine supplementation programs to pregnant women and school children in hyper-endemic areas.

- Vitamin D deficiency
  CBC programs to modify child caring practices and life styles. Vitamin D supplementation to pregnant women. Vitamin D fortification of edible oil and milk.

Table 9: Nutrition Interventions

Nutrition Disorders	High-Risk Groups	Specific Interventions		Public Health	Nutrition Monitoring	Communication for Behavior Change	
Child Undernutrition	Children, 6 to 24 months	Breast feeding / Complementary feeding / Growth Promotion		Management of childhood illness / Immunization	Clinic / community	Clinic / community	Mass media
Low Birth Weight	Pregnant women	Food / Micronutrient supplement		Management of high risk pregnancy	Antenatal check-up	Clinic / community	Mass media
Anemia	Pregnant women	Iron / Folic acid supplement	Iron fortification	Management of high risk pregnancy	Antenatal check-up	Clinic / community	Mass media
	Adolescent girls	Iron supplement	Iron fortification		Community / School / Youth group	Community / School / Youth group	Mass media
	School age children	Iron supplement	Iron fortification	Deworming	School	School	Mass media
	Children under 5 years	Complementary feeding	Iron fortification	Management of childhood illness	Clinic / community	Clinic / community	Mass media
IDD	Pregnant women	Iodine supplement	Salt iodization	Management of high risk pregnancy	Antenatal check-up	Clinic / community	Mass media
	School age children	Iodine supplement	Salt iodization		School	School	Mass media
Vitamin D Deficiency	Children, 6 to 24 months	Sun bathing / Complementary feeding	Vitamin D fortification		Clinic / community	Clinic / community	Mass media
	Young women	Vitamin D supplement	Vitamin D fortification		Antenatal check-up	Clinic / community	Mass media
Obesity	Adults	Diet counseling		Health promotion / Management of diet related diseases	Clinic / community	Clinic / community	Mass media

Source: World Bank

Micronutrients fortification

Staple foods can be fortified or enriched with various micronutrients (Annex 2). The unit cost of micronutrient fortification programs is usually much less than that of supplementation programs (Table 10). For instance, the estimated annual per capita cost of salt iodization is about one fifth of the cost of iodine supplementation. Iron fortification is one tenth the cost of iron supplementation to pregnant women.[108, 244] Fortification is a sustainable and equitable solution to ensure micronutrient coverage of the entire population, if the fortification programs are truly

institutionalized, as seen in industrialized countries. Fortification of several food items, such as wheat flour and bakery products, rice, salt, sugar, condiment, and milk, is likely to provide the potential coverage larger than fortification of single food items.

Many MENA countries have started to move forward with universal salt iodization. All countries in the region should adopt this policy, including those countries currently not iodizing salt. Iodine compounds can be also added to potable water for the purpose of both water purification and iodization, if water systems permit. Countries should also consider iron fortification of staple foods to decrease the widespread anemia in the region. WHO/EMRO and UNICEF are promoting iron fortification of wheat, as wheat is a major staple food consumed in many MENA countries.[237]

The most critical factor for long term success is quality control, both at the plant and consumer levels, to verify specified fortification levels are within acceptable limits. Initial investment in technical and institutional capacity building is likely to be needed, since problems can occur in monitoring and sustaining the quality of the programs.[13] Before implementation, feasibility studies are required to identify food consumption patterns, production and distribution systems, legal and institutional framework, and costs and incentive systems. Multi-sectoral commitment and private sector participation are essential.[124]

Table 10: Costs of Micronutrient Fortification Programs

Country	Food Vehicle	Fortificant	Cost (US$/person/ year)	Year
Several	Salt	Iodine (50 – 80 ppm)	0.02 – 0.06	1992
India	Salt	Iodine (50 ppm) + Iron (1,000 ppm)	0.12 – 0.18	1991
Guatemala	Sugar	Vitamin A (15,000 IU/kg)	0.29	1994
Guatemala	Sugar	Iron (1.3 %)	0.1	1981
Egypt	Wheat flour	Iron (25 – 35 ppm)	0.15	1980
Venezuela	Corn flour / Wheat flour	Iron (20 – 50 mg/kg) Vitamin A (39,000 IU/kg)	0.07 – 0.08	1994

(Source: 121, 237, 244)

Categorizing nutrition issues in MENA countries

Table 8 suggests that MENA countries can be categorized into three types of nutrition disorder patterns.

- Type 1:
  High malnutrition and micronutrient deficiency; low economic and social indicators; *e.g.,* Yemen, Iraq.

- Type 2:
  Relatively large population with malnutrition, with large urban-rural gaps and high micronutrient deficiency; relatively well performing middle-income economy with a significant number of poor; *e.g.,* Iran, Tunisia.

- Type 3:
  High micronutrient deficiency and obesity; relatively high income with pockets of poverty and comparatively low social indicators; *e.g.,* Saudi Arabia, Bahrain.

[13] Bahrain started fortifying wheat flour with iron and vitamins in 1993, however, the program was discontinued after one year, primarily because of financial constraints.[237]

Combination of interventions for each type

Type 1 countries require both specific nutrition interventions and comprehensive health and social programs. Decreasing malnutrition among small children and pregnant women should be the first priority. Particularly among MENA countries, Yemen and Iraq require special international support. Yemen, with the most serious malnutrition problems and the lowest income level in the region, needs to increase the effectiveness of its social service sector, including nutrition and health. Iraq could rehabilitate in a relatively short time once the international sanctions are lifted. The international community should prepare a prioritized strategy to rehabilitate the country when the situation allows.

Type 2 countries also require both specific nutrition interventions and comprehensive health and social programs targeted to decrease inequity within the country. Nutrition and other social programs should be targeted to the rural population and urban poor, particularly women and small children. Food and agriculture policies should be carefully assessed for effectiveness and real nutritional impacts on the vulnerable groups.[14]

Type 3 countries need to emphasize CBC programs for preventing obesity and micronutrient deficiencies and to proceed with micronutrient fortification programs. These countries also require nutrition, health and social programs targeted to their vulnerable groups. They may need technical assistance to bring their programs up to international standards.

Strategic Options for the World Bank

To assist MENA countries in improving nutrition, the World Bank may consider several strategic options listed below:

- Stimulate country discussions.
  This review, which summarizes major nutrition issues in the region, should be disseminated among stakeholders both in the social and economic sectors of MENA countries. This will stimulate discussions in each country and help put nutrition back on the policy agenda. A regional conference including the public and private sectors, NGOs, and academics may be an option to formulate a regional strategy.

- Put nutrition back on the policy agenda.
  Nutritional status is one of the best proxies to measure poverty and social development. Therefore, nutrition issues should be taken into account in the country assistance strategy (CAS) and should be discussed with governments in the context of economic and social development. For example, the new CAS of Yemen indicates that poverty reduction, health, nutrition and population (HNP), and education are priorities. A system for regular monitoring of nutrition status has to be established in each country, as well as special surveys to analyze specific issues.

- Support specific programs.
  Bank HNP programs should emphasize nutritional improvement. Nutrition programs[15] should include: maternal and child nutrition care including health services, CBC, training,

[14] Countries at risk for undernutrition need to design effective programs to reach the poor. In the case of Egypt, the urban poor receive income transfers and secure dietary energy intakes from self-targeted food subsidy programs.(8)

[15] An example of nutritional program package is the Nutrition Minimum Package (MINPAC), which targets: exclusive breast feeding for about six months; appropriate complementary feeding until 24 months; adequate vitamin A intake

and monitoring; micronutrients and food supplementation; and micronutrient fortification. Nutritional activities in current national public health programs should be strengthened to meet international standards. To ensure sustainability of the programs, their costs need to be carefully estimated, and feasible financing plans, including donor assistance, need to be prepared. For instance, community involvement will be a key strategic element to sustain programs in Yemen, where the government's resources are scarce and therefore, the Bank will pilot a community-based child development project in partnership with UNICEF.

- Partner and facilitate technical assistance.
  Each country has to improve current programs and prepare new ones to meet international nutritional standards. Even those countries that do not require financial assistance may need technical support for planning, implementing, and monitoring their nutrition programs. The Bank could facilitate technical assistance in partnership with other organizations such as WHO, UNICEF, FAO, and reputable NGOs, while taking into account of each agency's technical advantage. The Bank could also help to coordinate and mobilize the technical and financial resources of other agencies, including the private sector.

- Coordinate and monitor other sector programs.
  The Bank is a unique agency with multi-sectoral expertise. Other sectors, including water and sanitation, agriculture, education, and industry, can assist in designing and monitoring programs that produce positive impacts on nutrition. All poverty reduction programs should use nutrition indicators, such as the results of periodic national surveys and specific surveys in intervention and control areas, for assessing the impacts of interventions and adjusting them. The Bank could support the institutional capacity building of Ministries of Health, which could play a leading role in intersectoral coordination.

5. Conclusion - Nutrition as a Priority Issue

Nutrition disorders impede the economic development of a country. Poor nutritional status will lead to poor educational attainment and decreased economic productivity, plus rising health care costs. Long term economic loss caused by nutrition disorders should not be underestimated because failing to invest in good nutritional outcomes now will incur even greater costs in the future.

Improving people's nutritional status should be a priority for all MENA countries. The countries must realize that economic development strategies until now have not improved nutrition as much as expected. Any new development strategy should include specific schemes to improve nutritional status, particularly among women, children, and rural populations; this would also strengthen economic and social development overall.

Policy makers need to reach a consensus to make nutrition a country's priority among many developmental issues. Strong political commitment at the highest level is needed to implement and sustain effective nutritional interventions. The World Bank will work together with governments to sustain the economic, social, and human development of their countries, and to assure a basic human right of people—adequate and balanced nutrition.

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for women and small children; nutritional management during and after illness; iron and folic acid supplementation for pregnant women; and regular use of iodized salt.

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Annex 1. Nutrition Disorders - Background Information

Child Malnutrition

Child malnutrition in a certain population is usually evaluated anthoropometrically through stunting, wasting, and underweight, in comparison with a standard reference population such as the United States National Center for Health Statistics (NCHS) tables.[88] Severe malnutrition refers to the status lower than –3SD of the reference population. Moderate malnutrition refers to lower than –2SD but higher than –3SD.

Stunting refers to low height for age, reflecting a relatively long-term malnutrition status. Stunting is slowing of skeletal growth and stature resulted from extended periods of inadequate food intake and repeated childhood diseases. It is considered to be the most stable parameter for child malnutrition. Wasting refers to low weight for height, reflecting an acute malnutrition status that may be caused by temporary famine, sudden economical depression or a war. It is a sensitive index of current nutritional status. Underweight refers to low weight for age. It is a general and simple parameter for malnutrition, but doesn't consider height differences.

Marasmus is an extreme form of protein energy malnutrition, characterized by loss of muscle mass and adipose tissue. Marasmus results from a prolonged reduction of food intake under famine-like conditions. Kwashiorkor is another form of extreme protein energy malnutrition, results from a diet with a low protein content relative to energy. It also arises from an inadequate intake of dietary protein concomitant with acute protein losses induced by trauma, sepsis, and so on. Unlike marasmus, kwashiorkor does not result in a depletion of skeletal muscle protein: instead the visceral and serum protein pool is depleted and edema occurs.

Unless there are absolute food shortage, child malnutrition is mainly due to incorrect child feeding practices including complementary feeding, repeated childhood diseases such as diarrhea and respiratory infection, incorrect care of sick children, and lack of personal hygiene and environmental sanitation. The incidences of malnutrition are usually the highest among the children over six months and under five years of age.

Breastfeeding and Weaning

Breastfeeding is internationally promoted as the wide range of benefits is well recognized. It is recommended that breastfeeding should be started immediately after birth, continued exclusively for about six months, with complementary foods for up to two years.[207, 231, 234] This is particularly important in developing countries, where bottle feeding practices often fail to meet proper nutritional and sanitary conditions: *e.g.*, baby formula prepared with contaminated water or too diluted. Baby Friendly Hospital Initiative, started in 1991 by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), has transformed over 12,700 hospitals in 14 countries into centers of support for breastfeeding.[207]

Breast milk contains nutritional substances ideal in quantity and quality for optimal growth and development of infants. In addition to its nutritional value, breast milk favorably changes the pH of stools and the intestinal flora, thus protecting against bacterial diarrhea.[43] Colostrum is a high caloric, high protein, thin yellow fluid present in the breast before birth and for the first few days thereafter, which contains antibodies, lymphocytes and macrophages as well as nutrients. Colostrum also stimulates the passage of meconium of newborn.

On average, about 600 - 750 ml breast milk is produced per day. Lactating mothers require additional 600 - 800 kcal of dietary energy and 15 g of protein per day.[83] Since infants' nutritional requirements increase, complementary solid foods should be introduced after six months. Gradual weaning over weeks or months is recommended.

In addition, breastfeeding provides emotional and psychological benefits to both mothers and infants. Suckling stimulates oxytocin excretion, which stimulates milk secretion as well as uterine contraction and helps postpartum recovery. Prolactin, a hormone regulating milk production, inhibits ovulation and causes postpartum amenorrhea. Thus, breastfeeding also provides natural contraception.

Fetal Malnutrition

Fetal malnutrition usually reflects the status of health and nutrition of pregnant women. Although intrauterine growth retardation (IUGR) is more suitable for assessing fetal malnutrition, it is often difficult to determine accurate gestational age in developing countries.[55] Therefore, low birth weight is usually used for assessing the prevalence of fetal malnutrition.

Low birth weight is defined as the birth weight less than 2,500 g.[5, 55] Low birth weight infants include small for gestational age infants born at term, appropriate for gestational age infants born prematurely, and a few normal infants in the lower end of the growth distribution. The prevalence of low birth weight in developing countries is estimated at about 16 percent; it is about six percent in the industrialized countries. It is sometimes difficult to estimate the incidences of low birth weight in developing countries, since the proportion of the infants weighed at birth varied greatly: *e.g.* 86 percent in Jordan, 22 percent in Morocco, and only 6 percent in Yemen.[45]

IUGR is defined as birth weight below the 10th percentile of the birth weight for gestational age, sex specific, single/twins risk curve.[55] IUGR is mainly caused by fetal malnutrition due to maternal malnutrition, pre-eclampsia and other maternal complications, cigarette smoking, and so on. IUGR is also caused by fetal disorders such as chromosomal anomaly and intrauterine viral infection.[162] IUGR is estimated at about 24 percent of live births in developing countries.

Fetal malnutrition can lead to structural or functional changes in utero that permanently increase susceptibility to chronic diseases. People born with low birth weight are reported to show higher incidences of high blood cholesterol levels, hypertension, and lower glucose tolerance that may lead to diabetes mellitus.[5, 32, 92, 101, 116, 157, 174, 179, 239] Considering that chronic non-communicable diseases are increasing in most developing countries, maternal care requires more attention for decreasing IUGR and low birth weight infants.

Body Mass Index (BMI)

Body Mass Index (BMI) is one of the common indicators of adult overweight and obesity, as well as underweight and adult malnutrition. BMI is calculated through the formula below.[88] The incidences of chronic non-communicable diseases such as diabetes mellitus and cardiovascular diseases are lowest when BMI is around 22. Underweight, overweight, and obesity are defined as below.

BMI = Weight (kg) / Height (m)^2

Underweight	BMI < 20
Overweight	BMI > 25
Obesity	BMI > 30

Protein, Carbohydrates and Fat

Protein, carbohydrates, and fat are macrocomponents of the diet and the principal sources of energy: protein, 4 kcal/g; carbohydrates, 4 kcal/g; and fat, 9 kcal/g.[83]

Proteins account for about three-fourths of the dry matter in most human tissues other than bone and adipose tissues. Proteins are made up of about 20 common amino acids: nine amino acids are not synthesized by mammals and are therefore dietary essential, whereas others are synthesized from dietary sources of carbon, usually from carbohydrates, and nitrogen. Amino acids are required for the synthesis of body protein and other important nitrogen-containing compounds, such as creatine, peptide hormones, and some neurotransmitters.

Carbohydrates are the principal dietary sources of energy, particularly in developing countries. The principal dietary carbohydrates are sugars and complex carbohydrates. Sugars include monosaccharides, such as glucose and fructose, and disaccharides, such as sucrose, maltose, and lactose. Sugars are found in fruits, milk, honey, corn syrups, candies, sweet desserts and soft drinks. Complex carbohydrates or polysaccharides comprise starches and dietary fibers. Starches are polymers of glucose and found in cereal grains and their products such as bread and rice, potatoes, legumes, and a few other vegetables. Dietary fibers are indigestible complex carbohydrates such as cellulose, pectin, and algal polysaccharides. Dietary fibers bind to mineral elements and interfere with absorption, although consumption of fiber rich diet is related to a reduced risk of cardiovascular diseases and colon cancer.

Fats or tryglycerides are composed of three fatty acids esterified to glycerol. Fats are the most concentrated source of dietary energy and sources of a few essential fatty acids. Fats facilitate absorption of fat-soluble vitamins, as well as enhance the palatability of food. Dietary sources of fats are meats, poultry, fish, shellfish, milk and milk products, eggs, edible oils, and margarine. Cholesterol and phospholipids are major components of all cell membranes and of myelin. Cholesterol is also the precursor of the steroid hormones and of the bile acids. High levels of LDL-cholesterol in plasma relate an increased risk of atherosclerotic vascular disease, especially coronary heart disease, whereas high levels of HDL-cholesterol are associated with a reduced risk.[43, 82] The strongest dietary determinant of blood cholesterol levels is the content of saturated fatty acids, which are mainly present in animal fats.

Recommended Dietary Allowance (RDA)

	US (25-50 year old)		Japan (30-39 year old)	
	Male	Female	Male	Female
Total Dietary Energy (kcal/day)*	2,900	2,200	2,500	2,000
Protein (g/day)	63	50	70	60

*Fats contribute about 36 % of total energy in US, whereas 26 % in Japan. (Source: 83, 98)

Nutritional Anemia

Nutritional anemia is a condition in which the hemoglobin (Hb) content of the blood is lower than normal, as a result of a deficiency of one or more essential nutrients--usually iron, less frequently folic acid or vitamin B_{12}.[5] Iron deficiency anemia is the most common nutritional disorder in both developing and industrialized countries. Protein energy malnutrition usually accompanies nutritional anemia, however, iron deficiency anemia frequently occurs in those individuals with sufficient, or even over intakes of, protein and dietary energy.

Iron is a constituent of Hb, the oxygen carrying molecule of the red blood cells, myoglobin, and a number of enzymes.[83] In addition to these functional forms, as much as 30 percent of the body iron is found in storage forms such as ferritin and hemosiderin, mainly in the spleen, liver and bone marrow, and a small amount is associated with the blood transport protein transferrin. Clinical signs of iron deficiency include hypochromic-microcytic anemia, glossitis, spoon nails, loss of energy, tiredness, increased susceptibility to infection and reduction in intellectual performance and work capacity.[5, 43, 216, 235] Measurement of the concentration of Hb in whole blood is the most widely used screening test for iron deficiency anemia.[88]

Hb Levels Indicative of Anemia

Age / Gender	Hb level
Children 6 months - 5 years	< 11 g/dl
Children 6 - 14 years	< 12 g/dl
Non-pregnant Women	< 12 g/dl
Pregnant Women	< 11 g/dl
Adult Men	< 13 g/dl

Epidemiological Criteria

Prevalence	Mild / Moderate Anemia	Severe Anemia (Hb < 7 g/dl)
Severe	> 40 %	> 10 %
Moderate	10 - 39 %	1 - 9.9 %
Mild	1 - 9.9 %	0.1 - 0.9 %

(Source: 5, 216, 235)

Iron deficiency arises from inadequate dietary iron intakes, poor absorption, excessive loss caused by gastrointestinal bleeding, menstruation, parasite infection, and so on. Iron is required in greater amount during periods of rapid growth. Women of reproductive age lose 50 percent more iron than men, due to menstrual bleeding. Therefore, women of reproductive age, infants and young children who require higher iron intakes are more susceptible to iron deficiency.[43, 86, 216] Heme iron in animal products such as meat, liver, poultry, seafood, is highly absorbable, while nonheme iron in cereals, vegetables, fruits and dairy products is less bioavailable. Ascorbic acid, or vitamin C, in plant foods increases the absorption of nonheme iron when the two are ingested together. On the other hand, tannins, phytate, and dietary fiber, which are found in tea and bran, decrease nonheme iron absorption substantially. These inhibitors can be reduced by food processing, such as fermentation, sprouting, and cooking.[141, 235]

Folic acid and vitamin B_{12} are water-soluble vitamins which are involved in nucleic acid synthesis. Deficiency of folic acid or vitamin B_{12} causes megaloblastic anemia.[43, 83] Vitamin B_{12} (cobalamin) is also involved in synthesis of myelin in the nervous system, and deficiency may cause irreversible neurological abnormalities.

Folic acid is included in green leaves and is essential for cellular replication and differentiation. Since the recovery of anemia is usually better through iron and folic acid supplementation than iron alone, most of the current supplementation programs for pregnant women provide both iron and folic acid. Folic acid is known to prevent congenital neural tube defect when it is supplemented to the folic acid resistant women during the first trimester of

pregnancy.[5] Therefore, folic acid should be supplemented when a woman who has previous neural tube defect pregnancies plans to be pregnant again.

Iodine

Iodine deficiency disorders (IDD) cover a wide variety of clinical conditions including goiter, impaired physical and mental development, spontaneous abortions, still births, congenital anomalies, increased perinatal and infant mortality, and neurological and myxedematous cretinism.[57, 187] IDD is caused by lack of iodine in the soil of endemic areas, therefore whole population consuming local foodstuffs, regardless income levels, are likely to suffer.[232, 233] Endemic areas include mountainous regions and recurrently flooded plains where iodine in the soil is continually washed away, as well as deserts and oases where iodine is hardly supplied by rainfall. Pregnant women are the most at risk as IDD may cause irreversible damage to the fetus and infants. Iodine requirement for children increases with age, so goiter prevalence also increases with age among children in the endemic areas.[221]

Iodine, a trace element present in the human body in minute amounts, is an essential substrate for synthesis of thyroid hormones, *i.e.* thyroxine (T_4) and triiodothyronine (T_3).[83] Iodine is present in food and water largely as inorganic iodide and is absorbed rapidly. Seafoods are excellent dietary sources of iodine. Natural goitrogens are present in a certain vegetables such as cabbage, turnips and cassava. Low dietary intakes of iodine decrease thyroid hormone secretion, resulting increased secretion of thyroid stimulating hormone (TSH) through the negative feedback mechanism. If iodine intakes are limited for prolonged periods, hence TSH continues to stimulate the thyroid gland, an iodine deficiency goiter is developed.[43]

Surveys of goiter can be done by palpation or ultrasonographic measurement. The total goiter rate (TGR) is the prevalence of visible goiter and goiter detectable by palpation.[57, 221] The most widely used method of assessing iodine status is to determine urinary iodine excretion in a 24-hour urine specimen, or alternatively casual urine specimen in comparison with creatinine excretion.[88] Serum T_3 levels rather increase in clinically euthyroid iodine deficient individuals, whereas T_4 levels decrease. Serum TSH concentrations are notably higher in chronic severe iodine deficiency. Congenital hypothyroidism is usually screened by using a TSH cut-off of 20-25 mU/l whole blood (about 40-50 mU/l serum).

Severity of Iodine Deficiency Disorders Based on Total Goiter Rate in School-age Children

IDD Status	TGR Prevalence
No IDD / IDD Eliminated	< 5 %
Mild IDD	5 - 19.9 %
Moderate IDD	20 - 29.9 %
Severe IDD	> 30 %

(Source: 221)

Vitamin A

Vitamin A, a fat-soluble vitamin, is a group of compounds including retinol, retinaldehyde, and retinoic acid, which is essential for vision, growth, cellular differentiation and proliferation, reproduction and the integrity of the immune system.[5, 83, 88] Vitamin A requirement increases

during periods of rapid growth and development, lactation, and infections including diarrhea and measles.[52, 80] Preformed vitamin A is present only in foods of animal origin such as liver, fish liver oil, butter, whole milk and egg yolks. Carotenoid precursors of vitamin A, such as β-carotene, α- carotene, and cryptoxanthin, are present in carrots and in dark-green, leafy vegetables such as spinach.

Prominent clinical signs of vitamin A deficiency (VAD) are ocular and range from night blindness to various signs of xerophthalmia from conjunctival xerosis to corneal ulceration to blindness.[5, 43, 82] Other less specific sub-clinical signs include loss of appetite, hyperkeratosis, increased susceptibility to infections, delayed recovery, and metaplasia and keratinization of epithelial cells of the respiratory tract and other organs. Vitamin A, if ingested in very high doses, causes toxic manifestations, such as headache, vomiting, alopecia, liver damage, spontaneous abortion and birth defects including malformations of the cranium, face, heart, and central nervous system.

VAD is commonly assessed by ocular clinical signs.[222] Dietary surveys and food balance sheet data can also be used for assessing vitamin A supply in the diet. Serum retinol levels are the commonly measured indicators of vitamin A status, using a cut-off of 0.7 μmol/l.[88] WHO has set a prevalence >10 % as defining a public health problem.

Vitamin D

Vitamin D is essential for adequate intestinal absorption of calcium and phosphorus and for regulating bone mineralization.[83] Vitamin D, a fat-soluble vitamin, is a generic term of all steroids including vitamin D_3 (cholecalciferol) and vitamin D_2 (ergocalciferol). Dietary sources of vitamin D are animal foods such as liver, butter, fatty fish, and egg yolks.

Vitamin D_3 is also synthesized in the skin, if exposed to a sufficient amount of sunlight or artificial ultraviolet radiation through photochemical transformation of the precursor, 7-dehydrocholesterol.[88] The amount of vitamin D synthesized is dependent on the area of skin exposed, age, the wavelength of the ultraviolet light, the intensity of the light which is affected by time, season, and latitude. Dark skin with high melanin content requires a much longer exposure to achieve the same degree of synthesis than lighter skin.

Vitamin D deficiency is characterized by inadequate mineralization of the bone.[43, 82] In children, vitamin D deficiency results in rickets, which is deformation of the skeleton including abnormal softness of the skull, enlargement of epiphyses of the long bones and costochondral junction that causes bow legs and knock knees. In the adult, vitamin D deficiency leads to osteomalacia, undermineralization of the bone matrix and in the extreme, bone fractures. Clinical signs of vitamin D deficiency have been associated with serum 25-hydroxyvitamin D (25-OHD) concentrations below 3.0 ng/ml.[88]

Zinc

Zinc is a constituent of more than 200 metallo-enzymes involved in carbohydrate, lipid and protein metabolism and nucleic acid synthesis and degradation.[83] Zinc is essential for cell replication, tissue repair and growth, stabilization of membranes, hormone production and secretion. Dietary sources of zinc are meat, liver, eggs, seafood especially oysters, milk and dairy

products, cereals and legumes. The bioavailablity of zinc in plant products is lower than that in animal products, as phytate and dietary fiber reduce the zinc absorption.

The signs of zinc deficiency include loss of appetite, growth retardation, skin changes such as hyperkeratinization, immunological abnormalities, and delayed secondary sexual maturation.[167, 171] Zinc deficiency may be partially responsible for reduced cell-mediated immune function and impaired neurocognitive development in young children.[95] Some studies indicated that zinc deficiency during pregnancy lead to birth defects and low birth weight, whereas other studies failed to show the correlation.[185] Recent studies reported that zinc supplementation enhanced immunity of children against infectious diseases.[23, 44]

Low zinc concentrations in hair samples collected during childhood reflect a chronic suboptimal zinc status, in case severe protein-energy malnutrition or severe zinc deficiency is absent. Clinical signs of marginal zinc deficiency in childhood such as impaired growth and poor appetite are usually associated with hair zinc concentrations of less than 70 μg/g.[88]

Other Micronutrients

Micronutrients Deficiency Disorders

Micronutrients	Deficiency Disorders
Iron	Anemia, spoon nail
Iodine	Cretinism, goiter
Zinc	Growth retardation, hypogonadism
Vitamin A	Night blindness, xerophtalmia
Vitamin D	Rickets, osteomalacia
Vitamin E	Hemolysis, neurologic damage
Vitamin K	Hemorrhage from deficient prothrombin
Vitamin B_1	Beriberi, Wernicke-Korsakoff syndrome
Vitamin B_2	Cheliosis, angular stomatitis, corneal vascularization
Niacin	Pellagra
Vitamin B_6	Convulsions in infancy, anemia, neuropathy, seborrhea-like skin lesions
Folic acid	Pancytopenia, megaloblastic anemia
Vitamin B_{12}	Pernicious anemia
Vitamin C	Scurvy

(Source 5, 43, 83, 88)

In addition to the previously described micronutrients, such as iron, iodine, vitamin A, vitamin D, zinc, folic acid and vitamin B_{12}, there are essential other vitamins, minerals and trace elements: *e.g.*, vitamin B_1 (thiamin), vitamin B_2 (riboflabin), niacin, vitamin B_6 (pyridoxine), vitamin C (L-ascorbic acid), vitamin E, vitamin K, calcium, magnesium, copper and selenium. Specific deficiency disorders of these micronutrients are reported, as shown in the above table, however, negative consequences at subclinical level are likely to affect more people.

The levels of disorders vary widely from subclinical levels to small numbers of clinical cases in a limited endemic area to significant numbers of clinical cases in an area wide enough to be recognized as a public health problem. For example, pellagra, the niacin deficiency disorder, was a public health problem in a part of Africa where the diet is mainly composed of maize, whereas it was reported only in a limited area of Egypt.[88, 184]

Hereditary Disorders Resembling Nutrition Disorders

Various hereditary diseases also cause disorders similar to nutrients deficiency: *e.g.* hemolytic anemia and congenital hypothyroidism. Hemolytic anemia is caused by hemoglobin and red cell metabolism disorders, such as thalassemias, sickle cell diseases, and glucose-6-phosphate dehydrogenase (G6PD) deficiency.[43] Hereditary diseases such as G6PD deficiency and β-thalassemia are endemic in the MENA countries, as shown in the Table below.[21, 140]

Neonatal screening for congenital hypothyroidism shows the incidences of 0.33 per 1000 births in Egypt, 0.71 per 1000 births in Iran, 0.37 per 1000 birth in Saudi Arabia, 0.45 per 1000 birth in Oman, and 0.40 per 1000 births in WBG.[21, 59, 218] These incidences are higher than the incidences in Europe, which are between 0.2 and 0.28 per 1000 births. While the most common cause of congenital hypothyroidism in Europe is non-genetic hypoplastic or ectopic thyroid, significant numbers of cases in MENA countries are caused by genetic dyshormonogenesis.

Consanguinity is an important factor in autosomal recessive diseases, since related individuals are much more likely to share the same mutant allele. Only homozygotes have symptoms of thalassemia major and sickle cell anemia.[43] Prevalence of consanguineous marriage in MENA countries is estimated at 20-50 percent.[21] G6PD deficiency, although it is inherited as X-linked recessive, females may account for up to 10 percent in the region. Genetic counseling should be provided to the high risk family members to prevent common hereditary diseases, while paying attention to the cultural sensitivity of the issue.

Frequency of Hereditary Disorders Causing Anemia

	Total Consanguineous Marriages (%)	Hemoglobin Disorders							Sickle Cell Disease		G6PD Deficiency
		Carriers				Newborns					
		HbS (%)	HbC (%)	β thalassemia (%)	Total (%)	Carriers (per year)	Affected (per year)	Affected (per 1000)	Affected (%)	Carriers (%)	(%)
Bahrain	39	10		3	13	2,000	126	9	2.1	11.2	21~26
Egypt	28			3	3	58,000	808	0			4~26
Iran	18~73	1		1~12	4	95,000	1,896	1			18~23
Iraq	58	0~20		3	6	50,000	1,501	2	1.7	16.0	9~13
Jordan	50	1		3	4	6,000	97	1			5~10
Kuwait	54	+		+	4	2,000	47	1			20~22
Lebanon	17~30	1		3	4	3,000	70	1		0.3	3
Libya		2	1	1~2	4	8,000	166	1			3
Morocco		2	2	3	7	59,000	1,824	2			
Oman		5		1	6	4,000	128	2	0.4	6.1	12~27
Qatar		3		3	6	1,000	16	2			
Saudi Arabia	54	0~25	+	2	10	59,000	2,845	5	1.4	13.1	3~22
Syria		1		5	6	35,000	1,043	2			
Tunisia		2	+	3	6	14,000	390	2			2~7
United Arab Emirates	54	2		3	5	2,000	46	1			
West Bank and Gaza		1		3	4	3,000	54	1			
Yemen		4		2	6	38,000	1,571	2			

(Source: 21)

Annex 2. Possible Nutrition Interventions and Costs

Food Energy Security

Emergency assistance

In case of a large-scale famine, drought and other natural disasters, wars and conflicts, an emergency relief operation including food distribution is required. However, in many cases, the government of an affected country can not make necessary interventions, or an effective government does not exist in the country. Thus, international assistance plays the major role to secure foods for affected people. United Nations (UN) agencies such as World Food Programme (WFP), United Nations Children's Fund (UNICEF), and United Nations High Commissioner for Refugees (UNHCR), as well as bilateral donor agencies and non-governmental organizations (NGOs), provide emergency relief including food distribution. For example, the below table shows WFP's emergency relief operations in MENA region in 1995. Emergency assistance can not be a fundamental solution for securing food, therefore, sustainable developmental assistance must be followed the emergency phase assistance.

World Food Program Relief Operations (Emergency and Protracted) Approved in 1995 in MENA Region

Country	Operation	Beneficiaries	Total Food (tons)	Total WFP Cost (US$)
West Bank and Gaza	Rehabilitation of post-conflict victims in the Gaza Strip and Jericho	35,750	1,835	901,591
Iraq	Food assistance for destitute and vulnerable persons	2,151,000	184,232	86,178,874
Algeria	Food assistance to Western Saharan refugees	80,000	10,220	4,733,947

(Source: 219)

Direct transfer

Public assistance is a tool to secure food and nutrition, particularly dietary energy, for the vulnerable population in the country. Food stamps or ration books are distributed to the eligible families and individuals to obtain foods or purchase at subsidized prices. It is an effective method in the higher income countries where the eligible population is rather limited and legal and administrative structures are established. However, it is often difficult to define and monitor the eligibility. Managing the program is rather complicated and it is often difficult for the governments of developing countries to run the programs efficiently and effectively. In addition, it is not uncommon that the poor sell the subsidized food to buy other goods.

Food supplement

Supplement foods, as well as micronutrient supplements, can be distributed to the target population, such as pregnant and lactating women, small children, and school age children in developing countries. Supplement foods such as vegetable oil or soybean milk are distributed to the pregnant women who visit clinics that encourage them to receive antenatal check-ups. It would be a better option to give lactating mothers food supplements than to give infants breast milk substitutes. School feeding schemes also encourage the parents to send their children to

schools: *e.g.*, a WFP program in Yemen provides girls attending schools with supplement foods. However, the nutrition impacts of school feeding schemes are rather limited, as the schemes cover only a part of nutrition needs of the children.

Food subsidy

Food subsidy schemes aim to control the prices of staple foods to secure the availability of foods and alleviate protein energy malnutrition. Some countries universally subsidize foods such as wheat, bread, sugar, vegetable oil, and milk; other countries use self-targeted mechanisms by subsidizing only food items that are mainly consumed by the poor. Although food subsidy schemes are usually successful for securing dietary energy, these schemes are often untargeted, benefiting the better off population rather than the poor, become a heavy burden of the state budget, and discourage efficient and increased agricultural production by keeping prices low. Although most MENA countries have food subsidy schemes, many of them started to review the schemes so that it would target the needy population and be financially sustainable in the framework of structural reform. However, food subsidy issues are often too politically sensitive for radical reform.[1]

Micronutrients

Fortification

Generally consumed foodstuff can be fortified or enriched with various micronutrients. For example, salt can be fortified with iodine and iron; cereals with iron, vitamin A and B_1; milk with vitamin A and D; and sugar, margarine and edible oil with vitamin A.[5, 83, 124, 232, 235, 244] Fortification programs are well established in industrialized countries, *e.g.*, Switzerland and the United States of America (US) introduced salt iodization programs in the 1920s; and fortified milk is a major dietary source of vitamin D in the US. The unit cost of micronutrient fortification programs is usually much less than that of supplementation programs. For instance, estimated annual per capita cost of salt iodization is US$ 0.1, while that of iodine supplementation is US$ 0.5; estimated annual per capita cost of iron fortification is US$ 0.2, while that of iron supplement to pregnant women is US$ 2.[108, 244] Fortification is a sustainable and fundamental solution, if the fortification programs are truly institutionalized as seen in industrialized countries.

Salt iodization programs are ongoing in several MENA countries, such as Iran, Syria, and Yemen. Iran has established 22 salt iodization plants and 76 percent households in rural areas and 87 percent households in urban areas consumed iodized salt by 1995. In Syria, the single salt producer, Ministry of Industry, has been iodizing salt since 1992, however, it is estimated that only 36 percent of households are consuming iodized salt.[221] In Yemen, a universal salt iodization program started in 1995, and about 70 percent of salt consumed in urban areas is iodized by the end of 1998.[field interviews] Several MENA countries are now planning to start iron fortification of wheat flour.

Quality control and compliance are most important to succeed fortification programs. The required conditions for successful fortification programs are: sufficient technical and institutional capacity to implement and monitor the programs; quality control systems for monitoring concentrations and quality of fortified nutrients both at the plant and consumer levels; intersectoral coordination among health, industry and transportation for production and distribution; existence of only limited number of producers for ensuring the coverage of fortified

[1] Food subsidy issues are analyzed in the regional study on consumer food subsidies.[258]

items; restriction of leakage of unfortified items; appropriate price setting and incentive systems for retailers and consumers; consumer preference that accept fortified food.[16, 124, 178, 232] In addition, reliance on a single fortification approach to control micronutrient deficiencies is often a fragile strategy.[5] Therefore, fortifying a variety of different products rather than a single widely consumed food may be a better strategy in future.

Some countries also legally regulate food fortification. The below table shows some examples of legislation in various countries.

Legislation Pertaining to Salt Iodization

Country	Status	Level of Iodine (ppm)	Compounds Used
Iran	Mandatory	40	
Lebanon	Mandatory	10-200	KIO_3/KI
Morocco		80±10	KIO_3
Bolivia	Mandatory	50	KIO_3/KI
Honduras	Mandatory	>67	KIO_3
Pakistan	Legislation in process	60-70	KIO_3
Nigeria	Mandatory	50, 30	KI
Hungary	Voluntary	10	KI
Switzerland	Mandatory	15	KI
France	Voluntary	10-15	NaI
United States	Voluntary	100	KI

Legislation Pertaining to Wheat Flour Fortification

Country	Status	Legislation	Consumption
Lebanon	Prohibited		Widely
Morocco		No legislation	Widely
Honduras	Voluntary	Vitamin B_1 = 4.4; Vitamin B_2 = 2.6; Niacin = 35.2; Iron = 28.7; Calcium = 1,100 (mg/kg)	Not widely
Malawi	Voluntary	Nutrition labeling requirement	
Hungary	Voluntary	One serving must contain 1/3 of RDA	
Norway	Prohibited		
Switzerland	Voluntary	Vitamin B_1 = 4.4; Vitamin B_2 = 2.0; Niacin = 50; Iron = 29 (mg/kg)	
New Zealand	Prohibited	Legislation under review	

(Source: 135)

Supplementation

Micronutrients can be supplemented directly to the target population, such as pregnant and lactating women and small children. Supplementation programs are usually integrated with other public health interventions, such as maternal and child health care or school health programs.

Pregnant women in many developing countries receive iron and folic acid supplements during their antenatal visits. To avoid irreversible disorders of fetus and infants, pregnant women in the IDD endemic areas should receive oral or intramuscular administration of iodized oil as an interim measure before salt is fully iodized.[5, 188, 232] Vitamin A supplementation to children is integrated with regular health care visits and immunization programs including the National

Immunization Day.[5] It is recommended that lactating women in high VAD areas receive a high dose vitamin A supplement within eight weeks of delivery. Pregnant women should receive a low dose supplement but should avoid the high dose supplement, which may cause toxic disorders to the fetus. School health programs include iron, iodine, and vitamin A supplementation to school age children.

Supplementation programs are more targeted to the population in need than to universal fortification, although it is unlikely that all the affected population is covered. The unit costs of supplementation programs are usually much higher than that of fortification programs. For instance, estimated annual per capita cost of iodine supplementation is US$ 0.5, while that of salt iodization is US$ 0.1; estimated annual per capita cost of iron supplement to pregnant women is US$ 2, while that of iron fortification is US$ 0.2.[108, 244] The initial costs of supplementation programs are lower, as they simply utilize the existing public health service channels. Supplementation programs integrated to the public health services are efficient and sustainable, however, compliance varies and is hardly monitored, unless supplements are injected or orally administered at the presence of health professionals: *e.g.*, women may not take iron supplement because of the discomfort of side effects and misconceptions.[35, 150] When micronutrient deficiency problems are serious and urgent, specific interventions such as vitamin A supplementation or intramuscular iodine oil injection campaigns should be considered.

If people are aware of their needs for micronutrient supplements, as is often the case in industrialized countries, they are willing to buy supplement tablets. Social marketing of micronutrient supplements in combination with nutrition education programs could be tried in developing countries.

Public Health

An important factor of child malnutrition is repeated childhood diseases such as diarrhea and respiratory infection. These diseases decrease intake and absorption of nutrients and increase consumption of dietary energy and other nutrients such as vitamin A.[5, 80] Parasite infection including hookworm and malaria causes anemia.

Therefore, public health interventions to prevent and treat childhood diseases, including immunization programs, control of diarrhetic diseases, malaria control programs, and deworming programs, are expected to improve nutrition status. Water and environment sanitation programs are expected to improve nutrition status, since improving access to clean water and management of sewage and solid waste reduces risks of communicable diseases, such as diarrhea. Family planning programs decrease fertility and increase the intervals between pregnancies, therefore, contribute to reduce undernutrition and anemia among women and children.

Public health interventions used to be specific national programs, such as national population projects or national diarrhea control programs. Recently, these interventions are taking more integrated approach. For example, Integrated Management of Childhood Illness (IMCI)[182] includes case management of diarrhea, respiratory infection, malaria, and nutrition monitoring; and school health programs include growth monitoring, deworming, and micronutrient supplementation.

Communication for Behavior Change (CBC)

Delivering proper nutrition messages and educating the general public, particularly child care providers, is one of the most important nutrition interventions. Many nutrition disorders are caused by incorrect child caring practices, food habits, misallocation of food within a family, and lifestyle choices, but not by absolute shortage of nutritious food. People, especially mothers, need to be educated regarding breastfeeding and weaning practices, food items rich in micronutrients, combination and preparation of food to maximize absorption of nutrients, obesity as a risk factor of more serious diseases and healthy diet to avoid obesity.

Communication for behavior change (CBC) programs should be carefully designed, monitored and evaluated to achieve maximum impacts. Nutrition education can be provided interpersonally at schools, clinics, and communities. A mass media campaign is another strong measure to approach wider audience. Many developing countries may require international technical assistance, as skilled communication professionals are in shortage and institutional capacity to develop and continue the programs is weak. In addition, an incentive system needs to be designed to motivate health professionals to promote CBC programs.

Social and Economic Development

Since undernutrition is strongly related to the levels of poverty, poverty reduction through social and economic development is one of the essential factors to improve nutritional status. In the longer term, countries need to secure food supply through developing the agricultural sector, trade and transportation systems, and sound public financing policies. Trade and tariff policies, as well as food subsidy schemes, largely affect agricultural production and food pricing. Food distribution systems need to be improved for more equitable allocation of available food within a country. Since there are significant urban rural gaps in many developing countries, comprehensive rural sector development is required to improve nutrition in rural areas.

Examples of Program Costs and Impacts in Other Countries

The following are examples of nutrition intervention programs, their costs and impacts:

- Food supplementation targeted to children and mothers in Latin American countries
- Micronutrients fortification in various countries
- Iron supplementation to female factory workers in Indonesia
- Comprehensive nutrition and health interventions targeted to children in India

Food supplementation

Food supplementation programs targeted to children, pregnant and lactating women are widely implemented in many countries in various scales. The ration and distribution methods vary among programs and countries: the annual costs per beneficiary range from around US$4 to over US$60 in the below examples of Latin American countries. Most programs aim to provide around 300-350 kcal per child.

Food Supplementation to Children and Mothers in Latin America

	Beneficiaries	Food rations	Costs (1990, US$)
Bolivia urban areas	78,000 infants and preschool children (8 months to 5 years) selected by family income, location and nutritional status (weighed once a year).	250 ml of Chicolac (wheat flour, powdered milk and vegetable oil); a piece of corn bread.	$1,506,920 (1989) $19.32 / beneficiary Beneficiaries fee: $0.36 per child/month
Bolivia rural areas	75,000 infants and preschool children (8 months to 5 years) Meals are distributed in a church or households.	Skim milk, butter oil and wheat flour (donated). Meals are prepared for 260 days a year providing 350 kcal and 16 g protein per child.	$790,523. (1989) $10.54 / beneficiary Beneficiaries contribute to cover transportation, energy costs, and the packing of food.
Brazil	About 2 million children under 3 years of age, and pregnant and lactating women, in low-income households.	2 kg /month (4 kg for adult) of formulated foods and powdered milk.	$123 million $62.81 / beneficiary. Significant improvement observed.
	6 million children under 3 years, and pregnant and lactating women, in low-income households	Normally 1 kg each of powdered milk, sugar, rice, beans, cornmeal and manioc flour per month.	$104 million (1989) $16.78 / beneficiary. Results not significant.
Ecuador	14,888 children under 5 years, 23,107 malnourished children, and 28,050 pregnant and lactating women, for a total of 66,045 in the first trimester of 1990.	2-3 kg of leche-avana for children (237-354 kcal and 13.7-20.5 g protein) 1 kg of leche-avana and 5 kg of rice for women (1,936 kcal and 50.8 g protein) per month.	$4,122,540(1989) ($3,199,211 donated foods; $27,200 transportation; $10,600 storage; $885,529 personnel) $62.42 / beneficiary.
Guatemala	197,148 children under 7 years and pregnant and lactating women from low-income groups. Nutrition education, immunization and other health services are also provided.	1.38 kg each of corn and soybean, wheat, and rice, and 0.46 kg of oil are distributed at health posts. (639 kcal and 16g protein/day)	$791,944 $4.01 / beneficiary Similar program which provides 894 kcal and 26.2 g protein per day and costs $27.5 per beneficiary just for food costs.
Peru	234,451 infants and preschool children in day care centers, and 84,317 households (about 421,600 persons) at high risks. Program also provides nutrition education and growth monitoring	Monthly ration for an entire family is 6 kg bulgur, 3 kg corn and soybean, 1.5 kg oil and 2 kg dry peas (1,756 kcal and 56.4 g protein/day, ration for children provides 359 kcal, 9.3 g protein/day).	$5,077,181 ($4,494,279 for food $136,000 transportation $446,902 personnel) $7.74/beneficiary

(Source: 152)

Micronutrients fortification

The popular vehicles for micronutrient fortification are salt, sugar, and cereals. The annual costs for the fortification per person range from around US$ 0.01 to 0.3, at the highest around $1.00: *e.g.*, the iron fortification of biscuits in Chile.

Costs of Micronutrient Fortification Programs

Country	Food Vehicle	Fortificant	Cost (US$/person/year)	Year
Several	Salt	Iodine (50 - 80 ppm)	0.02 – 0.06	1992
India	Salt	Iodine (50 ppm) + Iron (1,000 ppm)	0.12 – 0.18	1991
Guatemala	Sugar	Vitamin A (15,000 IU/kg)	0.29	1994
Guatemala	Sugar	Iron (1.3 %)	0.1	1981
Egypt	Wheat flour	Iron (25 - 35 ppm)	0.015	1980
Venezuela	Corn flour / Wheat flour	Iron (20 - 50 mg/kg) Vitamin A (39,000 IU/kg)	0.07 – 0.08	1994

(Source: 121, 237, 244)

Estimated costs for the production of iodized salt in developing countries are as below. The average annual cost is US$0.037 per person, which adds 1.2 percent to the retail price of salt.

Estimated Production Costs of Iodized Salt in Developing Countries

	Range (US$/ton)	Average (US$/ton)	Average per person per year (US$/5 kg)
Cost components			
Iodine (40-100 ppm)	0.50 - 1.30	0.90	0.0045
Processing	2.35 - 5.50	4.00	0.0200
Extra packing material (if required)	0 - 4.00		
Administrative overhead	0.60 - 1.50	1.00	0.0050
Amortization	0.50 - 2.50	1.50	0.0075
Total iodization cost	3.95 - 14.80	7.40	0.0370
Retail price of salt	250 - 1,000	625.00	3.12
Iodization cost as % of retail price	1.0 - 1.5 %	1.2 %	1.2 %

(Source: 121)

The table below shows estimates of costs and benefits of iron fortification in Lebanon. The calculation assumes that; annual salary is $5000; a person works for 30 years; anemia reduces productivity by 20 percent; and 50 percent of anemia prevalence. Fortified bread could supply iron about 60 percent of RDA. The estimation shows a very high benefit-cost ratio of 7,500 to 1, regarding the lifetime income.

Costs and Benefits of Iron Fortification; Estimation for Lebanon (US$)

Capital costs	Feeder and installation ($6,000 x 11 mills x 2 sets)	132,000
	Inspection	90,000
Annual operation costs	Fortificant costs (300,000 ton bread)	90,000
Total fortification costs (300,000 ton bread)		312,000
Annual fortification cost per person (110 kg bread/person/year)		0.03
Fortification cost per person per lifetime		2
Anemia cost per person per lifetime		15,000
Benefit - cost ratio		7,500 : 1

(Source: 237)

Micronutrients supplementation

The Indonesian government launched iron supplementation programs in domestic companies in 1996 to reduce the level of anemia from 30 percent to 20 percent by 1998. Iron supplements (one tablet daily for 90 days or one tablet weekly for 16 weeks) were distributed to female factory workers, mainly in reproductive ages, in pay packets, in cafeterias, or in company clinics. In one of the companies, 35 percent of anemia cases were prevented at the cost of only US$3.47 per worker, or less than US$10 per anemia case prevented.

Costs and Benefits of Iron Supplementation Programs in Sample Companies in Indonesia

Province	East Kalimantan	Central Jawa	Jambi
Company	Sumalindo	Djarum Kudus	Nasari Priima
Number of workers receiving supplements	637	1,260	100
Compliance	92 %	83 %	95 %
Cost breakdown (US$)			
Promotion			
Meetings, transportation	50.15	31.34	220.23
Personnel	22.57	112.83	78.56
Monitoring and Communication/Education			
Pamphlets	242.37	0.00	123.28
Personnel and visits	268.28	133.72	251.15
Reporting			
Meetings, report supplies	109.90	1037.61	36.77
Personnel	24.66	112.41	78.14
Administration support	4.60	9.19	3.76
Blood Tests	675.30	1,752.19	321.35
Iron supplement distribution			
Iron tablets	239.45	572.09	206.85
Opportunity costs for workers	199.75	3,349.77	235.27
Personnel	22.98	262.43	156.71
Total costs by company (US$)	1,856.66	7,376.09	1,711.66
Running costs of province (US$)	356.46	1,200.59	179.69
Total costs (US$)	2,213.12	8,576.68	1,891.35
Costs per worker (US$)	3.47	6.81	1,8.91
No of cases of anemia prevented	223 (35 %)	498 (39 %)	19 (19 %)
Cost for case of anemia prevented (US$)	9.90	17.22	99.54

Note: US$1.00 = Indonesia RP 2393.0 (January 1997) (Source: 211, 213)

The iron supplementation also improves productivity by raising workers' capacity. It was reported that anemic women produce an average 5.3 percent less in factory work and perform 6.5 hours less housework per week.[173] Another example of iron supplementation program for the rubber plantation workers in Indonesia in 1974 showed a dramatic increase in productivity. After provision of iron pills for 60 days (at a cost of $0.13/worker/day), productivity increased by approximately 15 percent for tappers and 25 percent for weeders. The benefit-cost ratio in terms of latex production could be as high as 260:1.[34]

Comprehensive child nutrition intervention

The Second Tamil Nadu Nutrition Project funded by the World Bank aimed to reduce severe malnutrition among preschool children and infant mortality in the state of Tamil Nadu,

India. The project targeted more than 5 million children under 72 months of age and 2 million pregnant and lactating women in disadvantaged population groups.

Estimated Costs of the Second Tamil Nadu Nutrition Project (1991-1998)

Cost (US$ million)		Project Component
A. Service delivery 1. Nutrition 2. Health 3. Training	 91.09 30.12 6.61	Nutrition and health education; referral services; therapeutic food supplementation; equipment and drugs for maternal and child health; training for health/nutrition workers.
B. Communications	3.53	Demand stimulation; child feeding and care practices; community involvement.
C. Project management 1. Project coordination office 2. Communication/Training center 3. Monitoring and evaluation	 4.99 1.07 1.38	Project coordination office; monitoring and evaluation systems, a new institution for nutrition communication and training activities.
Total base cost	138.71	
Contingencies	0.38	
Total project cost	139.09	

(Source: 241)

Nutrition Components in the Current World Bank Projects and Nutrition Sector Works in MENA Region

Current Lending Projects

Country	FY	Project	Nutrition Components
Yemen	1999	Child Development	Nutrition management including micronutrient supplementation and growth monitoring for under five children through community-based activities
Egypt	1998	Health Sector	Vitamin A and iron supplementation, growth monitoring for under five children
Morocco	1996	Social Priority I: Basic Health	Maternal and child health components including breast feeding and iron supplementation
West Bank and Gaza	1995	Education and Health Rehabilitation	School health and nutrition education program

Non-Lending Sector Works

Country	FY	Title
Regional	1998	Nutrition Issues in the Middle East and North Africa Region
Regional	1998	Consumer Food Subsidy
Tunisia	1996	From Universal Food Subsidies to a Self-Targeted Program: A Case Study in Tunisian Reform (prepared by the Agricultural Operations Division, Country Department I, MENA).
Morocco	1992	Kingdom of Morocco: Nutrition and National Development Issues and Options

Annex 3: Overview of Food and Health Issues in MENA Countries

Food Supply

Most countries in the Middle East and North Africa (MENA) region are lower middle income countries.[1] However, the region includes high income countries such as oil producing Gulf states and one of the lowest income countries, Yemen.

The climate of the region is generally harsh with little rainfall. Most of the land in the region are arid deserts, and less than 10 percent of the land is arable.[150] About 30-40 percent of the arable land is irrigated. The agricultural sector consumes about 80 percent of the scarce water resources in the region, and water management and drainage systems are not yet sufficient.

Food crops produced in each country in the region are diverse based on available resources and production potentials. Iran, Egypt, Morocco and Saudi Arabia produce 70-80 percent of cereals. Iran and Egypt are the only major rice producers. Sugar, vegetables, and fruits are also produced in the region: Lebanon, Syria, Jordan, and Egypt export fruits and vegetables.

Livestock production is practiced under nomadic conditions in the semi-arid areas, which makes it difficult to increase production without overgrazing. In spite of the high potential for fishery production, 80-90 percent of the fish are caught by small scale fishermen. Foreign fleets operating in the Arab waters take about half of the total fish catch. Morocco, Tunisia, and Saudi Arabia managed to develop the fishery industry to the level of exporting fish and fish products. Iran has a large fishing area— including the Caspian— and exports $30-40 million worth of caviar annually.

Although MENA countries are increasing their food production, self-sufficiency ratios are declining. For example, the Gulf states, notably Saudi Arabia, managed to increase wheat production from 330,000 ton deficit in 1970 to 1,500,000 ton surplus by 1990. However, wheat self-sufficiency ratio is expected to decline again to about 60 percent by 2000.[150] This is mainly due to the rapid natural population growth, urbanization and international migration. Total wheat import to the MENA countries has increased about five times, meat about nine times, and sugar about three times in the last 20 years. Consumer demands are also changing, especially in the high income Gulf states; the Gulf states consume one third of all livestock products imported to the region.

Most MENA countries subsidize staple foods, such as wheat, bread, sugar, vegetable oil, and milk.[8, 11, 74, 150, 190, 243, 246, 251 258] Food subsidy policy aims to ensure availability of food and nutrition, however, it tends to become a heavy burden on the state budget, and does not necessarily target or benefit the poor. Therefore, MENA countries are reviewing their food policies and attempting to restructure their subsidy programs to be more sustainable and targeted.[2] For example, Tunisian food subsidy policy has changed from universal subsidy to self-targeted program that subsidizes food items consumed mainly by the poor, such as breads made from high extraction rate flour.[190]

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[1] The definitions of income groups are: low-income as GNP/c $765 or less; lower-middle-income as $766-$3,035; upper-middle-income as $3,036-$9,385; and high-income as $9,386 or more.[254]

[2] Food subsidy issues are analyzed in the World Bank regional study on consumer food subsidies.[258]

The extensive food subsidy schemes in Egypt have successfully increased food availability per capita to levels comparable to industrialized countries and levels higher than those of other countries in the region. By 1980, the subsidy schemes included 20 foods and benefited 90 percent of population, but it accounted for 19.5 percent of total government expenditure by 1982. In the late 1980s and early 1990s, the prices of subsidized foods had increased and the number of subsidized foodstuff had decreased. In 1995, the food subsidy scheme included only bread, wheat flour, sugar and edible oil, and accounted for about five percent of total government expenditure.[11]

Health and Population

Health and other social indicators vary among the MENA countries, depending on the level of economic and social development of each country.[253] Infant mortality rate (IMR), for example, is 8 in Israel and 11 in Kuwait, while it is estimated at 93 in Yemen and 161 in Iraq. Maternal Mortality Ratio (MMR) ranges from three in Israel to 1,000 in Yemen, and safe water access ranges 45 percent of population in Iraq to 100 percent of population in Bahrain and Qatar. Diarrhea and acute respiratory infection are still major causes of death in the poor areas such as Yemen and rural Egypt and Morocco, while 25 to 45 percent of adult deaths in the Gulf states, Jordan and West Bank and Gaza (WBG) are caused by cardiovascular diseases.[150, 247, 248, 249]

The epidemiological transition is underway in most MENA countries; non-communicable diseases are increasing, whereas infectious diseases still remain major causes of morbidity and mortality among less privileged people. The epidemiological transition has financial implications on the health care system in each country, since treatment of non-communicable diseases are much more costly than public health interventions to communicable diseases. In addition, unregulated introduction of modern medical technology increases health care cost rapidly. Now most of MENA countries are facing the pressure to reform their health care systems to be more efficient, effective, equitable, and sustainable.

Most social indicators in MENA countries are comparable to the countries of similar level of economic development in other regions, however, population growth rate and total fertility rate (TFR) in MENA countries are unusually high. TFR in the middle income countries in other regions are, for example, 1.5 in Croatia, 2.4 in Brazil, and 2.7 in Indonesia. On the other hand, TFR is 6.2 in Saudi Arabia and 7.0 in Oman, which are similar to the poorest countries such as Mozambique and Rwanda.[254] Although countries such as Tunisia and Egypt have implemented successful family planning programs, population in the region is expected to double in 30 years, even if annual population growth declines to 2.3 percent.

In addition to the natural growth, increased migration from rural to urban areas and from low and lower-middle income countries in and outside the region to high income Gulf states have significant social and economic impacts. The influx of foreign workers to the Gulf states resulted in five to seven percent annual population growth in the 1970s. The oil-producing countries attract workers from Egypt, Jordan, Syria, WBG, Yemen, Bangladesh, India, Indonesia, Korea, Pakistan, the Philippines, etc. Jordan exports workers to the Gulf states, while imports workers from Egypt. Local food habits have been also influenced by massive migration of foreign workers.[150]

The high fertility in the region is likely linked to the relatively low educational level of women. The adult literacy rates of females in over half of MENA countries are less than 60 percent and much lower than males. The secondary school enrollment rates of females are less

than 60 percent in around half of the countries. Women's education level is one of the most influential factors in reducing fertility and improving children's health and nutrition.[248]

Most people in the region speak Arabic (except Iran and Israel) and are Islamic (except Israel). Local tradition, which is not necessarily related to religion, often has implications for health, nutrition, education, and other social sectors. Women's status is mainly determined by local cultures and tradition, which vary along with economic, social and political situations. United Nations Development Programme (UNDP) reported that women's participation in key economic and political areas and decision making remained low in most MENA countries regardless their income levels.[191]

Basic Indicators in MENA Countries

	GNP/c (US $)	Area (thousand sq. km)	Arable Land per capita (1991) (sq.m)	Total Population (million)	Population Annual Growth Rate (%)	Adult Literacy Rate		Secondary School Enrollment		Safe Water Access (%)
						Male (%)	Female (%)	Male (%)	Female (%)	
Low Income										
Yemen	260	528	1,714	15.7	3.7	53	26	37	9	-
Lower-middle Income										
Egypt	790	1,001	1,761	63.3	1.8	64	39	82	71	84
Iraq	-	435	6,051	20.6	2.1	71	45	53	34	45
Morocco	1,110	447	4,264	27.0	2.0	57	31	43	32	59
Syria	1,120	185	5,680	14.6	2.9	86	56	50	41	87
Jordan	1,510	89	1,358	5.6	4.2	93	79	52	54	89
Algeria	1,600	2,382	3,202	28.8	2.0	74	49	66	58	-
Iran	1,780	1,648	4,438	70.0	2.5	78	59	76	62	90
Tunisia	1,820	164	6,361	9.2	1.6	79	55	58	53	86
WBG	1,870	6	-	2.3	3.7	84	-	-	-	
Lebanon	2,660	10	1,685	3.1	1.9	95	90	75	83	-
Upper-middle Income										
Oman	4,820	212	806	2.3	4.7	71	46	67	61	56
Libya	-	1,760	5,334	5.6	3.6	88	63	95	95	90
Saudi Arabia	7,040	2,150	2,441	18.8	3.4	72	50	57	47	93
Bahrain	7,840	1	80	0.6	3.6	85	85	97	100	100
High Income										
Qatar	11,600	11	100	0.6	5.3	79	79	82	82	100
Israel	15,920	21	-	5.7	2.6	95	89	83	89	99
Kuwait	17,390	18	29	1.7	2.7	82	75	65	64	-
UAE	17,400	84	127	2.5	3.1	79	80	88	97	98

	Life Expectancy at Birth		IMR	U5MR	MMR	TFR	Stunting	Wasting	Underweight	Low Birth	Anemia	TGR
	Male (years)	Female (years)	(per 1000 live birth)	(per 1000 live birth)	(per 100000 live births)		(Under 5) (%)	(Under 5) (%)	(Under 5) (%)	Weight (%)	(Women) (%)	(%)
Low Income												
Yemen	56	57	93	145	1,000	7	39	13	39	19	5 - 36	32
Lower-middle Income												
Egypt	60	63	57	78	170	4	30	5	12	10	17 - 79	5
Iraq	60	62	161	145	310	6	28	9	25	21	18	7
Morocco	64	68	64	74	372	3	24	2	9	9	20 – 40	20
Syria	66	71	28	34	179	6	27	9	13	11	30 – 52	73
Jordan	68	72	21	25	45	5	16	2	9	7	4 – 46	-
Algeria	68	71	34	39	140	4	18	9	13	9	19 – 42	9
Iran	68	69	33	37	120	5	19	7	16	9	20 – 50	30
Tunisia	68	70	28	35	138	3	23	4	9	8	41	4
West Bank and Gaza	70	74	28	-	70	6	14	6	15	-	23 - 56	-
Lebanon	68	71	33	40	-	3	12	3	3	10	27 - 49	15
Upper-middle Income												
Oman	68	73	15	18	190	7	23	13	23	8	15 - 54	10
Libya	63	67	50	61	220	-	15	3	5	5	6	6
Saudi Arabia	69	71	25	30	18	6	14	3	14	7	5 - 57	-
Bahrain	71	75	18	22	60	-	10	6	7	6	40 - 49	-
High Income												
Qatar	70	75	17	21	-	-	8	2	6	5	30	-
Israel	75	79	8	9	7	3	-	-	-	7	18 - 61	-
Kuwait	74	79	13	14	18	3	12	3	6	7	31 - 42	-
United Arab Emirates	74	76	15	18	20	4	-	-	-	6	22 - 62	-

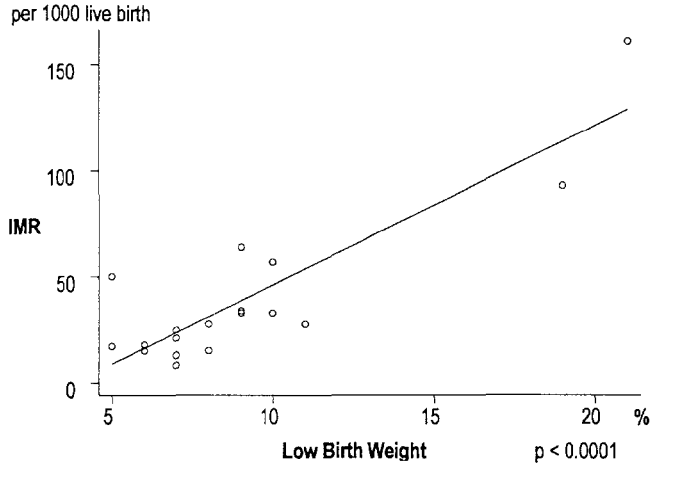
(Source: 55, 148, 150, 151, 206, 207, 216, 220, 221, 226, 228, 247, 248, 249, 254, 255)

Annex 4: Supplementary Data Analyses

Low Birth Weight

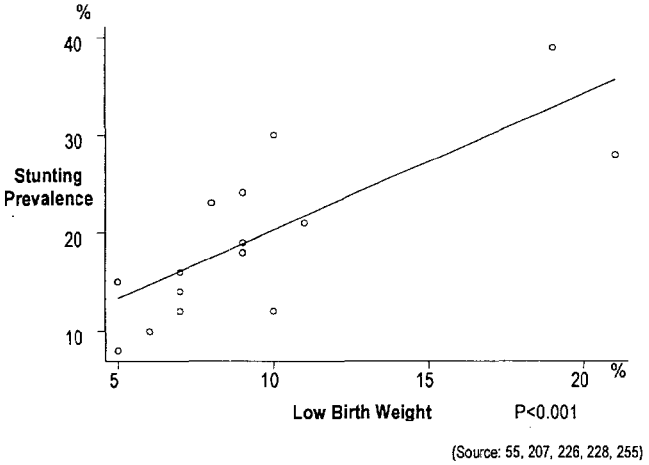
Figure 1 shows the strong positive correlation ($p<0.0001$) between low birth weight prevalence and infant mortality rate (IMR) among MENA countries. Figure 2 shows the positive correlation ($p<0.001$) between the low birth weight prevalence and the stunting prevalence among MENA countries. These results suggest that infants born with low birth weight are more likely to die during infancy, and if they survive, they are more likely to become stunted children. The results may also indicate that infant mortality, low birth weight, and stunting may share the same root causes—poor nutrition, health care, and sanitation.

Figure 1: Infant Mortality Rate (IMR) and Low Birth Weight in MENA Countries



(Source: 55, 207, 226, 255)

Figure 2: Stunting Prevalence and Low Birth Weight in MENA Countries



(Source: 55, 207, 226, 228, 255)

Nutrition and Female Education

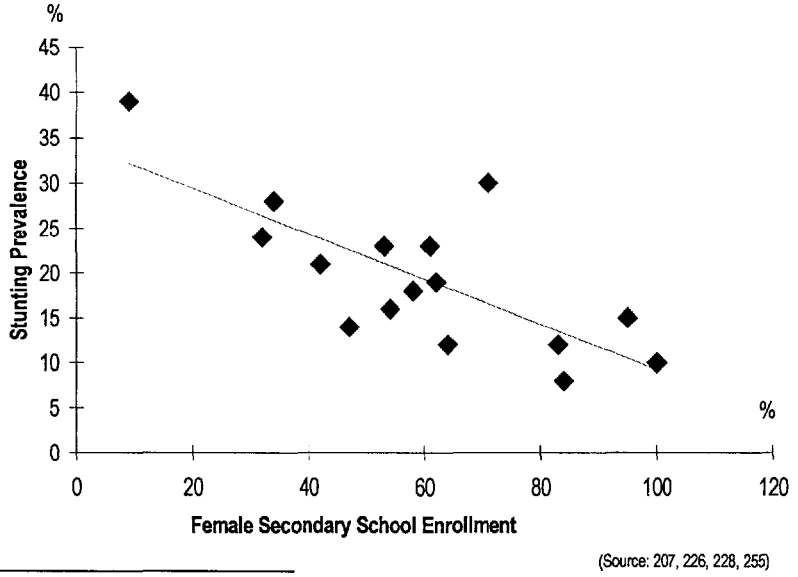
One of the major causes of childhood malnutrition is improper feeding and caring practices. Since the knowledge and attitude of caretakers, especially mothers, affects the nutritional status of children, it should follow that higher education levels among women should decrease the incidence of childhood malnutrition. Also, women with secondary and higher education tend to have fewer children so they can provide each child with better care. Women with higher education and fewer children usually have better nutrition and health status themselves, therefore are less likely to have infants with low birth weight. Frequently, societies that encourage women to be educated are also likely to have a better level of social services.

Figure 3 shows that in MENA countries, stunting prevalence declines significantly when female secondary school enrollment rates rise. (Stunting prevalence also declines when male secondary school enrollment rates rise, but the correlation is not statistically significant —Figure 4). Higher female secondary school enrollment rates also correlate with lower incidence of underweight (Figure 5). Prevalence of wasting, low birth weight, and exclusive breastfeeding up to three months have no significant correlation with higher female secondary school enrollment rates (Figure 6, 7, 8).

Since stunting prevalence is the most constant indicator of chronic childhood malnutrition, higher female education levels, and overall social development reflected by the female education level, are likely to contribute to lowered childhood malnutrition over a relatively long period. On the other hand, wasting (an indicator of acute childhood malnutrition), low birth weight (an indicator of maternal health), and good breastfeeding practices are not linked with female education levels. These results may suggest that general girls' education does not improve the nutrition of mothers and children. Therefore, to strengthen nutrition education, specific curricula on nutrition and child care are needed in formal education and for the general public.

How the effects of women's education is transmitted to nutritional status needs to be clarified.[1] Various factors, such as women's status, household income and access to health and

Figure 3: Stunting Prevalence and Female Secondary School Enrollment in MENA Countries

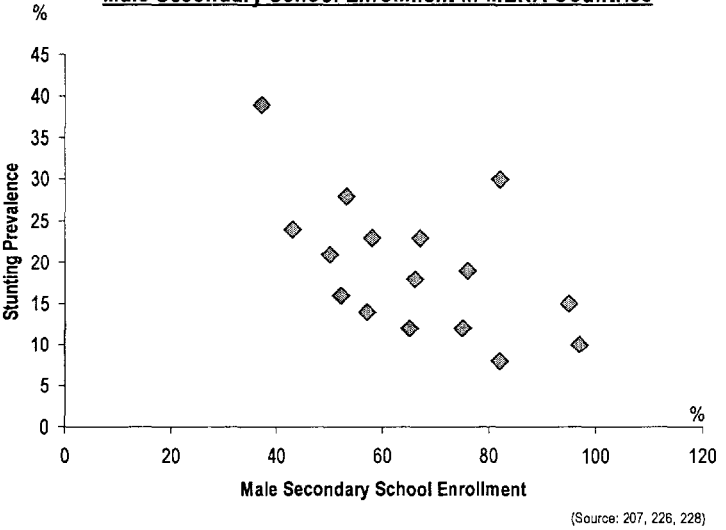


(Source: 207, 226, 228, 255)

[1] It is generally accepted that a mother's education contribute to reduce diarrhea in children, however, the pathways by which education brings this effect has remained largely speculative.[58]

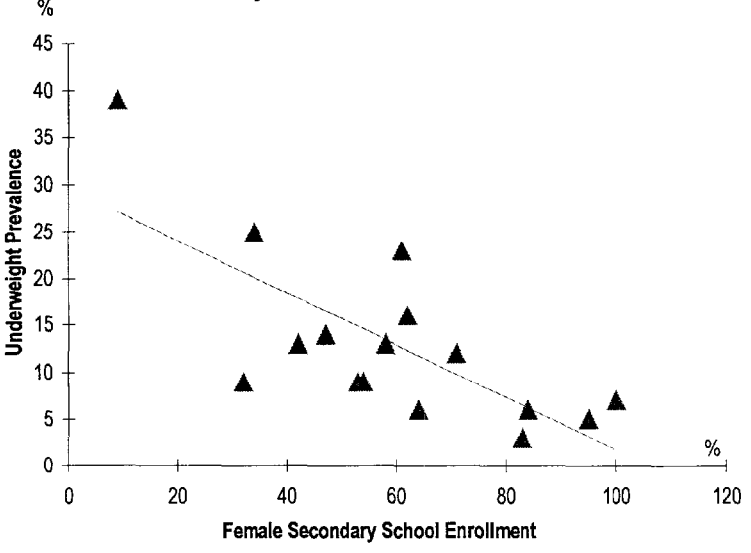
other social services, also affect nutrition and nutritional disorders. These factors are likely to carry different weights in determining the pattern of nutritional disorders. For example, a study in Jamaica[97] indicated that the increased child height correlated to the increased education of women in a household and the decreased distance to a private physician, marginally correlated to household income, but did not correlate to the father's education.

Figure 4: Stunting Prevalence and Male Secondary School Enrollment in MENA Countries



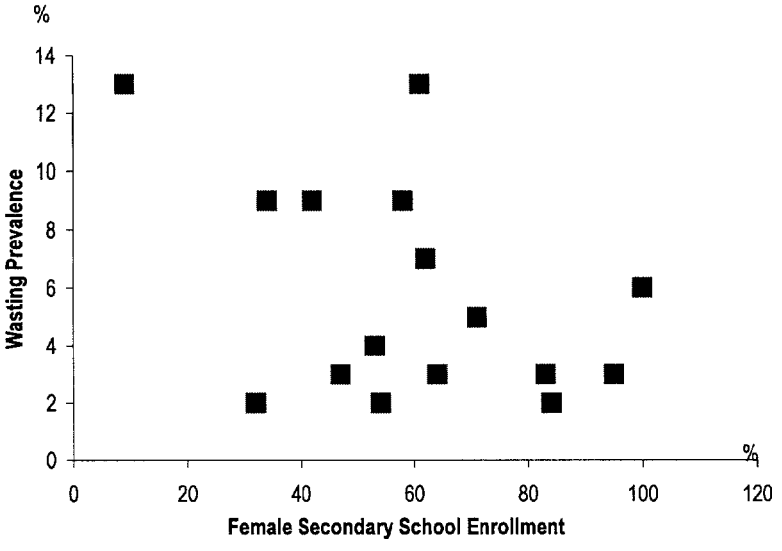
(Source: 207, 226, 228)

Figure 5: Underweight Prevalence and Female Secondary School Enrollment in MENA Countries



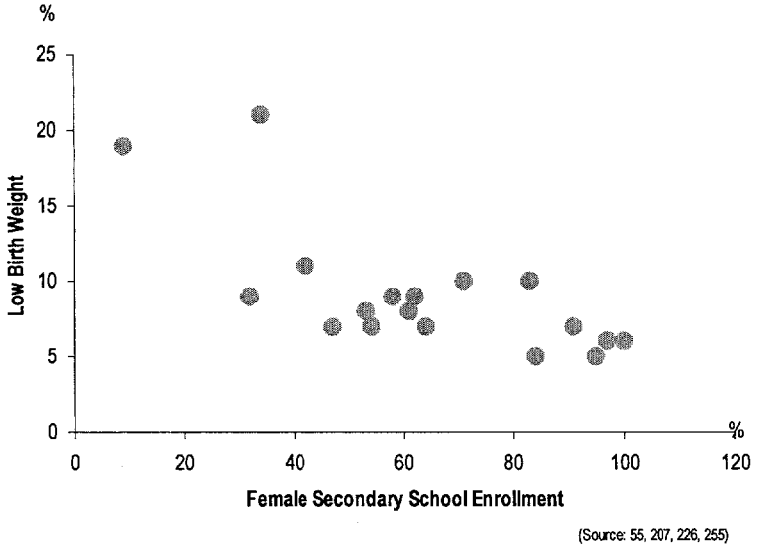
(Source: 207, 226, 228, 255)

Figure 6: Wasting Prevalence and Female Secondary School Enrollment in MENA Countries

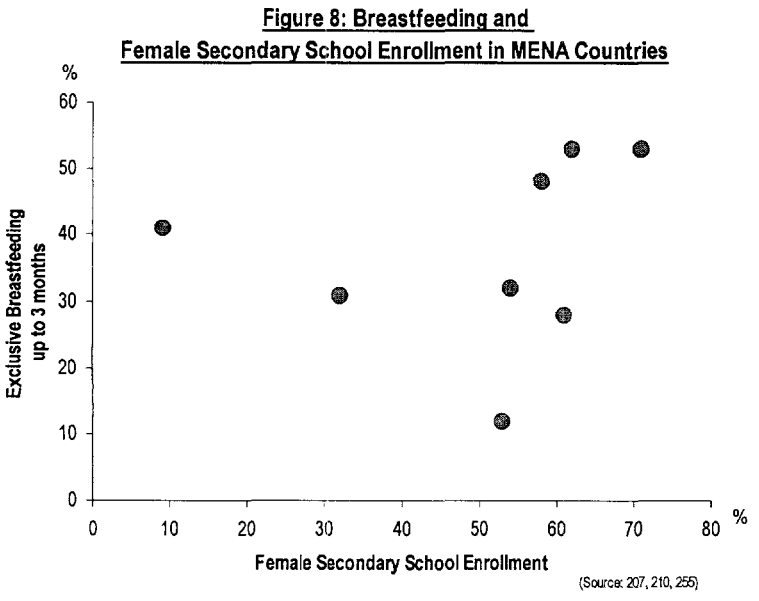


(Source: 207, 226, 228, 255)

Figure 7: Low Birth Weight and Female Secondary School Enrollment in MENA Countries



(Source: 55, 207, 226, 255)



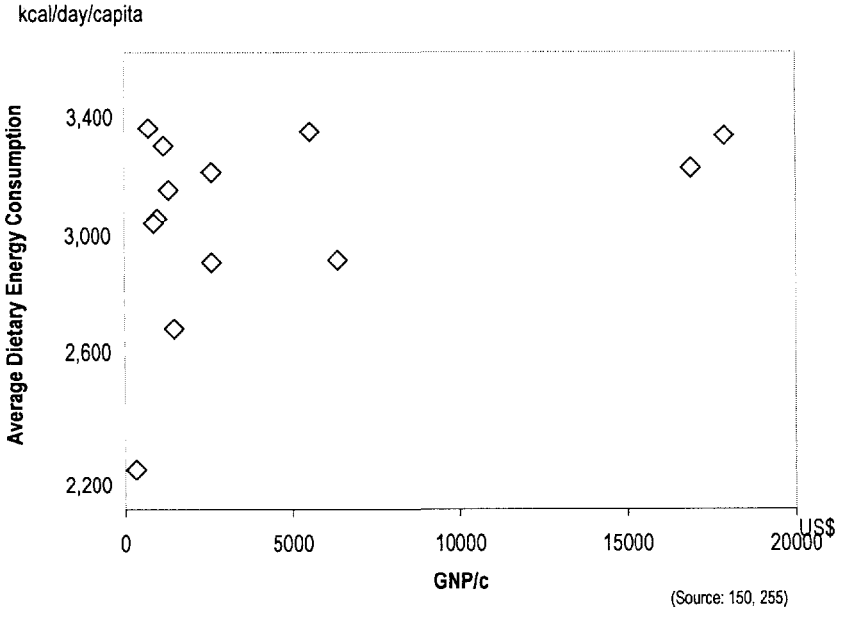
Nutrition and Economic Development

Childhood malnutrition is strongly linked to poverty, because poor people often can not afford to take adequate food and nutrition.[108, 242] Availability of food in general can be estimated by the amounts of dietary energy consumption. However, dietary energy consumption averages can be misleading about the level of poverty that exists, since food can be secured through public social welfare programs such as food subsidies and international assistance. Similarly, a national average dietary energy consumption rate gives no indication of how many people are underprivileged or the severity of their deprivation.

Even if dietary energy is secured, the poor usually cannot afford a sufficient variety of foodstuffs, especially the more expensive items such as meats, seafood and fruits; instead they tend to rely on cereals as major sources of dietary energy and protein. Decreased household income often leads to less variety, even when total dietary energy intake remains the same. Consumption of animal-origin foods is strongly linked to higher income, which in turn is linked to education, parental competency, housing and health conditions. Positive relationships between consumption of animal origin foods and indicators of health and growth are commonly observed in developing countries.[47] Animal origin foods not only provide nutrients including protein, iron, zinc, vitamin A and D, but also increase bioavailability of iron and zinc by decreasing intakes of plant origin inhibitors such as phytate. The poor cannot afford diversified diets so they are more susceptible to micronutrient deficiency, which in turn retards child growth and disease susceptibility.

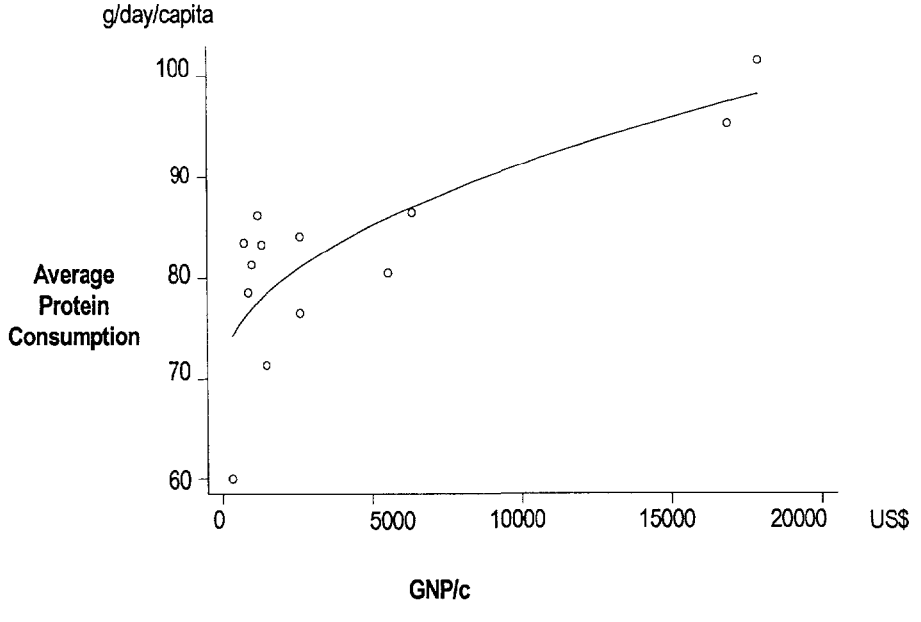
Figure 9 shows that the average dietary energy consumption and gross national products per capita (GNP/c) in MENA countries do not have a significant correlation. Figure 10 shows that the average protein consumption in MENA countries has a significant positive correlation with GNP/c. The average fat consumption has a positive, but less significant, correlation with GNP/c (Figure 11). The results reflect that most MENA countries secure foods in terms of dietary energy, and that people in the higher income countries in MENA region tend to consume increased amount of animal origin protein daily.[149, 150]

Figure 9: Dietary Energy Consumption and GNP/c in MENA Countries



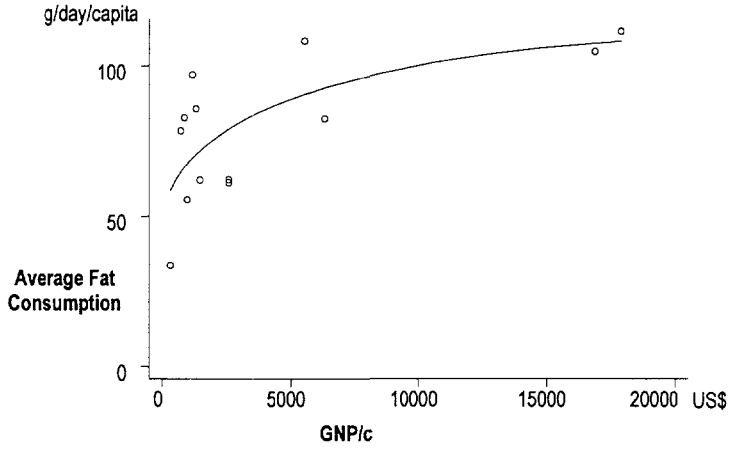
(Source: 150, 255)

Figure 10: Protein Consumption and GNP/c in MENA Copuntries



(Source: 150, 255)

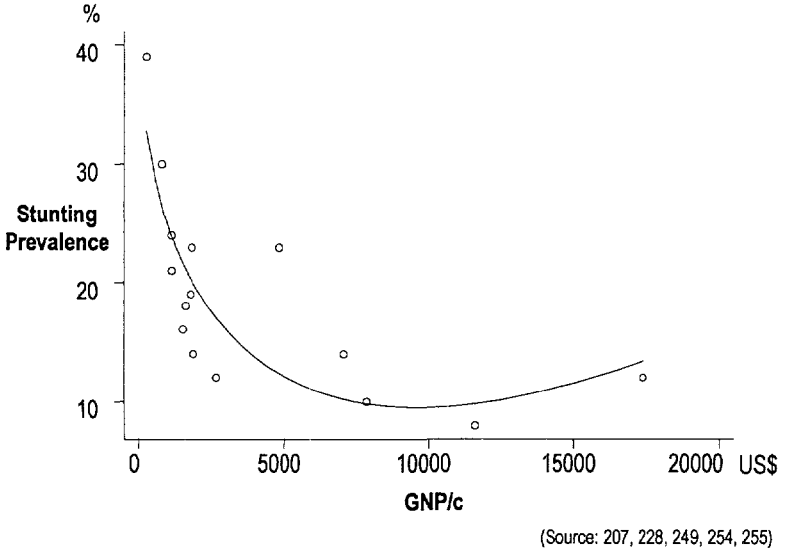
Figure 11: Fat Consumption and GNP/c in MENA Copuntries



(Source: 150, 255)

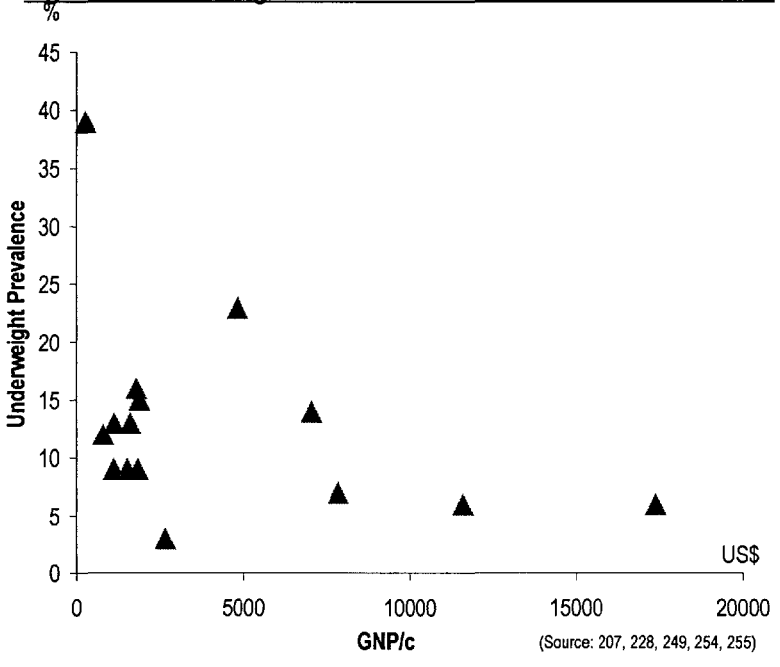
Although poverty is linked to malnutrition, economic development has contributed little to decrease childhood malnutrition. Figure 12 shows that stunting prevalence in MENA countries has a significant negative correlation with GNP/c in the low and lower-middle income levels, but less correlation in the range higher than upper-middle income levels. The prevalence of underweight, wasting, and low birth weight have no significant correlation with GNP/c in MENA countries (Figure 13, 14, 15). Usually economic development increases the quantity and variety of foods, the development of basic social services and infrastructure—including health, water, sanitation—and improvements in education. All of these factors contribute to reduce the risk of childhood malnutrition. However it takes more than general economic improvements to raise child nutrition status. It may also be necessary to raise public awareness and to invest in specific nutrition interventions.

Figure 12: Stunting Prevalence and GNP/c in MENA Countries



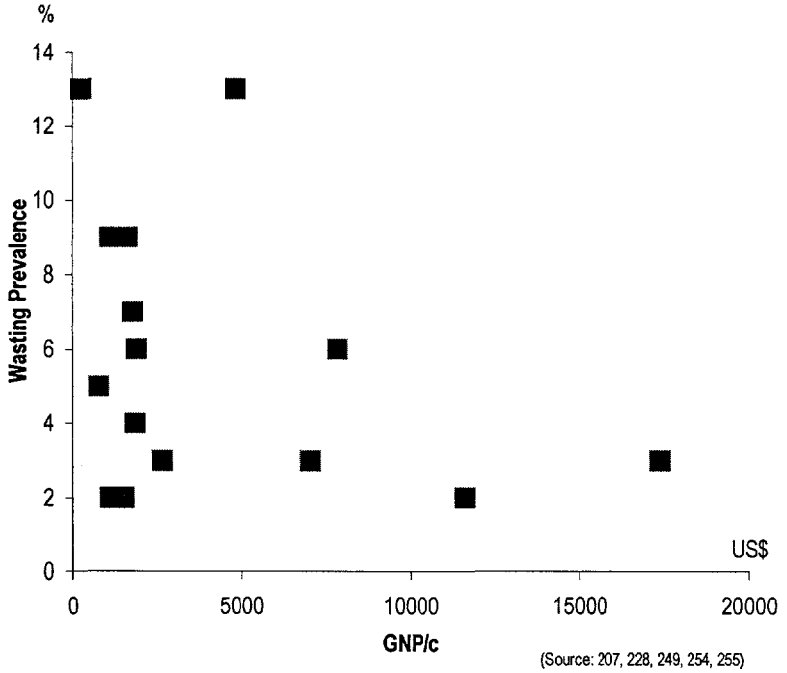
(Source: 207, 228, 249, 254, 255)

Figure 13: Underweight Prevalence and GNP/c in MENA Countries



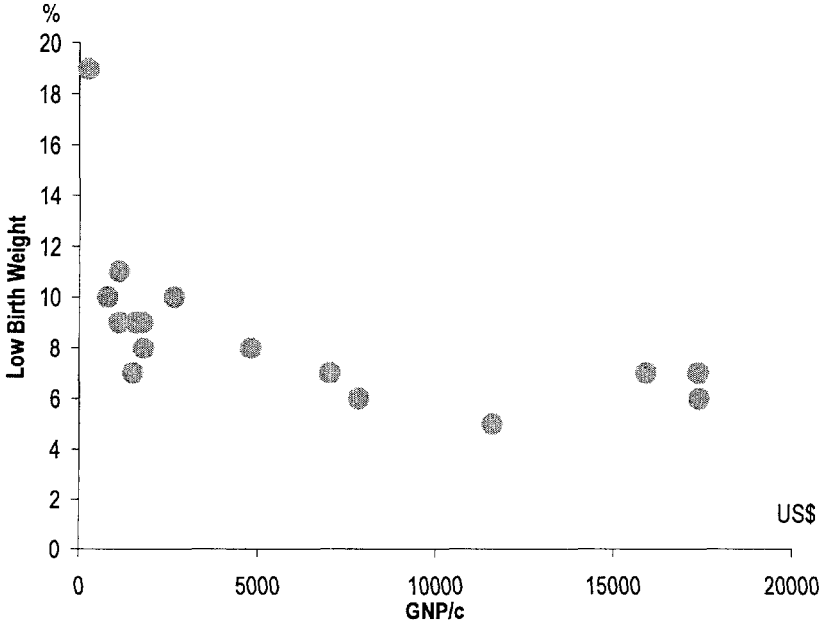
(Source: 207, 228, 249, 254, 255)

Figure 14: Wasting Prevalence and GNP/c in MENA Countries



(Source: 207, 228, 249, 254, 255)

Figure 15: Low Birth Weight and GNP/c in MENA Countries



(Source: 55, 207, 254, 255)

Figure 16 shows the relationship between stunting prevalence and GNP/c in Egypt.[2] Stunting prevalence constantly declined until 1995, although the decrease did not correlate directly with the increase in GNP/c. It increased from 21.6 percent to 29.8 percent during the rapid economic growth between 1995 and 1996.[5, 228, 255] Figure 17 shows the trend of stunting prevalence in the rural and urban areas in Egypt. While the stunting prevalence declined between 1988 and 1993, the difference between urban and rural areas continued to be about 10 percent. The urban/rural gap increased in 1996 when the national stunting prevalence increased.

The UN Food and Agriculture Organization (FAO) estimated average food supply based on agriculture production and international trade.[77, 78] Average supply of dietary energy and protein in Egypt constantly increased from 1970 to 1994 and is higher than in any other country in the region even though it has the second lowest income level, because some foods are heavily subsidized. As a result, food availability per capita has increased to levels comparable to industrialized countries,[74, 150] and Egyptian households are able to secure food even during periods of high inflation.[1, 2]

In 1981, the food subsidy scheme covered 20 food items and accounted for 19.5 percent of total government expenditures. Since the late 1980s, the Egyptian government gradually decreased the subsidies as a part of the economic structural reform.[8, 11, 258] By 1995, the scheme covered only bread, wheat flour, sugar, and edible oil, and accounted for only 5.5 percent of total government expenditure. Bread and wheat flour accounted for 42 percent of total daily energy

[2] The 1997 interim Egypt Demographic and Health Survey reported a decrease of stunting prevalence and a decrease in the urban/rural gap; but an increase of wasting prevalence (stunting prevalence: total 24.9 percent, urban 20.0 percent, rural 28.2 percent; wasting prevalence: 6.1 percent).[66]

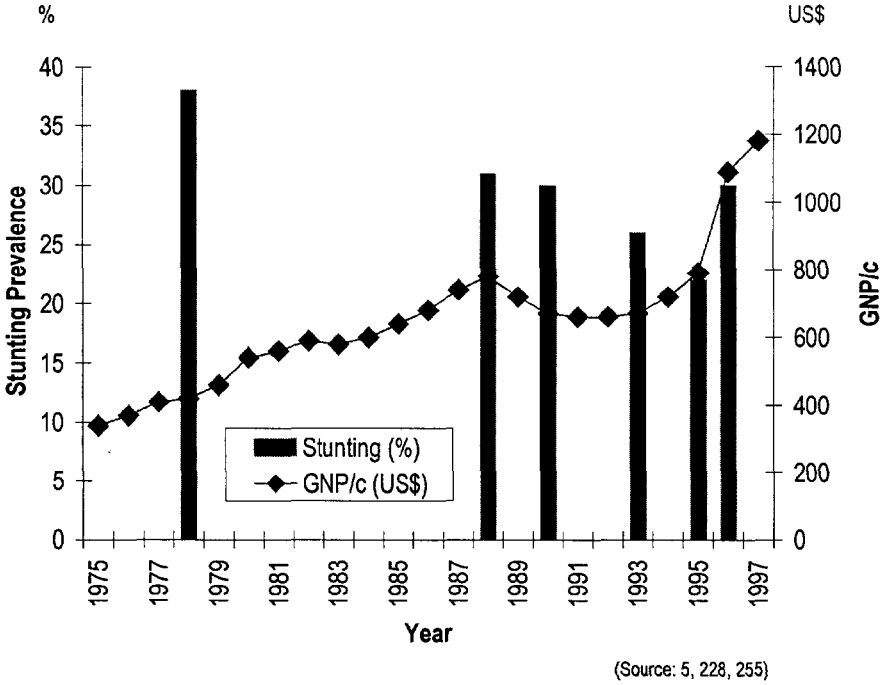
consumption in urban households and 23 percent in rural households, thus they are the largest sources of dietary energy in the Egyptian diet.

The FAO and the United Nations Economic and Social Commission for Western Asia (ESCWA) reported that the average consumption amounts changed as follows between 1985 and 1991,[74] before and after a major food and agricultural policy reform: (1) Increased: protein, wheat, rice, sugar, fruits, milk, fish; (2) Decreased: fat, edible oil, vegetables, meat, eggs; (3) No significant change: dietary energy, animal protein. The availability of rice and fruits increased because the total production increased due to the agricultural reform. Wheat was still subsidized, but the price increase rationalized consumption, loss and waste caused by the irrationally low price.

The nutrition impacts of the reform of food subsidy programs are yet unclear, since the major reform had taken place by 1992, while the stunting prevalence declined steadily until 1995. The cost of food subsidies increased from 1.3 percent of GDP in 1995 to 1.5 percent of GDP in 1996. The rice subsidy was canceled in 1992, and bread is more heavily subsidized than wheat flour.[3] This policy may hurt rural households more because they consume more rice and wheat flour and bake their own breads at home.[4]

The persistence of childhood malnutrition in Egypt is more related to child caring practices and infectious diseases such as diarrhea and intestinal parasite infection than food availability.[4] The recent increase of stunting prevalence, particularly in rural areas, may suggest that the investment in social sectors including health and sanitation has not been sufficient to improve and sustain the quality of the social services despite the economic development.

Figure 16: Stunting Prevalence and GNP/c in Egypt



(Source: 5, 228, 255)

[3] Consumer price of bread is about one thirds of actual production cost.[11]

[4] The poor in urban areas receive income transfers and secure dietary energy intakes from self-targeted food subsidy programs.[8]

Figure 17: Stunting Prevalence in Rural and Urban Areas in Egypt

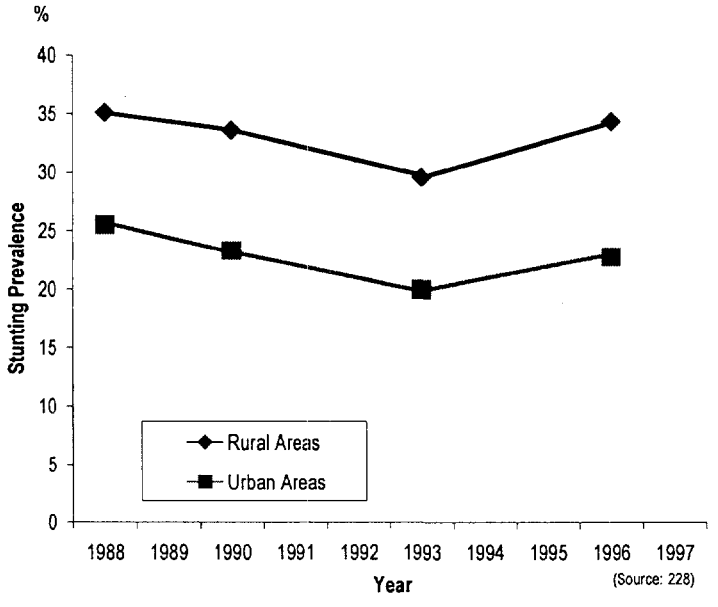


Figure 18 shows the trend of stunting prevalence and GNP/c in Tunisia.[5] GNP/c in Tunisia grew steadily, whereas stunting prevalence increased from 17.9 percent in 1988 to 22.5 percent in 1995.[5, 228, 255] Figure 19 shows the trend of stunting prevalence in the rural and urban areas in Tunisia. The gap between rural and urban areas also widened between 1988 and 1995, and the national stunting prevalence increased. The stunting prevalence was as high as 32.6 percent in rural areas in 1995, compared to only 14.5 percent in urban areas.

The food subsidy programs in Tunisia increased the availability of foods during the 1980s.[158] In 1990, roughly 58 percent of dietary energy intake and 62 percent of protein intake were derived from subsidized food.[190] Since the programs were not well targeted and reached 9.5 percent of total government expenditure in 1989, the Tunisian government started to reform the food policy from universal subsidies to a self-targeted program.[190, 258] As the reform has taken place gradually since the early 1990s, nutrition impacts of the reform are not yet fully evaluated.

Figure 20 shows the trend of the average protein supply[6] and GNP/c in Tunisia based on the FAO estimation.[77, 78] The supply of total and animal origin protein increased until 1989, when the stunting prevalence decreased. Since 1989, the protein supply declined despite the steady increase of GNP/c. Figure 21 shows the trend of stunting prevalence and supply of animal origin protein. The supply of animal origin protein increased until 1989, when the stunting prevalence decreased, then it decreased again.

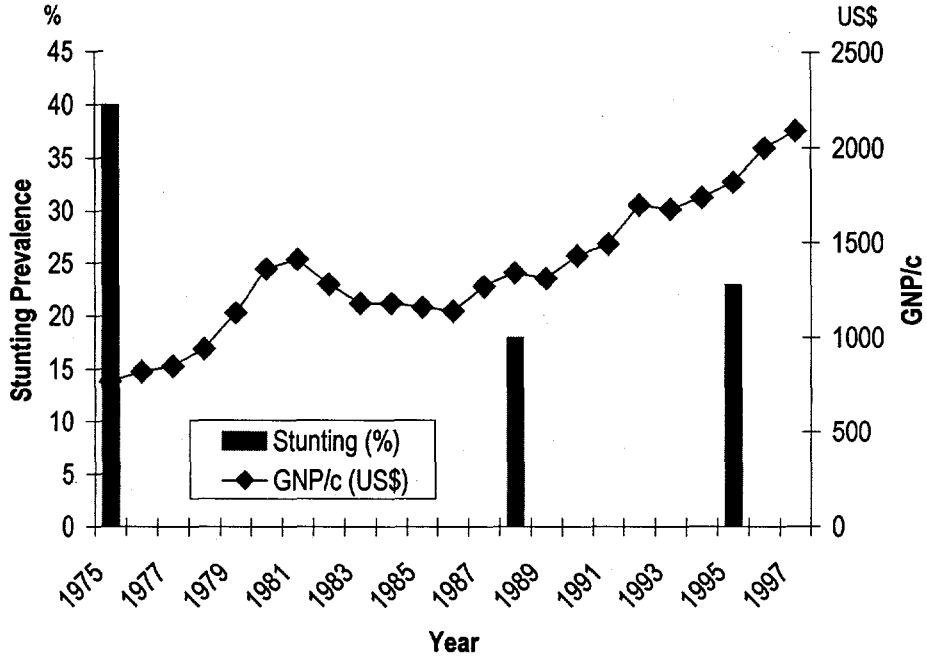
Consumption of protein, particularly animal origin protein, is most likely to reflect an increase in income. Although the average supply does not necessarily reflect the actual amount of consumption or the situation of underprivileged groups of the population, it suggests that the quality of life of people might have declined despite economic development and that poverty and poor social services prevail particularly in rural areas.

---

[5] Preliminary results of 1996/98 survey conducted by the National Institute for Nutrition indicated a significant decrease of child undernutrition in Tunisia (stunting prevalence: total 9.5 percent, urban 7.6 percent, rural 11.6 percent; wasting prevalence 1.3 percent).[field interviews]

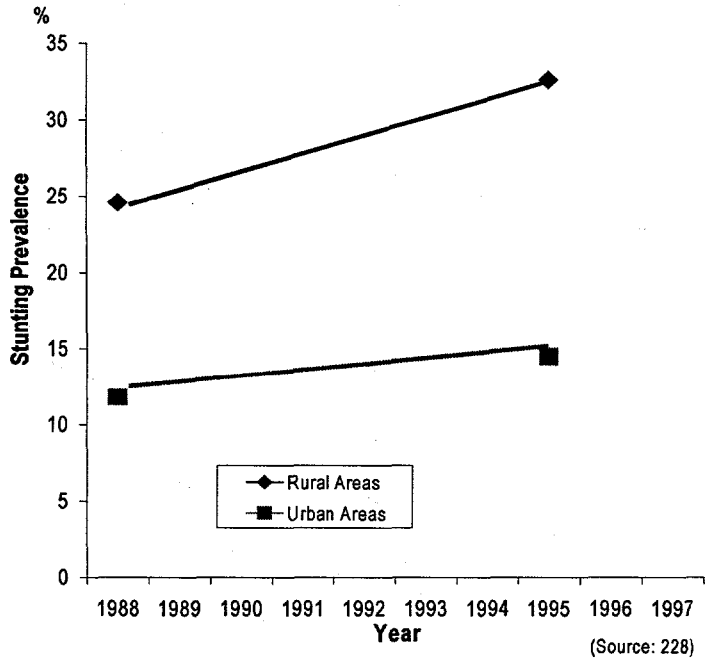
[6] Food consumption data in Tunisia after 1985 were not available.

Figure 18: Stunting Prevalence and GNP/c in Tunisia



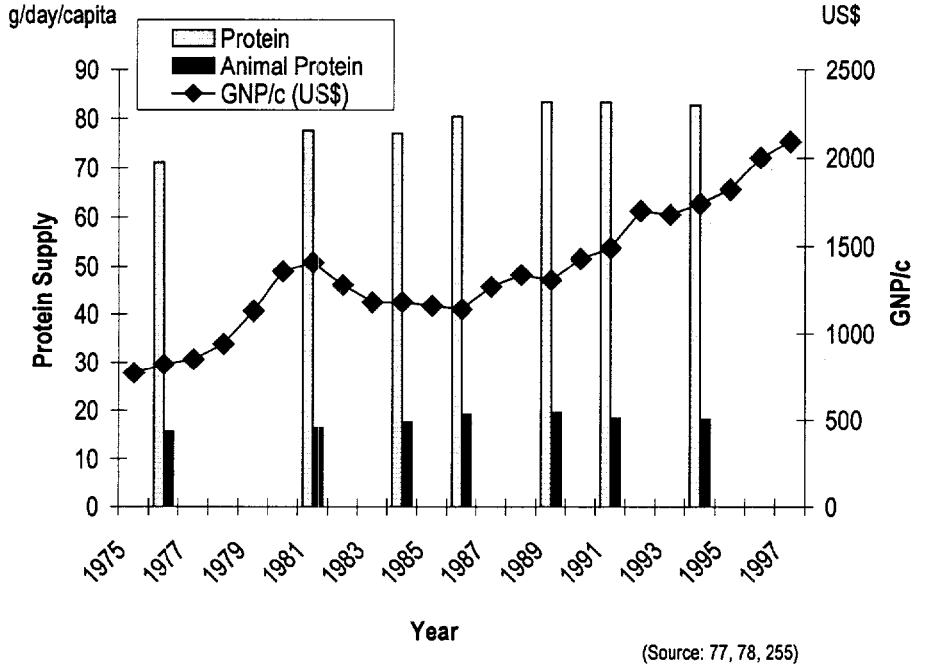
(Source: 5, 228, 255)

Figure 19: Stunting Prevalence in Rural and Urban Areas in Tunisia



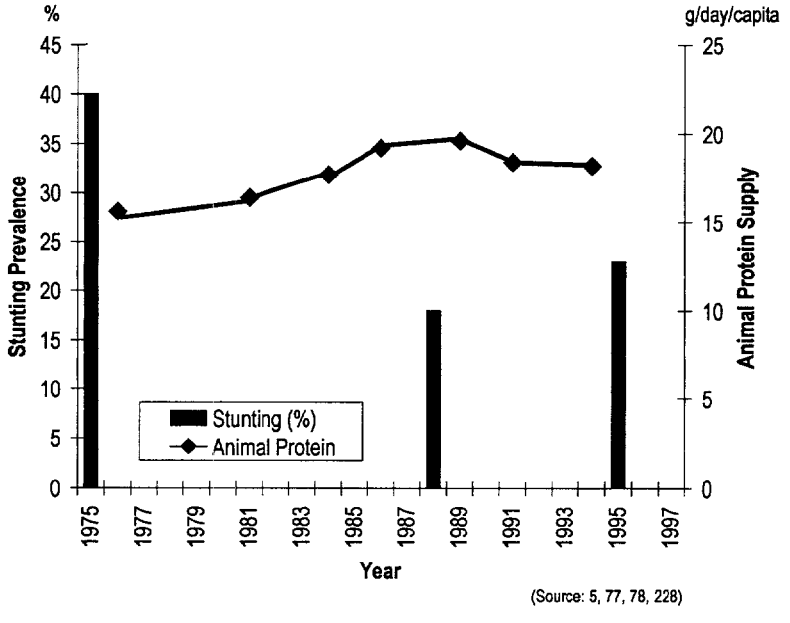
(Source: 228)

Figure 20: Food Supply and GNP/c in Tunisia



(Source: 77, 78, 255)

Figure 21: Stunting Prevalence and Food Supply in Tunisia



(Source: 5, 77, 78, 228)

Micronutrient Deficiency

Iron

There is high anemia prevalence among women and children throughout MENA countries, regardless of income level. For example, the anemia prevalence among reproductive age women in a high income country, Kuwait, is 42 percent, which is similar to lower income countries such as Egypt and WBG, while the obesity prevalence among Kuwaiti women is as high as 44 percent. The anemia prevalence among children under five year old in many MENA countries is alarmingly high, between 40 and 80 percent. The anemia prevalence among school age children is also high, although it is generally lower than that of under five year children.

The major dietary source of iron in MENA countries is cereals.[216, 235] Unlike heme iron in animal products, the bioavailability of nonheme iron in cereals is low, and tannin, phytate, and dietary fiber significantly reduce the absorption. People in MENA countries consume a lot of tea, which is high in tannin, during meals and social occasions. Unleavened breads and breads baked with high extraction rate flour are high in phytate and dietary fiber, that reduce bioavailability of iron. Vitamin C from fruits and vegetables can increase absorption of nonheme iron, however, fruits are consumed in various amounts depending on seasonal availability and income. It is necessary to raise people's awareness of how anemia can be prevented by more diversified diets including animal products, fruits, and leavened bread, by not consuming tea during meals, and not giving tea to small children. Iron fortification of staple food should be also needed.

High fertility, short birth intervals, poor maternal health care, unbalanced diet, and lack of nutrition knowledge are all risk factors for high anemia prevalence among women in MENA countries regardless of income levels. Although iron supplementation is offered at the antenatal check-ups, compliance is often problematic. Pregnant women often do not take the iron supplements because of the side effects such as stomach discomfort, or misconceptions that iron supplements may cause abortion or excess enlargement of the fetus.[150] The coverage of supplementation programs is also an issue, since lower socio-economic groups have the highest risk and are less likely to receive regular antenatal check-ups. Adolescent girls, especially in rural areas, require more attention and specific interventions.

Anemia among children under five years is caused by incorrect child feeding practices, high child morbidity such as diarrhea, and mothers' anemia during pregnancy and lactation. Bread and sweet tea are common complementary foods that could cause anemia in young children. One of the major causes of anemia among school age children is intestinal parasite infection, although an accurate prevalence has not been established.

Iodine

Iodine deficiency disorders (IDD) are major public health problems since most MENA countries have areas with little iodine in the soil, *e.g.* mountainous areas of Iran, Iraq, Lebanon, Morocco, Syria, Tunisia, and Yemen, and oases in desert areas of Egypt and Libya.[232, 233] Very high TGR was reported in Iran, Syria, Yemen, and the New Valley area in Egypt.[207, 221] IDD is seen even in coastal areas because people do not consume enough seafood due to dietary habits or high prices.

Iran has made a significant progress on IDD control. The national survey in 1989 indicated that 14 of 24 provinces were IDD endemic areas. The survey was followed by a series of national IDD control programs: 22 salt iodization plants have been established, 76 percent of

households in rural areas and 87 percent of households in urban areas consumed iodized salt by 1995; iodized oil has been distributed to the hyperendemic areas.[137, 221]

The national IDD surveillance was also conducted in Syria in 1990.[221] TGR exceeded 80 percent in many areas including rural Damascus, Aleppo, Idleb, Reqqa, Sweida, Der'a, Tartous and Quneitra. TGR was 77 percent in rural areas, and 69 percent in urban areas. The single salt producer, Ministry of Industry, has been iodizing salt since 1992, however, it is estimated that only 36 percent of households are consuming iodized salt. Oral iodized oil has been also distributed to children under two years of age and pregnant women.

IDD control in Yemen has just begun.[7] Although no nationwide surveillance data are available, a survey was conducted in 1991 in the mountainous central highlands, including Sana'a, Dhamar, Ibb and Hajja, where more than 60 percent of the population reside.[210] The survey showed that 78 percent of girls and 60 percent of boys in Sana'a had goiter, and the goiter prevalence reached over 95 percent in some hyperendemic rural areas. The Ministry of Public Health, in collaboration with UNICEF, launched a national IDD control program in 1995, targeting universal salt iodization. Iodized salt is currently consumed by only 21 percent of households.

In WBG, neonatal screening for thyroid stimulating hormone (TSH) is carried out on all newborn infants at the public hospitals and clinics. The neonatal screening found 10 positive cases out of 27,000 tested in 1994 and 81 positive cases out of 45,000 tested.[218] Endemic hypothyroidism is observed in Khan Younis area in Gaza at about 15 percent goiter prevalence, however, this may due to hereditary factors. All salt used in WBG is imported from Israel, but the salt is not iodized, and Israeli authorities do not allow production or distribution of iodized salt within WBG.[218, field interviews]

Vitamin A

Vitamin A deficiency (VAD) is largely under control in MENA countries. ACC/SCN expects that MENA will be the only region of developing countries that can eliminate clinical VAD before the year 2000. The MENA countries' dietary patterns include a relatively large amount of green leafy vegetables, which are rich in carotene, the precursor of vitamin A.

The 1995 national VAD survey in Egypt showed 0.2 percent of clinical VAD prevalence among the children between six months and three years, and 11.3 percent of subclinical VAD with low serum retinol levels.[5] VAD is increasing in Iraq: according to a subnational survey in 1994, clinical VAD among children under five years in Iraq was 2.4 percent. In Morocco, the 1997 national survey showed subclinical VAD prevalence was 41 percent.

A 1992 survey in Tihama region in Yemen observed an overall clinical VAD prevalence of 1.7 percent and a total of 2.1 percent in children aged one to six years, with the highest prevalence of 2.9 percent seen in children aged five to six years.[222] Clinical VAD was more frequently seen in boys than girls. The subclinical VAD prevalence among children aged one to five years was 62.4 percent. Subsequently a one-time vitamin A supplement activity was implemented in the region and a pilot program is being implemented of universal vitamin A distribution in conjunction with the National Immunization Day.[210]

[7] By October 1998, about 70 percent of salt consumed in urban areas in Yemen is iodized. The Ministry of Public Health conducted a national IDD surveillance in October and November, 1998.[field interviews]

A national survey in 1994 in Oman found that 20.8 percent of subclinical VAD with low serum retinol levels.[222] Children of 18 months of age were most affected with a prevalence of 22.8 percent. A survey in 1981 indicated a clinical VAD prevalence of 1.5 percent with higher rates among boys than girls, however, another survey in 1991 on children under two years old found no clinical VAD cases. These data may indicate that clinical VAD is under control in Oman.

Vitamin D

Despite the abundant sunlight in the region, vitamin D deficiency exists in many MENA countries including Iran, Kuwait, Libya, Morocco, Saudi Arabia, WBG and Yemen.[60, 63, 67, 148, 151, 176, 210, field interviews] Vitamin D deficiency in MENA countries is due to the low dietary vitamin D intake and life styles and habits that avoid sunlight. People live in dark houses; keep infants wrapped for long periods; and women wear thick dark veils. In Saudi Arabia, another possible factor is an increase in ultraviolet light insulation due to air borne dust particles. Rickets is usually most common at the end of the first year, and it disappears by the fifth year.

A hospital based study in Kuwait in 1995 reported that serum 25-hydroxy vitamin D (25-OHD) levels were significantly lower in a sample of 50 veiled women than in another sample of 22 unveiled women.[63] The women were between 14 and 45 years of age, had no other health problems, and had no more than three previous pregnancies. Two clinical osteomalacia cases were found among the veiled women, in addition to the four cases found previously at the same hospital. All six cases were single women between 14 and 24 years old, showing clinical symptoms from bone pains to fracture of a femur and radiological signs in pelvis, femur, scapula and ribs. All were treated successfully by administering vitamin D. This study suggests that clinical and subclinical vitamin D deficiency is widespread among veiled Kuwaiti women and that young unmarried women are particularly at risk, as they tend to cover themselves more thoroughly than the older married women.

In Saudi Arabia, surveys in 1992 showed that serum 25-OHD levels are lower in the population in northern provinces and higher in western provinces, lower in urban areas than in rural areas, lower among the occupants of mud or brick houses than the occupants of tents, and the lowest in female adolescents and preschool children than other age and gender groups. A hospital-based survey in 1991 showed 1.3 percent of rickets cases among 16,125 children admitted.[148] Another study showed that women in the higher socio-economic group had higher 25-OHD levels, since they ate more animal origin food, lived in better housing, and attended antenatal care more regularly to receive vitamin D supplements.[176] Mothers of infants with rickets were found to be low serum 25-OHD levels.[60] In addition, hereditary disorders such as familial vitamin D resistance rickets were also reported in Saudi Arabia.[148, 151]

Low serum 25-OHD levels in mothers of infants with rickets were also reported in Libya.[67] These mothers usually wear traditional veils. Infants born from low 25-OHD level mothers have low 25-OHD levels at birth. Prolonged breast feeding by mothers with low 25-OHD levels was likely to increase the risks, as breast milk is the major source of vitamin D. The infants with rickets were often malnourished, since rickets causes hypotonia and poor suck, and therefore decreases breast milk intake.

In Yemen, a 1972 survey in six villages in the northern part of the country reported 16.5 percent of rickets prevalence among children aged six months to four years, and a survey in a village in the north in 1987 reported an overall prevalence of rickets as 27 percent among under five children.[210] In Gaza, about 400 rickets cases have been found in children under two years of

age during the last three years. They were treated successfully by introducing sufficient sun bathing.[field interviews]

Zinc

Human zinc deficiency cases were recorded for the first time in Egypt and Iran in the early 1960s.[166,167, 171] Egyptian cases showed severe anemia, retarded growth and sexual maturation, complicated with hookworm infection and schistosomiasis. Iranian cases showed similar symptoms, without hookworm infection and schistosomiasis but accompanied by geophagia.[8] Their diets consisted mainly of beans and bread made of wheat flour but animal products were rarely consumed. In both cases, the symptoms were eased by zinc supplementation therapy.

A study of pregnant women in Egypt in 1982 reported that most of the 42 women studied had zinc intake of less than two thirds of RDA, and a third of the women were overweight.[110] More than half of their zinc intake was from cereals, and one fourth was from dairy, meat and eggs. The plasma zinc concentration was positively associated with the birth weight, and also motor performance in infants at six months of age.

Prevailing dietary patterns in MENA countries are low in bioavailable zinc and high in inhibitory factors such as phytate, zinc deficiency may be the underlying cause in the high prevalence of child growth retardation, low birth weight and anemia. Although the prevalence of zinc deficiency is unknown, mild and moderate forms are likely to be widespread in the region. The prevalence of zinc deficiency is probably similar to that of nutritional iron deficiency because the same dietary pattern induces both. Dietary modification interventions, including improved cereal varieties and reduction phytate by leavening and fermentation, should be promoted.[5, 83, 141]

[8] Geophagia is the habit to eat clay. Clay will compose insoluble complex with zinc, and reduce zinc bioavailability. In Shiraz province in south Iran, each person ate about 500 g clay per day in the early 1960s. Zinc deficiency accompanied to geophagia is reported in Turkey, too.[167, 171]

Annex 5: MENA Nutrition Data Tables

Algeria

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	39	/1000 live births		207
	1980	139	/1000 live births		
	1960	255	/1000 live births		
Infant Mortality Rate	1996	34	/1000 live births		207
	1960	152	/1000 live births		
Crude Birth Rate	1996	30	/1000		207
	1970	49	/1000		
Crude Death Rate	1996	6	/1000		207
	1970	16	/1000		
Life Expectancy at Birth	1995	68	years	Male	255
		71	years	Female	
	1970	53	years		196
Maternal Mortality Ratio	1994	140	/100000 live births		255
Low Birth Weight	1990s	9	%		
Breastfeeding	1990s	48	%	Exclusively breastfed (0-3m)	207
	1990s	29	%	Breastfed with complementary food (6-9m)	
	1990s	21	%	Still breastfeeding (20-23m)	
Stunting (under 5y)	1995	18.3	%	Total, moderate & severe	228
		6.8	%	Total, severe	
		18.3	%	Male, moderate & severe	
		7.0	%	Male, severe	
		18.2	%	Female, moderate & severe	
		6.6	%	Female, severe	
		18.0	%	Urban, moderate & severe	
		7.0	%	Urban, severe	
		18.5	%	Rural, moderate & severe	
		6.5	%	Rural, severe	
Underweight (under 5y)	1995	12.8	%	Total, moderate & severe	228
		3.4	%	Total, severe	
		13.0	%	Male, moderate & severe	
		3.1	%	Male, severe	
		12.5	%	Female, moderate & severe	
		3.6	%	Female, severe	
		12.7	%	Urban, moderate & severe	
		3.8	%	Urban, severe	
		12.8	%	Rural, moderate & severe	
		3.0	%	Rural, severe	
Wasting (under 5y)	1995	8.9	%	Total, moderate & severe	228
		2.8	%	Total, severe	
		9.0	%	Male, moderate & severe	
		2.8	%	Male, severe	
		8.8	%	Female, moderate & severe	
		2.8	%	Female, severe	
		10.1	%	Urban, moderate & severe	
		3.1	%	Urban, severe	
		7.7	%	Rural, moderate & severe	
		2.4	%	Rural, severe	

Overweight (under5y)	1995	9.2	%	Total	
		8.5	%	Male	
		9.8	%	Female	
		10.9	%	Urban	
		7.4	%	Rural	
Energy Intake	1989	2,866	Kcal	per day	150
	1981	2,604	Kcal	per day	
	1971	1,834	Kcal	per day	
	1961	1,736	Kcal	per day	
Protein Intake	1989	76.6	g	per day	150
	1981	66.9	g	per day	
	1971	48.1	g	per day	
	1961	47.9	g	per day	
Fat Intake	1989	61.2	g	per day	150
	1981	59.6	g	per day	
	1971	35.9	g	per day	
	1961	32.1	g	per day	
Anemia	1987	28	%	Urban, prevalence of anemia	30
	1987	19	%	Semi-urban, prevalence of anemia	
	1987	32	%	Rural, prevalence of anemia	
	1987	29	%	Urban, prev. of iron deficiency in anemia cases	
	1987	27	%	Semi-urban, prev. of iron def. in anemia cases	
	1987	22	%	Rural, prev. of iron deficiency in anemia cases	
	1987	48	%	Urban, prev. of folic acid def. in anemia cases	
	1987	45	%	Semi-urban, prev. of folic acid def. in anemia	
	1987	22	%	Rural, prev. of folic acid def. in anemia cases	
Total Goiter Rate (6-11y)	1990s	9	%		207
% Household Consuming Iodized Salt	1990s	92	%		207

Bahrain

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	22	/1000 live births		207
	1980	42	/1000 live births		
	1960	203	/1001 live births		
Infant Mortality Rate	1996	18	/1000 live births		207
	1960	130	/1000 live births		
Crude Birth Rate	1996	22	/1000		207
	1970	40	/1000		
Crude Death Rate	1996	4	/1000		207
	1970	9	/1000		
Life Expectancy at Birth	1995	71	years	Male	255
		75	years	Female	
	1970	62	years		196
Maternal Mortality Ratio	1990	60	/100000 live births		207
Low Birth Weight	1990s	6	%		207
Stunting (under 5y)	1989	9.9	%	Total, moderate & severe	228
	1989	3.0	%	Total, severe	
	1989	10.3	%	Male, moderate & severe	
	1989	3.0	%	Male, severe	
	1989	9.6	%	Female, moderate & severe	
	1989	3.0	%	Female, severe	

	1989	12.1	%	Urban, moderate & severe	
	1989	3.8	%	Urban, severe	
	1989	7.8	%	Rural, moderate & severe	
	1989	2.2	%	Rural, severe	
Underweight (under 5y)	1989	7.2	%	Total, moderate & severe	228
	1989	0.8	%	Total, severe	
	1989	7.8	%	Male, moderate & severe	
	1989	0.9	%	Male, severe	
	1989	6.7	%	Female, moderate & severe	
	1989	0.8	%	Female, severe	
	1989	8.7	%	Urban, moderate & severe	
	1989	1.0	%	Urban, severe	
	1989	5.8	%	Rural, moderate & severe	
	1989	0.7	%	Rural, severe	
Wasting (under 5y)	1989	5.5	%	Total, moderate & severe	228
	1989	0.9	%	Total, severe	
	1989	5.7	%	Male, moderate & severe	
	1989	0.8	%	Male, severe	
	1989	5.2	%	Female, moderate & severe	
	1989	1.0	%	Female, severe	
	1989	6.5	%	Urban, moderate & severe	
	1989	1.3	%	Urban, severe	
	1989	4.5	%	Rural, moderate & severe	
	1989	0.5	%	Rural, severe	
Overweight (under 5 y)	1989	4.7	%	Total, >2SD	228
		3.5	%	Male, >2SD	
		5.9	%	Female, >2SD	
Overweight (age 15-21)	1993	15.6	%	Male, BMI >= 25	144
		17.4	%	Female, BMI >= 25	
Anemia	1997	39.2	%	Preschool male	151
		29.6	%	female	
		30.1	%	Primary school male	
		29.7	%	female	
		22.5	%	Intermediate school, male	
		50.3	%	female	
		12.5	%	Secondary school male	
		49.0	%	female	
		33.8	%	Urban, Preschool male	
		25.4	%	female	
		24.1	%	Urban, Primary school male	
		23.1	%	female	
		26.7	%	Urban, Intermediate school male	
		43.3	%	female	
		8.4	%	Urban, Secondary school male	
		31.7	%	female	
		44.8	%	Rural, Preschool male	
		33.8	%	female	
		38.5	%	Rural, Primary school male	
		41.5	%	female	
		18.3	%	Rural, Intermediate school male	
		56.7	%	female	
		16.7	%	Rural, Secondary school male	

		66.7	%	female	
Hypertension	1992	12	%		149
Diabetes	1992	9	%		149
Decayed, Missing,	1980s	3.2		6yr(deciduous teeth)M	149
or Filled Teeth		2.5		6yr(deciduous teeth)F	
		2.8		6yr(deciduous teeth)T	
		1.1		12yrM	
		1.6		12yrF	
		1.3		12yrT	
		1.7		15yrM	
		2.1		15yrF	
		1.9		15yrT	

Egypt

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	78	/1000 live births		207
	1980	175	/1000 live births		196
	1960	282	/1000 live births		196
Infant Mortality Rate	1996	57	/1000 live births		207
	1960	189	/1000 live births		196
Crude Birth Rate	1996	27	/1000		207
	1970	40	/1000		196
Crude Death Rate	1996	7	/1000		207
	1970	17	/1000		196
Life Expectancy at Birth	1995	60	years	Male	255
		63	years	Female	
	1970	51	years		196
Maternal Mortality Ratio	1990	170	/100000 live births		207
Low Birth Weight	1990s	10	%		207
Breastfeeding	1990s	53	%	Exclusively breastfed (0-3m)	207
	1990s	37	%	Breastfed with complementary food (6-9m)	
Stunting (under 5y)	1990s	25	%	Moderate & severe	207
	1996	29.8	%	Total, moderate & severe	228
		13.4	%	Total, severe	
		31.0	%	Male, moderate & severe	
		14.1	%	Male, severe	
		28.4	%	Female, moderate & severe	
		12.7	%	Female, severe	
		22.8	%	Urban, moderate & severe	
		9.4	%	Urban, severe	
		34.4	%	Rural, moderate & severe	
		14.1	%	Rural, severe	
Stunting (age 8-18)	1992	23	%	Young male working children	62
Both Wasting and Stunting (age 8-18)	1992	3	%	Young male working children	62
Underweight (under 5y)	1990s	15	%	Moderate & severe	207
	1990s	4	%	Severe	
	1996	12.4	%	Total, moderate & severe	228
		2.6	%	Total, severe	
		12.7	%	Male, moderate & severe	
		2.9	%	Male, severe	
		12.2	%	Female, moderate & severe	

		2.4	%	Female, severe	
		9.9	%	Urban, moderate & severe	
		1.7	%	Urban, severe	
		14.1	%	Rural, moderate & severe	
		3.3	%	Rural, severe	
Wasting (under 5y)	1990s	6	%	Moderate & severe	207
	1996	4.6	%	Total, moderate & severe	228
		1.2	%	Total, severe	
		4.7	%	Male, moderate & severe	
		1.5	%	Male, severe	
		4.5	%	Female, moderate & severe	
		1.0	%	Female, severe	
		4.7	%	Urban, moderate & severe	
		1.3	%	Urban, severe	
		4.5	%	Rural, moderate & severe	
		1.2	%	Rural, severe	
Wasting (age 8-18)	1992	16	%	Young male working children	62
Overweight (under 5y)	1996	8.6	%	Total	228
	1996	7.4	%	Male	
	1996	9.9	%	Female	
	1996	8.7	%	Urban	
	1996	8.5	%	Rural	
Overweight (8-18y)	1992	3	%	Young male working children	62
Anemia (8-18y)	1992	77	%	Young male working children	62
Total Goiter Rate (6-11y)	1990s	5	%		207
% Household Consuming Iodized Salt	1990s	0	%		207
Energy Intake	1989	3,336	Kcal	per day	150
	1981	3,206	Kcal	per day	
	1971	2,467	Kcal	per day	
	1961	2,272	Kcal	per day	
Protein Intake	1989	83.5	g	per day	150
	1981	79.4	g	per day	
	1971	64.7	g	per day	
	1961	61.3	g	per day	
Fat Intake	1989	78.4	g	per day	150
	1981	73.3	g	per day	
	1971	53.3	g	per day	
	1961	45.2	g	per day	
Parasite Infection (8-18y)	1992	72	%	Prevalence in young male working children	62

Iran

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	37	/1000 live births		207
	1980	126	/1000 live births		196
	1960	233	/1000 live births		196
Infant Mortality Rate	1996	33	/1000 live births		207
	1960	145	/1000 live births		196
Crude Birth Rate	1996	35	/1000		207
	1970	45	/1000		196
Crude Death Rate	1996	6	/1000		207
	1970	16	/1000		196

Life Expectancy at Birth	1995	68	years	Male	255
		69	years	Female	
	1970	55	years		196
Maternal Mortality Ratio	1990	120	/100000 live births		207
Low Birth Weight	1990s	9	%		207
Breastfeeding	1990s	53	%	Exclusively breastfed (0-3m)	207
Stunting (under 5y)	1995	18.9	%	Total, moderate & severe	228
		5.3	%	Total, severe	
		19.5	%	Male, moderate & severe	
		5.2	%	Male, severe	
		18.4	%	Female, moderate & severe	
		5.3	%	Female, severe	
		12.2	%	Urban, moderate & severe	
		2.9	%	Urban, severe	
		24.8	%	Rural, moderate & severe	
		8.1	%	Rural, severe	
Underweight (under 5y)	1995	15.7	%	Total, moderate & severe	228
		2.9	%	Total, severe	
		15.0	%	Male, moderate & severe	
		2.7	%	Male, severe	
		16.3	%	Female, moderate & severe	
		3.1	%	Female, severe	
		13.3	%	Urban, moderate & severe	
		1.8	%	Urban, severe	
		18.7	%	Rural, moderate & severe	
		3.8	%	Rural, severe	
Wasting (under 5y)	1995	6.6	%	Total, moderate & severe	228
		0.6	%	Total, severe	
		6.1	%	Male, moderate & severe	
		0.4	%	Male, severe	
		7.1	%	Female, moderate & severe	
		0.8	%	Female, severe	
		6.9	%	Urban, moderate & severe	
		0.8	%	Urban, severe	
		6.4	%	Rural, moderate & severe	
		0.4	%	Rural, severe	
Total Goiter Rate (6-11y)	1990s	30	%		207
% Household Consuming Iodized Salt	1990s	82	%		
Cretinism Prevalence	1990	20	%		134
Energy Intake	1989	3,181	Kcal	per day	150
	1981	3,046	Kcal	per day	
	1971	2,328	Kcal	per day	
	1961	1,929	Kcal	per day	
Protein Intake	1989	84.1	g	per day	150
	1981	79.9	g	per day	
	1971	61.2	g	per day	
	1961	52.1	g	per day	
Fat Intake	1989	62.2	g	per day	150
	1981	67.6	g	per day	
	1971	45.0	g	per day	
	1961	34.0	g	per day	

Na	1981	186	mEq/24h	24h urinary sodium excretion >=14yr	159
		141	mEq/24h		
Hypertension	1981	12	%	Male, >=30yr prevalence, >140/90	159

Iraq

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1995	145	/1000 live births		226
	1980	83	/1000 live births		196
	1960	171	/1000 live births		196
Infant Mortality Rate	1995	161	/1000 live births		226
	1960	117	/1000 live births		196
Crude Birth Rate	1996	37	/1000		207
	1970	48	/1000		196
Crude Death Rate	1996	9	/1000		207
	1970	16	/1000		196
Life Expectancy at Birth	1995	60	years	Male	255
		62	years	Female	
	1970	55	years		196
Maternal Mortality Ratio	1990	310	/100000 live births		207
Low Birth Weight	1995	21	%		226, 229
Stunting (under 5y)	1997	28	%	Moderate & severe	229
	1991	21.8	%	Total, moderate & severe	228
		7.3	%	Total, severe	
		20.0	%	Urban, moderate & severe	
		24.7	%	Rural, moderate & severe	
Underweight (under 5y)	1997	25	%	Moderate & severe	229
	1991	11.9	%	Total, moderate & severe	228
		2.3	%	Total, severe	
		11.4	%	Urban, moderate & severe	
		24.7	%	Rural, moderate & severe	
Wasting (under 5y)	1997	9	%	Moderate & severe	229
	1991	3.4	%	Total, moderate & severe	228
		0.4	%	Total, severe	
		3.3	%	Urban, moderate & severe	
		3.5	%	Rural, moderate & severe	
Total Goiter Rate (6-11y)	1990s	7	%		207
	1992	41.5	%	Female of child bearing age in Ninewah	134
	1993	44.2	%	School age children	134
		57	%	Ninevah (north)	
		54	%	Baghdad (central)	
		37	%	Basnah (south)	
% Household Consuming Iodized Salt	1990s	50	%		207
Energy Intake	1989	2,887	Kcal	per day	150
	1981	2,815	Kcal	per day	
	1971	2,291	Kcal	per day	
	1961	2,066	Kcal	per day	
Protein Intake	1989	71.8	g	per day	150
	1981	73.8	g	per day	
	1971	61.3	g	per day	
	1961	58.3	g	per day	

Fat Intake	1989	75.3	g	per day	150
	1981	62.1	g	per day	
	1971	43.6	g	per day	
	1961	41.9	g	per day	

Israel

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	9	/1000 live births		207
	1980	19	/1000 live births		196
	1960	39	/1000 live births		196
Infant Mortality Rate	1996	8	/1000 live births		207
	1960	32	/1000 live births		196
Crude Birth Rate	1996	21	/1000		207
	1970	26	/1000		196
Crude Death Rate	1996	6	/1000		207
	1970	7	/1000		196
Life Expectancy at Birth	1995	75	years	Male	255
		79	years	Female	
	1970	71	years		196
Maternal Mortality Ratio	1990	7	/100000 live births		207
Low Birth Weight	1990s	7	%		207
Stunting (18months)	1981	32.7	%	Cohort study, baseline	84
(10yr, same cohort)	1990	7.2	%	follow up	
(9 months)	1982	17.5	%	Cohort study, baseline	
(10yr, same cohort)	1990	8.2	%	follow up	
Low BMI in the Aged	1996	1.1	%	<19kg/m2	123
Low Serum Albumin	1996	11.4	%	Male, <35g/l	123
in the Aged		16.9	%	Female, <35g/l	
High BMI in the Aged	1996	13.5	%	>30kg/m2	123
Anemia	1983	44.7	%	Jewish, Hb<11g/dl 6m	114
		43.7	%	Arab, Hb<11g/dl 6m	
		60	%	Jewish, Hb<11g/dl 12m	
		71	%	Arab, Hb<11g/dl 12m	
		4.5	%	Jewish, Hb<10g/dl (severe) 6m	
		7.7	%	Arab, Hb<10g/dl (severe) 6m	
		13.1	%	Jewish, Hb<10g/dl (severe) 12m	
		19.6	%	Arab, Hb<10g/dl (severe) 12m	

Jordan

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	25	/1000 live births		207
	1980	64	/1000 live births		196
	1960	139	/1000 live births		196
Infant Mortality Rate	1996	21	/1000 live births		207
	1960	97	/1000 live births		196
Crude Birth Rate	1996	38	/1000		207
	1970	51	/1000		196
Crude Death Rate	1996	5	/1000		207
	1970	18	/1000		196
Life Expectancy at Birth	1995	68	years	Male	255
		72	years	Female	
	1970	54	years		196

Maternal Mortality Ratio	1990	45	/100000 live births		247
Low Birth Weight	1990s	7	%		207
Breastfeeding	1990s	32	%	Exclusively breastfed (0-3m)	207
		48	%	Breastfed with complementary food (6-9m)	
		13	%	Still breastfeeding (20-23m)	
Stunting (under 5y)	1990s	16	%	Moderate & severe	207
	1995	15.8	%	Total, moderate & severe	228
		4.3	%	Total, severe	
		16.2	%	Male, moderate & severe	
		4.7	%	Male, severe	
		15.5	%	Female, moderate & severe	
		3.8	%	Female, severe	
		15.8	%	Urban, moderate & severe	
		3.7	%	Urban, severe	
		27.3	%	Rural, moderate & severe	
		8.9	%	Rural, severe	
Underweight (under 5y)	1990s	9	%	Moderate & severe	207
	1995	6.4	%	Total, moderate & severe	228
		0.8	%	Total, severe	
		6.6	%	Male, moderate & severe	
		1.0	%	Male, severe	
		6.2	%	Female, moderate & severe	
		0.7	%	Female, severe	
		4.9	%	Urban, moderate & severe	
		0.7	%	Urban, severe	
		9.9	%	Rural, moderate & severe	
		1.3	%	Rural, severe	
Wasting (under 5y)	1990s	2	%	Moderate & severe	207
	1995	3.1	%	Total, moderate & severe	228
		0.6	%	Total, severe	
		3.7	%	Male, moderate & severe	
		0.8	%	Male, severe	
		2.5	%	Female, moderate & severe	
		0.4	%	Female, severe	
		2.6	%	Urban, moderate & severe	
		0.5	%	Urban, severe	
		3.5	%	Rural, moderate & severe	
		0.6	%	Rural, severe	
Overweight (under 5y)	1995	5.7	%	Total	228
		5.1	%	Male	
		6.2	%	Female	
% Household Consuming Iodized Salt	1990s	75	%		207
Energy Intake	1989	2,634	Kcal	per day	150
	1981	2,629	Kcal	per day	
	1971	2,497	Kcal	per day	
	1961	2,218	Kcal	per day	
Protein Intake	1989	71.4	g	per day	150
	1981	68.9	g	per day	
	1971	68.3	g	per day	
	1961	56.3	g	per day	
Fat Intake	1989	62.0	g	per day	150

	1981	56.5	g	per day	
	1971	62.2	g	per day	
	1961	48.1	g	per day	

Kuwait

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	14	/1000 live births		207
	1980	35	/1000 live births		196
	1960	128	/1000 live births		196
Infant Mortality Rate	1996	13	/1000 live births		207
	1960	89	/1000 live births		196
Crude Birth Rate	1996	22	/1000		207
	1970	47	/1000		196
Crude Death Rate	1996	2	/1000		207
	1970	6	/1000		196
Life Expectancy at Birth	1995	74	years	Male	255
		79	years	Female	
	1970	66	years		196
Maternal Mortality Ratio	1994	18	/100000 live births		255
Low Birth Weight	1990s	7	%		207
Breastfeeding	1989	60.6	%	<3yr	22
Bottle Feeding		14	%	<3yr	
Mixed Feeding		25.4	%	<3yr	
Stunting (under 6y)	1984	12.2	%	Total, moderate & severe	228
		5.1	%	High socioecon. gr., moderate & severe	
		17.3	%	Low socioecon. gr., moderate & severe	
Underweight (under 6y)	1984	6.4	%	Total, moderate & severe	228
		2.8	%	High socioecon. gr., moderate & severe	
		9.0	%	Low socioecon. gr., moderate & severe	
Wasting (under 6y)	1984	2.6	%	Total, moderate & severe	228
		1.4	%	High socioecon. gr., moderate & severe	
		3.4	%	Low socioecon. gr., moderate & severe	
BMI (adult)	1995	28.3+/-5.3	kg/m2	Adult mean	12
Overweight (adult)		70.2	%	BMI>25	
Obesity (adult)		36.4	%	BMI>30	
Overweight (<5yr)	1993	5.2	%	wt/ht>120% of reference population	149
	1979	1.8	%		
Overweight (6-7yr)	1984	18.1	%	Male, wt/ht>120% of reference population	149
		26.8	%	Female	
Overweight (6-9yr)	1995	12.8	%	Male, wt/ht>120% of reference population	149
		14.9	%	Female	
Overweight (6-14yr)	1992	20.0	%	Male, wt/ht>120% of reference population	149
		23.1	%	Female	
	1985	49.0	%	Male, wt/ht>120% of reference population	149
		59.0	%	Female	
	1981	24.6	%	Male, wt/ht>120% of reference population	
		47.9	%	Female	
Energy Intake	1989	3,195	Kcal	per day	150
	1981	2,961	Kcal	per day	
	1971	2,640	Kcal	per day	
	1961	2,594	Kcal	per day	
Protein Intake	1989	95.3	g	per day	150

	1981	90.2	g	per day	
	1971	74.6	g	per day	
	1961	76.8	g	per day	
Fat Intake	1989	104.9	g	per day	150
	1981	93.0	g	per day	
	1971	71.3	g	per day	
	1961	76.0	g	per day	
Stroke Incidence	1997	27.6	/100000	Crude	7
		145.6	/100000	Adjusted	
Diabetes	1980	17.8	/1000	Total (excluding non-Kuwaiti)	149
		17.0	/1000	Male (excluding non-Kuwaiti)	
		18.7	/1000	Female (excluding non-Kuwaiti)	
Hypertension (>20yr)	1985	19.3	%	Total	149
		22.6	%	Male	
		16.1	%	Female	
Dental Caries (pre-school 18-48m)	1985	18	%	>=5 decayed, missed, or filled teeth prevalence	10

Lebanon

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	40	/1000 live births		207
	1980	40	/1000 live births		196
	1960	85	/1000 live births		196
Infant Mortality Rate	1996	33	/1000 live births		207
	1960	65	/1000 live births		196
Crude Birth Rate	1996	25	/1000		207
	1970	35	/1000		196
Crude Death Rate	1996	7	/1000		207
	1970	11	/1000		196
Life Expectancy at Birth	1995	68	years	Male	255
		71	years	Female	
	1970	64	years		196
Maternal Mortality Ratio	1990	300	/100000 live births		207
Low Birth Weight	1990s	10	%		207
Stunting (under 5y)		12.2	%	Total, moderate & severe	228
		12.6	%	Male, moderate & severe	
		3.3	%	Male, severe	
		11.8	%	Female, moderate & severe	
		2.5	%	Female, severe	
Underweight (under 5y)	1996	3.0	%	Total, moderate & severe	228
		3.3	%	Male, moderate & severe	
		0.4	%	Male, severe	
		2.8	%	Female, moderate & severe	
		0.1	%	Female, severe	
Wasting (under 5y)	1996	2.9	%	Total, moderate & severe	228
		3.0	%	Male, moderate & severe	
		0.8	%	Male, severe	
		2.8	%	Female, moderate & severe	
		0.6	%	Female, severe	
Total Goiter Rate (6-11y)	1990s	15	%		207
Thyroid Enlargement (mountain)	1990s	40--75	%		134

(coastal areas)		17	%		
% Household Consuming Iodized Salt	1990s	92	%		207
Energy Intake	1989	3,274	Kcal	per day	150
	1981	2,875	Kcal	per day	
	1971	2,474	Kcal	per day	
	1961	2,466	Kcal	per day	
Protein Intake	1989	86.2	g	per day	150
	1981	83.0	g	per day	
	1971	64.2	g	per day	
	1961	65.0	g	per day	
Fat Intake	1989	97.1	g	per day	150
	1981	85.2	g	per day	
	1971	61.9	g	per day	
	1961	62.2	g	per day	

Libya

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	61	/1000 live births		207
	1980	118	/1000 live births		196
	1960	269	/1000 live births		196
Infant Mortality Rate	1996	50	/1000 live births		207
	1960	160	/1000 live births		196
Crude Birth Rate	1996	41	/1000		207
	1970	49	/1000		196
Crude Death Rate	1996	7	/1000		207
	1970	16	/1000		196
Life Expectancy at Birth	1995	63	years	Male	255
		67	years	Female	
	1970	52	years		196
Maternal Mortality Ratio	1990	220	/100000 live births		207
Low Birth Weight	1994	5	%		207
Stunting (under 5y)	1995	15.1	%	Total, moderate & severe	228
		4.5	%	Total, severe	
		16.4	%	Male, moderate & severe	
		5.1	%	Male, severe	
		13.8	%	Female, moderate & severe	
		3.9	%	Female, severe	
		13.9	%	Urban, moderate & severe	
		4.1	%	Urban, severe	
		18.1	%	Rural, moderate & severe	
		5.3	%	Rural, severe	
Underweight (under 5y)	1995	4.7	%	Total, moderate & severe	228
		0.6	%	Total, severe	
		5.0	%	Male, moderate & severe	
		0.8	%	Male, severe	
		4.4	%	Female, moderate & severe	
		0.4	%	Female, severe	
		4.2	%	Urban, moderate & severe	
		0.5	%	Urban, severe	
		5.9	%	Rural, moderate & severe	
		0.8	%	Rural, severe	

Wasting (under 5y)	1995	2.7	%	Total, moderate & severe	228
		0.4	%	Total, severe	
		2.7	%	Male, moderate & severe	
		0.5	%	Male, severe	
		2.7	%	Female, moderate & severe	
		0.3	%	Female, severe	
		2.5	%	Urban, moderate & severe	
		0.3	%	Urban, severe	
		3.3	%	Rural, moderate & severe	
		0.7	%	Rural, severe	
Total Goiter Rate (6-11y)	1990s	6	%		207
	1993	23	%	Children of all ages in the north	134
% Household Consuming Iodized Salt	1990s	90	%		207
Energy Intake	1989	3,324	Kcal	per day	150
	1981	3,564	Kcal	per day	
	1971	2,506	Kcal	per day	
	1961	1,654	Kcal	per day	
Protein Intake	1989	80.5	g	per day	150
	1981	88	g	per day	
	1971	60.5	g	per day	
	1961	39.2	g	per day	
Fat Intake	1989	108.3	g	per day	150
	1981	128.9	g	per day	
	1971	73.8	g	per day	
	1961	32.2	g	per day	
Hair Zinc Concentration	1983	213+/-36	ug/g		122
(newborn)					
(toddlers)		88+/-35	ug/g		
(school children)		89+/-25	ug/g		

Morocco

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	74	/1000 live births		207
	1980	152	/1000 live births		196
	1960	220	/1000 live births		196
Infant Mortality Rate	1996	64	/1000 live births		207
	1960	135	/1000 live births		196
Crude Birth Rate	1996	26	/1000		207
	1970	47	/1000		196
Crude Death Rate	1996	7	/1000		207
	1970	17	/1000		196
Life Expectancy at Birth	1995	64	years	Male	255
		68	years	Female	
	1970	52	years		196
Maternal Mortality Ratio	1995	372	/100000 live births		255
Low Birth Weight	1990s	9	%		207
Breastfeeding	1990s	31	%	Exclusively breastfed (0-3m)	207
		33	%	Breastfed with complementary food (6-9m)	
		20	%	Still breastfeeding (20-23m)	
Stunting (under 5y)	1992	24.2	%	Total, moderate & severe	228
		8.7	%	Total, severe	

		24.2	%	Male, moderate & severe	
		9.1	%	Male, severe	
		24.2	%	Female, moderate & severe	
		8.3	%	Female, severe	
		13.2	%	Urban, moderate & severe	
		3.1	%	Urban, severe	
		30.0	%	Rural, moderate & severe	
		11.6	%	Rural, severe	
Underweight (under 5y)	1992	9.5	%	Total, moderate & severe	228
		2.0	%	Total, severe	
		10.1	%	Male, moderate & severe	
		2.0	%	Male, severe	
		8.9	%	Female, moderate & severe	
		2.0	%	Female, severe	
		3.3	%	Urban, moderate & severe	
		0.6	%	Urban, severe	
		12.7	%	Rural, moderate & severe	
		2.8	%	Rural, severe	
Wasting (under 5y)	1992	2.2	%	Total, moderate & severe	228
		0.4	%	Total, severe	
		2.5	%	Male, moderate & severe	
		0.6	%	Male, severe	
		1.9	%	Female, moderate & severe	
		0.3	%	Female, severe	
		1.9	%	Urban, moderate & severe	
		0.4	%	Urban, severe	
		2.4	%	Rural, moderate & severe	
		0.5	%	Rural, severe	
Overweight (<5yr)	1992	6.8	%	Total	228
		6.0	%	Male	
		7.6	%	Female	
		9.0	%	Urban	
		5.6	%	Rural	
Total Goiter Rate (6-11y)	1990s	20	%		207
	1993	22	%	Total	134
		44	%	Mountain	
		19	%	Coast	
TSH>5mu/ml prevalence	1993	9	%	WHO survey	134
Urinary Iodine Excretion	1993	18	ug/l		25
		24	ug/l		
		117	ug/l		
Energy Intake	1989	3,020	Kcal	per day	150
	1981	2,697	Kcal	per day	
	1971	2,464	Kcal	per day	
	1961	2,141	Kcal	per day	
Protein Intake	1989	81.3	g	per day	150
	1981	71.2	g	per day	
	1971	65.5	g	per day	
	1961	57.3	g	per day	
Fat Intake	1989	55.6	g	per day	150
	1981	49.6	g	per day	
	1971	42.1	g	per day	

	1961	35.3	g	per day	

Oman

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	18	/1000 live births		207
	1980	95	/1000 live births		196
	1960	280	/1000 live births		196
Infant Mortality Rate	1996	15	/1000 live births		207
	1960	164	/1000 live births		196
Crude Birth Rate	1996	44	/1000		207
	1970	50	/1000		196
Crude Death Rate	1996	4	/1000		207
	1970	21	/1000		196
Life Expectancy at Birth	1995	68	years	Male	255
		73	years	Female	
	1970	47	years		196
Maternal Mortality Ratio	1990	190	/100000 live births		207
Low Birth Weight	1990s	8	%		207
Breastfeeding	1990s	28	%	Exclusively breastfed (0-3m)	207
		85	%	Breastfed with complementary food (6-9m)	
		64	%	Still breastfeeding (20-23m)	
Stunting (under 5y)	1995	23.0	%	Total, moderate & severe	228
		8.0	%	Total, severe	
		23.1	%	Male, moderate & severe	
		8.2	%	Male, severe	
		22.9	%	Female, moderate & severe	
		7.9	%	Female, severe	
		21.2	%	Urban, moderate & severe	
		8.3	%	Urban, severe	
		25.6	%	Rural, moderate & severe	
		7.6	%	Rural, severe	
Underweight (under 5y)	1995	23.3	%	Total, moderate & severe	228
		3.3	%	Total, severe	
		23.1	%	Male, moderate & severe	
		3.9	%	Male, severe	
		23.6	%	Female, moderate & severe	
		4.3	%	Female, severe	
		20.6	%	Urban, moderate & severe	
		2.8	%	Urban, severe	
		27.5	%	Rural, moderate & severe	
		4.0	%	Rural, severe	
Wasting (under 5y)	1995	12.8	%	Total, moderate & severe	228
		1.5	%	Total, severe	
		13.7	%	Male, moderate & severe	
		1.9	%	Male, severe	
		12.8	%	Female, moderate & severe	
		1.2	%	Female, severe	
		11.8	%	Urban, moderate & severe	
		1.7	%	Urban, severe	
		14.3	%	Rural, moderate & severe	
		1.3	%	Rural, severe	
Total Goiter Rate (6-11y)	1990s	10	%		207

% Household Consuming Iodized Salt	1990s	35	%		

Qatar

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	21	/1000 live births		207
	1980	55	/1000 live births		196
	1960	239	/1000 live births		196
Infant Mortality Rate	1996	17	/1000 live births		207
	1960	145	/1000 live births		196
Crude Birth Rate	1996	19	/1000		207
	1970	34	/1000		196
Crude Death Rate	1996	4	/1000		207
	1970	13	/1000		196
Life Expectancy at Birth	1995	70	years	Male	255
		75	years	Female	
	1970	61	years		196
Low Birth Weight	1988	5	%		255
Stunting (under 5y)	1995	8.1	%	Total, moderate & severe	228
		8.3	%	Male, moderate & severe	
		8.4	%	Female, moderate & severe	
Underweight (under 5y)	1995	5.5	%	Total, moderate & severe	228
		6.9	%	Male, moderate & severe	
		4.7	%	Female, moderate & severe	
Wasting (under 5y)	1995	1.5	%	Total, moderate & severe	228
		1.7	%	Male, moderate & severe	
		1.4	%	Female, moderate & severe	
Overweight (<5yr)	1995	6.8	%	Total	228
		5.3	%	Male	
		8.6	%	Female	
Overweight (adults)	1989	30.1	%		149
Obesity (adults)	1989	33.6	%		

Saudi Arabia

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	30	/1000 live births		207
	1980	85	/1000 live births		196
	1960	292	/1000 live births		196
Infant Mortality Rate	1996	25	/1000 live births		207
	1960	170	/1000 live births		196
Crude Birth Rate	1996	35	/1000		207
	1970	48	/1000		196
Crude Death Rate	1996	4	/1000		207
	1970	18	/1000		196
Life Expectancy at Birth	1995	69	years	Male	255
		71	years	Female	
	1970	52	years		196
Maternal Mortality Ratio	1993	18	/100000 live births		255
Low Birth Weight	1990s	7	%		207
Breastfeeding	1995	92.4	%	Urban	19
(prevalence)		94.5	%	Rural	
(duration)		11	months	Urban	

		13	months	Rural	
Stunting (under 6y)	1980	14.0	%	Urban, moderate & severe	228
		41.0	%	Rural, moderate & severe	
		13.0	%	Rural, severe	
Underweight (under 6y)	1980	14.0	%	Urban, moderate & severe	228
		46.0	%	Rural, moderate & severe	
		8.0	%	Rural, severe	
Wasting (under 6y)	1980	3.0	%	Urban, moderate & severe	228
		12.0	%	Rural, moderate & severe	
		1.0	%	Rural, severe	
BMI mean	1993	25+/-5	kg/m2	Male age 33+/-15yr	149
		26+/-6	kg/m2	Female age 33+/-15yr	
Overweight Prevalence	1993	29	%	Male age 33+/-15yr	149
		27	%	Female age 33+/-15yr	
Obesity Prevalence	1993	16	%	Total, Male age 33+/-15yr	
		24	%	Total, Female age 33+/-15yr	
		18	%	Urban, Male age 33+/-15yr	
		28	%	Urban, Female age 33+/-15yr	
		12	%	Rural, Male age 33+/-15yr	
		18	%	Rural, Female age 33+/-15yr	
Overweight (adults)	1997	31.2	%	Total	15
		33.1	%	Male	
		29.4	%	Female	
Obesity (adults)	1997	22.1	%	Total	
		17.8	%	Male	
		26.6	%	Female	
Urinary Iodine <10 ug/dl	1994	22	%	National iodine survey on children (8-10yr)	134
<5 ug/dl		7	%		
Energy Intake	1989	2,874	Kcal	per day	150
	1981	2,777	Kcal	per day	
	1971	1,886	Kcal	per day	
	1961	1,772	Kcal	per day	
Protein Intake	1989	86.5	g	per day	150
	1981	77.7	g	per day	
	1971	48.3	g	per day	
	1961	48.1	g	per day	
Fat Intake	1989	82.5	g	per day	150
	1981	80.2	g	per day	
	1971	33.9	g	per day	
	1961	26.5	g	per day	
Vitamin D	1984	5.7	ng/ml	Median 25-OHD in pregnant women	176
		25.2	%	25-OHD <4ng/ml in pregnant women	
Mean Serum	1993	10	mmol/L	Male	149
Glucose Concentration		12	mmol/L	Female	
Prevalence of IGT	1993	10	%	Total, Male	149
		9	%	Total, Female	
Prevalence of Diabetes		11.8	%	Total, Male	
		12.8	%	Total, Female	
		16	%	35-64yr,Male	
		20	%	35-64yr,Female	
		11.7	%	Urban, Male	
		13.8	%	Urban, Female	

		6.8	%	Rural, Male	
		7.4	%	Rural, Female	
Mean Serum	1993	4+/-1.5	mmol/L	Male	149
Cholesterol		4.25+/-1.5	mmol/L	Female	
Prevalence of		10	%	5.2-6.2mmol/L	
Hypercholesterolemia		12	%	5.2-6.2mmol/L	
		7.5	%	>6.2mmol/L	
		9	%	>6.2mmol/L	
		6	%	>6.2mmol/L, urban	
		8	%	>6.mmol/L, urban	
		8	%	>6.2mmol/L, Rural	
		9	%	>6.2mmol/L, Rural	

Syria

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	34	/1000 live births		207
	1980	73	/1000 live births		196
	1960	201	/1000 live births		196
Infant Mortality Rate	1996	28	/1000 live births		207
	1960	136	/1000 live births		196
Crude Birth Rate	1996	31	/1000		207
	1970	47	/1000		196
Crude Death Rate	1996	5	/1000		207
	1970	14	/1000		196
Life Expectancy at Birth	1995	66	years	Male	255
		71	years	Female	
	1970	56	years		196
Maternal Mortality Ratio	1990	179	/100000 live births		255
Low Birth Weight	1990s	11	%		207
Breastfeeding	1990s	50	%	Breastfed with complementary food (6-9m)	207
Stunting (under 5y)	1990s	21.0	%	Moderate & severe	207
	1993	26.6	%	Total, moderate & severe	228
		11.9	%	Total, severe	
		27.8	%	Male, moderate & severe	
		12.9	%	Male, severe	
		25.8	%	Female, moderate & severe	
		11.0	%	Female, severe	
		26.0	%	Urban, moderate & severe	
		11.4	%	Urban, severe	
		27.6	%	Rural, moderate & severe	
		12.5	%	Rural, severe	
Underweight (under 5y)	1990s	13.0	%	Moderate & severe	207
	1990s	4.0	%	Severe	
	1993	12.1	%	Total, moderate & severe	228
		3.0	%	Total, severe	
		12.9	%	Male, moderate & severe	
		2.8	%	Male, severe	
		11.3	%	Female, moderate & severe	
		3.2	%	Female, severe	
		11.5	%	Urban, moderate & severe	
		2.7	%	Urban, severe	
		12.8	%	Rural, moderate & severe	

		3.3	%	Rural, severe	
Wasting (under 5y)	1990s	9.0	%	Moderate & severe	207
	1993	8.1	%	Total, moderate & severe	228
		2.1	%	Total, severe	
		8.5	%	Male, moderate & severe	
		2.6	%	Male, severe	
		7.7	%	Female, moderate & severe	
		1.5	%	Female, severe	
		8.7	%	Urban, moderate & severe	
		2.0	%	Urban, severe	
		7.5	%	Rural, moderate & severe	
		2.1	%	Rural, severe	
Total Goiter Rate (6-11y)	1990s	73	%		
% Household Consuming Iodized Salt	1990s	36	%		207
Energy Intake	1989	3,003	Kcal	per day	150
	1981	3,105	Kcal	per day	
	1971	2,412	Kcal	per day	
	1961	2,362	Kcal	per day	
Protein Intake	1989	78.6	g	per day	150
	1981	84.2	g	per day	
	1971	64.2	g	per day	
	1961	65.1	g	per day	
Fat Intake	1989	82.7	g	per day	150
	1981	93.7	g	per day	
	1971	65.0	g	per day	
	1961	59.7	g	per day	

Tunisia

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	35	/1000 live births		207
	1980	100	/1000 live births		196
	1960	254	/1000 live births		196
Infant Mortality Rate	1996	28	/1000 live births		207
	1960	170	/1000 live births		196
Crude Birth Rate	1996	24	/1000		207
	1970	39	/1000		196
Crude Death Rate	1996	6	/1000		207
	1970	14	/1000		196
Life Expectancy at Birth	1995	68	years	Male	255
		70	years	Female	
	1970	54	years		196
Maternal Mortality Ratio	1990	138	/100000 live births		255
Low Birth Weight	1990s	8	%		207
Breastfeeding	1990s	12	%	Exclusively breastfed (0-3m)	207
		16	%	Still breastfeeding (20-23m)	
Stunting (under 5y)	1995	22.5	%	Total, moderate & severe	228
		22.3	%	Male, moderate & severe	
		10.1	%	Male, severe	
		22.6	%	Female, moderate & severe	
		8.5	%	Female, severe	
		14.5	%	Urban, moderate & severe	

		32.6	%	Rural, moderate & severe	
Underweight (under 5y)	1995	9.0	%	Total, moderate & severe	228
		8.0	%	Male, moderate & severe	
		2.2	%	Male, severe	
		9.3	%	Female, moderate & severe	
		1.8	%	Female, severe	
		6.0	%	Urban, moderate & severe	
		12.0	%	Rural, moderate & severe	
Wasting (under 5y)	1995	3.9	%	Total, moderate & severe	228
		3.5	%	Male, moderate & severe	
		1.2	%	Male, severe	
		4.3	%	Female, moderate & severe	
		1.2	%	Female, severe	
		3.7	%	Urban, moderate & severe	
		4.1	%	Rural, moderate & severe	
Total Goiter Rate (8-10y)	1980s	9.5	%		134
(6-11y)	1990s	4.3	%		207
% Household Consuming Iodized Salt	1990s	98	%		207
Energy Intake	1989	3,119	Kcal	per day	150
	1981	2,779	Kcal	per day	
	1971	2,368	Kcal	per day	
	1961	2,103	Kcal	per day	
Protein Intake	1989	83.3	g	per day	150
	1981	77.5	g	per day	
	1971	63.1	g	per day	
	1961	56.4	g	per day	
Fat Intake	1989	85.7	g	per day	150
	1981	65.3	g	per day	
	1971	57.6	g	per day	
	1961	43.1	g	per day	

United Arab Emirates

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1996	18	/1000 live births		207
	1980	64	/1000 live births		196
	1960	240	/1000 live births		196
Infant Mortality Rate	1996	15	/1000 live births		207
	1960	160	/1000 live births		196
Crude Birth Rate	1996	19	/1000		207
	1970	36	/1000		196
Crude Death Rate	1996	3	/1000		207
	1970	11	/1000		196
Life Expectancy at Birth	1995	74	years	Male	255
		76	years	Female	
	1970	61	years		196
Maternal Mortality Ratio	1990	20	/100000 live births		255
Low Birth Weight	1990s	6	%		207
Breastfeeding	1990s	26	%	Still breastfeeding (20-23m)	207
Overweight (Adult)	1993	32.8	%	BMI 25-29.9	149
Obesity (Adult)		38.3	%	BMI >30	
Total Goiter Rate (6-11y)	1990s	46	%	Al Jazeera, hospital based	134

		66	%	Al Mafraq, hospital based	
Energy Intake	1989	3,309	Kcal	per day	150
	1981	3,199	Kcal	per day	
	1971	3,208	Kcal	per day	
	1961	2,814	Kcal	per day	
Protein Intake	1989	101.6	g	per day	150
	1981	101.6	g	per day	
	1971	78.2	g	per day	
	1961	72.5	g	per day	
Fat Intake	1989	111.5	g	per day	150
	1981	110.3	g	per day	
	1971	76.1	g	per day	
	1961	85.2	g	per day	

West Bank and Gaza

Indicator	Year	Data	Unit	Note	Ref. No.
Infant Mortality Rate		28	/1000 live births		249
Life Expectancy at Birth	1995	70	years	Male	249
		74	years	Female	
Maternal Mortality Ratio		70	/100000 live births		249
Stunting (under 5y)	1995	14.2	%	Gaza, moderate & severe	228
		3.7	%	Gaza, severe	
		13.8	%	Gaza, male, moderate & severe	
		3.5	%	Gaza, male, severe	
		14.6	%	Gaza, female, moderate & severe	
		3.9	%	Gaza, female, severe	
Underweight (under 5y)	1995	15.1	%	Gaza, moderate & severe	228
		2.3	%	Gaza, severe	
		16.5	%	Gaza, male, moderate & severe	
		2.1	%	Gaza, male, severe	
		14.0	%	Gaza, female, moderate & severe	
		2.4	%	Gaza, female, severe	
Wasting (under 5y)	1995	5.7	%	Gaza, moderate & severe	228
		0.2	%	Gaza, severe	
		6.5	%	Gaza, male, moderate & severe	
		0.3	%	Gaza, male, severe	
		5.0	%	Gaza, female, moderate & severe	
		0.1	%	Gaza, female, severe	

Yemen

Indicator	Year	Data	Unit	Note	Ref. No.
Under-5 Mortality Rate	1995	145	/1000 live births		248
	1980	198	/1000 live births		196
	1960	340	/1000 live births		196
Infant Mortality Rate	1995	93	/1000 live births		248
	1960	230	/1000 live births		196
Crude Birth Rate	1996	53	/1000		207
	1970	48	/1000		196
Crude Death Rate	1996	23	/1000		207
	1970	11	/1000		196
Life Expectancy at Birth	1995	57	years		248
		56	years		255

	1970	57	years		196
Maternal Mortality Ratio	1995	1,000	/100000 live births		248
Low Birth Weight	1990s	19	%		207
Breastfeeding	1990s	31	%	Still breastfeeding (20-23m)	207
Stunting (under 5y)	1993	39.0	%	Total, moderate & severe	228
		22.7	%	Total, severe	
		41.5	%	Male, moderate & severe	
		23.1	%	Male, severe	
		36.1	%	Female, moderate & severe	
		22.3	%	Female, severe	
		29.0	%	Urban, moderate & severe	
		14.0	%	Urban, severe	
		44.4	%	Rural, moderate & severe	
		27.5	%	Rural, severe	
Underweight (under 5y)	1993	39.0	%	Total, moderate & severe	228
		13.1	%	Total, severe	
		41.3	%	Male, moderate & severe	
		14.1	%	Male, severe	
		36.5	%	Female, moderate & severe	
		12.0	%	Female, severe	
		31.2	%	Urban, moderate & severe	
		6.9	%	Urban, severe	
		43.0	%	Rural, moderate & severe	
		16.2	%	Rural, severe	
Wasting (under 5y)	1992	12.7	%	Total, moderate & severe	228
		2.9	%	Total, severe	
		14.3	%	Male, moderate & severe	
		3.4	%	Male, severe	
		11.4	%	Female, moderate & severe	
		2.5	%	Female, severe	
Total Goiter Rate (6-11y)	1990s	32	%		207
% Household Consuming Iodized Salt	1990s	21	%		
Vitamin A Deficiency	1990s	7.2	%	Prevalence of serum retinol <10microg/dl	222
		63.0	%	Prevalence of serum retinol <20microg/dl	
		0.5	%	Prevalence of night blindness	
Energy Intake	1989	2,142	Kcal	per day	150
	1981	2,070	Kcal	per day	
	1971	1,961	Kcal	per day	
	1961	1,908	Kcal	per day	
Protein Intake	1989	60.0	g	per day	150
	1981	61.8	g	per day	
	1971	58.8	g	per day	
	1961	58.9	g	per day	
Fat Intake	1989	33.5	g	per day	150
	1981	39.1	g	per day	
	1971	36.0	g	per day	
	1961	36.4	g	per day	

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