

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

U·M·I

University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600

Order Number 9410654

**The effects of income on food and nutritional status in the
Middle Eastern area (1960–1985)**

Younis, Sadoon Jumah, Ph.D.

The University of Arizona, 1993

U·M·I

**300 N. Zeeb Rd.
Ann Arbor, MI 48106**

**THE EFFECTS OF INCOME ON FOOD AND NUTRITIONAL STATUS IN THE
MIDDLE EASTERN AREA (1960 - 1985)**

by

Sadoon Jumah Younis

A Dissertation Submitted to the Faculty of the

COMMITTEE OF ARID LAND RESOURCE SCIENCES

**In Partial Fulfillment of the Requirements
For the Degree of**

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 9 3

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

2

As members of the Final Examination Committee, we certify that we have read the document prepared by Sadoon Jumah Younis entitled The Effects of Income on Food and Nutritional Status in the Middle Eastern Area (1960 - 1985)

and recommend that it be accepted as fulfilling the requirements for the Degree of Doctor of Philosophy / Arid Lands Resource Sciences

Dr. Roger Fox Roger Fox

Nov. 15, 1993
Date

Dr. Chuck Hutchinson Chuck Hutchinson

11/15/93
Date

Dr. Amir Ajami Amir I. Ajami

11/16/93
Date

Date

Date

Final approval and acceptance of this document is contingent upon the candidate's submission of the final copy of the document to the Graduate College.

I hereby certify that I have read this document prepared under my direction and recommend that it be accepted as fulfilling the requirement.

Dr. Roger Fox Roger Fox

Nov. 15, 1993

Director

Date

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Sadler

Acknowledgements

I would first like to thank Professor Dr. Roger Fox for his guidance and patients throughout my studies at the University of Arizona. He has always been willing and ready to steer me in the right direction when ever I have wandered away. His support and trust has been deeply felt.

I wish to express sincere gratitude to Professor Dr. Chuck Hutchinson, who has been a constant source of support during this study.

Appreciation is extended to Professor Amir Ajami for having stimulated my interest in this field.

Special thanks must be expressed to Professor Dr. Michael Bonine for his helpful suggestions.

I would like to thank Dr. Eric Monke for his help and contribution especially in the first years of my study.

I would also like to thank my friend Jose Coronado who has given me support and encouragement throughout my study.

Most importantly, my deepest appreciation is extended to my patient and understanding family, my wife Ahlam, my son Husam and my daughters Wisam and Usir, for their sacrifices and support to get this job done.

To my parents

I owe a debt of gratitude to my parents who have made many sacrificed, and provided me with love, caring and encouragement that allowed me to flourish in this world. My exposure to the many good things in life has been solely due to their unselfish giving. May God bless them and grant them a peaceful and prosperous life.

TABLE OF CONTENTS

1. LIST OF TABLES.....	8
2. LIST OF APPENDIX TABLES.....	11
3. LIST OF FIGURES.....	12
4. ABSTRACT.....	13
5. INTRODUCTION.....	15
5.1 Background.....	15
5.2 Brief History and Definition of the Term "Middle East".....	19
5.3 Objectives.....	24
5.4 Organization of the Study.....	25
6. REVIEW OF INCOME, NUTRITION AND FOOD CONSUMPTION STUDIES.....	26
6.1 Introduction.....	26
6.2 Studies of the Middle Eastern Countries.....	26
6.2.1 Income, Food and Nutrition Studies.....	26
6.2.2 Food Policy Studies.....	32
6.3 Studies of Other Countries.....	36
6.4 Conclusion.....	40
7. CONSUMPTION THEORY.....	41
7.1 Introduction.....	41
7.2 The Income Consumption Curve.....	41
7.3 Engel's Curve.....	43
7.4 Income Elasticity of Demand.....	44
7.5 Conclusion.....	48
8. METHODOLOGY.....	49
8.1 Introduction.....	49
8.2 Data Sources.....	50
8.3 Data Limitation.....	50
8.4 Data Availability.....	51
8.5 Econometric Models.....	52
8.5.1 Estimated Parameters for Wheat, Corn, Rice and Total Grain Consumption Related to per Capita Gross National Products.....	54
8.5.2 Estimated Parameters for Egg, Beef and Poultry Consumption Related to Per Capita Gross National Products.....	63
8.5.3 Estimated Relationship Between Income and Social Indicators.....	68
8.6 Multiple Regression Models.....	78
8.7 Conclusion.....	88
9. ESTIMATED INCOME ELASTICITIES OF FOOD AND DISCUSSION OF THE RESULTS.....	89
9.1 Introduction.....	89
9.2 Estimated Income Elasticities of Wheat, Rice, Corn and Total Grain Consumption.....	90
9.3 Estimated Income Elasticities of Egg, Beef and Poultry Consumption.....	95

TABLE OF CONTENTS - Continued

9.4 Income Elasticities of Food by Type of Country.....	95
9.4.1 Oil Exporting Countries.....	95
9.4.2 Labor Exporting Countries.....	96
9.4.3 Agricultural Producing Countries.....	97
9.5 Income and Social Indicators Analyses Discussion.....	98
9.5.1 Oil Exporting Countries.....	98
9.5.2 Labor Exporting Countries.....	102
9.5.3 Agricultural Producing Countries.....	103
9.6 Conclusion.....	104
10. CONCLUSION AND RECOMMENDATION.....	106
10.1 Recommendation.....	107
11. APPENDIXES OF TABLES.....	109
12. BIBLIOGRAPHY.....	129

LIST OF TABLES

TABLE 1, Absolute Poverty for the Middle Eastern Countries, 1975.....	18
TABLE 2, Income Elasticities for Calorie Intake From Various Foods By Calorie Consumption Group, 1974/75.....	39
TABLE 3, Calorie and Protein Equivalents of Selected Foods Consumed in the Middle East (100 grams).....	53
TABLE 4, Estimated Income Parameters Related to Wheat Consumption.....	57
TABLE 5, Estimated Income Parameters Related to Rice Consumption.....	58
TABLE 6, Estimated Income Parameters Related to Corn Consumption.....	59
TABLE 7, Estimated Income Parameters Related to Total Grain Consumption.....	60
TABLE 8, Estimated Income Parameters Related to Egg Consumption.....	65
TABLE 9, Estimated Income Parameters Related to Beef Consumption.....	66
TABLE 10, Estimated Income Parameters Related to Poultry Consumption.....	67

LIST OF TABLES - Continued

TABLE 11, Estimated Income Parameters Related to Population per Physician.....	71
TABLE 12, Estimated Income Parameters Related to Crude Birth Rate.....	72
TABLE 13, Estimated Income Parameters Related to Crude Death Rate.....	73
TABLE 14, Estimated Income Parameters Related to Infant Mortality Rate.....	74
TABLE 15, Estimated Income Parameters Related to Child Death Rate.....	75
TABLE 16, Estimated Income Parameters Related to Life Expectancy.....	76
TABLE 17, Estimated Income and Population per Physician Parameters Related to Life Expectancy.....	80
TABLE 18, Estimated Income and Population per Physician Parameters Related to Infant Mortality Rate..	81
TABLE 19, Estimated Income and Life Expectancy Parameters Related to Crude Death Rate.....	82
TABLE 20, Estimated Income and Life Expectancy Parameters Related to Crude Birth Rate.....	83
TABLE 21, Estimated Income and Infant Mortality Rate Parameters Related to Crude Birth Rate.....	84

LIST OF TABLES - Continued

TABLE 22, Estimated Unadjusted Income Elasticities of Wheat, Rice, Corn and Total Grain Consumption.....	91
TABLE 23, Estimated Partial Income Elasticities Related to Oil Price Change of Grain Consumption.....	93
TABLE 24, Estimated Adjusted Income Elasticities of Food Consumption.....	94
TABLE 25A, Income Parameters Related to Social Indicators.....	99
TABLE 25B, Income Parameters Related to Social Indicators.....	100
TABLE 25C, Income Parameters Related to Social Indicators.....	101

LIST OF APPENDIX TABLES

APPENDIX TABLE 1, Gross National Product (GNP) Per Capita, Selected Middle Eastern Countries, 1967-1987 (US\$ 1980).....	109
APPENDIX TABLE 2, Population of Selected Middle Eastern Countries, 1960-1985 (millions).....	111
APPENDIX TABLE 3, Grain Consumption in Selected Middle Eastern Countries, 1960-1980 (1000 MT).....	113
APPENDIX TABLE 4, Food Consumption in Selected Middle Eastern Countries, 1975-1984 (Kg/Capita/Year).....	119
APPENDIX TABLE 5, Social Indicators, Selected Middle Eastern Countries, 1960-1985.....	123
APPENDIX TABLE 6, Public Expenditures on Education, Military and Health, Selected Middle Eastern Countries, 1973-1984 Per Capita (US\$).....	127

LIST OF FIGURES

FIGURE 1, The Middle Eastern Countries.....	23
FIGURE 2, The Income Consumption Curve (ICC).....	42
FIGURE 3A, Engel Curve.....	45
FIGURE 3B, Engel Curve.....	46
FIGURE 3C, Engel Curve.....	46

Abstract

The income of most countries of the Middle East grew rapidly after 1973 when the price of oil dramatically increased. To examine the effect of the income growth on food and nutrition status, eleven countries were chosen from the Middle Eastern area. These include Algeria, Libya and Saudi Arabia, which are oil exporting countries, Egypt, Morocco, Tunisia and Yemen, which are labor exporting countries, and Jordan, Sudan, Syria and Turkey, which are agricultural producing countries.

The variables of this study are per capita income, food consumption, which includes wheat, rice, corn, beef, poultry and eggs, and social indicators, which include population per physician, crude birth rate, crude death rate, infant mortality rate, child death rate and life expectancy. The data for these variables were collected from 1960-1985.

Single and multiple regression analyses were used to explain the effects of changes in income on food consumption and social indicators.

The results of these analyses showed that income elasticities of wheat, rice and corn consumption were less than one for all countries. In addition, the income elasticities for egg, beef and poultry were more than one for most of the eleven countries.

The results of the income effect on social indicators showed that as income increases the crude birth rate, crude death rate, child death rate and infant mortality rate decreased, moreover, as hypothesized, population per physician and life expectancy increased.

Morocco is the only country that showed insignificant results for most of the analysis.

Chapter 1

INTRODUCTION

5.1 Background

The arid lands of the world contain some of the most important and impressive evidence of the earth's past human occupations, from the Pyramids of Giza in Egypt to the Great Wall of China.

Arid lands constitute one of the world's major ecosystems and provide a significant contribution to the global economy. Covering one-third of the world's land area, they provide at least a fifth of the world's food supply, one half of the world's production of precious and semi-precious minerals, and they contain the bulk of the world's oil and natural gas reserves. Yet, only approximately 14 - 15 percent of the world's population resides in the arid lands, and this population is concentrated mainly on the semi-arid fringes, where their socioeconomic condition varies from high levels of material affluence to propertyless poverty (Heathcote 1983).

The Middle East, an arid and semi-arid region, has many natural resources. It was well known to past civilizations as one of the richest arid areas of the world.

Many countries in this region discovered oil and natural gas in the 1950s and 1960s and became dependent on its export, deriving more than 90 percent of their national incomes from it.

The Middle Eastern area was a major beneficiary of the 1973 increase in oil prices. Furthermore, some countries which depend on agricultural production and labor exports benefitted indirectly as a result of the oil states' need for food and immigrant labor. In addition, the oil exporting countries increased their programs of financial assistance to the rest of the region. The result has been a rapid rise in per capita income in most of the area.

During the 1970s and 1980s most of the region's countries achieved a significant increase in per capita gross national product as shown in Appendix Table 1. In addition, 1974 was the start of an acceleration of economic growth, both rapid and widely diffused. Since then, there has been a large increase in the demand for food as a result of income improvement and population growth.

Most countries in this region have substantially increased their agricultural development, which has enhanced food production. The increases in income, food production and imports should have improved the nutritional status, health, education and other social and demographic features in this region. The published studies of nutritional status

in the Middle East, however, do not reflect the expected improvements in all levels of the population (see Table 1 and Chapter 2).

Population in the Middle East has doubled over the past 25 years, Appendix Table 2. There was a significant increase in grain consumption (wheat, rice and corn) during the last two decades for most of the countries in the region (Appendix Table 3). The consumption of eggs, beef, poultry and sugar in kilograms per capita grew rapidly (Appendix Table 4). Over the 1966 to 1980 period, staple food consumption increased by an average of 3.9 percent per year.

Population per Physicians during the 1960 to 1985 period were decreasing in most countries. Crude birth rates, death rates, and infant mortality rates declined in most countries during the same period; life expectancy improved in all Middle East countries (Appendix Table 5).

Appendix Table 6 shows the public expenditure per capita (in US dollars) for military, health, and education during the period between 1974 to 1984. The expenditure for the military jumped to more than four times the expenditures on education and on health in the whole period. However, health and education expenditures were also increased.

Despite the general improvement in average nutritional levels for some high income countries, malnutrition and under nutrition are common in many countries of the region,

Table 1
Absolute Poverty for the Middle Eastern Countries, 1975

Countries	Estimated Absolute Poverty Income Level (US\$/Capita)		Estimated Population Below Absolute Poverty Income Level(%)	
	Urban	Rural	Urban	Rural
Algeria	NA	NA	20	NA
Egypt	131	94	21	25
Iraq	NA	399	NA	40
Jordan	230	100	NA	NA
Morocco	157	101	38	45
Sudan	137	NA	NA	85
Tunisia	204	97	20	15
Turkey	342	270	NA	NA
Yemen A.R.	NA	100	NA	NA

NA: Not Available

Source: World Bank. Social Indicators of Development.
London: John Hopkins University Press, 1988.

especially in rural areas. In Tunisia, for example, a 1980 survey found that more than one third of the urban population was getting less than the minimum calorie requirement for normal, productive functioning, and close to half of this group was seriously malnourished. In Egypt, a 1981 survey found that 35 percent of the population was getting less than the necessary 2000 calories per day. A 1979 nutrition survey in the Yemen Arab Republic found severe malnutrition among more than half of the urban children and two thirds of the rural children (Joe Stork and Kurn Pfeifer, 1987).

In general, problems of malnutrition are common throughout the region, particularly among the landless, small farmers, wage earners, and the unemployed who live in rural and poor urban areas.

5.2 Brief History and Definitions of the Term "Middle East"

The definition and the modern history of the middle eastern area are important to an understanding of the background of the region in this study. This background identifies the roots of income, food and nutrition problems in the area.

The Middle East has its own long and distinct history, although the term by which it is known today originated in

Europe.

In the fifteenth century the Portuguese began explorations to find a new route to the east. With increasing contact, the area farthest away from Europe came to be called the Far East, while the lands on the eastern shores of the Mediterranean that lay between Europe and the Far East became in common parlance, the "Near East". The term was generally used to describe the lands that had come to be ruled as a part of the Ottoman Empire after 1453.

The term "Middle East" arose from the imperatives of late nineteenth-century strategy and diplomacy, which needed a name for the region between the "Near East," based in Turkey, and the "Far East," based in China. Both terms, "Middle East" and "Near East," reflected a European, ethno-centered view of the world, in which the strongest powers, politically, economically, and militarily were European or European oriented.

The term, which appears to have originated in the British India office during the 1850s in the early days of expansionist rivalry between Russia and Britain, became current in the English-speaking world around 1900 when the American naval historian Alfred Thayer Mahan employed it in a discussion of British naval strategy in relation to Russian activity in Iran and a German project for a Berlin to Baghdad railway. Mahan used the term "Middle East" in

his article written in the September 1902 issue of National Review. A newly discovered source reveals, however, an earlier use of the term by a British officer, General Thomas Edward Gordon, in 1900, in his article entitled "The Problems of the Middle East." In 1903, Valentine Chirol, chief of the foreign department of the Times, wrote a book called The Middle Eastern Question (Koppes 1976).

The Middle East designation was developed further during the First World War when the operational theater of the Mesopotamia expeditionary force came to be distinguished as "Middle East" from the "Near East" of Palestine and Syria, in which the Egyptians' Expeditionary Force operated.

Indeed, the term "Middle East" has become so popular that it is employed by the Soviets and even the inhabitants of the region itself, though sometimes with reference to slightly different areas.

North Africa itself was used during the second World War as the subregion of the "Middle East" where fighting between Allied and Axis troops was actually taking place, particularly the western desert of Egypt and Libya. During that war, the British began to officially categorize those Asian and North African lands that lay west of India as the "Middle East". In this century "the Near East" and North Africa are increasingly being displaced by the term "Middle East".

The term "Middle East" is a cumbersome and, for some, even a misleading description. Its use is further encumbered by indicating different things to different people. Some apply it to areas much further east than in the historical definition, and not to Africa which may be geographically more logical. Thus, North Africa is no longer in the "Middle East," a nonsensical proposition for others. There are those who apply it to the "Muslim World," an area considered too extensive for most purposes because it could reach as far as Pakistan, Malaysia, and Indonesia; while reference to "Arabia" only would exclude Turkey, Iran, and Cyprus. Despite the conflicting usage, these terms do emphasize that the scope of the area being described is not subject to a uniform regional character or other indigenous indicators. Being as diverse as the countries of Europe, these lands are included in a single term merely because they are "near to" or in "the middle" of the regions perceived by powerful outsiders.

For the purpose of this study, the Middle East is defined to include the following countries (Figure 1): Algeria, Cyprus, Egypt, Iraq, Iran, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, United Arab Emirate, Yemen A.R. and Yemen D.R.

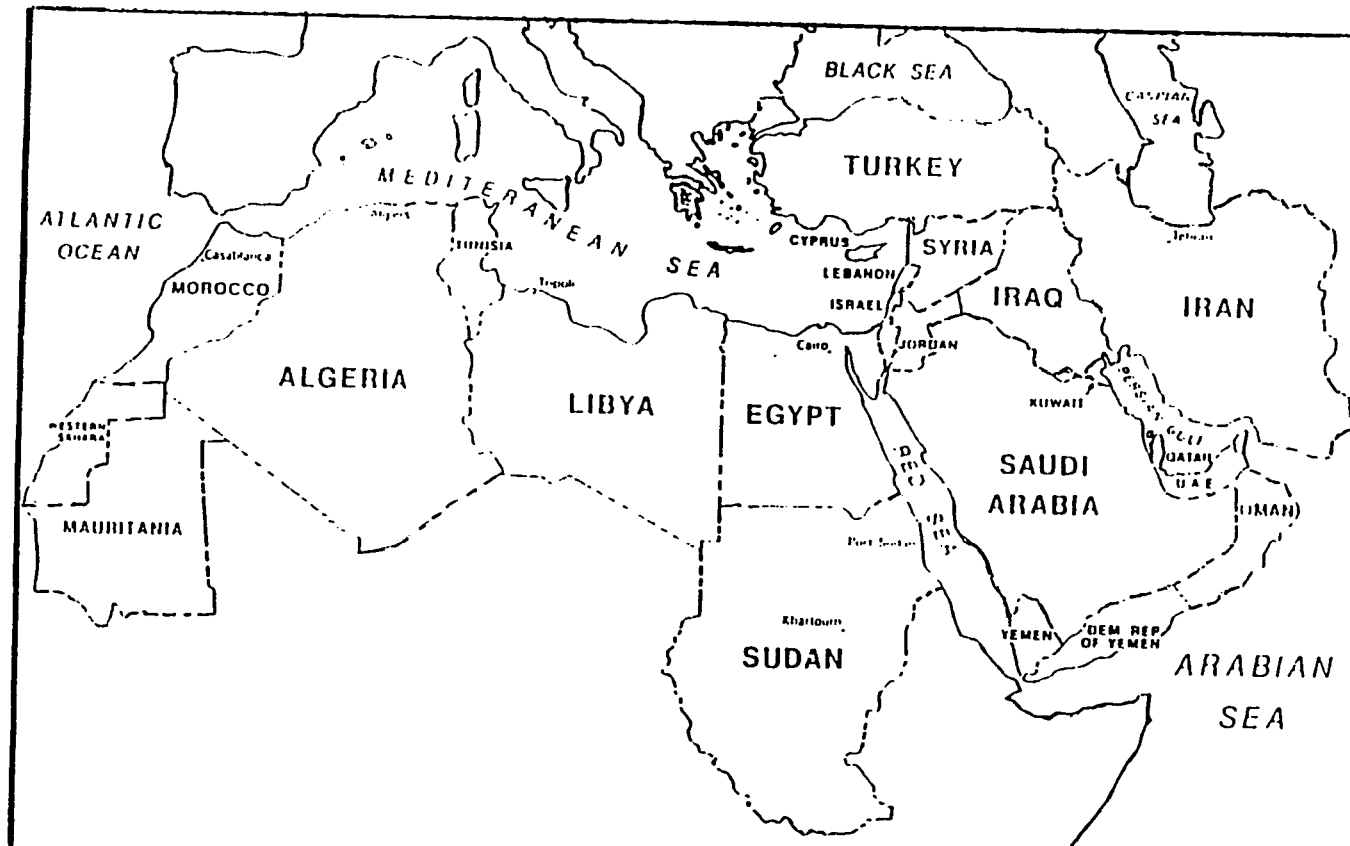


Figure 1: The Middle Eastern Countries

5.3 Objectives

The specific objectives of this study are:

1- To provide a summary of the magnitudes of relevant economic, social and nutritional variables for each country with a view to describing changes in such variables within the Middle East. The variables that will be included in this study are: Per capita Gross National Products (GNP), as an independent variable, food consumption variables, which include wheat, rice, corn, total grain, eggs, beef, poultry, as dependant variables, and social indicators of health and demographic features, which include life expectancy, population per physician, crude birth rate, crude death rate, infant mortality rate and child death rate.

2- To study and test the impact of changes in per capita income on per capita food consumption (wheat, rice, corn, total grain, eggs, beef and poultry) and social indicators in each country through comparative economic analyses from 1960 to 1985, using food consumption behavior model for the following three country groups:

a- Oil exporting countries: Algeria, Libya and Saudi Arabia.

b- Labor exporting countries: Egypt, Morocco, Tunisia and Yemen Arab Republic.

c- Agricultural producing countries: Jordan, Sudan, Syria and Turkey.

5.4 Organization of the Study

Chapter 2 reviews the income, food and nutrition studies of the Middle Eastern area and other specified countries. The third chapter provides a brief discussion of consumption theory, income consumption curves, Engel's Curve and income elasticities of demand. Chapter 4 constructs the methodology for estimating the effects of income on food consumption and social indicators and describes the statistical analysis employed. Chapter 5 discusses the results of the analysis. The main estimators are: income elasticities of consumption (wheat, rice, corn, total grain, eggs, beef, and poultry) and social indicators parameters (life expectancy, population per physician, crude birth rate, crude death rate, infant mortality rate and child death rate). Conclusions and recommendations are presented in Chapter 6.

Chapter 2

REVIEW OF INCOME, NUTRITION AND FOOD CONSUMPTION STUDIES

6.1 Introduction

The governments of the Middle Eastern countries are very protective of scientific information and restrict studies, especially of income and nutrition. However, a few countries in the region have allowed some studies to be done on the subject.

The studies in this chapter are divided into two categories: studies of Middle Eastern countries and of other countries.

6.2 Studies of the Middle Eastern Countries

6.2.1 Income, Food and Nutrition Studies

Although the countries of the Middle East have similar climates and cultures, they have vastly different income levels, infrastructures, education levels, levels of political stability and natural resources. Thus the nutrition problems and the approaches used to solve them are diverse.

The Waslien study in 1981 showed that, "despite rapid improvement, there was still extensive poverty in oil exporting countries as in Iran, Iraq, and Saudi Arabia as well as in Sudan, where more than ten percent of the population obtained less than the minimum calories needed to survive" (Waslien, p. 100). Even though the calorie content of the diet is generally adequate for most countries of the region, National Food Consumption surveys indicate that diets are inadequate in several nutrients. For example, the riboflavin intake of all occupational groups from unskilled manual laborers to administrators were inadequate in Morocco and Tunisia. The diets of the poor city dwellers were likely to be inadequate in all nutrients including protein and calories. According to Jaffan's study (1987) high population growth in the region , which averaged 2.7 per cent during the period 1966-1980, combined with the increase in per capita income, helped to bring about a substantial rise in urbanization, labor migration and food consumption throughout the Middle East. The growth of consumption of basic staple food in the region, which averaged 3.1 per cent during the period 1966-1973 was shifted upward after 1973 to an average rate of 4.8 per cent annually between 1973 - 1980. Shifts were even more dramatic in the consumption of livestock products, especially meat, with annual growth shifting from 4.1 per cent in the earlier period to 6.8

percent in the latter for all meats consumption. Poultry consumption rose from 9.6 per cent to 14 per cent.

The gap between demand and supply of staple foods that spread throughout the Middle East during the 1970s is projected to grow steadily through the 1990s and to the end of the century.

In terms of income in the Middle Eastern countries, Shapouri (1984) emphasized that "higher oil prices indirectly raised earnings in Tunisia, Morocco, and Egypt, as workers migrated to oil producing areas and sent home remittances, which accounted for 21 percent, 51 percent, and 89 percent, respectively, of the 1981 merchandise import of these countries" (p. 25).

Pellett (1983) studied food and nutrition in the Middle East region. He reviewed food production, food and nutrient availability, and major health problems related to nutritional deficiency. Pellett concluded that despite the high wealth of countries of the Middle Eastern region, malnutrition was still prevalent.

Mollett (1986) shows in his study that the effective demand for food (in terms of dietary energy) in the Middle East rose 4.3 percent from the early 1970s to the early 1980s. Food production generally rose at a much lower rate than population growth for the whole region in the same periods. For example, during the 1973-1983 period, the

population growth of Iraq and Algeria rose over 3.0 percent per year. In Egypt, Yemen, Morocco and Tunisia the population rose between 2.0 and 2.9 percent per year. During the same period the food production growth for all these countries was between 1.0 and 1.9 percent per year. Mollet's conclusion agreed with Pellett (1983) that despite the general improvement of the average nutritional level for some high income countries, malnutrition and under nutrition are common in many countries of the region, especially in rural areas.

Weinbaum (1982) indicated that the nutritional level in the region has been rising more rapidly in urban areas than in rural areas, and the gap between the middle classes and the poor in the cities is believed to be widening, as a result of government food policies in favor of urban areas.

Income disparity between rural and urban populations is getting wider. For example, the preliminary results of the 1979 census in Jordan showed that the average urban income was sixty percent higher than the average rural income at the same year (Jaffan 1987).

Hussain and Lunven (1987) stated that "urbanization is usually accompanied by changes in consumption habits. Surveys undertaken in Tunisia and Brazil show that food staples of the traditional rural diet (mainly hard wheat and barley in Tunisia and maize and rice in Brazil) have become

less important in urban diets. These items are replaced by new types of foods, particularly processed cereals such as bread and noodles, livestock products, and vegetables. The urban diet also includes more industrially processed items, sugar and fat. In addition, some nutritionally less desirable beverages such as soft drinks, tea and even alcohol are being regularly consumed, particularly by middle and high income groups" (p. 53).

A 1979 survey in Yemen found severe malnutrition, both in terms of calories and nutrients, among more than half of the urban children and two thirds of the rural children. In Tunisia a survey in 1980 found that more than one third of the urban population was getting less than their minimum calorie requirements to function productively. Furthermore, close to half of this group was seriously malnourished. In Egypt a survey in 1981 showed that thirty five percent of the population was getting less than the necessary two thousand calories per day (Stork and Pfeifer, 1987).

Alderman and Von Braun (1984) used data collected in household surveys between December 1981 and March 1982 of 1389 households in seventy-seven villages throughout Egypt to investigate income distribution and consumption. They concluded that the calorie consumption was high on the average, but was low for approximately seventeen percent of both the urban and rural population. They found the

probability that a family would consume less than household energy requirements was negatively correlated with income. In addition their analysis shows that income transfers through the ration system have a clearly progressive effect on income distribution, but favor the urban population and the population of the Nile Delta.

Gencaga (1986), however, concluded in his study of food consumption in Turkey that it was not acceptable to hypothesize "low incomes lead to low levels of intake which, in turn, lead to malnutrition." In addition, there was no apparent relationship between low income and quality of diet as measured by the minimum levels of animal protein contained in the diet" (p. 90).

There are three factors which account for the lack of income and malnutrition relationship among the low income population. First, rural solidarity manifested in food gifts which were not reported as income and exchanges of services for food, allow families to consume food valued at more than their total reported income in cash or kind. The second factor is the possibility of substitution within the food basket. There are large differences in the cost of calories and protein from different sources, therefore, low income groups to shift to cheaper sources of nutrients and they are still maintain healthy intake levels. The last factor is the result of measurement problem. The survey

measures incomes in rural area as a certain ratio of the gross revenue from animal husbandry and crops. Yet the ratio of the return to land and labor in both activities is closely related to the degree to which farm activities are commercialized. A modern dairy farm, for example, may have to incur up to 90 percent of its gross revenue as expenses, while this could be as little as 30 percent under traditional practices. Collection of data at that level detail was beyond the scope of the survey" (p. 86). In addition, most high income farmers and the self employed are known to under report income and food consumption.

6.2.2 Food Policy Studies

Middle Eastern government policies have tended to increase prices for manufactured goods and lower prices for food products. Yet, while they attempt to lower the prices of farm inputs, the benefits of these subsidies are captured by a privileged few (Bates, 1981). These policies are shifting the income to one sector or groups in the urban areas close to the government and lowering the purchasing power of the majority.

Tuma (1990) emphasized the points that, though awareness of the problem of food shortages has been increasing, there has been no effective food production

policy in any of the countries of the region. Food is simply considered a part of agriculture. Economic variables that should influence food production do not seem influential, apparently because government intervention and control have rendered them ineffective, because the prices are controlled by government. This may explain why prices, foreign aid, land per agricultural population, and terms of trade have little direct impact on food production.

The major policy instruments, however, have been control of marketing and prices, and the application of tax and subsidies to various products. However, the major determinants of food production seem to be non-economic, such as tradition, political stability, and a bias in favor of industry and the urban sectors.

The market economy policy which has emerged in Sudan, for example, is extremely fragile. Standards of living have been so reduced that slight fluctuations in prices or weather easily push large numbers of people into conditions of great distress. Food insecurity becomes the norm, a tangible expression of the emergent growth in the land of absolute poverty (Mark 1990).

Saudi Arabia, on the other hand, has shown it is possible to develop large scale irrigated wheat production in arid environments provided that sufficient money is available for infrastructure construction and for

subsidizing the production process. Without this money, Saudi Arabia would not, in fact, be able to produce its own food supply.

The wheat price support program in Saudi Arabia started in 1979. It set the original purchase price at (Saudi Rials) 3500 per ton, about six times the world market price. In 1984 the Saudi government wheat subsidy was (Saudi Rials) 3700 million, which equaled US\$ 1.2 billion more for the program than importing the wheat (Wallrafen 1987).

Beaumont (1989), agreed with Wallrafen about Saudi Arabia agricultural policy; however, he said there are few countries in the region which can enact policies on such a scale. For the other countries of the Middle East, with perhaps the exception of Turkey, their dependency is on wheat imports.

Looney (1988), however, concluded that the rapid expansion in agricultural production in Saudi Arabia cannot continue because the agriculture sector has been almost entirely dependent on government subsidies and loans for its expansion. Furthermore, the sector is not responding to increased demand. Clearly, the government tried to increase production without considering comparative advantage in the use of resources. In addition, the agriculture sector does not appear to be responsive to non-subsidized credit from the commercial banking system.

In Iran, Shafaeddin (1988), showed wheat and meat products suffered from a 45 percent to 100 percent decreasing rate of protection in the mid-1970s. The government policies were a major contributory factor to the slow growth of agriculture. These policies were biased against the agricultural sector in its main policies (prices, subsidies, and credit) particularly after the oil boom of 1973-1974.

Dethier and Funk (1987), in the first page of their article in The Middle East Report, quote part of the 1974 speech of US Secretary of Agriculture, Earl Butz: "I went down to Cairo with a little wheat in my pocket and they had the red carpet out for me there ... I was speaking the language of food, and they understand." Dethier and Funk concluded that the political embrace of Washington and Cairo has directly affected what Egypt's 45 million people eat and how much they pay for it.

The central problems being discussed in Dethier and Funk's study are the complex interplay of current and future food deficits, rapid population growth, attempts to improve the quality of food consumption, and the need to upgrade the nutritional levels available to low income groups. Ultimately, any really successful agricultural development program must allow for closing the existing gaps between the best and poorest fed. (Askari and Cummings 1978).

The food crisis in the Middle East is a crisis of equity. The "food riots" that punctuated the 1980s in Egypt, Morocco, Tunisia, and Sudan were primarily fueled by the resentment of poorer classes that they should assume an unfair share of the costs of austerity, an austerity brought on by international pressure to cut subsidies. More recently, this certainly seems to have been the case in Jordan and Algeria (Wenger and Stork, 1990).

Most of the studies on food consumption, nutritional status and food policies in the Middle East region are in agreement on one point: the area faces problems of shortage in the supply of staple foods, and malnutrition is prevalent among the population, especially in rural areas. The food policies in the Middle East countries favor urban areas and are biased toward industrial sectors rather than agricultural sectors and food supply.

In addition, the food policies are directed by the central governments and are designed to satisfy a political purpose rather than solve the social, economic, and malnutrition problems of the rural population.

6.3 Studies of Other Countries

Bates (1981) concluded that food policy in Africa like that of the Middle East is a derived policy that is

developed in an effort to solve the political and economic problems of persons other than farmers. Food policy is employed to obtain peaceful relations between governments and their urban constituents, and to secure the allegiance of powerful elites. In Sudan, for example, the average effective rate of price protection was 170 percent in 1971 for manufacture commodities. This contrasts with the previous estimate of minus 27% for agriculture. Bates commented that "further tariff concessions have undoubtedly increased [industrial] protection" (p. 150). Bates' study illustrates the considerable inducement given by price incentive policies to industrial as opposed to agricultural development.

A study of Ghana by Kyereme (1984), estimated calories in terms of energy deficits, calculated by subtracting each household's individual calorie count from a poverty line or required daily allowance. The deficit can also be computed in terms of food expenditures by subtracting each individual's household total food expenditure from the food poverty line. The basic result of Kyerem's study confirms Engel's Law that as income increases, food consumption increases too. In addition, the income is the most important variable that affects observed food poverty.

Ames and Mukendi (1990) concluded that the strategy of devaluation must be accompanied by investment, credit,

price, and income distribution policies to sustain the adjustment process. In Zaire, however, devaluation has resulted in inflation and a serious reduction in per capita income with serious consequences for food security. In addition, devaluation has had a negative impact on the poor regardless of the impact of low-cost subsidized food or food aid.

Gray (1982) studied the effects of changes in nominal income and relative prices on per capita calorie intake in Brazil by fitting individual commodity-by-commodity consumption functions. Such consumption functions are able to estimate the income and relative price of calorie intake. She applied the log by quadratic method to derive income elasticities and allow a commodity to go from a luxury (income elasticity $b > 1$), to a necessity ($0 < b < 1$) and to an inferior good ($b < 0$) with rising income, as shown in Table 2.

Dewalt (1983) used the linear correlation among food variables and household economic indices in Mexico. She concluded that there was a linear relation between meat, milk, eggs, and other foods to economic standing. No significant relationship was demonstrated between economic standing based on income and the consumption of maize and beans. However, increasing income resulted in better diets in this region of Mexico.

Table 2

Income Elasticities For Calorie Intake from Various Foods
by Calorie Consumption Group, 1974/75

Food	Lowest 15 Percent		Lowest 30 Percent		Highest 70 Percent	
	Urban	Rural	Urban	Rural	Urban	Rural
Cereals	0.838	0.702	0.540	1.27	0.032	0.109
Cassava flour	-2.78	-2.24	-2.57	-3.21	-0.289	-0.740
Vegetables	1.52	1.29	1.21	1.13	0.322	0.252
Beef	0.957	1.70	0.841	0.574	0.408	0.472
Egg	0.865	0.263	1.01	0.622	0.340	0.419

Source: Gray, Cheryl Williamson. Food Consumption Parameters For Brazil And Their Applicatin To Food Policy. Research Report 32, International Food Policy Research Institute, September 1982.

6.4 Conclusion

Middle Eastern and other countries face different problems pertaining to food consumption and nutrition. The studies show that governments control food and nutrition policies directly and indirectly. The governments explain their intervention by claiming to protect food security. The objectives of most of the governmental interventions are for political ends rather than economic or social efficiency. Most of the subsidy policies favor urban areas, therefore, most rural areas and farmers have limited income to improve their nutritional status.

Chapter 3

CONSUMPTION THEORY

7.1 Introduction

Food behaviorists often argue that the quantity and quality of food consumed by an individual or household is affected by the sources and amount of individual household income. Economists, in contrast, argue that if the time and effort spent in earning the individual or household income is held constant, then only the amount of income affects the consumption decisions made for any given set of relative prices (Friedman 1957). In other words, economists assume perfect competition but the behaviorists imply that not enough observations of income sources and relative prices are made for food.

7.2 The Income Consumption Curve

The Income Consumption Curve (ICC) is the locus of optimum consumption bundles for different incomes, given the normal ceteris paribus assumption. Figure 2 shows an individual's preference mapping and budget lines that represent alternative income levels. Given an income of Y ,

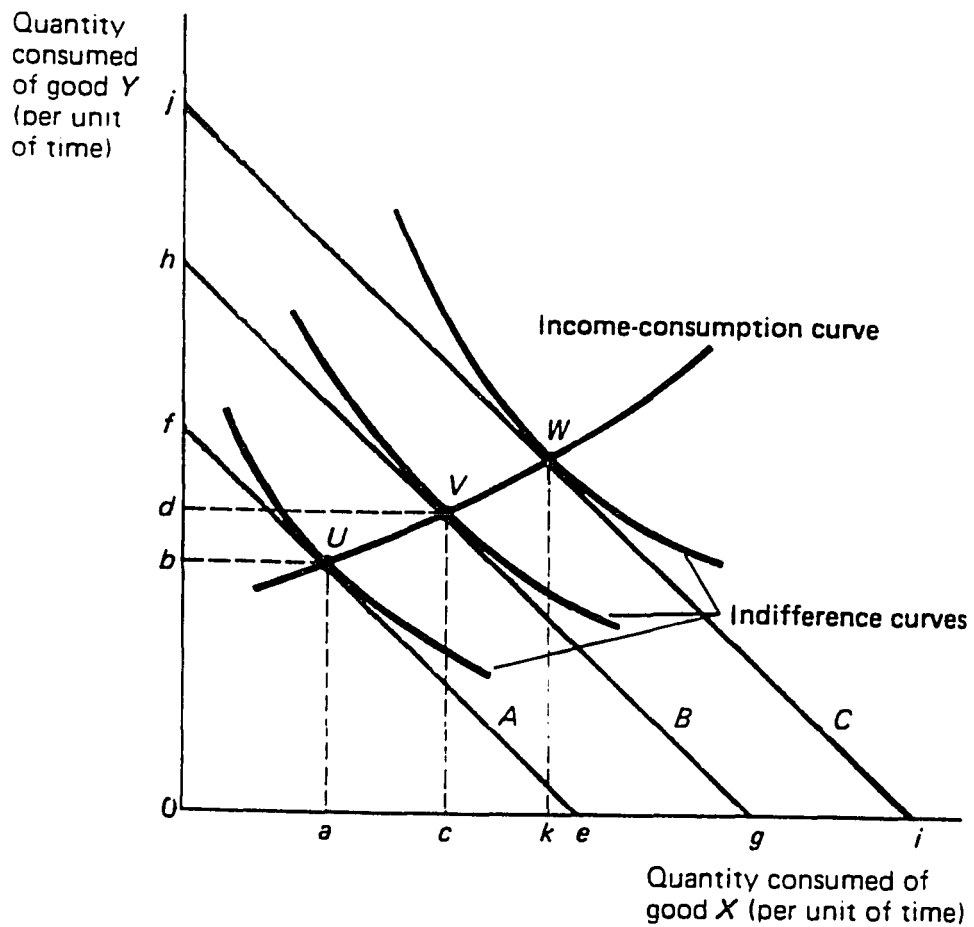


Figure 2: The Income Consumption Curve (ICC)

Note: X and Y are measured in dollars expenditure

and a budget line Y_1, Y_1' , the individual's optimum consumption bundle is A. An increase in income results in a parallel outward shift in the budget line. The budget lines labeled $Y_2 Y_2'$ and $Y_3 Y_3'$ represent successive increases in income, holding all prices constant. If the indifference curves I_2 and I_3 are typical of this individual's preference ordering, the optimum consumption bundles at higher levels will be B and C, respectively. The line through the points A, B, and C traces out optimum consumption bundles or consumption equilibria as income changes. This curve is the income consumption curve.

The ICC in Figure 2 slopes up and to the right, showing that the consumption of both goods X and Z increases as income increases (Freeman III, 1983).

7.3 Engel's Curve

In theory, the elasticities or parameters of the Engel relationship describe the reaction of an individual whose income is rising, with given prices and a given utility function.

From the information in Figure 3A the relationship between income and consumption of good X and between the income and the consumption of good Z can be established. The relationship between income and X can be shown in Figure 3A

for the points A', B', and C'. A', B', C' correspond to the points A, B, and C in Figure 2. Thus, the Engel Curve defines the consumption of a good as a function of income holding all prices constant.

The shape of a consumer's Engel Curve for a particular good will depend on the nature of the good, the nature of the consumer's tastes, and the level at which the commodity prices are held constant (Mansfield, 1985). For example, Engel Curves with quite different shapes are shown in Figures 3B and 3C. In Figure 3B, the quantity consumed of the good increases with income, but at a decreasing rate. According to the Engel Curve in Figure 3C, the quantity consumed of the good increases with income, but at an increasing rate.

7.4 Income Elasticity of Demand

The relationship between income and the consumption of a good can be characterized quantitatively by a measurement known as the income elasticity of demand. "Income elasticities show the relationships between changes in quantity demanded and changes in income, low values normally exist for staple foods, and high values are found for egg, meat, dairy products and fruits (Monke and Fox 1993).

The income elasticity of demand for a good X is the

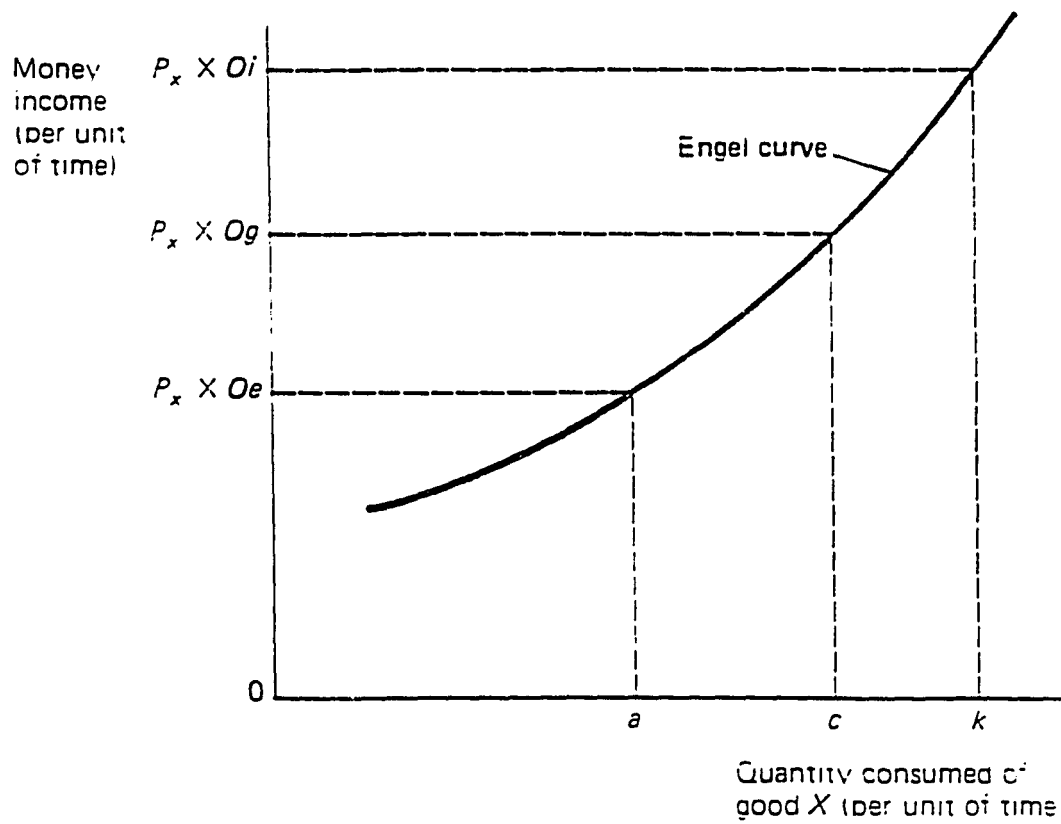


Figure 3A: Engel Curve: An Engel Curve is the relationship between the equilibrium quantity purchased of a good and the level of income.

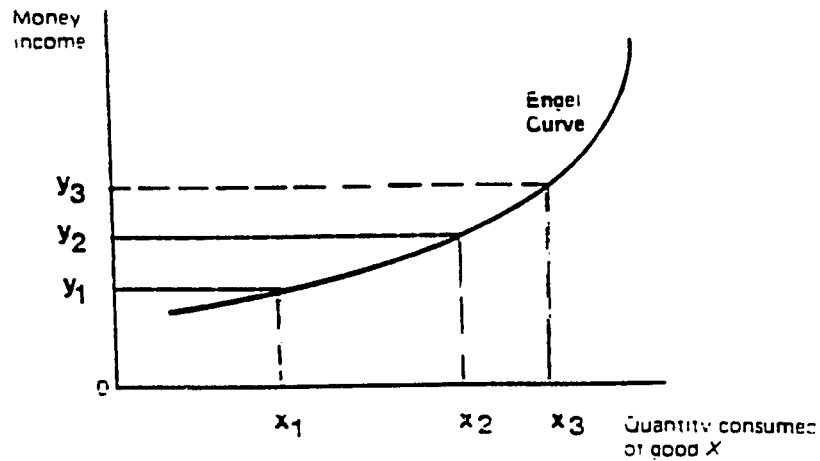


Figure 3B: Engel Curve: The quantity consumed of the good increases with income, but at decreasing rate.

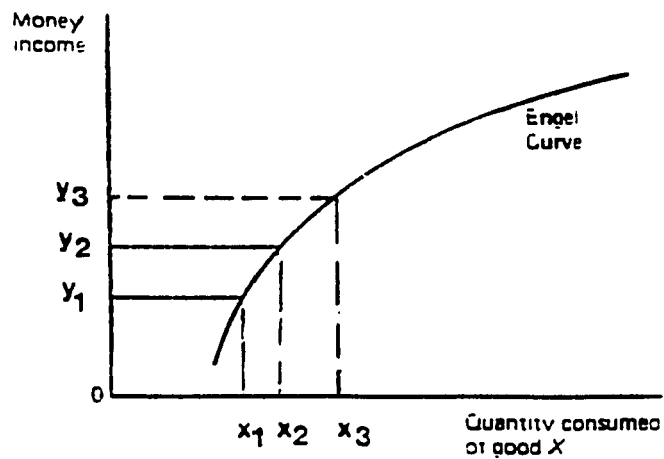


Figure 3C: Engel Curve: The quantity consume of the good increases with income, but at an increasing rate.

percentage change in its quantity demanded for a given percentage change in money income Y , as shown in this equation:

$$\epsilon_Y \equiv \frac{\frac{\Delta X}{X}}{\frac{\Delta Y}{Y}} = \frac{\Delta X}{\Delta Y} \cdot \frac{Y}{X}$$

According to this definition of income elasticity, if income and consumption of X move in the same direction, the income elasticity is positive. In principle, the income elasticity of demand can take any positive or negative value. The sign and magnitude of the income elasticity can be used to classify goods with respect to their income consumption relationship as follows:

- 1- Superior good: the consumption of good X rises or falls more than proportionately to the increase or decrease in income, specifically ($EY > 1$). Livestock products and seafood are examples of commodities that often have $EY > 1$.
- 2- Normal good: the consumption of good X rises or falls less than proportionately with the rise or decrease in income, specifically ($0 < EY < 1$).
- 3- Inferior good: the consumption of good X varies inversely with income, specifically ($EY < 0$). This implies a substitution relationship between goods, usually indicative of staple food, such as potatoes or beans in low income families (Freeman III, 1983).

For example, Table 2 page 35 shows the income elasticities of food consumption for Brazil (Gray, 1982).

7.5 Conclusion

This chapter explains the theoretical relationships between income growth and food consumption. The income consumption curve is the locus of optimum consumption bundles for different incomes. Income elasticity of demand for a good is the percentage change in its consumption for a given percentage change in income. Income elasticity of demand can take any positive or negative value. The sign and magnitude of the income elasticity can be used to classify goods with respect to their income consumption relationship.

Chapter 4 and 5 contain estimates of income consumption curves and income elasticities of demand for selected commodities and countries in the Middle East.

Chapter 4

METHODOLOGY

8.1 Introduction

There are several methods of food analysis, especially those dealing with the effects of income on food consumption, health and education. For example, Alderman and Von Braun (1984) used a demand equation model to estimate the marginal propensity to consume foods controlled by the Egyptian food rationing program. They also studied the subsidy system to determine the effect of rationing on income distribution and consumption.

Paris and Hoathakker, (1955), investigated several non-linear Engel functions and calculated that the semi-logarithmic form is most suited to necessities, and that a double logarithmic form best describes the demand for luxuries.

This study examines the effect of income on nutritional status through information on food consumption (in mega calories) of wheat, rice, corn, total grain, eggs, beef, and poultry (in grams of protein); health and demographic indicators which include population per physician, crude birth rate, crude death rate, infant mortality rate, child

death rate, and life expectancy.

The first section of this chapter lists the data sources. The available data are enumerated in the next section. The econometric models are discussed in the third section. These models include the estimated parameters for wheat, corn, rice, total grain, eggs, beef and poultry consumption and the estimated relationship between income and the social indicators. The fourth section contains the conclusion.

8.2 Data Sources

The data required for this study were collected from the following sources:

- 1- United Nations publications.
- 2- United States of America, Department of Agricultural publications.
- 3- World Bank publications.
- 4- International Monetary Fund publications.

8.3 Data Limitation

Repeated efforts to obtain data from USDA and UN sources for this study were unsuccessful. Due to this circumstance data availability for wheat, rice, corn and

total grain were limited to a period ranging from 1960 to 1980 for grain and from 1974 to 1984 for meat consumption.

8.4 Data Availability

Gross national product (GNP) per capita per year in United States dollars at 1980 value for the period (1967-1987) was used as the measure of income in this analysis as shown in Appendix Table 1.

The definition of disposable personal income is the income remaining to persons after deduction of personal taxes and all other payments to governments, or the total for all individual savings and consumption expenditures.

Gross National Product is a statement of the aggregation, at market prices, of the final goods and services produced in the national economy during a given year. Aggregation is shown in terms of consumer purchases, government purchases, gross private domestic investments and exports of goods and services (Sloan and Zurcher 1970).

From the definitions of disposable personal income and the gross national product, the personal income is normally highly correlated with per capita gross national product. Therefore, it is appropriate to use per capita gross national products in this study as a measure of per capita income. In addition, gross national products are the only

data available to represent income in United States dollars at 1980 values for all eleven countries in this study during the period of 1960 through 1987.

Grain consumption data for wheat, corn, rice and total grain in Appendix Table 3 were converted from metric tons to per capita per year mega calories by using the Middle East food consumption equivalents shown in Table 3. The data for egg, beef, and poultry consumption in Appendix Table 4 were converted to per capita per year grams of protein consumption by using the protein equivalents in Table 3. The social indicators data included life expectancy (LE), population per physician (Pop/Phy), crude birth rate (CBR), crude death rate (CDR), infant mortality rate (IMR), and child death rate (ChDR). Data on these variables were available for 1974 to 1985 only for the eleven countries in the study (Appendix Table 5).

8.5 Econometric Models

To study the effects of income growth on food consumption and social indicators in the Middle Eastern area, different econometric models were used. The analysis was done for eleven countries in three country groups:

- 1- Oil Exporting Countries: Algeria, Libya and Saudi Arabia.
- 2- Labor Exporting Countries: Egypt, Morocco, Tunisia and

Table 3
Calorie and Protein Equivalents of Selected
Foods Consumed in the Middle East
(100 grams)

Food Component	Kilo Calories	Grams of Protein
Wheat	354	10.5
Corn	351	9.4
Rice	354	7.2
Eggs	242	10.0
Beef	245	13.8
Poultry	228	16.0

Source: Pellet, P. C. and Shadarevian Sossy, Food Consumption Tables Use in the Middle East, Second Edition, American University of Beirut, 1970.

Yemen A.R.

3- Agricultural Producing Countries: Jordan, Sudan, Syria and Turkey.

These countries were chosen on the basis of the available data during the study periods in order to estimate the income effects on food consumption status.

In order to estimate the relationships between income and consumption of wheat, corn, rice, total grain, eggs, beef and poultry, linear double-logarithmic and multiple and single regression analyses were used to estimate the income elasticities of demand for each country and commodity. Single and multiple regression models were used to estimate the effects of income on social indicators.

According to the available data during the period from 1960 to 1985, several regression models were used to choose the best fit appropriate for this study.

8.5.1 Estimated Parameters for Wheat, Corn, Rice and Total Grain Consumption Related to Per Capita Gross National Products

Various functional forms were tried, including square root, semi-logarithmic, straight linear, and quadratic. Results of these equations (not included in this dissertation) did not adequately explain the relationships

of food consumption to income. High standard errors, low t values, low R squared and theoretically incorrect signs of the coefficients were indicators of poor fits.

The linear logarithmic form was used for simplicity and because it generally provided the best statistical results. Previous studies have used the log linear model. For example, Gray (1982), used this model to estimate food consumption parameters for Brazil. "The log linear form has several advantages. The two major ones being its ease of estimation and the convenience for interpretation and forecasting purposes of assuming constant elasticities for all individuals in a group. The use of this form is highly plausible for low income or well-nourished group for luxury goods" (Gray 23).

Wheat, corn, rice and total grain parameters were estimated from the following equations:

$$\ln CW_i = a + a_1(\ln Y_i) + a_2D \quad (1)$$

$$\ln Cc_i = b + b_1(\ln Y_i) + b_2D \quad (2)$$

$$\ln CR_i = r + r_1(\ln Y_i) + r_2D \quad (3)$$

$$\ln CG_i = T + T_1(\ln Y_i) + T_2D \quad (4)$$

$\ln CW_i$, $\ln Cc_i$, $\ln CR_i$ and $\ln CG_i$ are logarithms of annual per capita consumption in mega calories of wheat, corn, rice and total grain, respectively. $\ln Y_i$ is the logarithm of per capita real GNP. W , c , R and G represent wheat, corn, rice and total grain consumption, respectively. i is a country

subscript. a , b , r and T are the intercept values of the equations for wheat, corn, rice and total grain consumption, respectively. a_1 , b_1 , r_1 and T_1 are the coefficients of wheat, corn, rice and total grain consumption, respectively. D is a dummy variable used to capture differences in slope parameters for income growth related to world oil price increases in 1973, holding the intercept fixed. D has value zero from 1967 through 1973 and value one from 1974 through 1980. a_2 , b_2 , r_2 and T_2 are the coefficients of wheat, corn, rice and total grain consumption related to the dummy variable for oil price change. According to consumption theory, the nature of these goods, and the status of the Middle Eastern people, the expected relationship between income and wheat, rice, corn and total grain consumption should be positive but less than one, because these goods are considered normal goods in this study. The results of the above equations are shown in Tables 4 through 7.

Table 4 contains the estimated coefficients a , a_1 and a_2 and their corresponding t statistics for the wheat equations. Statistics are included for per capita wheat consumption related to per capita income and the dummy variable to reflect oil price changes. The t value is used to test the null hypothesis, which states that the individual coefficient is equal to zero.

At 95% confidence interval there is a significant

Table 4
Estimated Income Parameters Related to
Wheat Consumption

Countries	a	a ₁	t	a ₂	t ₁	R ²
<u>Oil Exporting</u>						
Algeria	5.35	0.13	0.83	0.04	0.33	0.41
Libya	4.62	0.21	2.28*	0.14	1.09	0.85
S. Arabia	3.44	0.32	3.33*	-0.28	-1.24	0.74
<u>Labor Exporting</u>						
Egypt	3.11	0.51	2.35*	0.16	2.51*	0.80
Morocco	7.04	-0.10	-0.15	0.00	0.02	0.01
Tunisia	-2.27	1.53	4.63*	-0.13	-0.93	0.84
Yemen A.R.	NA	NA	NA	NA	NA	NA
<u>Ag. Producing</u>						
Jordan	7.78	-0.24	-0.76	0.07	0.70	0.08
Sudan	2.22	0.39	0.75	0.28	2.65*	0.53
Syria	5.15	0.17	0.49	0.09	0.30	0.42
Turkey	5.65	0.17	0.52	0.01	0.07	0.12

a = Constant

a₁ = Income parameter

a₂ = Dummy variable parameter

t = t statistics for income

t₁ = t statistics for dummy variable

Number of years (14): 1967-1980

NA: Not Available

* Significantly different from zero at the 95% confidence interval

Table 5
Estimated Income Parameters Related to
Rice Consumption

Countries	b	b ₁	t	b ₂	t ₁	R ²
<u>Oil Exporting</u>						
Algeria	3.99	0.71	0.91	-0.51	-0.85	0.07
Libya	1.14	0.34	1.91*	-0.10	-0.25	0.32
S. Arabia	3.01	0.22	1.91*	0.15	0.56	0.77
<u>Labor Exporting</u>						
Egypt	4.22	0.11	0.50	-0.04	-0.57	0.03
Morocco	18.17	-2.58	-1.02	0.42	0.80	0.09
Tunisia	NA	NA	NA	NA	NA	NA
Yemen A.R.	-2.83	0.72	0.46	0.31	0.46	0.23
<u>Ag. Producing</u>						
Jordan	-3.78	1.05	3.22*	-0.16	-1.52	0.51
Sudan	NA	NA	NA	NA	NA	NA
Syria	1.15	0.33	0.53	0.01	0.02	0.27
Turkey	-3.87	0.96	2.92*	-0.18	-2.08*	0.46

b = Constant

b₁ = Income parameter

b₂ = Dummy variable parameter

t = t statistics for income

t₁ = t statistics for dummy variable

Number of years (14): 1967-1980

NA: Not available

* Significantly different from zero at the 95% confidence interval

Table 6
Estimated Income Parameters Related to
Corn Consumption

Countries	r	r ₁	t	r ₂	t ₁	R ²
<u>Oil Exporting</u>						
Algeria	-10.83	1.83	2.16	0.46	0.70	0.81
Libya	NA	NA	NA	NA	NA	NA
S. Arabia	NA	NA	NA	NA	NA	NA
<u>Labor Exporting</u>						
Egypt	4.20	0.24	1.77	0.13	3.27*	0.81
Morocco	2.80	0.24	0.22	-0.06	-0.25	0.01
Tunisia	-17.67	3.21	2.01*	0.71	1.11	0.76
Yemen A.R.	NA	NA	NA	NA	NA	NA
<u>Aq. Producing</u>						
Jordan	-14.92	2.69	5.54*	0.26	1.67	0.90
Sudan	NA	NA	NA	NA	NA	NA
Syria	NA	NA	NA	NA	NA	NA
Turkey	6.59	-0.28	-2.56*	0.07	2.48*	0.33

r = Constant

r₁ = Income parameter

r₂ = Dummy variable parameter

t = t statistics for income

t₁ = t statistics for dummy variable

Number of years (14): 1967-1980

NA: Not available

* Significantly different from zero at the 95% confidence interval

Table 7
Estimated Total Grain Consumption Parameters
Related to Income

Countries	T	T ₁	t	T ₂	t ₁	R ²
<hr/>						
<u>Oil Exporting</u>						
Algeria	4.99	0.19	1.14	0.04	0.35	0.54
Libya	4.65	0.22	2.48*	0.13	1.04	0.86
S. Arabia	3.91	0.29	3.79*	-0.17	-0.93	0.83
<u>Labor Exporting</u>						
Egypt	4.52	0.38	2.77*	0.12	3.00*	0.85
Morocco	6.93	-0.06	-0.10	-0.01	-0.05	0.01
Tunisia	-2.78	1.61	4.54*	-0.10	-0.67	0.85
Yemen A.R.	NA	NA	NA	NA	NA	NA
<u>Ag. Producing</u>						
Jordan	4.77	0.21	0.73	0.07	0.78	0.27
Sudan	NA	NA	NA	NA	NA	NA
Syria	5.18	0.21	0.50	0.09	0.30	0.43
Turkey	6.01	0.13	0.46	0.01	0.13	0.12
<hr/>						

T = Constant

T₁ = Income parameter

T₂ = Dummy variable parameter

t = t statistics for income

t₁ = t statistics for dummy variable

Number of years (14): 1967-1980

NA: Not available

* Significantly different from zero at the 95% confidence interval

positive linear relationship between per capita income and wheat consumption in Libya, Saudi Arabia, Egypt and Tunisia. In addition, these countries had R squared values between 0.74 and 0.85. The results of the estimated coefficients for these four countries correspond to the expected signs and are theoretically accepted. However, the results of the analyses for the other countries are not significant. In Egypt and Sudan, the dummy variables had a significant effect on wheat consumption, because the income growth in these countries significantly increased after 1974. However, the dummy variables for the other nine countries had no significant effect on wheat consumption, because the income growth after 1974 was not high enough to be captured in the analysis. Morocco, Yemen, Jordan and Turkey had very low R squared values. This indicates that variation in the independent variables has little effect on wheat consumption.

The estimated coefficients of per capita rice consumption related to per capita income are shown in Table 5. Libya, Saudi Arabia, Jordan and Turkey had a significantly positive linear relation between per capita income and per capita rice consumption, at a 95% confidence interval. The regression analysis results of estimated parameters for these four countries were theoretically acceptable, and have the same expected

signs. Algeria, Egypt, Yemen and Syria had a positive relationship between income and rice consumption, but it was not significant. Morocco was the only country that had a negative relationship between income and rice consumption, but it was not significant. Dummy variable parameters had significant and negative relationship with rice consumption for Turkey only .

Table 6 contains the estimated parameters for corn consumption related to income growth. Using the t value test, with a 95% confidence interval, Algeria, Tunisia and Jordan had significant and positive relationships between income and corn consumption. These results were accepted theoretically and had the expected signs. However, Turkey was the only country that had a negative relationship between income and corn consumption. Morocco had no significant relationship between income and corn consumption according to the R squared value close to zero and very low t value. The rest of the countries had R squared values ranging from 0.90 to 0.33. Algeria, Tunisia and Jordan have coefficient values (r_1) for corn consumption related to income greater than one. The oil price change had a significant effect on corn consumption in Egypt and Turkey at a 95% confidence interval.

Table 7 contains the estimated total grain consumption coefficients related to per capita gross national products.

Libya, Saudi Arabia, Egypt and Tunisia had a significant positive relationship between total grain consumption and per capita income, because the demand for food was high. In addition, these four countries had high correlation coefficients with an R squared value between 0.83 and 0.86. The dummy variable coefficient showed a significant relation for total grain consumption only in the case of Egypt.

8.5.2 Estimated Parameters of Egg, Beef and Poultry Consumption Related to Per Capita Gross National Products

The data for egg, beef and poultry were available from 1975 to 1984. By using the Soritec program the best estimates were provided by the linear logarithmic regression form.

The following equations were used to estimate the coefficient parameters of egg, beef, and poultry demand.

$$\ln CE_i = e + e_1 \ln Y_i \quad (5)$$

$$\ln CB_i = f + f_1 \ln Y_i \quad (6)$$

$$\ln CP_i = g + g_1 \ln Y_i \quad (7)$$

$\ln CE_i$, $\ln CB_i$ and $\ln CP_i$ are logarithms of per capita consumption (grams of protein equivalent) of eggs, beef and poultry respectively. e , f , and g are the intercepts of eggs, beef and poultry respectively. e_1 , f_1 and g_1 are the

coefficient values of egg, beef and poultry consumption related to the income. Dummy variables of oil price changes were not used in these equations because data were not available before 1974, which was the period when the price of oil was low.

The expected signs for these equations should be positive for the relationships between income and egg, beef and poultry consumption. In addition, the value of the income parameters of these goods is expected to be higher than the value of the parameters for wheat, rice, corn and total grain consumption.

The equations succeed in explaining a substantial proportion of the variation in egg, beef and poultry consumption as shown in Tables 8, 9 and 10.

Table 8 contains the estimated coefficients for egg consumption (e_1) and its corresponding t statistics. At a 95% confidence interval, Algeria, Egypt, Tunisia, Yemen, Sudan and Syria had a positive and significant relationship between income and egg consumption. Their R squared values were 0.80, 0.51, 0.67, 0.71, 0.43 and 0.65, respectively. These results are theoretically acceptable. Morocco and Jordan had very low R squared values, meaning that no correlation between egg consumption and income exists from the available data. Except for Morocco and Jordan, all the countries studied had positive coefficients for income

Table 8
Estimated Income Parameters Related to
Egg Consumption

Countries	e	e ₁	t	R ²
<u>Oil Exporting</u>				
Algeria	-9.34	1.92	5.69*	0.80
Libya	-12.48	2.03	1.77	0.28
S. Arabia	3.65	0.26	1.04	0.12
<u>Labor Exporting</u>				
Egypt	1.81	0.58	2.88*	0.51
Morocco	6.54	-0.10	-0.13	0.00
Tunisia	-14.33	2.86	4.07*	0.67
Yemen A.R.	-20.12	4.17	4.39*	0.71
<u>Aq. Producing</u>				
Jordan	7.19	-0.17	-0.29	0.01
Sudan	1.08	1.49	2.46*	0.43
Syria	-10.25	2.30	3.84*	0.65
Turkey	NA	NA	NA	NA

e = Constant

e₁ = Income parameter

t = t value

Number of years (10): 1975-1984

NA: Not available

* Significantly different from zero at the 95% confidence interval

Table 9
Estimated Income Parameters Related to
Beef Consumption

Countries	f	f ₁	t	R ²
<hr/>				
<u>Oil Exporting</u>				
Algeria	-11.91	2.36	10.88*	0.94
Libya	-14.62	2.43	2.31*	0.40
S. Arabia	-7.19	1.47	5.22*	0.77
<u>Labor Exporting</u>				
Egypt	2.99	0.58	1.16	0.14
Morocco	15.84	-1.39	-1.09	0.13
Tunisia	3.93	0.38	0.67	0.05
Yemen A.R.	3.23	0.40	2.01*	0.34
<u>Ag. Producing</u>				
Jordan	-50.82	7.76	3.73*	0.63
Sudan	8.52	0.64	2.68*	0.47
Syria	-28.78	4.79	2.66*	0.47
Turkey	NA	NA	NA	NA
<hr/>				

f = Constant

f₁ = Income parameter

t = t value

Number of years (10): 1975-1984

NA: Not available

* Significantly different from zero at 95% confidence interval

Table 10
Estimated Income Parameters Related to
Poultry Consumption

Countries	g	g ₁	t	R ²
<u>Oil Exporting</u>				
Algeria	-9.73	2.11	5.96*	0.82
Libya	-17.26	2.68	2.85*	0.50
S. Arabia	-1.69	1.05	4.80*	0.74
<u>Labor Exporting</u>				
Egypt	-6.61	2.11	6.93*	0.86
Morocco	2.65	0.55	0.14	0.00
Tunisia	-5.15	1.67	3.84*	0.65
Yemen A.R.	-30.62	6.09	3.89*	0.65
<u>Ag. Producing</u>				
Jordan	-24.97	4.39	4.22*	0.69
Sudan	1.81	1.44	2.06*	0.35
Syria	-6.22	1.79	1.51	0.22
Turkey	NA	NA	NA	NA

g = Constant

g₁ = Income parameter

t = t value

Number of years (10): 1975-1984

NA: Not available

* Significantly different from zero at the 95% confidence interval

related to egg consumption.

The estimated parameters for beef consumption related to per capita income are shown in Table 9. At a 95% confidence interval there was significant and positive relationship between per capita income and per capita meat consumption in Algeria, Libya, Saudi Arabia, Yemen, Jordan, Sudan and Syria. R squared values for these countries ranged between 0.94 and 0.34. In addition, these results correspond to the expected signs and are theoretically acceptable.

Table 10 contains the estimated coefficients of per capita poultry consumption. Using the t test, at a 95% confidence interval, there was a significant positive relationship between income and poultry consumption in all countries except for Morocco and Syria. The estimated parameters of income related to poultry consumption were theoretically accepted. Morocco and Syria, however, had a insignificant relationship between income and poultry. In addition, these two countries had the lowest R squared values, 0.00 for Morocco and 0.22 for Syria.

8.5.3 Estimated Relationship Between Income and Social Indicators

The following equations were used to explain the

relationship between income and the social factors:

Single regression models:

$$\text{Pop/Phy} = h + h_1 Y_i \quad (8)$$

$$\text{CBR}_i = j + j_1 Y_i \quad (9)$$

$$\text{CDR}_i = k + k_1 Y_i \quad (10)$$

$$\text{IMR}_i = l + l_1 Y_i \quad (11)$$

$$\text{ChDR}_i = m + m_1 Y_i \quad (12)$$

$$\text{LE}_i = n + n_1 Y_i \quad (13)$$

Pop/Phy, CBR, CDR, IMR, ChDR, and LE are the population per physician, crude birth rate, crude death rate, infant mortality rate, child death rate, and life expectancy, respectively. h , j , k , l , m and n are the intercepts of Pop/Phy, CBR, CDR, IMR, ChDR and LE, respectively. h_1 , j_1 , k_1 , l_1 , m_1 and n_1 are the coefficients of Pop/Phy, CBR, CDR, IMR, ChDR and LE, related to per capita income. i is a country subscript.

The expected signs of the coefficients h_1 , j_1 , k_1 , l_1 and m_1 for equations 8 through 12 are negative. Theoretically, when income increases the number of physicians will increase, therefore, the ratio of population per physician will decrease. The CBR, CDR, IMR and ChDR coefficients should be negatively related to the income because as income increases more investment in health, food

and nutrition will result. This causes CBR, CDR, IMR and ChDR to go down. The expected coefficient n_1 in equation 13 should be positive, because an increase in income will allow for an increase in investment in health care and nutrition to create healthier diets that will increase life expectancy. Tables 11 through 16 show the estimated parameters of the income and social indicators.

The estimated coefficients of population per physician related to income growth are shown in Table 11. The coefficients for Algeria, Libya, Egypt, Tunisia, Yemen, Jordan and Syria reveal negative values. These are significantly different from zero at the 0.05 level. These results are theoretically acceptable. The income coefficients for Turkey, Saudi Arabia, Morocco and Sudan were not significant.

Table 12 represents the estimated coefficients for crude birth rate related to per capita income. By using the t test, with 95% confidence interval, Libya, Egypt, Tunisia, Yemen and Turkey had a significant linear relationship between income and crude birth rate (CBR). Libya, Egypt, and Tunisia had the highest R squared values of 0.44, 0.66, and 0.78 respectively.

Table 13 expresses the estimated parameters of crude death rate (CDR) related to changes in per capita income. There was a negative relationship between these variables

Table 11
Estimated Income Parameters Related to Population
per Physician

Countries	h	h_1	t	R^2
<hr/>				
<u>Oil Exporting</u>				
Algeria	10570.10	-3.36	-5.08*	0.74
Libya	1200.03	-0.05	-2.18*	0.37
S. Arabia	1271.61	0.05	0.98	0.10
<u>Labor Exporting</u>				
Egypt	3378.95	-4.79	-4.25*	0.67
Morocco	11753.52	5.25	0.16	0.00
Tunisia	7413.78	-2.87	-2.08*	0.32
Yemen A.R.	39269.41	-62.13	-7.83*	0.87
<u>Ag. Producing</u>				
Jordan	9170.35	-5.13	-7.89*	0.87
Sudan	8798.00	1.12	0.10	0.00
Syria	5025.30	-1.83	-3.58*	0.59
Turkey	1962.49	-0.27	-0.28	0.01
<hr/>				

h = Constant

h_1 = Income parameter

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 12
Estimated Income Parameters Related
to Crude Birth Rate

Countries	j	j ₁	t	R ²
<u>Oil Exporting</u>				
Algeria	53.34	-0.0034	-1.66	0.23
Libya	50.80	-0.0005	-2.48*	0.44
S. Arabia	46.88	-0.0002	-1.67	0.24
<u>Labor Exporting</u>				
Egypt	43.85	-0.0148	-4.18*	0.66
Morocco	35.33	0.0092	0.17	0.00
Tunisia	45.50	-0.0089	-5.67*	0.78
Yemen A.R.	50.87	-0.0059	-2.42*	0.39
<u>Ag. Producing</u>				
Jordan	55.20	-0.0070	-1.38	0.17
Sudan	46.52	-0.0003	0.04	0.00
Syria	43.39	0.0020	0.76	0.06
Turkey	51.11	-0.0144	-2.16*	0.34

j = Constant

j₁ = Income parameter

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 13
Estimated Income Parameters Related
to Crude Death Rate

Countries	k	k ₁	t	R ²
<u>Oil Exporting</u>				
Algeria	19.92	-0.0032	-3.73*	0.61
Libya	15.43	-0.0004	-2.76*	0.49
S. Arabia	15.26	-0.0002	-1.18	0.13
<u>Labor Exporting</u>				
Egypt	19.58	-0.0157	-10.65*	0.93
Morocco	15.69	-0.0031	-0.19	0.00
Tunisia	14.04	-0.0037	-2.79*	0.46
Yemen A.R.	32.12	-0.0207	-4.50*	0.69
<u>Ag. Producing</u>				
Jordan	20.76	-0.0079	-6.26*	0.81
Sudan	21.66	-0.0099	-0.68	0.05
Syria	18.64	-0.0072	-5.34	0.76
Turkey	12.38	-0.0023	-0.45	0.02

k = Constant

k₁ = Income parameter

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 14
Estimated Income Parameters Related
to Infant Mortality Rate

Countries	i	i ₁	t	R ²
<hr/>				
<u>Oil Exporting</u>				
Algeria	190.80	-0.0400	-4.22*	0.66
Libya	131.04	-0.0038	-2.89*	0.51
S. Arabia	124.74	-0.0019	-0.97	0.09
<u>Labor Exporting</u>				
Egypt	110.63	-0.0200	-0.63	0.04
Morocco	134.35	-0.0325	-0.23	0.01
Tunisia	183.27	-0.0726	-7.88*	0.87
Yemen A.R.	189.76	-0.0536	-0.92	0.09
<u>Ag. Producing</u>				
Jordan	131.90	-0.0451	5.00*	0.74
Sudan	136.56	-0.0394	-0.38	0.02
Syria	128.31	-0.0460	-3.56*	0.59
Turkey	231.00	-0.08360	-0.78	0.06
<hr/>				

i = Constant

i₁ = Income parameter

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 15
Estimated Income Parameters Related
to Child Death Rate

Countries	m	m ₁	t	R ²
<hr/>				
<u>Oil Exporting</u>				
Algeria	31.92	-0.0074	-4.29*	0.67
Libya	23.13	-0.0010	-2.86*	0.51
S. Arabia	24.24	-0.0009	-1.10	0.24
<u>Labor Exporting</u>				
Egypt	57.81	-0.0850	-4.23*	0.67
Morocco	27.53	-0.0143	-0.28	0.01
Tunisia	19.73	-0.0038	-0.31	0.10
Yemen A.R.	21.78	0.0364	1.19	0.14
<u>Ag. Producing</u>				
Jordan	16.72	-0.0080	-5.67*	0.78
Sudan	38.16	0.0677	0.36	0.01
Syria	13.46	-0.0061	-3.78*	0.61
Turkey	47.16	-0.0213	-0.49	0.03
<hr/>				

m = Constant

m₁ = Income Parameters

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 16
Estimated Income Parameters Related
to Life Expectancy

Countries	n	n ₁	t	R ²
<u>Oil Exporting</u>				
Algeria	52.34	0.0022	3.39*	0.56
Libya	43.90	0.0018	3.28*	0.57
S. Arabia	58.19	0.0000	0.03	0.00
<u>Labor Exporting</u>				
Egypt	44.98	0.0248	6.34*	0.82
Morocco	51.79	0.0055	0.25	0.01
Tunisia	88.74	-0.0192	-0.92	0.09
Yemen A.R.	32.50	0.0226	6.19*	0.81
<u>Ag. Producing</u>				
Jordan	47.89	0.0097	6.74*	0.83
Sudan	87.65	-0.0688	-0.53	0.03
Syria	51.32	0.0093	3.28*	0.54
Turkey	59.99	0.0014	0.13	0.00

n = Constant

n₁ = Income Parameter

t = t ratio value

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

for all the eleven countries studied. Algeria, Libya, Egypt, Jordan, Tunisia and Syria show high R squared values and high t values, which means a significant relationship exists between per capita income and crude death rate at a 95% confidence interval.

In Table 14 contains the estimated coefficient for infant mortality rate (IMR). Algeria, Libya, Tunisia, Jordan and Syria had high R squared values of 0.66, 0.51, 0.87, 0.77 and 0.56 respectively. These countries also had high t values, which means that there is a significant and negative relationship between per capita income and infant mortality rate at a 95% confidence interval. However, Saudi Arabia, Egypt, Morocco, Yemen, Sudan and Turkey had exceedingly low R squared values and low t values.

The growth of per capita income had a negative effect on child death rate (ChDR) for all the countries except for Sudan and Yemen, as shown in Table 15. In addition to high t values, Algeria, Libya, Egypt, Jordan and Syria also expressed high R squared values of 0.67, 0.51, 0.62, 0.78 and 0.61, respectively. With high R squared and t values, a significant relationship existed between per capita income and child death rate, which is theoretically compatible with these results.

The results of the estimated coefficients of life expectancy (LE) related to per capita income growth are

presented in Table 16. At a 95% confidence interval Algeria, Libya, Egypt, Yemen, Jordan and Syria had significantly high correlations between income and life expectancy as represented by the t value and R squared results. However, Tunisia and Sudan had a negative coefficient sign value, which is not significant. With low t values and R squared values of zero for Saudi Arabia, Morocco, and Turkey, no statistical relationship between income and life expectancy can be found in the available data.

8.6 Multiple Regression Models

The following regression equations were used to explain the relationship between income and population per physician to life expectancy; income and population per physician to infant mortality rate; income and life expectancy to crude death rate; income and life expectancy to crude birth rate; and income and infant mortality rate to crude birth rate:

$$LE_i = p + p_1Y_i + p_2Pop/Phy_i \quad (14)$$

$$IMR_i = s + s_1Y_i + s_2Pop/Phy_i \quad (15)$$

$$CDR_i = z + z_1Y_i + z_2LE_i \quad (16)$$

$$CBR_i = q + q_1Y_i + q_2LE_i \quad (17)$$

$$CBR_i = v + v_1Y_i + v_2IMR_i \quad (18)$$

p , s , z , q and v are the intercepts of LE , IMR , CDR and CBR .

p_1 , s_1 , z_1 , q_1 and v_1 are the coefficients of per capita

income related to LE, IMR, CDR and CBR. p_2 and s_2 are the coefficients of Pop/Phy related to LE and IMR. z_2 is the coefficient of LE related to CDR. q_2 and v_2 are the coefficients of LE and IMR related to CBR.

On a theoretical basis, the expected signs for the coefficient p_1 should be positive. The coefficients s_1 , z_1 , q_1 and v_1 should be negative. The expected signs for the coefficients p_2 , z_2 and q_2 are negative, however, the coefficients s_2 and v_2 should be positive.

Tables 17, 18, 19, 20 and 21 contain the results of the above equations.

The estimated parameters for income and population per physician related to life expectancy are presented in Table 17. The estimated coefficients of income to life expectancy are significantly different from zero at the 0.05 level in Algeria, Libya and Egypt. The coefficients in these three countries also have positive signs as expected. The effect of population per physician had a negative coefficient value when related to life expectancy in eight of the countries studied. This relationship between population per physician and life expectancy is the same as the expected signs. Jordan and Turkey are the only countries that have coefficients of Pop/Phy related to LE significantly different from zero at the 0.05 level. Saudi Arabia, Morocco and Sudan had very low R squared values and low t

Table 17

Estimated Income and Population per Physician Parameters
Related to Life Expectancy

Countries	p	p ₁	p ₂	R ²
<u>Oil Exporting</u>				
Algeria	48.03	0.0040 (1.71)	0.0000 (0.02)	0.57
Libya	53.73	0.0014 (1.96)*	-0.0082 (-1.13)	0.64
S. Arabia	64.22	0.0002 (0.25)	-0.0047 (-0.90)	0.09
<u>Labor Exporting</u>				
Egypt	41.28	0.0300 (4.40)*	0.0010 (0.94)	0.83
Morocco	51.13	0.0052 (0.23)	0.0001 (0.34)	0.02
Tunisia	140.53	-0.0392 (-1.65)	-0.0069 (-1.48)	0.28
Yemen A.R.	37.17	0.0153 (1.46)	-0.0001 (-0.75)	0.82
<u>Ag. Producing</u>				
Jordan	60.88	0.0024 (0.73)	-0.0014 (-2.40)*	0.92
Sudan	117.55	-0.0650 (-0.49)	-0.0034 (-0.87)	0.11
Syria	59.07	0.0065 (1.44)	-0.0015 (-0.82)	0.58
Turkey	80.97	-0.0014 (-0.90)	-0.0107 (-19.21)*	0.98

p = Constant

p₁ = Income parameter

p₂ = Population per physician parameter

Parentheses indicate t values.

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 18

Estimated Income and Population per Physician Parameters
Related to Infant Mortality Rate

Countries	S	S ₁	S ₂	R ²
<u>Oil Exporting</u>				
Algeria	190.75	-0.0380 (-2.02)*	0.0000 (-0.01)	0.60
Libya	89.82	-0.0004 (-1.43)	0.0499 (2.52)*	0.74
S. Arabia	85.29	-0.0035 (-2.62)*	0.0310 (3.76)*	0.67
<u>Labor Exporting</u>				
Egypt	131.37	-0.0533 (-0.78)	-0.0061 (-0.53)	0.07
Morocco	138.49	-0.0307 (-0.20)	-0.0004 (-0.32)	0.02
Tunisia	165.76	-0.0658 (-5.92)*	0.0024 (1.07)	0.89
Yemen A.R.	368.98	-0.3372 (-2.50)*	-0.0046 (-2.25)*	0.44
<u>Ag. Producing</u>				
Jordan	63.71	-0.0074 (-0.32)	0.0073 (1.77)	0.81
Sudan	91.91	-0.0451 (-0.50)	0.0051 (1.92)*	0.33
Syria	12.50	-0.0039 (-0.44)	0.0230 (6.32)*	0.93
Turkey	23.25	-0.0578 (-1.31)	0.1059 (6.97)*	0.87

S = Constant

S₁ = Income parameter

S₂ = Population per physician parameter

Parentheses indicate t values

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 19

Estimated Income and Life Expectancy Parameters
Related to Crude Death Rate

Countries	z	z ₁	z ₂	R ²
<u>Oil Exporting</u>				
Algeria	53.88	-0.0003 (-0.73)	-0.6884 (-8.23)*	0.96
Libya	17.20	-0.0003 (-1.40)	-0.0403 (-0.40)	0.50
S. Arabia	18.84	-0.0002 (-1.15)	-0.0615 (-0.71)	0.18
<u>Labor Exporting</u>				
Egypt	30.83	-0.0094 (-3.47)*	-0.2501 (-2.52)*	0.96
Morocco	50.10	0.0006 (0.07)	-0.6646 (-5.43)*	0.79
Tunisia	16.43	-0.0042 (-3.17)*	-0.0269 (-1.33)	0.56
Yemen A.R.	72.57	0.0075 (4.52)*	-1.2443 (-18.88)*	0.99
<u>Ag. Producing</u>				
Jordan	54.12	-0.0012 (-0.58)	-0.6966 (-3.64)*	0.92
Sudan	19.24	-0.0080 (-0.52)	0.0276 (0.72)	0.11
Syria	36.16	-0.0040 (-2.73)*	-0.3415 (-2.92)*	0.88
Turkey	40.93	-0.0016 (-1.87)*	-0.4759 (-17.36)*	0.97

z = Constant

z₁ = Income parameter

z₂ = Life expectancy parameter

Parentheses indicate t values

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 20

Estimated Income and Life Expectancy Parameters
Related to Crude Birth Rate

Countries	Q	Q ₁	Q ₂	R ²
<u>Oil Exporting</u>				
Algeria	134.29	0.0040 (2.82)*	-1.680 (-8.32)*	0.96
Libya	49.78	-0.0005 (-1.65)	0.024 (0.18)	0.44
S. Arabia	48.88	-0.0002 (-1.62)	-0.034 (-0.65)	0.27
<u>Labor Exporting</u>				
Egypt	44.29	-0.0150 (-1.66)	-0.010 (-0.03)	0.66
Morocco	149.82	0.0200 (0.78)	-2.210 (-5.24)*	0.78
Tunisia	47.38	-0.0090 (-5.56)*	-0.021 (-0.82)	0.80
Yemen A.R.	70.90	0.0080 (3.34)*	-0.620 (-6.64)*	0.91
<u>Ag. Producing</u>				
Jordan	143.60	0.0110 (0.97)	-1.850 (-1.73)	0.40
Sudan	43.59	0.0020 (0.21)	0.033 (1.45)	0.21
Syria	30.99	-0.0003 (-0.07)	0.242 (0.78)	0.13
Turkey	85.63	-0.0140 (-4.30)*	-0.580 (-5.68)*	0.86

Q = Constant

Q₁ = Income parameter

Q₂ = Life Expectancy parameter

Parentheses indicated t values

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

Table 21

Estimated Income and Infant Mortality Rate Parameters
Related to Crude Birth Rate

Countries	V	V ₁	V ₂	R ²
<u>Oil Exporting</u>				
Algeria	11.43	0.0050 (5.83)*	0.220 (11.99)*	0.96
Libya	32.88	0.0000 (0.31)	0.137 (6.32)*	0.92
S. Arabia	39.82	-0.0001 (-1.73)	0.060 (6.42)*	0.88
<u>Labor Exporting</u>				
Egypt	48.65	-0.0160 (-4.67)*	-0.043 (-1.49)	0.74
Morocco	-9.66	0.0200 (0.75)	0.335 (5.38)*	0.78
Tunisia	22.03	0.0050 (0.11)	0.128 (3.18)*	0.90
Yemen	47.37	-0.0050	0.020	0.50
<u>Ag. Producing</u>				
Jordan	15.36	0.0100 (0.77)	0.030 (1.82)	0.42
Sudan	35.25	0.0030 (0.61)	0.083 (5.38)*	0.78
Syria	24.44	0.0090 (3.02)*	0.150 (3.06)*	0.57
Turkey	37.77	-0.0090 (-4.15)*	0.058 (8.66)*	0.94

V = Constant

V₁ = Income parameter

V₂ = Infant Mortality parameters

Parentheses indicate t values

Number of years (11): 1975-1985

* Significantly different from zero at the 95% confidence interval

statistics values. This means that there is no observable statistical relationship between these variables and life expectancy.

Table 18 contains the estimated parameters for income and population per physician related to the infant mortality rate. Algeria, Saudi Arabia, Tunisia and Yemen had coefficients of income that significantly related to IMR. The coefficients of population per physician related to infant mortality rate were positive for Libya, Saudi Arabia, Tunisia, Jordan, Sudan, Syria and Turkey, which correspond to the expected signs. Libya, Saudi Arabia, Jordan, Sudan, Syria and Turkey have a significant relationship between Pop/Phy and IMR. Yemen, however, showed a significant coefficient but with a negative sign. Egypt and Morocco expressed very low R squared values and t statistics values.

Table 19 contains the coefficients of income and life expectancy related to crude death rate. The coefficients of income related to crude death rate were negative for all the countries, except for Morocco and Yemen. In addition, the coefficient values for life expectancy were negative. This is logical theoretically because as income and life expectancy increase, the crude death rate should decrease. Saudi Arabia and Sudan were the only countries with very low R squared and t statistics values, therefore, their estimated coefficients are not significant related to CDR.

The estimated coefficients of per capita income and life expectancy related to the crude birth rate are shown in Table 20. In Turkey the estimated coefficients of income and life expectancy related to CBR are significant, and are accepted theoretically. These results match the expected signs for both income and LE. Algeria and Yemen had significant positive signs for their income coefficients, which were not expected. These results are due to the fact that Algeria lost approximately one million people in the war with France in the 1960s. In addition, the war caused more than a million people to flee the country, which further depleted the population. This event created an attitude in Algeria that tried to increase the population. Moreover, religious beliefs in Algeria do not allow for contraceptives or abortion, which inhibits a decrease in CBR. Therefore, the increasing crude birth rate in Algeria had a positive relationship with an increase in income.

Yemen has other factors that influence the relationship between income and CBR. The major income source of Yemen is its labor force that works outside the country, predominantly in Saudi Arabia. In addition, Yemen had a civil war in the 1960s that cost thousands of Yemenis' lives. Therefore, it is necessary for the CBR to increase for an increase in income to result. In addition, religious beliefs also exist in Yemen that strongly discourage the use

of birth control. These factors contribute to the positive relationship between income and CBR.

Jordan, Morocco and Sudan had positive coefficient values for income related to crude birth rate, however, they were insignificant. Libya, Saudi Arabia, Egypt, Tunisia and Syria had negative signs for the income coefficient that match the expected values. These values were also insignificant.

The life expectancy coefficients for Algeria, Morocco, Yemen and Turkey are significant, and have the expected negative sign. Libya, Sudan and Syria, however, had positive signs for estimated coefficient of LE related to CBR, but was insignificant. The other countries in this study had estimated coefficients with negative signs, but were insignificant.

Table 21 contains the parameters for per capita income and infant mortality rate related to the crude birth rate. All eleven countries studied exhibited high R squared values ranging from 0.42 to 0.96. The coefficients of income related to CBR were negative in sign and significant for Egypt, Yemen and Turkey. Saudi Arabia also had an insignificant coefficient of income. The coefficients for the other countries had a positive and significant relationship. All countries except for Egypt expressed positive relationships between infant mortality rate and

crude birth rate, which is theoretically acceptable. Egypt and Yemen had negative and positive coefficient signs, respectively, but both were insignificant.

8.7 Conclusion

Soritec Sampler Program was used in this study to estimate the income coefficients for wheat, corn, rice, total grain, egg, beef and poultry consumption. Linear logarithmic single and multiple regression models were utilized to estimate the relationship between the food consumption variables and income growth. Dummy variables were used to account for the difference in the income slope after the oil price shock in 1973 and 1974. Single and multiple regressions were applied to estimate the correlation between an increase in income and the social indicators studied. The results of the analysis, shown in Tables 4 through 21, explain the effect of income on food consumption and social indicators. Most of the relationships discussed are theoretically acceptable.

Chapter 5

Estimated Income Elasticities of Food and Discussion of the Results

9.1 Introduction

One of the objectives of this study was to identify the relationship between income growth and food consumption, and in addition to provide further analyses of the relationships between income and social indicators, such as health and demographic characteristics.

The first section of this chapter shows how income elasticities of demand for wheat, rice, corn and total grain consumption are estimated. The second section shows how to estimate income elasticities for egg, beef, and poultry consumption. The third section discusses the results of the income elasticities of food for oil exporting countries, labor exporting countries and agricultural producing countries. In the fourth section, the relationships between per capita income and social indicators for oil exporting, labor exporting and agricultural producing countries are discussed.

9.2 Estimated Income Elasticities of Wheat, Rice, Corn and Total Grain Consumption

The Methodology chapter contains the models used to estimate the coefficients of wheat, rice, corn and total grain consumption while utilizing the linear logarithmic model, as shown in equations 1 through 4.

The income elasticities of wheat, rice, corn, and total grain consumption are estimated by using the coefficients in Tables 4 through 7 and the estimated dummy variable elasticities related to the food consumption as follows:

$$EaFi = EuFi + EpFi \quad (19)$$

Ea is the adjusted income elasticity after considering the effects of oil price changes on income by using the dummy variable. Eu is the unadjusted income elasticity, which is equal to the income coefficient a_1 , b_1 , r_1 and t_1 of wheat, rice, corn and total grain consumption in equations 1 through 4 (Table 22). Ep is the partial income elasticity related to the changes in oil price after 1974 by using the dummy variables. F is the subscript for crops; i is the subscript for country.

The purpose for using dummy variables in equations 1 through 4 is to estimate the effect of the oil price shock

Table 22

Estimated Unadjusted Income Elasticities of Wheat,
Rice, Corn and Total Grain Consumption

Countries	Wheat	Rice	Corn	Total Grain
<u>Oil Exporting</u>				
Algeria	0.13	0.17	1.83*	0.19
Libya	0.21*	0.34*	NA	0.22*
S. Arabia	0.32*	0.22*	NA	0.29*
<u>Labor Exporting</u>				
Egypt	0.51*	0.11	0.24	0.38
Morocco	-0.10	-2.58	0.24	-0.06
Tunisia	1.53*	NA	3.21*	1.61*
Yemen A.R.	NA	0.72	NA	NA
<u>Ag. Producing</u>				
Jordan	-0.24	1.05*	2.69	0.21
Sudan	-0.39	NA	NA	NA
Syria	0.17	0.33	NA	0.21
Turkey	0.17	0.96*	-0.28*	0.13

NA: Not Available

Sources: Tables 4,5,6 and 7

* Significantly different from zero at 95% confidence interval

after 1973 on the income growth for the eleven countries in this study. Therefore, the estimated elasticities of the dummy variables related to wheat, rice, corn and total grain consumption should be added to the unadjusted income elasticities of wheat, rice, corn and total grain consumption. In this analyses, Egypt, Sudan and Turkey are the only countries that have a significant coefficient of dummy variables related to these crops.

The Soritec program was used to estimate the Ep_w , Epc , Ep_R and Ept . W , C , R , and T represent wheat, corn, rice and total grain consumption respectively, as shown in Table 23 for Egypt, Sudan and Turkey.

Therefore, the estimated adjusted income elasticities of wheat, corn, rice and total grain consumption are calculated by the following equations:

$$EW_i = a_{1i} + Ep_{wi} \quad (20)$$

$$EC_i = b_{1i} + Ep_{ci} \quad (21)$$

$$ER_i = r_{1i} + Ep_{Ri} \quad (22)$$

$$ET_i = t_{1i} + Ep_{Ti} \quad (23)$$

where EW_i , EC_i , ER_i and ET_i are the estimated income elasticities of wheat, corn, rice and total grain consumption, respectively. i is a subscript of the countries. Table 24 contains the estimated income elasticities of these crops after the adjustment.

Table 23

Estimated Partial Income Elasticities Related
to Oil Price of Grain Consumption

Countries	Wheat	Rice	Corn	Total Grain
Egypt	0.01		0.01	0.01
Sudan	0.03			
Turkey		-0.01		

Source: Soritec statistic program output

Note 1: These values are the coefficients of the dummy variables that are multiplied by (\bar{Y}/\bar{Q}) .

Note 2: These are the only countries that have significant coefficients of dummy variables at the 95% confidence interval (see Tables 4, 5, 6 and 7).

Table 24
Estimated Income Elasticities of Food Consumption

Countries	W	R	C	G	E	B	P
<u>Oil Exporting</u>							
Algeria	0.13	0.71	1.83*	0.19	1.92*	2.36*	2.11*
Libya	0.21*	0.34*	NA	0.22*	2.03	2.43*	2.68*
S. Arabia	0.32*	0.22*	NA	0.29*	0.26	1.47*	1.05*
<u>Labor Exporting</u>							
Egypt	0.52*	0.11	0.25*	0.39*	0.58*	0.58	2.11*
Morocco	-0.10	-2.58	0.24	-0.06	-0.10	-1.39	0.55
Tunisia	1.53*	NA	3.21*	1.61*	2.86*	0.38	1.67*
Yemen A.R.	NA	0.72	NA	NA	4.17*	0.40*	6.09*
<u>Ag. Producing</u>							
Jordan	-0.24	1.05*	2.69	0.21	-0.17	7.76*	4.39*
Sudan	0.43*	NA	NA	NA	1.49*	0.64*	1.44*
Syria	0.21	0.33	NA	0.21	2.30*	4.79*	1.79
Turkey	0.17	0.95*	-0.28*	0.13	NA	NA	NA

W = Wheat

C = Corn

R = Rice

G = Total Grain

E = Eggs

B = Beef

P = Poultry

NA: Not Available

Source: Tables 8, 9, 10, 22 and 23

NA: Not Available

* Significantly different from zero at the 95% confidence interval

9.3 Estimated Income Elasticities of Egg, Beef and Poultry Consumption

The data for eggs, beef and poultry were available from 1975 through 1984. Therefore, the dummy variables were not used in this analysis to estimate the parameters of consumption. The linear logarithmic model was used to estimate the income elasticities as shown in equations 5, 6 and 7 in the previous chapter. Therefore, the income elasticities of eggs, beef and poultry consumption are the coefficients e_1 , f_1 and g_1 , respectively, as shown in Table 24.

9.4 Income Elasticities of Food by Type of Country

9.4.1 Oil Exporting Countries

Algeria, Libya and Saudi Arabia have positive income elasticities of wheat, rice, corn and total grain consumption. These signs are theoretically accepted and have the expected signs. In addition, all these income elasticities have values less than one except corn consumption for Algeria which is greater than one. Therefore, these goods have income elasticities less than one and are considered normal goods, i.e., a one percent

increase in real GNP per capita will be associated with less than a one percent increase in quantity consumed.

The income elasticities for egg, beef and poultry consumption of these three countries also have positive values. All these elasticities have values greater than one except Saudi Arabia which has an income elasticity of 0.29 for egg. Egg, beef and poultry are thereby considered superior goods for these countries except egg for Saudi Arabia. Algeria has significant income elasticities for corn, egg, beef and poultry. Libya and Saudi Arabia share significant income elasticities for wheat, rice, beef, poultry and total grain.

9.4.2 Labor Exporting Countries

Estimated income elasticities for wheat, corn, rice, egg, beef, poultry and total grain consumption are positive for all the countries studied, except for Morocco, as shown in Table 24. These positive signs of the elasticities are similar to the expected signs, and are theoretically accepted, which means that the people there demand more food as income increases. Egypt and Tunisia have significant income elasticities for wheat, corn, egg, poultry and total grain consumption. Egypt has estimated income elasticities for poultry greater than one. Concerning the other goods,

Egypt has estimated income elasticities less than one making them normal goods. Yemen has significant income elasticities for egg and poultry consumption. Morocco does not have any significant income elasticities for any of the food consumption included in this study. Tunisia has elasticities greater than one for wheat, corn, total grain, egg and poultry consumption. This means that wheat and corn consumption in Tunisia increased at a faster rate than income because the consumption of these goods may be used indirectly for livestock to produce poultry and egg. Therefore, the estimated elasticities show values greater than one.

9.4.3 Agricultural Producing Countries

Estimated income elasticities of rice, total grain, beef and poultry are positive for all the countries in this study group. These signs are expected and are theoretically correct.

Jordan has negative signs for income elasticities of wheat and eggs, but they are insignificant. Sudan only has a positive and significant estimated income elasticity for wheat consumption. Jordan and Turkey have a positive and significant estimated income elasticity for rice consumption. Their estimations are accepted theoretically

and have the expected signs. Jordan is the only country that has a significant elasticity for corn. Sudan and Syria have a positive and significant income elasticity of beef consumption. They both have values greater than one. Jordan, Sudan and Syria have a positive and significant income elasticities of beef. Estimated income elasticities of poultry are significant and positive for Jordan and Sudan, both have values more than one, which means that these goods are considered to be superior goods.

9.5 Income and Social Indicators Analyses Discussion

9.5.1 Oil Exporting Countries

Algeria and Libya had significant relationship between per capita income and all social indicators as shown in Table 25A. These results were theoretically accepted. Saudi Arabia, however, had insignificant relationship between per capita income and social indicators. From these results, income is a major factor affecting health and changes the social indicators in Algeria and Libya.

The multiple regression analysis results are shown in Tables 25B and C. Income growth has a positive impact on LE for Algeria and Libya, and the infant mortality rate is decreasing when income increases in Algeria and Saudi

Table 25A
Estimated Income Parameters Related to
Social Indicators

Countries	h_1	j_1	k_1	i_1	m_1	n_1
<u>Oil Exporting</u>						
Algeria	-3.36*	-0.0034	-0.0032*	-0.0400*	-0.0074*	0.0022*
Libya	-0.05*	-0.0005*	-0.0004*	-0.0038*	-0.0006*	0.0018*
S. Arabia	0.05	-0.0002	-0.0002	-0.0019	-0.0009	0.0000
<u>Labor Exporting</u>						
Egypt	-4.79*	-0.0148*	-0.0157*	-0.0200	-0.0850*	0.0248*
Morocco	5.25	-0.0092	-0.0031	-0.0325	-0.0143	0.0055
Tunisia	-2.87	-0.0089*	-0.0037	-0.0726*	-0.0038	-0.0192
Yemen	-62.13*	-0.0059*	-0.0207*	-0.0536	0.0364	0.0226*
<u>Ag. Producing</u>						
Jordan	-5.13*	-0.0070	0.0079*	-0.0451*	-0.0080*	0.0097*
Sudan	1.12	-0.0003	-0.0099	-0.0394	0.0677	-0.0688
Syria	-1.83*	0.0020	-0.0072*	-0.0460*	-0.0061*	0.0093*
Turkey	-0.27	-0.0144*	-0.0023	-0.0860	0.0213	0.0014

h_1 , j_1 , k_1 , i_1 , m_1 and n_1 are the estimated coefficients of income related to Pop/Phy, CBR, CDR, IMR, ChDR and LE, respectively.

* Significantly different from zero at the 95% confidence interval

Source: Tables 11, 12, 13, 14, 15 and 16

Table 25B

Estimated Income, Pop/Phy and LE Parameters Related to
LE, IMR and CDR

D.Variables	LE		IMR		CDR	
I.Variables	Income	Pop/Phy	Income	Pop/Phy	Income	LE
Countries	P ₁	P ₂	s ₁	s ₂	z ₁	z ₂
<u>Oil Exporting</u>						
Algeria	0.0040	0.000	-0.038*	0.000	-0.000	0.688*
Libya	0.0014*	-0.008	-0.000	0.050	-0.000	0.040
S. Arabia	0.0002	-0.005	-0.004*	0.031*	-0.000	0.062
<u>Labor Exporting</u>						
Egypt	0.0300*	0.001	-0.053	-0.006	-0.009*	0.250*
Morocco	0.0052	0.000	-0.031	-0.000	-0.001	-0.665*
Tunisia	-0.0392	-0.007	-0.066*	0.002	-0.004*	-0.027
Yemen	0.0153	-0.000	-0.337*	-0.005*	0.008*	-1.244*
<u>Ag. Producing</u>						
Jordan	0.0024	-0.001*	-0.007	0.007*	-0.001	-0.696*
Sudan	0.0650	-0.003	-0.045	0.005*	-0.008	0.028
Syria	0.0065	-0.002	-0.004	0.023*	-0.004*	-0.342*
Turkey	-0.0014	-0.011*	-0.058	0.106*	-0.002*	-0.476*

P₁ and P₂ are the estimated coefficients of income and Pop/Phy related to LE.

s₁ and s₂ are the estimated coefficients of income and Pop/Phy related to IMR.

z₁ and z₂ are the estimated coefficients of income and LE related to CDR.

* Significantly different from zero at the 95% confidence interval

Source: Tables 17, 18 and 19

Table 25C
Estimated Income, LE and IMR Parameters
Related to CBR

D.Variables	CBR		CBR	
I.Variables	Income	LE	Income	IMR
Countries	Q ₁	Q ₂	V ₁	V ₂
<u>Oil Exporting</u>				
Algeria	0.0036*	-1.680	0.0050	0.2200*
Libya	-0.0005	0.2400	0.0000	0.1370*
S. Arabia	-0.0002	-0.0344	-0.0001	0.0600*
<u>Labor Exporting</u>				
Egypt	-0.0150	-0.0100	-0.0160*	-0.0430
Morocco	0.0200	-2.2100*	0.0200	0.3350*
Tunisia	-0.0090	-0.0210	-0.0003	0.1280*
Yemen A.R.	0.0080*	-0.6200*	-0.0050*	0.0200
<u>Ag. Producing</u>				
Jordan	0.0110	-1.8500	0.0100	0.3000*
Sudan	0.0020	0.0330	0.0030	0.0830*
Syria	0.0003	0.2420	0.0090	0.1500*
Turkey	-0.0140*	-0.5800*	-0.0090*	0.0580*

Q₁ and Q₂ are the estimated coefficients of income and LE related to CBR.

V₁ and V₂ are the estimated coefficients of income and IMR related to CBR.

* Significantly different from zero at the 95% confidence interval

Source: Tables 20 and 21

Arabia. Algeria is the only country whose LE had a significant and negative impact on CDR. IMR coefficients in these countries have significant impacts on lower CBR.

9.5.2 Labor Exporting Countries

The estimated coefficients from equations 8 through 13 in Table 25A show that income was an important factor to lower the Pop/phy, CBR, CDR, IMR, and ChDR and improve LE in the labor exporting countries. The income also has a significant impact on decreasing Pop/phy, CBR, CDR and in Egypt, Tunisia and Yemen. At a 95% confidence interval Tunisia and Turkey had significant relationship between income and IMR. Egypt and Turkey had significant relationship between income and LE.

The estimated coefficients of equations 14-18 are shown in Tables 25B and C. Egypt, Morocco and Yemen showed income had significant impact on LE. CDR is decreasing by the impact of income growth and improvement of LE in Egypt and Tunisia. LE has a negative impact on CDR in Morocco. Income and Pop/phy are important to lower the IMR in Yemen. LE has a negative impact on CBR in Morocco and Yemen. The CBR of Morocco and Tunisia declined when IMR went down and vice versa.

9.5.3 Agricultural Producing Countries

The coefficients of the equations 8 through 13 are shown in Table 25A. Income has a positive impact to lower the Pop/phy, IMR, ChDR and improve LE in Jordan and Syria. CDR declines when income goes up in Syria.

The coefficients of the multiple regression equations are shown in Table 25B and C. Declining Pop/phy has a significant impact to improve LE and decline IMR in Jordan and Turkey. Pop/phy has a positive relationship with IMR for all four countries. Thus, Pop/phy decreases when these countries hire more physicians, therefore, IMR decreases. Income and LE are significantly decreasing the CDR in Syria and Turkey. LE in Jordan is an important factor to lower the CDR, these relationships are theoretically accepted.

Income, LE and IMR are significantly affected to decline CBR in Turkey. IMR has a positive impact on CBR in all four countries. There are some countries that show insignificant relationships between income and CBR. The reasons behind this result is derived from religious beliefs, which prohibits birth control (refer to chapter 4: Algeria and Yemen).

9.6 Conclusion

The results of this chapter show that increases in income have a significant effect on food consumption in all eleven countries and at the time studied. These trends appeared very clearly in the empirical results of all goods consumption. Most of these results are significant.

Income elasticities for demand of eggs, beef and poultry are higher than the income elasticities for demand of wheat, rice, corn and total grain in most of the eleven countries in this study.

The consumption for food was higher in oil exporting countries and labor exporting countries than agricultural producing countries especially with regard to grain consumption. All three groups had a high consumption for egg, beef and poultry and most of the income elasticities of these goods had a value more than one and higher than the income elasticities of wheat, corn, rice and total grain.

The results of the analysis of income effects on social indicators showed that growth in income also has a significant correlation with a decreasing rate of physician per population and decreasing crude birth rates, crude death rates, infant mortality rates and child death rates in most of the eleven countries. Income growth has a positive effect on life expectancy in most of the countries studied,

especially oil exporting countries. The results show that Moroccan statistics reveal no significant relationship between income and food consumption and most social indicators, which is probably due to relatively poor data, because all the analyses for grain consumption, meat consumption and most of the social indicators were not significantly related to income growth.

Chapter 6

Conclusion and Recommendation

Theoretically, human consumption of food is related to income. As per capita income rises from a relatively low level, food consumption will increase up to a certain level of income and remain relatively stable or decrease with further increases in income depending upon the food source. This is a phenomenon known as Engel's Law. From the income elasticities definition, the sign and the magnitude of the income elasticities can be used to classify goods with respect to their income relationships.

The results of this study show a positive association between per capita income and food consumption. Wheat, corn, rice and total grain consumption are normal goods in most of the Middle Eastern countries in this study, because the income elasticity is positive and less than one.

The results of per capita egg, beef and poultry consumption related to per capita income show that the income elasticities are positive and greater than one in most of the eleven countries. Therefore, these goods are superior goods. This means the demand for these goods increases in higher proportion than the proportion in the increases of income. In addition, some of the grain goods

are shown to be superior goods.

From these results that Middle Eastern people are still below the satisfaction level and demand more food when their income increases. The results of the analysis showed that the income had a significant impact on health indicators and demographic characteristics in oil exporting, labor exporting and agricultural producing countries. With an increase in income health care improved and food consumption increased in both quality and quantity. This caused the death rate to decrease, life expectancy to increase and infant mortality rate to decrease in most of the countries.

Oil exporting countries share the same results in most of the analysis, especially the social indicator analysis. Labor exporting and agricultural producing countries are shown to have similar signs of income elasticities of foods except Morocco and Jordan. In general the results of this study showed that income was a very important factor in improving the nutrition and health status in the region.

10.1 Recommendations

1- In order for policy makers to make appropriate decisions for improving economic and social conditions, scientific studies need to be initiated pertaining to each country group in rural and urban areas to establish a more

precise estimation of the relationships between income, nutritional status, health condition and social indicators.

2- Instead of agricultural self sufficient policies in most of the Middle East countries, higher priority should be allocated to comparative advantage theory to utilize the available resources efficiently.

3- From the results of this study, it appears that Middle East policy makers need to emphasize increasing egg, meat and poultry production, which can be achieved within a short term. In addition, price policies, transportation, storage and infrastructures should be assigned high priority.

Appendix Table 1

Gross National Product (GNP) per Capita, Selected
Middle Eastern Countries, 1967-87 (US\$ 1980)

Year	Algeria	Egypt	Jordan	Libya	Morocco	S. A.
1967	690	310	NA	1110	640	490
1968	710	320	NA	1510	680	500
1969	760	340	NA	1840	710	530
1970	840	350	1030	1890	720	570
1971	940	350	980	1860	750	680
1972	1080	340	1010	1990	730	830
1973	1120	350	960	2440	740	980
1974	1560	350	950	3170	790	1710
1975	1490	350	1010	4560	810	2880
1976	1610	390	1180	6770	850	5520
1977	1690	430	1230	6630	870	7200
1978	1720	430	1370	6840	870	7760
1979	1970	470	1360	8300	890	8680
1980	2200	510	1500	9550	890	10510
1981	2340	510	1490	9150	820	14360
1982	2320	540	2600	9170	860	15540
1983	2380	560	1540	8550	860	12960
1984	2370	580	1580	7240	850	10460
1985	2440	580	1560	6610	850	8630
1986	2070	570	1680	5550	920	6950
1987	2050	540	1520	5500	900	NA

NA: Not Available

Appendix Table 1 (cont.)

Gross National Product (GNP) per Capita, Selected
Middle Eastern Countries, 1967-87 (US\$ 1980)

Year	Sudan	Syria	Tunisia	Turkey	Yemen
1967	350	580	690	930	NA
1968	350	590	730	960	NA
1969	330	690	740	990	NA
1970	330	610	790	1020	220
1971	340	690	840	1070	260
1972	320	760	980	1130	280
1973	280	740	950	1160	310
1974	300	1090	1070	1200	320
1975	330	1270	1100	1250	330
1976	380	1320	1090	1340	360
1977	430	1250	1100	1360	380
1978	410	1310	1160	1370	410
1979	360	1390	1240	1320	430
1980	350	1490	1340	1260	430
1981	340	1610	1380	1260	430
1982	360	1570	1350	1270	550
1983	360	1530	1380	1280	540
1984	330	1440	1410	1340	540
1985	290	1440	1410	1380	550
1986	280	1330	1300	1480	580
1987	280	1160	1340	1550	590

NA: Not Available

Source: The World Bank. World Bank Atlas. Baltimore: John Hopkins University Press, 1988-1989.

Appendix Table 2

Population in Selected Middle Eastern Countries,
1960 - 1985
(millions)

Year	Algeria	Egypt	Jordan	Libya	Morocco	S. Arabia
1960	10.80	25.92	1.67	1.35	11.64	4.79
1961	11.03	26.58	1.70	1.40	11.97	4.90
1962	10.92	27.26	1.76	1.45	12.25	5.02
1963	11.21	27.95	1.82	1.50	12.50	5.14
1964	11.68	28.66	1.87	1.56	12.73	5.27
1965	11.92	29.39	1.91	1.62	13.02	5.41
1966	12.66	30.14	1.97	1.69	13.37	5.55
1967	13.00	30.91	2.04	1.76	13.70	5.70
1968	13.50	31.69	2.10	1.84	14.20	5.86
1969	13.91	32.50	2.19	1.91	14.80	6.03
1970	14.33	33.33	2.30	1.98	15.31	6.20
1971	14.77	34.08	2.38	2.07	15.38	6.38
1972	15.27	34.84	2.46	2.15	15.70	6.57
1973	15.77	35.62	2.54	2.24	16.31	6.76
1974	16.28	36.42	2.62	2.33	16.80	6.97
1975	16.78	37.23	2.70	2.43	17.31	7.25
1976	17.30	37.87	2.78	2.56	17.83	7.62
1977	17.91	38.79	2.71	2.67	18.36	8.06
1978	17.58	39.82	2.77	2.79	18.91	8.49
1979	18.19	40.98	2.84	2.91	19.47	8.93
1980	18.67	42.29	2.92	3.04	20.05	9.37
1981	19.25	43.47	3.02	3.18	20.65	9.81
1982	19.86	44.67	3.13	3.33	20.41	10.25
1983	20.25	45.92	3.25	3.47	20.96	10.68
1984	21.04	47.19	3.38	3.62	21.54	11.13
1985	21.85	48.50	3.51	3.79	22.12	11.59

Appendix Table 2 (cont.)

Population in Selected Middle Eastern Countries,
1960 - 1985
(millions)

Year	Sudan	Syria	Tunisa	Turkey	Yemen
1960	11.85	4.56	4.16	27.51	4.01
1961	12.20	4.69	4.26	28.24	4.13
1962	12.57	4.84	4.35	28.93	4.22
1963	12.94	4.99	4.44	29.66	4.32
1964	13.08	5.12	4.53	30.39	4.41
1965	13.30	5.33	4.62	31.37	4.49
1966	13.48	5.50	4.72	32.02	4.57
1967	13.60	5.68	4.82	32.60	4.64
1968	13.67	5.87	4.92	33.59	4.70
1969	13.75	6.06	5.03	34.44	4.77
1970	14.09	6.26	5.13	35.32	4.84
1971	14.44	6.48	5.20	36.22	4.91
1972	14.81	6.71	5.28	37.13	4.99
1973	14.96	6.94	5.33	38.07	5.08
1974	15.34	7.19	5.46	39.04	5.18
1975	15.73	7.44	5.61	40.09	5.28
1976	16.13	7.72	5.77	40.92	5.38
1977	16.95	8.02	5.93	41.77	5.53
1978	17.56	8.15	6.08	42.64	5.68
1979	18.13	8.42	6.22	43.53	5.84
1980	18.68	8.70	6.39	44.44	5.99
1981	19.28	9.00	6.57	45.37	6.16
1982	19.89	9.30	6.70	46.31	6.33
1983	20.53	9.61	6.84	47.28	6.51
1984	21.17	9.93	7.03	48.27	6.69
1985	21.82	10.27	7.26	49.27	6.89

Source: International Financial Statistics, Yearbook 1988,
International Monetary Fund.

Appendix Table 3

Grain Consumption in Selected Middle Eastern Countries,
1960 - 1980 (1000 MT)

Year	Algeria			Egypt		
	Wheat	Corn	Rice	Wheat	Corn	Rice
1960	1748	8	9	2490	1745	621
1961	1358	12	6	3139	2032	985
1962	1778	14	8	3308	2185	960
1963	1745	1	8	3407	2301	1034
1964	1426	9	5	3465	2154	852
1965	1723	5	6	3595	2378	690
1966	1539	5	5	2934	2486	957
1967	1915	13	5	4059	2435	951
1968	2234	15	8	3466	2315	1059
1969	1601	15	7	3497	2432	1230
1970	2081	22	13	4046	2473	1340
1971	2202	26	18	4399	2390	1382
1972	2302	26	17	4656	2547	1388
1973	2505	24	6	4987	2950	1399
1974	2500	25	7	5190	3010	1413
1975	2633	109	7	5733	3248	1325
1976	3139	129	15	5793	3480	1379
1977	3200	165	11	6049	3345	1480
1978	3000	230	25	7052	3659	1504
1979	3000	230	11	7170	3732	1463
1980	3150	260	11	7476	4100	1478

Appendix Table 3 (cont.)

Grain Consumption in Selected Middle Eastern Countries,
1960 - 1980 (1000 MT)

Year	Jordan			Libya	
	Wheat	Corn	Rice	Wheat	Rice
1960	225	2	24	137	10
1961	303	2	18	120	7
1962	307	79	23	162	8
1963	278	5	21	153	10
1964	352	12	26	171	12
1965	389	12	25	206	17
1966	309	28	23	215	16
1967	293	NA	18	246	12
1968	312	4	19	267	23
1969	273	23	19	286	19
1970	230	20	26	255	23
1971	322	21	25	242	16
1972	344	30	18	320	46
1973	347	35	20	348	33
1974	425	28	20	370	40
1975	315	45	22	551	27
1976	323	53	24	546	56
1977	350	69	24	610	34
1978	360	96	30	563	55
1979	370	101	33	640	45
1980	380	116	35	720	45

NA: Not Available

Appendix Table 3 (cont.)

Grain Consumption in Selected Middle Eastern Countries,
1960 - 1980 (1000 MT)

Year	Morocco			S. Arabia	
	Wheat	Corn	Rice	Wheat	Rice
1960	1041	281	8	264	87
1961	1260	94	9	238	143
1962	1352	277	8	293	121
1963	1519	326	13	292	101
1964	1519	265	13	315	144
1965	1731	209	13	348	144
1966	2152	185	11	389	127
1967	2087	234	16	332	126
1968	2729	392	31	270	153
1969	2351	423	25	440	153
1970	2519	340	7	470	205
1971	2806	401	11	560	127
1972	2262	398	8	460	133
1973	2654	250	19	467	139
1974	2788	421	18	550	222
1975	2679	370	12	546	259
1976	3122	402	16	710	257
1977	3146	356	21	770	406
1978	3399	446	13	900	498
1979	2407	418	18	1200	477
1980	3411	473	23	1300	480

Appendix Table 3 (cont.)

Grain Consumption in Selected Middle Eastern Countries,
1960 - 1980 (1000 MT)

Year	Sudan	Syria		
	Wheat	Wheat	Corn	Rice
1960	124	998	NA	27
1961	103	947	NA	36
1962	130	1128	NA	22
1963	147	1076	NA	36
1964	254	926	NA	30
1965	204	1106	NA	33
1966	278	904	NA	37
1967	293	1332	NA	41
1968	252	793	NA	40
1969	242	1254	NA	44
1970	359	1237	NA	44
1971	431	1260	NA	53
1972	256	1265	NA	60
1973	379	1325	NA	66
1974	412	1514	NA	82
1975	385	1615	55	58
1976	535	1805	80	50
1977	547	2500	99	116
1978	570	1950	179	91
1979	550	2000	225	70
1980	580	2100	340	100

NA: Not Available

Appendex Table 3 (cont.)

Grain Consumption in Selected Middle Eastern
Countries, 1960- 1980 (1000MT)

Year	Tunisia		Turkey		Rice
	Wheat	Corn	Wheat	Corn	
1960	600	15	7010	760	130
1961	601	46	7517	1005	165
1962	510	NA	7354	795	128
1963	527	2	7494	1020	102
1964	496	13	7703	980	143
1965	672	17	7959	837	139
1966	511	36	8210	1000	140
1967	691	18	8890	1001	137
1968	690	4	8916	1036	136
1969	784	16	7351	1040	155
1970	631	12	9198	1065	175
1971	939	14	9642	1100	181
1972	1208	25	9866	1075	198
1973	1070	17	9300	1045	207
1974	890	17	9450	1180	205
1975	1273	93	10020	1190	178
1976	1450	63	10640	1240	184
1977	1298	120	11457	1265	200
1978	1390	131	11777	1300	235
1979	1460	151	12244	1298	222
1980	1400	161	12500	1297	230

NA: Not Available

Appendix Table 3 (cont.)

Grain Consumption in Selected Middle Eastern
Countries, 1960-1980(1000MT)

Yemen Arab Rep.

Year	Wheat	Corn	Rice
1960	NA	NA	3
1961	NA	NA	3
1962	NA	NA	3
1963	NA	NA	4
1964	NA	NA	4
1965	NA	NA	4
1966	NA	NA	4
1967	NA	NA	4
1968	NA	NA	4
1969	NA	NA	5
1970	NA	NA	6
1971	NA	NA	9
1972	NA	NA	2
1973	NA	NA	4
1974	NA	NA	6
1975	313	107	7
1976	433	72	5
1977	405	111	9
1978	480	54	9
1979	475	60	9
1980	480	80	30

NA: Note Available

Source: USDA, Foreign Agricultural Service, Foreign
Agricultural Circular, Grain, Washington D.C.1981.

Appendix Table 4

Food Consumption in Selected Middle Eastern Countries,
1975-1984
Kg/Capita/Year

Countries	1975	1976	1977	1978	1979
Algeria					
Egg	1.10	2.18	2.18	2.40	3.50
Beef	1.72	2.01	2.01	1.95	2.60
Poultry	2.14	2.23	2.23	2.28	2.10
Egypt					
Egg	1.85	2.02	2.02	1.92	2.20
Beef	6.47	4.16	4.16	4.25	3.90
Poultry	2.39	2.42	2.42	2.45	4.10
Jordan					
Egg	4.51	3.85	3.85	3.68	NA
Beef	0.37	0.35	0.35	0.34	NA
Poultry	2.35	2.95	2.95	2.47	NA
Libya					
Egg	1.63	1.40	1.40	1.46	NA
Beef	3.23	7.96	7.96	1.38	NA
Poultry	1.63	2.27	2.27	2.56	NA
Morocco					
Egg	3.35	3.28	3.28	3.24	NA
Beef	5.26	4.22	4.22	4.31	NA
Poultry	2.19	2.74	2.74	2.73	NA
S. Arabia					
Egg	NA	3.18	3.18	2.96	NA
Beef	0.90	1.78	1.78	2.45	NA
Poultry	5.53	9.13	9.13	14.69	NA

NA: Not Available

Appendix Table 4 (cont.)

Food Consumption in Selected Middle Eastern Countries,
1975-1984
Kg/Capita/Year

Countries	1980	1981	1982	1983	1984
Algeria					
Egg	3.90	3.80	3.60	3.60	3.50
Beef	4.10	4.20	3.90	5.20	5.50
Poultry	4.90	5.30	4.40	5.40	4.40
Egypt					
Egg	2.20	2.30	2.10	2.10	3.00
Beef	4.60	5.60	5.20	8.40	6.50
Poultry	3.80	4.50	5.50	5.50	5.70
Jordan					
Egg	3.70	3.30	3.20	3.00	7.20
Beef	6.30	6.30	6.80	5.30	3.20
Poultry	9.40	7.10	14.20	14.20	13.40
Libya					
Egg	5.30	5.20	7.10	7.10	6.50
Beef	16.50	13.80	17.40	17.80	15.50
Poultry	8.70	8.70	11.40	11.40	12.20
Morocco					
Egg	3.90	3.80	3.60	3.60	3.50
Beef	4.10	4.20	3.90	5.20	5.50
Poultry	4.90	5.30	4.40	5.40	4.40
S. Arabia					
Egg	4.50	3.80	3.90	3.90	10.50
Beef	7.00	7.10	7.20	8.70	7.10
Poultry	26.70	22.90	23.60	28.20	32.90

Appendix Table 4 (cont.)

Food Consumption in Selected Middle Eastern Countries,
1975-1984
Kg/Capita/Year

Countries	1975	1976	1977	1978	1979
Sudan					
Egg	1.25	1.29	1.29	1.28	NA
Beef	9.58	9.59	9.59	9.58	NA
Poultry	0.76	0.76	0.76	0.79	NA
Syria					
Egg	4.74	5.14	5.14	5.18	NA
Beef	1.63	1.78	1.78	1.80	NA
Poultry	2.66	6.51	6.25	3.83	NA
Tunisia					
Egg	3.15	3.22	3.22	3.90	NA
Beef	4.52	5.93	5.93	5.17	NA
Poultry	4.27	4.11	4.11	5.06	6.00
Yemen A.R.					
Egg	0.41	0.62	0.62	1.40	2.70
Beef	2.11	1.97	1.97	1.64	2.40
Poultry	0.31	0.71	0.71	4.99	8.30

NA: Not Available

Appendix Table 4 (cont.)

Food Consumption in Selected Middle Eastern Countries,
1975-1984
Kg/Capita/Year

Countries	1980	1981	1982	1983	1984
Sudan					
Egg	1.80	1.80	1.90	NA	2.00
Beef	11.10	11.30	11.30	10.90	11.60
Poultry	1.10	1.10	1.20	1.20	1.20
Syria					
Egg	7.80	7.40	8.00	8.00	9.60
Beef	3.10	3.10	5.10	6.40	8.00
Poultry	5.60	5.10	7.40	7.40	8.40
Tunisia					
Egg	5.40	5.40	6.20	6.20	7.10
Beef	4.80	5.10	4.90	5.70	8.40
Poultry	6.60	5.90	8.00	5.20	6.10
Yemen A.R.					
Egg	3.70	3.60	3.60	3.60	3.10
Beef	2.00	2.00	2.40	2.40	2.30
Poultry	9.70	8.60	9.10	9.10	7.20

NA: Not Available

Source: International Marketing Data and Statistics. 1978-1985.

Note: There is no data available of Turkey.

Appendix Table 5

Social Indicators, Selected Middle Eastern Countries, 1960-1985

Countries	1960	1965	1970	1975	1976	1977	1978
Algeria							
CBR	50.4	50.0	48.1	47.7	47.5	47.4	47.5
CDR	22.9	19.8	16.7	14.9	14.6	14.3	14.1
IMR	165.0	155.0	144.0	131.7	129.1	126.6	123.8
ChDR	38.8	34.4	29.7	24.7	23.6	22.6	21.5
LE	47.0	49.9	52.7	54.6	54.9	55.2	55.5
Pop/Phy	5530.0	8400.0	7870.0	6910.0	4750.0	5330.0	3200.0
Egypt							
CBR	43.5	41.7	38.5	37.8	38.0	38.4	38.2
CDR	19.0	17.0	15.1	13.6	13.4	13.1	12.8
IMR	128.0	NA	NA	101.0	NA	110.0	85.0
ChDR	34.0	21.0	NA	39.0	NA	16.4	15.0
LE	46.1	48.8	51.3	54.3	54.9	55.6	56.0
Pop/Phy	2550.0	2260.0	1900.0	2340.0	1180.0	1090.0	1120.0
Jordan							
CBR	49.0	48.0	47.6	47.0	47.0	46.9	46.8
CDR	19.9	17.5	15.5	12.6	11.8	10.9	10.3
IMR	157.5	117.0	97.5	81.1	78.7	76.7	73.9
ChDR	26.3	19.1	12.5	8.0	7.5	7.0	6.6
LE	46.6	49.9	54.1	58.3	59.0	59.8	60.3
Pop/Phy	5800.0	4670.0	3780.0	3630.0	3140.0	2700.0	2690.0
Libya							
CBR	49.0	49.5	50.7	48.9	48.3	47.7	47.3
CDR	19.3	17.3	15.6	13.7	13.3	12.9	12.6
IMR	157.5	142.5	128.1	114.1	111.2	108.3	105.6
ChDR	35.5	29.1	23.3	17.9	16.9	15.8	14.9
LE	46.6	49.1	51.7	54.1	54.6	55.1	
55.6							
Pop/Phy	6580.0	3970.0	2710.0	940.0	990.0	900.0	610.0
Morocco							
CBR	51.8	50.0	47.4	46.2	45.9	45.6	45.5
CDR	23.4	20.3	17.2	14.7	14.3	13.8	13.5
IMR	160.5	148.6	136.4	122.0	119.0	115.9	113.0
ChDR	36.8	31.6	26.6	20.9	19.7	18.6	17.5
LE	46.7	49.2	51.7	54.1	54.6	55.1	55.6
Pop/Phy	9410.0	12010.0	12810.0	13860.0	11040.0	22890.0	19340.0
S. Arabia							
CBR	48.9	48.5	47.9	46.8	46.4	46.1	45.8
CDR	22.5	20.3	18.1	15.7	15.2	14.7	14.3
IMR	184.5	164.0	145.5	129.0	125.8	122.7	119.6
ChDR	47.7	38.4	30.3	23.6	22.4	21.1	20.0
LE	43.0	45.7	48.5	51.5	52.1	52.7	53.2
Pop/Phy	16370.0	9400.0	7460.0	2010.0	1820.0	1700.0	1640.0

Appendix Table 5 (cont.)

Social Indicators, Selected Middle Eastern Countries, 1960-1985

Countries	1979	1980	1981	1982	1983	1984	1985
Algeria							
CBR	47.7	47.9	48.1	47.5	47.0	42.0	41.0
CDR	13.8	13.6	13.4	13.2	13.0	11.0	10.0
IMR	120.6	117.6	114.5	111.0	107.0	82.0	85.0
ChDR	20.4	19.2	18.0	17.0	NA	8.0	8.0
LE	55.8	56.1	56.4	56.5	57.0	60.5	60.0
Pop/Phy	3620.0	NA	3100.0	2560.0	2606.0	2606.0	NA
Egypt							
CBR	37.4	36.6	35.7	35.1	34.0	36.0	36.0
CDR	12.5	12.1	11.7	11.3	11.0	10.0	10.0
IMR	NA	103.0	110.0	105.0	102.0	94.0	94.0
ChDR	NA	14.0	16.0	13.0	12.0	11.0	11.0
LE	56.3	56.6	56.9	57.3	57.5	60.5	58.0
Pop/Phy	2840.0	970.0	760.0	760.0	770.0	761.0	NA
Jordan							
CBR	46.7	46.6	46.5	45.7	45.0	46.0	39.0
CDR	9.8	9.4	9.0	8.5	8.0	8.0	7.0
IMR	71.6	69.3	66.9	64.4	62.0	50.0	53.0
ChDR	6.2	5.8	5.4	5.1	NA	3.0	3.0
LE	60.8	61.3	61.7	63.2	64.0	64.0	64.0
Pop/Phy	2840.0	1890.0	1200.0	940.0	900.0	890.0	NA
Libya							
CBR	47.2	47.1	47.0	46.0	45.0	46.0	45.0
CDR	12.3	12.1	11.9	11.5	11.0	11.0	10.0
IMR	102.9	100.2	97.5	93.2	91.0	91.0	84.0
ChDR	14.0	13.1	12.2	NA	NA	10.0	10.0
LE	56.0	50.5	65.9	60.3	57.5	59.0	59.0
Pop/Phy	830.0	730.0	620.0	640.0	630.0	650.0	650.0
Morocco							
CBR	45.8	46.0	46.2	43.2	40.0	36.0	36.0
CDR	13.2	12.9	12.5	13.0	11.0	11.0	11.0
IMR	110.1	107.2	104.3	101.2	91.0	91.0	90.0
ChDR	16.5	15.5	14.5	NA	NA	10.0	10.0
LE	56.0	56.5	56.9	57.1	57.5	59.0	59.0
Pop/Phy	11200.0	NA	18600.0	16700.0	16300.0	16150.0	16150.0
S. Arabia							
CBR	45.7	45.6	45.5	44.2	43.0	43.0	42.0
CDR	14.0	13.8	13.5	13.5	12.0	9.0	8.0
IMR	116.7	113.8	110.9	109.2	101.0	61.0	61.0
ChDR	18.9	17.9	16.8	13.0	NA	4.0	4.0
LE	53.7	54.1	54.6	NA	56.5	62.0	62.0
Pop/Phy	1710.0	1740.0	1800.0	1660.0	1680.0	760.0	NA

NA: Not Available

Appendix Table 5 (cont.)

Social Indicators, Selected Middle Eastern Countries, 1960-1985

Countries	1960	1965	1970	1975	1976	1977	1978
Sudan							
CBR	46.5	46.6	46.7	47.0	47.0	47.1	47.0
CDR	24.5	23.5	22.1	20.3	19.9	19.6	19.3
IMR	168.0	160.0	150.4	138.0	135.2	129.8	127.1
ChDR	40.1	36.6	32.4	27.2	26.1	25.0	23.9
LE	39.0	40.5	41.8	43.9	44.5	45.0	45.5
Pop/Phy	33420.0	23670.0	14060.0	11440.0	10010.0	8780.0	8350.0
Syria							
CBR	47.0	47.5	46.5	45.9	46.1	46.3	46.5
CDR	17.7	16.0	13.5	10.3	9.7	9.2	8.7
IMR	132.0	115.5	96.0	76.1	72.5	69.0	66.2
ChDR	24.8	18.5	12.1	7.1	5.4	5.7	5.2
LE	49.7	53.0	57.3	62.0	63.0	63.9	64.5
Pop/Phy	4630.0	NA	3860.0	3100.0	2730.0	2570.0	2530.0
Tunisia							
CBR	48.9	46.1	40.6	36.0	35.6	35.2	34.9
CDR	21.0	17.7	14.6	11.2	10.3	9.4	9.0
IMR	158.9	144.9	131.3	110.3	104.6	98.9	94.9
ChDR	36.1	30.1	24.5	16.7	14.6	12.5	11.2
LE	48.1	51.2	54.2	57.2	57.9	58.7	59.2
Pop/Phy	10030.0	8040.0	5930.0	4630.0	4810.0	3580.0	4010.0
Turkey							
CBR	43.1	41.2	37.9	33.6	33.0	32.5	32.3
CDR	15.8	14.4	12.2	10.4	10.2	10.1	9.9
IMR	189.5	165.5	147.5	135.5	133.7	131.9	129.3
ChDR	50.0	39.1	31.2	26.2	25.5	24.8	23.8
LE	50.5	53.0	56.6	59.7	60.0	60.3	60.8
Pop/Phy	2800.0	2860.0	2230.0	1850.0	1750.0	1760.0	1690.0
Yemen A.R.							
CBR	49.7	49.0	48.8	48.7	48.6	48.6	48.6
CDR	28.9	27.4	26.5	25.2	24.8	24.3	23.9
IMR	211.6	NA	NA	160.0	NA	NA	NA
ChDR	60.0	NA	NA	NA	NA	31.0	31.0
LE	35.8	37.2	38.5	40.2	40.6	41.1	41.5
Pop/Phy	13090.0	8240.0	NA	20590.0	17090.0	16140.0	14810.0

NA: Not Available

Appendix Table 5 (cont.)

Social Indicators, Selected Middle Eastern Countries, 1960-1985

Countries	1979	1980	1981	1982	1983	1984	1985
Sudan							
CBR	46.9	46.8	46.6	46.3	46.0	45.0	45.0
CDR	19.0	18.7	18.4	17.6	17.0	17.0	17.0
IMR	127.1	124.5	121.8	119.2	117.0	113.0	112.0
ChDR	22.9	21.9	20.8	20.1	NA	18.0	18.0
LE	45.8	46.2	46.6	47.2	48.0	48.0	48.0
Pop/Phy	8380.0	8800.0	9800.0	8420.0	8800.0	8960.0	8960.0
Syria							
CBR	46.8	47.1	47.5	47.2	46.0	45.0	44.0
CDR	8.4	8.1	7.7	7.3	7.0	8.0	8.0
IMR	64.1	62.0	59.9	58.5	56.0	55.0	54.0
ChDR	4.9	4.6	4.3	4.1	NA	4.0	4.0
LE	64.8	65.0	65.3	66.8	67.5	63.5	64.0
Pop/Phy	2462.0	2310.0	2240.0	2250.0	2180.0	2170.0	NA
Tunisia							
CBR	34.6	34.4	34.2	34.0	33.0	32.0	32.0
CDR	9.0	9.1	9.1	9.0	9.0	9.0	9.0
IMR	92.4	90.0	87.6	86.2	83.0	79.0	78.0
ChDR	10.5	9.8	9.1	8.9	NA	8.0	8.0
LE	59.7	60.2	60.6	60.7	61.5	62.0	62.0
Pop/Phy	3580.0	3690.0	3900.0	3700.0	2180.0	3710.0	3710.0
Turkey							
CBR	32.6	32.9	33.2	NA	NA	NA	30.0
CDR	9.7	9.5	9.2	NA	NA	NA	8.0
IMR	126.0	122.6	119.2	NA	NA	NA	84.0
ChDR	22.5	21.2	19.9	NA	NA	9.0	9.0
LE	61.3	61.8	62.4	NA	NA	NA	64.0
Pop/Phy	1660.0	1630.0	1530.0	1520.0	1500.0	1450.0	NA
Yemen A.R.							
CBR	48.5	48.5	48.5	48.2	48.0	46.0	48.0
CDR	23.5	23.2	22.8	22.5	22.0	18.0	21.0
IMR	NA	190.0	190.0	169.3	152.0	146.0	154.0
ChDR	41.0	50.0	50.0	45.3	NA	35.0	34.0
LE	41.8	42.2	42.6	43.5	44.0	47.0	45.0
Pop/Phy	13320.0	11670.0	7100.0	6200.0	6480.0	5600.0	NA

NA: Not Available

CBR: Crude Birth Rate (per thousand population)

CDR: Crude Death Rate (per thousand population)

IMR: Infant Mortality Rate (per thousand population)

ChDR: Child (1-4 years) Death Rate (per thousand population)

LE: Life Expectancy (years)

Pop/Phy: Population per Physician

Sources: World Bank. World Development Report. 1985World Bank. World Tables, Social Data. Vol11, 1985.

Appendix Table 6

Public Expenditures on Education, Military and Health,
Selected Middle Eastern Countries, 1973-1984
Per Capita (US\$)

Countries	1973	1974	1978	1979	1980	1984
Algeria						
Education	43	50	115	131	171	117
Military	9	17	36	33	37	45
Health	7	9	18	22	21	35
Egypt						
Education	11	15	28	19	25	31
Military	48	56	91	46	44	61
Health	6	7	9	7	39	9
Jordan						
Education	9	18	31	53	69	126
Military	54	54	87	120	144	226
Health	4	5	10	19	27	28
Libya						
Education	186	185	387	358	399	293
Military	46	174	156	171	167	1020
Health	60	103	80	105	132	105
Morocco						
Education	19	18	41	49	53	43
Military	10	12	42	44	53	34
Health	5	5	8	8	10	6
S. Arabia						
Education	56	175	504	521	680	753
Military	139	282	1004	1837	1862	2091
Health	15	38	137	123	103	486
Sudan						
Education	6	11	4	18	20	19
Military	7	6	14	81	11	13
Health	1	2	3	3	1	1
Syria						
Education	14	18	55	69	73	74
Military	56	76	147	238	256	274
Health	2	3	4	5	5	7

Appendix Table 6 (cont.)

Public Expenditures on Education, Military and Health,
Selected Middle Eastern Countries, 1973-1984
Per Capita (US\$)

Countries	1973	1974	1978	1979	1980	1984
Tunisia						
Education	28	34	58	67	73	74
Military	7	8	30	9	52	71
Health	10	11	24	25	30	33
Turkey						
Education	16	NA	44	48	NA	37
Military	23	NA	64	57	NA	64
Health	8	NA	10	11	NA	10
Yemen A.R.						
Education	1	1	10	18	19	49
Military	3	5	52	68	72	124
Health	2	2	4	6	7	12

NA: Not Available

Source: Sivard, Ruth Leger. World Military and Social Expenditures, Washington D.C., 1983, 1984, 1985.

Selected Bibliography

- Alderman, Harold and Von Braun, Joachin. "The Effect of the Egyptian Food Ration Subsidy System on Income Distribution and Consumption". Research Report 45. Washington: International Food Policy Research Institute, July 1984.
- Ames, Glenn C.W. and Yampulu, Mukendi. "Subsidized Imports, Currency Devaluation and Agricultural Decline, Impact on Food Supply and Demand Balance in Zair". Food Policy. June 1990, 239-249.
- Askari, Hussein and Cummings, John. "Food Shortages in the Middle East". Middle Eastern Studies. London: Frank and Cass, Vol 14, 3, October 1978, 326-351.
- Bates, Robert H. "Food Policy in Africa: Political Causes and Social Effects". Food Policy. August 1981 147-157.
- Beaumont, Peter. "Wheat Production and Growing Food crisis in the Middle East". Food Policy. November 1989, 378-384.
- Dethier, Jean-Jacques and Funk, Kathy. "The Language of Food: PL 480 in Egypt". Middle East Report. Vol. 17, No. 2, March -April 1987, 22-27.
- Dewalt, Kathleen M. "Income and Dietary Adequacy in an Agricultural Community: Mexico". Social Science Medicine. Vol. 17 No. 23, 1983, 1877-1886.
- Duffield, Mark. "Absolute Distress, Structural Causes of Hunger in Sudan". Middle East Report. September-October 1990, 4-11.
- Food and Agriculture Organization of the United Nation. Food Consumption Tables, for International Use. FAO, Washington, USA, October, 1949.
- . The State of Food and Agriculture, 1982. Rome. FAO, 1983.
- . The State of Food and Agriculture, 1982. Rome. FAO, 1985.
- FreemanIII, Myrick A. Intermediate Microeconomic Analysis. New York: Harper and Row, 1983.
- Friedman, Milton. A Theory of the Consumption Function. Princeton: University of Princeton Press, 1957.

- Gencuga, Hasan. "Exploration of Food Consumption and Nutritional Status: Turkey". Food Policy. ed. Charles Mann and Barbara Huddleston. Bloomington: Indiana University Press, 1986.
- Gray, Cheryl Williamson. "food consumption parameters for Brazil and their Application to food policy". Research Report 32. Washington: International Food Policy Research Institute. September 1982.
- Heathcote, R.L. The Arid Lands: Their Use And Abuse. New York: Longman Inc., 1983.
- Hussain, Anwar M. and Paul Lunven. "Urbanization and Hunger in the Cities". Food and Nutrition Bulletin. Vol. 9, No. 4, 1987, 50-61.
- International Monetary Fund, International Finance Statistics, Yearbook 1988. Washington: IMF, 1988.
- Jaffan, Raja H. Atae, Yogesh ed. "Development Strategies in the Middle East: Agriculture Prospect and Policy Implications". Region Review, Food Deficiency Studies and Perspectives. Bangkok, Thailand: UNESCO, 1987.
- Koppes, Clayton R. "Captain Mahan, General Gordon and the Origins of the Term Middle East". Middle Eastern Studies. October 1976, 95-98.
- Kyereme, Stephen Sarkodie. Food Consumption and Poverty in Ghana. Cornell University, August 1984.
- Looney, Robert E. "Viability of Saudi Arabian Agriculture". Food Policy. August 1988, 240.
- Mansfield, Edwin. Microeconomics, Theory and Applications. Shorter 5th ed. New York: W.W. Norton & Co., 1985.
- Mollett, J. A. "The State of Food and Agriculture in Islamic Countries". Food Policy. November 1986, 279-284.
- Monke, Eric and Fox, Roger (1993). "Economic Perspectives on Malnutrition". Unpublished paper, Department of Agricultural Economics, University of Arizona, Tucson.
- Paris, S. J. and Houthakker, H.S. The Analysis of Family Budgets. Cambridge: Cambridge University Press, 1955.
- Pellett, P. C. and Sossy, Shadarevian. Food Consumption and Tables Use in the Middle East, Second Edition, American University of Beirut. 1970.

- Pellett, Peter L. Food and Nutrition in the Near East Region, a Situation Analysis. Center for International Studies, Massachusetts Institute of Technology. Cambridge, Massachusetts. December 1983.
- Shafaeddin, Mehdi. "Agricultural Price Policies and the Oil Boom, Wheat and Meat in Iran, 1962-1978". Food Policy. May 1988, 185-197.
- Shapouri, Shahla. Middle East and North Africa, Outlook and Situation Report. USDA, RS 84-3. April 1984, 25.
- Sivard, Ruth Leger. World Military and Social Expenditures, 1983. Washington, D.C., 1983.
- . World Military and Social Expenditures, 1984. Washington, D.C., 1984.
- . World Military and Social Expenditures, 1985. Washington, D.C., 1985.
- Sloan, Harold S. and Zurcher, Arnold. Dictionary of Economics. New York: Barnes and Noble Books, 1970.
- Stork, Joe and Pfeifer, Karen. "Bullets, Banks and Bushels: The Struggle for Food in the Middle East". Middle East Report. Vol. 17, No. 2, March-April 1987, 3-6.
- . "The Struggle for Food in the Middle East". Middle East Report. March-April 1984, RS-84-3.
- Tuma, Elias. "Food Production in the Middle East Since 1950 Glut of Deficit". Department of Economics, University of California, Davis, California. Semmion No. 364, August 1990.
- . "Population, Food and Agriculture in the Arab Countries". The Middle East Journal. 28 No. 4, 1974, 381-395.
- United States Department of Agriculture. Foreign Agricultural Services. "Grains," Foreign Agricultural Circular. FG 9-76. Washington: USDA, May, 1981.
- . Foreign Agricultural Services. "Grains," Foreign Agricultural Circular. FG 22-82. Washington: USDA, May, 1981.
- . Foreign Agricultural Services. "Grains," Foreign Agricultural Circular. FG 13-82. Washington : USDA, April, 1982.

- Wallrafen, Hannes. "The Middle East Living by the Sword Aprimer". Middle East Report. January-February 1987, 23.
- Waslien, Carol L. "Food and Nutrition Programs in North Africa and the Middle East". Food Technology. September 1981, 99-104.
- Wenger, Martha and Stork, Joe. "The Food Gap in the Middle East". Middle East Report. September-October 1990, 15-20.
- Weinbaum, Marrin G. Food Development and Politics in the Middle East. London: Westview Press, 1982.
- World Bank. Social Indicators of Development. London: John Hopkins University Press, 1988.
- . World Development Report, 1982. New York: Oxford University Press, 1982.
- . World Development Report, 1987. New York: Oxford University Press, 1987.
- . Yemen Arab Republic, Development of a Traditional Economy. Washington, D.C., 1979.
- . World Tables, Economic Data. Vol. I, 1985.
- . World Tables, Social Data. Vol. II, 1985.