The double burden of malnutrition

Case studies from six developing countries

FAO
FOOD AND
NUTRITION
PAPER

84

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2006

ISBN 92-5-105489-4

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Foreword

There is growing recognition of the emergence of a "double burden" of malnutrition with under- and overnutrition occurring simultaneously among different population groups in developing countries. This phenomenon is not limited to upper-income developing countries, but is occurring across the globe in countries with very different cultures and dietary customs. There is accumulating evidence that when economic conditions improve, obesity and diet-related non-communicable diseases may escalate in countries with high levels of undernutrition. There is also evidence to indicate that undernutrition *in utero* and early childhood may predispose individuals to greater susceptibility to some chronic diseases.

Historically the menu of programmes to address nutrition problems in developing countries has focused primarily on reducing undernutrition and has met with varying degrees of success. There are only a handful of programmes, mainly in high-income countries, which have had some success in reducing the burgeoning growth of overweight, obesity and associated non-communicable diseases. It is now being understood that more aggressive strategies are needed and that attention to both under- and overnutrition should be incorporated into nutrition action plans and programmes.

This publication is the result of a multi-country effort to assess the extent of the double burden of malnutrition in six case study countries and identify programmes currently in place or needed to prevent and manage nutritional problems. The work represents ongoing efforts by FAO to document changes in diet and monitor population-level nutritional status and the prevalence of diet-related non-communicable diseases.

The case studies presented in this publication were prepared using existing secondary data in China, Egypt, India, Mexico, the Philippines and South Africa. Collaborating institutes include the Chinese Center for Disease Control and Prevention, the National Nutrition Institute, Egypt, the Nutrition Foundation of India, the National Institute of Public Health, Mexico, the Food and Nutrition Research Institute, the Philippines and the Medical Research Council, South Africa. The project was supported financially by the FAO-Norway Partnership Programme.

For many of those involved in preparing the case studies, this was a valuable opportunity to reassess priority nutrition problems and review programmes in place to address the problems. Some of the case study countries were already systematically monitoring patterns of dietary intake, nutritional status and risk factors related to non-communicable diseases, while others acknowledged a need to improve monitoring efforts. Most recognized the need to intensify efforts to prevent and manage overweight and obesity and disease processes associated with overnutrition, while maintaining efforts to eliminate undernutrition and micronutrient deficiencies.

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Aknowledgements
Special thanks go to all of the authors whose papers appear in this publication. Particular acknowledgement is due to Dr Osman Galal, School of Public Health, University of California Los Angeles for his considerable assistance and contribution to the Egypt case study. We would also like to thank Terri Ballard, Ruth Charrondiere and Cristina Lopriore, Food and Agriculture Organization; Pirjo Pietinen, Department of Nutrition, National Public Health Institute, Finland; Dr David Sanders and Thandi Puoane, School of Public Health, University of the Western Cape and Dr Veronica Tuffrey, Centre for Public Health Nutrition, University of Westminster for their assistance in reviewing one or more of the papers in this publication.

Acronyms

24HDR	24-hour dietary recall
AE	adult equivalent
AIS	acquired immune deficiency syndrome
ARC	Agriculture Research Centre (Egypt)
ASR	age-standardized incidence rate
ASSA	Actuarial Society of South Africa
BHS	barangay health station (the Philippines)
BMD	bone mass density
BMI	body mass index
BP	blood pressure
CAPMAS	Central Agency for Public Mobilization and Statistics (Egypt)
CED	chronic energy deficiency
CHD	coronary heart diseases
CHNS	China Economic, Population, Nutrition and Health Survey
CU	consumption unit
CVD	cardiovascular disease
DALY	disability-adjusted life year
DES	dietary energy supply
DLHS	District-Level Household Survey (India)
DR-NCD	diet-related non-communicable disease
DWCD	Department of Women and Child Development (China)
EDHS	Egypt Demographic and Health Survey

EHDR	Egypt Human Development Report
EMR	East Mediterranean Region
FAO	Food and Agriculture Organization of the United Nations
FBG	fasting blood glucose
FCT	Food Composition Table (the Philippines)
FHSIS	Field Health Service Information System (the Philippines)
FNRI-DOST	Food and Nutrition Research Institute, Department of Science and Technology (the Philippines)
FTRI	Food Technology Research Institute (Egypt)
GDP	gross domestic product
GDI	gender development index
GNP	gross national product
HCV	hepatitis C virus
HDI	human development index
HES	Health Examination Survey (Egypt)
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
HPE	Health Profile of Egypt
HSRC	Human Sciences Research Council (South Africa)
IARC	International Agency for Research on Cancer
ICCIDD	International Council for Control of Iodine Deficiency Disorders
ICD	International Classification of Diseases
ICMR	Indian Council of Medical Research
ICN	International Conference on Nutrition (Rome, December 1992, FAO and WHO)

IDA	iron-deficiency anaemia
IDD	iodine deficiency disorder
IFPRI	International Food Policy Research Institute
IGT	impaired glucose tolerance
IIPS	International Institute of Population Sciences
INEGI	National Institute of Informatics, Statistics and Geography (Mexico)
INP	India Nutrition Profile
ISCC	inter-sectoral coordinating committee/council
IUGR	intrauterine growth retardation
LAC	Latin America and the Caribbean (region)
LBW	low birth weight
LPE	Lipid Profile among Egyptians
MCDS	Mexican Chronic Diseases Survey
MDG	Millennium Development Goal
MECC	Middle East Cancer Consortium
MHIES	Mexican Household Income and Expenditure Survey
MHS	Mexican Health Survey
MISS	Mexican Institute of Social Security
MNE	multinational enterprise
MNS	Mexican Nutrition Survey
MOHP	Ministry of Health and Population (Egypt)
MPCE	monthly per capita expenditure
MTPPAN	Medium-Term Philippine Plan of Action for Nutrition

NAP	National Agricultural Policy (India)
NCD	non-communicable disease
NCHS	National Center for Health Statistics
NCI	National Cancer Institute (Egypt)
NCPR	National Cancer Registry Programme (India)
NFCS	National Food Consumption Survey (South Africa)
NFHS	National Family Health Survey (India)
NFI	Nutrition Foundation of India
NGO	non-governmental organization
NHP	National Hypertension Project (Egypt)
NIN	National Institute of Nutrition (India)
NNC	National Nutrition Council (the Philippines)
NNI	National Nutrition Institute (Egypt)
NNMB	National Nutrition Monitoring Board (India)
NNS	National Nutrition Survey (China, the Philippines)
NPNL	non-pregnant, non-lactating
NSSO	National Sample Survey Organization (India)
OECD	Organisation for Economic Co-operation and Development
PA	physical activity
PAHO	Pan-American Health Organization
PBMI	percentile body mass index for age
PDS	public distribution system
PEM	protein-calorie malnutrition

PHS	Philippine Health Statistics
PPP	purchasing power parity
PPY	percentage points a year
RDA	recommended dietary allowance
RENI	recommended energy and nutrient intake
RGI	Registrar General of India
RHU	rural health unit (the Philippines)
RNI	recommended nutrient intake
SADHS	South African Demographic and Health Survey
SAMRC	South African Medical Research Council
SANBDS	South African National Burden of Disease Study
SAVACG	South African Vitamin A Consultative Group
SR	serum retinol
STD	sexually transmitted disease
TB	tuberculosis
TGR	total goitre rate
TPDS	targeted public distribution system
U5MR	under-five mortality rate
UIE	urinary iodine excretion
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
UNU	United Nations University

USDA	United States Department of Agriculture
VAD	vitamin A deficiency
WC	waist circumference
WFP	World Food Programme
WHO	World Health Organization
WHR	waist-to-hip ratio
YLL	year of life lost
YRBS	Youth Risk Behaviour Study (South Africa)

Assessment of the double burden of malnutrition in six case study countries

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INTRODUCTION

The concepts of nutrition transition and the double burden of malnutrition have been introduced over the past decade. There is documentation of the occurrence of each in many developing countries that are in rapid economic transition (Shetty and Gopalan, 1998; Shetty and McPherson, 1997; *Public Health Nutrition*, 2002; Gillespie and Haddad, 2003) This paper draws on evidence from six countries (China, Egypt, India, Mexico, the Philippines and South Africa) to document the nutrition transition and the double burden by summarizing the trends in dietary changes and accompanying changes in nutritional status and disease burden experienced in the past 20 years. Many contributory factors have influenced these processes, including urbanization, demographic shifts, sedentary lifestyles and the liberalization of markets. In-depth discussion of these drivers has been reviewed extensively in recent literature (FAO, 2004; *Development Policy Review*, 2003).

Double burden of malnutrition

The double burden of malnutrition refers to the dual burden of under- and overnutrition occurring simultaneously within a population. Historically, undernutrition has been associated with higher prevalence of infectious diseases; as populations move into epidemiologic and demographic transition, increases in overweight and obesity begin to appear, while undernutrition and infectious disease become past problems. Today, the burden of disease and malnutrition does not fit neatly into the classic stages of transition, but reflects a modified pattern referred to as the protracted-polarized model, where infectious and chronic diseases coexist over long periods of time (Frenk *et al.,* 1989 in Chopra, 2004a). Evidence of this has been documented in countries as diverse as China (Cook and Dummer, 2003) and South Africa (Chopra, 2004a).

The protracted-polarized model represents a change in the documented pattern of the epidemiologic transition that occurred in Europe and North America in the nineteenth century. The classic pattern of "epidemiologic transition" constitutes a shift from high mortality and fertility patterns to lower mortality followed by lower fertility. Improvements in water and sanitation, and more effective public health services such as immunization result in an associated shift in disease burden from high rates of infectious disease to increasing non-communicable disease (NCD). In tandem with this shift, life expectancy increases and the demographic profile shifts towards lower child-to-adult dependency ratios and greater numbers of elderly in the population, with NCD becoming more predominant as longevity increases.

Underweight and obesity are both among the top ten leading risk factors for the global burden of disease (WHO, 2002). The current double burden of malnutrition seen in many developing countries is brought about by a coupling of risk factors. Progress in improving water and sanitation systems has been slow and the development of sound public health systems weak, thwarting efforts to reduce undernutrition. At the same time, increasing urbanization and changing dietary patterns and lifestyles are contributing to a rapid rise in overweight and diet-related chronic diseases.

Although there seems to be clear evidence of a double burden of malnutrition and disease at the global level, it is not clear how critical the issue is at the national level and to what extent developing countries need to concern themselves with the seemingly incongruous problems of under- and overnutrition and infectious and chronic disease. Some countries, such as South Africa and the United Republic of Tanzania, report no decline in numbers of cases of infectious diseases including tuberculosis (TB), malaria and HIV/AIDS, while the incidences of coronary heart disease (CHD), diabetes and stroke are on the rise (Kitange, no date). The protracted-polarized model of epidemiologic transition has been documented in South Africa, with poor people suffering increased mortality from infectious, chronic and accidental/violent causes (Chopra, 2004b). Regarding malnutrition, there is increasing documentation of rising rates of overweight and obesity among children and adults, and slow progress in reducing undernutrition, particularly in children under five years of age. This paper attempts to summarize and evaluate the problem of the double burden of malnutrition and disease as reported in the six country case studies, and discusses potential options for addressing both sides of the problem.

Characteristics of the nutrition transition

The nutrition transition refers to changes in the composition of the diet, usually accompanied by changes in physical activity levels. Popkin (2003) has characterized the nutrition transition into three stages: receding famine, degenerative disease, and behavioural change. In the first stage, diets are primarily derived from plant-based food sources, tend to be monotonous and are based more on home food production that requires high levels of physical activity related to planting, harvesting and processing. The second stage encompasses dietary changes that generally include more animal source foods, higher intakes of fat – both vegetable oils and saturated fat from animal products – increased use of sugar and other sweeteners, and higher reliance on food produced and processed outside the home or immediate community. Mandatory physical activity to produce food and procure water and fuelwood, including agriculture-based labour and household labour, is often also reduced. The final stage involves a shift to a diet with less saturated fat and decreasing reliance on processed foods. Typically, this stage encompasses increased intakes of whole grains, fruits and vegetables and decreased consumption of saturated fat, with a preference for animal source foods with lower saturated fat content (fish and poultry). Intensive physical labour related to agricultural production is not reintroduced, but non-obligatory physical activity is increased.

In which populations is the nutrition transition occurring?

The diets of most of the world's population lie somewhere between the first and second stages of nutrition transition, while subsections of populations in North America and northern and southern Europe may be moving into the third stage. In most of the case study countries there is evidence of a rapid movement from primarily plant-based diets to diets with greater proportions of energy derived from meat, milk products, animal fats and vegetable oils.

Urban populations are typically the first to begin incorporating more fats, animal source foods and processed products into the diet. Dietary changes are not however limited to urban areas, nor to wealthier population groups. Research by Mendez, Du and Popkin (2004) on dietary transition in China used a scale of "urbanicity", which considered access to health care, housing, communications and transport in urban and rural areas. They found increasing intakes of animal source foods and edible oils in low urbanicity urban areas and more urbanized rural areas. In low-income areas of Brazil, processed bakery products, processed meat products, sweets and soft drinks were among the most commonly consumed foods (Sawaya, Martins and Martins, 2004). Falling prices are another stimulus for dietary changes. A high-fat diet is much more affordable today than it was 30 years ago (Popkin, 2002). In China, over a period of six years in the 1990s, the relative prices of fish, pork and oil all decreased (Mendez, Du and Popkin, 2004).

KEY DEVELOPMENT INDICATORS AND LINKAGES TO THE DOUBLE BURDEN OF MALNUTRITION IN THE CASE STUDY COUNTRIES

Economic, health and social indicators for each of the case study countries are presented in Table 1. Rapid urbanization has been linked to dietary change and obesity in developing countries (Mendez and Popkin, 2004). There is a wide range in the proportions of urban population among the case study countries, with Mexico being the most urbanized and India the least. Low birth weight (less than 2 500 g) has been identified as a risk factor for developing NCDs in later life (Barker, 2004). Among the case study countries, India has the highest percentage of infants born with low birth weight, followed by the Philippines and South Africa. The demographic transition, particularly the ageing of the population and longer life expectancy, can also contribute to increased incidence of NCD. Of the case study countries, China appears to be ageing the fastest, with the largest percentage of adults aged 65 years and older and the smallest of children up to 14 years. High adult literacy rates and improvements in water and sanitation contribute to decreasing undernutrition, particularly among children under five years of age. Mexico, the Philippines and China have adult literacy rates of more than 90 percent, infant mortality rates of less than 35 per 1 000 live births, and life expectancy of more than 70 years. HIV prevalence is a grave public health concern in South Africa and is reflected in this country having the lowest life expectancies for both men and women.

TABLE 1
Economic, health and social development indicators

Indicator	China	Egypt	India	Mexico	Philippines	South Africa
Annual population growth rate (%)	1.2	2.2	1.9	2.0	2.3	2.0
Percentage urban population	37.7	42.1	28.1	75.2	60.2	56.5
Population aged 0–14 years (%)	23.7	35.2	33.3	32.8	36.6	33.2
Population aged ≥ 65 years (%)	7.1	4.6	5.1	5.0	3.7	3.9
Infants with low birth weight (%)	6	12	30	9	20	15
Infant mortality rate (per 1 000 live births)	31	35	67	24	29	52
HIV prevalence (%)	.01	< 0.1	0.4-1.3	0.3	< 0.1	21.5
Life expectancy (overall)	71	68.8	63.9	73.4	70	47.7
Life expectancy (female)	73.2	70.8	64.4	76.3	71.9	51.9
Life expectancy (male)	68.8	66.6	63.1	70.3	67.9	46
Adult literacy (%)	90.9	55.6	61.3	90.5	92.6	86
Population with access to improved sanitation (%)[1]	40	98	28	74	83	87
Population with access to an improved water source (%)[2]	75	97	84	88	86	86
GDP per capita (US$)	989	1 354	487	6 320	975	2 299
GDP per capita (PPP US$)	4 850	3 810	2 670	8 970	4 170	10 070
Population with less than US$1/day (%)	16.6	3.1	34.7	9.9	14.6	7.1

[1] Access to safe sanitation is defined as access to adequate excreta disposal facilities such as a connection to a sewer or septic tank system, a pour-flush latrine, simple pit latrine or ventilated improved pit latrine. An excreta disposal system is considered adequate if it is private or shared and if it can prevent human, animal and insect contact with excreta.
[2] Access to safe water is defined as reasonable access to any of the following water supplies used for drinking: household connection, public standpipe, borehole, protected well, protected spring and rainwater collection.
Source: UNDP, 2004.

REVIEW OF TRENDS IN FOOD AVAILABLE FOR CONSUMPTION IN THE SIX CASE STUDY COUNTRIES

Trends in food availability using FAOSTAT data

The Food and Agriculture Organization of the United Nations (FAO) maintains a comprehensive database of food production from 1960 to the present. Country-specific food balance sheets provide information on the supply and utilization of many different commodities. Factors accounting for food supply include production, imports, stock changes and exports. The per capita supply of energy, protein and fats for many food commodities can be calculated by extrapolating from these data.

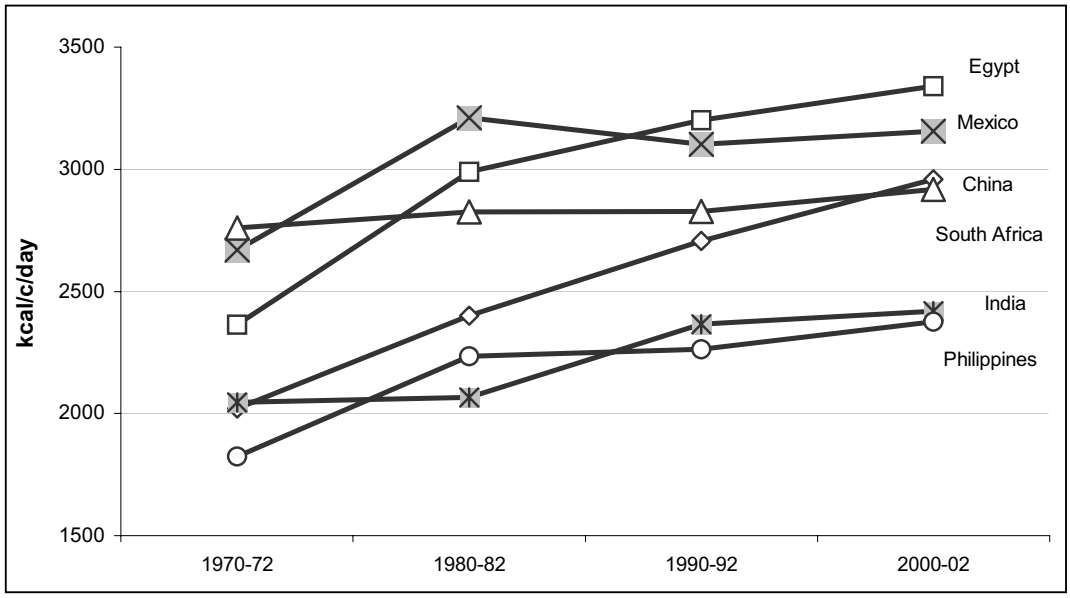
When analysing FAO food supply statistics it is important to consider the application of the per capita measurements. These figures are based on population totals for all ages and represent *average, not actual,* per capita availability. Actual food availability may vary by region, socio-economic level and season. Certain difficulties are encountered when estimating trade, production and stock changes on an annual scale. In order to reduce these errors, three-year averages should be calculated. This paper uses three-year averages for 1970–1972, 1980–1982, 1990–1992 and 2000–2002.

Trends in availability of dietary energy

Between 1970 and the present, per capita dietary energy supply increased in all the case study countries (Figure 1), although rates of growth were different. The largest absolute increase in caloric availability was in Egypt, and the largest percentage increase over the period from 1970–1972 to 2000–2002 occurred in China (49 percent). Over the same period, Egypt and the Philippines experienced increases of 41 and 30 percent, respectively.

The slowest growth in per capita dietary energy supply over the past 30 years was in South Africa. However, of the six countries analysed, South Africa started with the highest per capita dietary energy supply and its still remains higher than India's and the Philippines'.

FIGURE 1
Trends in dietary energy availability, 1970 to 2000



Commodity trends

Food availability and the percentages of dietary energy derived from basic food groups were calculated for 1970–1972 and 2000–2002 (Tables 2 to 4). Per capita supply of cereals and starchy staples has increased in all but one of the countries, but their percentage contribution to total energy supply has generally declined. Legumes, pulses and nuts have mainly remained stable or declined in terms of both quantity and percentage of dietary energy supplied. Oils, fats and animal products have increased in all case study countries, with the exception of fats/oils in Egypt. Fruits and vegetables have increased in most countries, as has percentage of energy from fruits and vegetables. The World Cancer Research Fund (1997) recommends that at least 7 percent of dietary energy be supplied from fruits and vegetables and, based on food balance sheet data, this goal would be achievable (assuming equitable distribution) in three countries. Sugar and sweeteners increased in all countries except South Africa, but the proportion of energy derived from sugar has not increased as dramatically as those from animal source foods and oil.

TABLE 2
Trends in food supply of different commodities (kg/capita/year), 1970–1972 and 2000–2002

Food group	China		Egypt		India		Mexico		Philippines		South Africa	
	1970	2000	1970	2000	1970	2000	1970	2000	1970	2000	1970	2000
Cereals, roots and tubers	266	251	185	257	164	179	179	192	142	168	195	215
Legumes, pulses and nuts	12	10	12	17	22	19	21	17	5	7	5	6
Oils and fats	3	11	10	8	5	12	8	13	5	7	10	14
Meat, fish, poultry	15	80	15	40	7	11	49	74	51	60	46	51
Milk	2	11	34	50	33	64	85	114	17	20	84	53
Eggs	2	17	1	2	0.5	2	6	16	3	6	4	6
Vegetables	45	246	130	183	44	69	33	57	66	62	46	43
Fruit	5	45	38	92	25	38	81	116	78	100	35	37
Sugar and sweeteners	3	7	48	75	29	38	37	49	22	30	40	33
Other	2	27	2	3	2	34	31	53	14	18	74	81

TABLE 3
Percentage of dietary energy supply from major food groups, 1970–1972 and 2000–2002

Food group	China		Egypt		India		Mexico		Philippines		South Africa	
	1970	2000	1970	2000	1970	2000	1970	2000	1970	2000	1970	2000
Cereals, roots and tubers	82.1	57.7	66.8	64.8	67.6	60.8	54.9	46.8	59.0	56.1	54.7	59.6
Legumes, pulses and nuts	5.3	3.5	4.5	4.6	9.2	6.2	7.5	5.1	1.3	1.9	1.7	2.0
Oils and fats	2.9	8.7	9.4	5.9	5.8	11.6	6.6	9.0	6.6	6.9	7.9	12.1
Meat, fish, poultry	4.8	15.4	2.5	3.7	1.1	1.4	6.0	9.9	10.7	11.2	8.8	8.6
Milk	0.2	0.7	1.9	2.2	3.0	4.2	4.9	5.4	1.2	1.0	4.5	3.0
Eggs	0.4	2.3	0.2	0.3	0.1	0.2	0.8	1.8	0.7	1.1	0.5	0.8
Vegetables	1.7	5.2	3.6	3.3	1.4	1.9	0.7	1.2	2.7	2.0	1.3	1.3
Fruit	0.3	1.8	3.0	4.7	1.5	2.0	3.3	3.6	5.5	5.6	1.4	1.5
Sugar and sweeteners	1.4	2.2	10.5	10.1	9.5	10.2	13.6	15.0	10.4	11.7	14.1	11.5
Other	0.7[1]	2.4[1]	0.3	0.4	0.8	1.4	1.7	2.2	1.9	2.6	5.1	5.4

[1] In China, the majority of the "other" category represents alcoholic beverages.

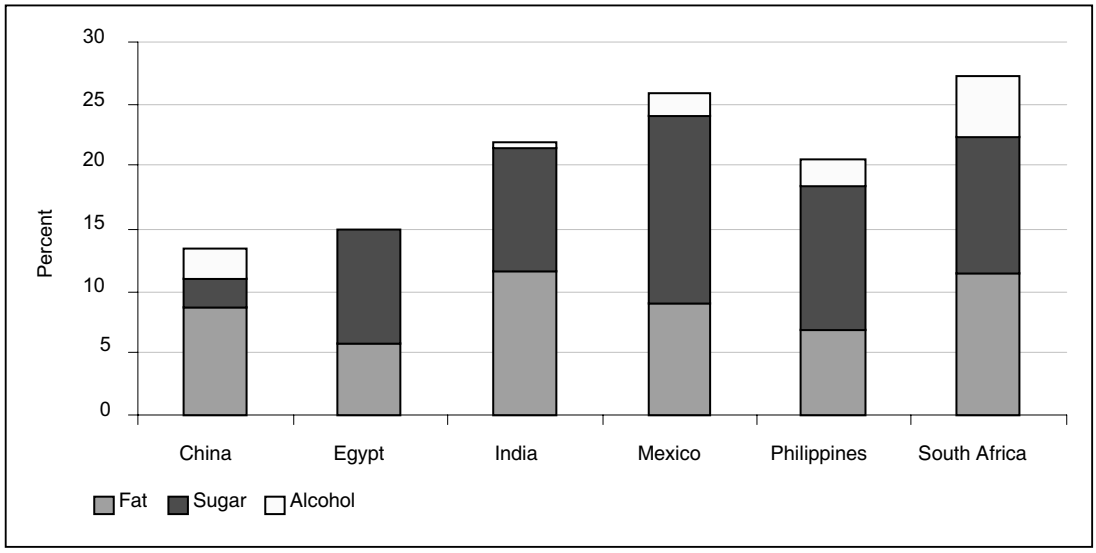
In terms of qualitative changes to the diet, China, India and Mexico exhibit the same pattern of declining per capita intakes of cereals and legumes and pulses and nuts, and increasing intakes of all the other food groups (Table 4). South Africa exhibits the most widely divergent pattern of increasing cereal and pulse intakes and decreasing intakes of meat, fish and poultry and sugars and sweeteners. Per capita supply of oils and fats has risen in all the countries except Egypt.

TABLE 4
Direction of the shift in percentage dietary energy from food groups, 1970–2000

Food group	China	Egypt	India	Mexico	Philippines	South Africa
Cereals, roots and tubers	↓	↓	↓	↓	↓	↑
Legumes, pulses and nuts	↓	↑	↓	↓	↑	↑
Oils and fats	↑	↓	↑	↑	↑	↑
Meat, fish, poultry	↑	↑	↑	↑	↑	↓
Milk	↑	↑	↑	↑	↓	↓
Eggs	↑	↑	↑	↑	↑	↑
Vegetables	↑	↓	↑	↑	↓	-
Fruit	↑	↑	↑	↑	↑	↑
Sugar and sweeteners	↑	↓	↑	↑	↑	↓
Other	↑	↑	↑	↑	↑	↑

Shaded arrows highlight declining trend.

FIGURE 2
Percentages of daily energy supply from fat, sugar and alcohol, 2000–2002



In Mexico and South Africa, more than one-quarter of the dietary energy available per capita is assigned to sugar, fat or alcohol (Figure 2). In three of the six countries analysed, sugars and sweeteners account for more than 10 percent of daily energy supply,[1] and in South Africa alcohol accounts for 5 percent of total dietary energy supply. WHO/FAO set a population nutrient intake goal of 15 to 30 percent of energy from fat (WHO/FAO, 2003). Extrapolating from FAOSTAT data, consumption of fat remains below the recommendation of 15 to 30 percent of total dietary energy intake in the case study countries.

[1] The food balance sheet data from which the figure is derived are not representative of actual food energy intake (food consumption) but indicate overall availability, and are generally thought to be an overestimation of actual consumption. This note of caution should be kept in mind when comparing the data with dietary goals.

DIETARY INTAKE DATA

Dietary intake survey data provide a more precise measure of the food consumption habits of households and individuals. These data can be used to look at differences in consumption by such characteristics as income, gender and place of residence.

Most of the dietary intake data from the case study countries come from nationally representative surveys that use a variety of methodologies and capture different age groups. Although it is not appropriate to compare these data with data from FAOSTAT, trends from both could be expected to go in the same direction, but this is not always the case.

Trends in dietary energy intake

Nearly all the case study countries show a trend towards declining energy intake (measured as kilocalories [kcal] per capita per day) (Table 5). This pattern has also been observed in other developing countries, leading to debate over the seemingly paradoxical increase in overweight and obesity at lower reported dietary energy intakes (Stubbs and Lee, 2004; Heini and Weinsier, 1999; Prentice and Jebb, 1995). The declining trend in dietary energy intake also contrasts with FAOSTAT data on total dietary energy availability. The real picture of what is happening appears to lie somewhere in between.

Some researchers support their intake data with the theory that there have been large declines in energy expenditure. Thus, increasing overweight is possible even at lower intakes because there is a greater energy imbalance (India case study). Others conclude that the declining trend reflects problems with data collection and the well-documented tendency of underreporting and systematic bias in intake measures, with heavier persons consistently underreporting more frequently than individuals of normal weight (Mexico case study; Livingstone and Black, 2003).

Both of these explanations may be true. Underreporting of energy intake is one of the major limitations of dietary intake studies (Livingstone and Black, 2003). At the same time, energy expenditures have fallen dramatically as a result of the modernization of agriculture and the increased use of motor vehicles, computers and labour-saving technologies. Recent evidence from the United States, where obesity rates have risen from 15 to 31 percent, has reversed the idea of the "American paradox" in which reported energy intakes were falling while obesity rates climbed. Reports for recent years show increases in reported energy intakes for both men and women (*MMWR Weekly*, 2004).

These findings highlight a need for better dietary intake instruments and training of the staff who carry out dietary intake studies, as well as a critical need for more and better information on energy expenditure. Information on energy expenditure is not routinely included in most national-level surveys. However, if energy expenditure is believed to be a major factor in rising obesity and risk of NCD, measurement instruments and collection of energy expenditure data need to be improved and supported.

TABLE 5
Trends in dietary energy intake from household surveys

	Kcal/c/day (year)	Kcal/c/day (year)	Kcal/c/day (year)	Trend	Comments
China	3 006 (1989)	2 635 (1993)	2 467 (2000)	Decreasing	Adults 20–59 yrs: 24-hr recall
Egypt		2 602 (2000)	1995 (2004)	Decreasing	Mothers: 24-hr recall
India	2 340 (1975–79)	2 283 (1988–90)	2 255 (2000–01)	Decreasing	Rural areas only
Mexico		1 624 (1988)	1 471 (1999)	Decreasing	Females 12–49 yrs: 24-hr recall
Philippines	1 808 (1982)	1 684 (1993)	1 905 (2003)	Increasing	1993 unusual year of economic crisis One-day household food weighing Total amount consumed by all household members
South Africa			1 128 (1999)		Children 1–6 yrs. Unweighted average of age groups 1–3 and 4–6

Energy density of the diet

One apparently consistent trend is that of increased energy density of diets. The percentage of energy derived from fat has increased in all the case study countries, especially China where it rose by nearly 10 percent over the past decade. The highest percentage of dietary energy from fat (31 percent) is in Mexico, and the lowest in India (14 percent). The low meat consumption in India is a likely explanation for this low figure.

TABLE 6
Trends in percentage of dietary energy from fat

	Percentage of energy from fat (year)			Trend	Comments
China	19.3 (1989)	22.2 (1993)	28.9 (2000)	Increasing	Adults
India	9 (1979)		14 (2001)	Increasing	Rural areas only, not all states
Mexico		25.8 (1988)	31.3 (1999)	Increasing	Females 12–49 yrs
Philippines	15 (1987)	15 (1993)	18 (2003)	Increasing	
South Africa	17 (1962)		25.8 (1999)	Increasing	Black schoolchildren in urban Gauteng

Trends in dietary intake by food group

FAOSTAT data are used to show changes in food intake in much of the initial work on the occurrence of a nutrition transition in developing countries (Popkin, 1994). There is fairly good concordance between commodity trends using FAOSTAT data and trends in consumption of different food groups using dietary intake data.

The five case study countries for which trend data on dietary intake by food group are available show much the same pattern of dietary changes. The main trends observed from intake data are:

- decreasing intakes of cereals, roots and tubers;
- decreasing intakes of legumes, nuts and seeds (except in China);

- no change or an increase in intakes of edible fats and oils;
- large increases in intakes of fish, meat and poultry (except in India);
- increasing intakes of sugars and sweets;
- increasing intakes of fruits and vegetables (except in rural China and the Philippines).

Beneficial and detrimental aspects of observed changes

The adverse effects of the observed patterns of dietary change, including the increases in saturated fat, cholesterol and dietary energy density, have been the subject of much recent literature, while the positive effects have largely been overlooked. Transition from a predominantly cereal-based diet to one that includes more meat and dairy products should have a positive impact on the intakes of high-quality protein and several micronutrients. In particular, intakes of vitamin A and iron, two of the most widespread micronutrient deficiencies worldwide, should show improvement.

The crossover from beneficial to detrimental is experienced when intakes of commodities (sugar, alcohol) or dietary components (saturated fat, salt) reach levels known to create disease risk factors. These levels have been reviewed recently in the WHO/FAO report on diet, nutrition and the prevention of chronic disease, which forms the basis for the population nutrient intake goals listed in Table 7 (WHO/FAO, 2003). The Philippines case study highlights the beneficial effects of the dietary changes, which are reflected by an increased proportion of people consuming the recommended percentages of energy from carbohydrates and fat. However, decreasing consumption of fruits and vegetables in the Philippines and China is reflected in lower percentages of the population with recommended intakes of these commodities (Table 7).

TABLE 7
Trends in achievement of population nutrient intake goals

Country	Year	% of population with 15–30% energy intake from fat	% of population with < 10% energy intake from free sugars	% of population with 55–75% energy intake from carbohydrate	% of population consuming ≥ 400g/day fruits and vegetables
China	1989	43.9	99.6	56.3	29.3
	2000	44.3	97.8	54.8	21.3
Mexico	1988	40.9		44.2	
	1999	39.6	97.4	44.3	9.3
Philippines	1993	37.6	94.3	53.0	11.5
	2003	46.2	92.1	57.9	8.2

The impact of changes in dietary patterns on micronutrient intake

Given the increasing intake of animal source foods, and in some countries the increased intake of fruits and vegetables, a trend towards improved intakes of micronutrients (particularly iron and vitamin A) could be expected. Data from Mexico, China and the Philippines indicate that there is a marginal positive trend towards increased consumption of iron in the diets of children (Table 8). Intakes of vitamin A also increased for children in the Philippines and China, while vitamin C intake decreased slightly in China but increased in the Philippines.

In the Philippines, adult intake of vitamin A has increased, but intakes of iron and vitamin C have not shown any change. In Mexico, adult intake of vitamin A has increased, but intake of iron has decreased.

The trends among children are encouraging, and indicate that dietary changes are having a positive impact on micronutrient intakes. Changes among adults are less dramatic, and do not indicate much of a positive trend, except in the case of vitamin A. Given the large increase in meat, fish and poultry consumption, an improvement in the iron intake of adults could be expected, but this is not observed. This seemingly contradictory pattern could be the result of:

- changes in consumption patterns within animal source foods – the Philippines consumes more pork, which has lower iron content than beef;
- revisions in food composition tables – again in the Philippines, where the tables now include more processed and canned fish products, which contain less iron than the values used previously.

TABLE 8
Percentage changes in intakes of iron, vitamin A and vitamin C

Country	Iron intake		Vitamin A intake		Vitamin C intake		Comments
	Children	Adults	Children	Adults	Children	Adults	
China	+ 3%		+ 4%		- 4%		1991 and 2000: children 2–5 yrs
Mexico		- 30%		+ 193%			1988 and 1993: females 12–49 yrs
Philippines	+ 3%	0	+ 35%	+ 16%	+ 28%	0	1993 and 2003: adults < 20 yrs, children 3–59 months (1993) and 6–59 months (2003)

TRENDS IN NUTRITIONAL ANTHROPOMETRY AND MICRONUTRIENT DEFICIENCIES AMONG CHILDREN AND ADULTS

Caution is needed regarding inter-country comparisons of data related to trends in nutritional anthropometry and micronutrient status of adults and children, because years, age groups and cut-off points may not be consistent. An effort was made to document such differences among the countries.

Trends in the nutritional status of children

Some progress in reducing child undernutrition has been achieved in all of the case study countries. The differing biological significance of anthropometric indicators of child growth is an important consideration in the current analysis. Stunting is a deficit in gain in length/height caused by deficits of a chronic nature. Wasting reflects short-term deprivation. Underweight is a combination of the two indicators, and has been termed "overall malnutrition". In situations of improving food security and improvements in health, water and sanitation, wasting prevalence should decrease rapidly. Stunting prevalence will be slower to improve, as the indicator is cumulative of past deprivation. Prevalence of underweight will usually decline at a faster rate than that of stunting.

China's progress between 1992 and 2000 has been the most rapid of the case study countries, with rates of stunting falling by 55 percent, from 31 to 14 percent, prevalence of underweight declining 42 percent, from 17.4 to 10 percent, and wasting decreasing by 35 percent, from 3.4 to 2.2 percent. Progress has been slower in all the other countries, with prevalence rates of stunting declining 38 percent in Egypt, 13 percent in the Philippines and 22 percent in Mexico (calculation of percentage changes was not possible for India and

South Africa because of differences in age groups). Reductions in the prevalence of underweight have been faster, with reductions of more than 30 percent in Egypt and Mexico, but only 5 percent in the Philippines. Wasting prevalence is now very low in Mexico and Egypt, but has increased in the Philippines from 5.6 to 6.5 percent.

The Center for Disease Control classifies rates of stunting of more than 30 percent, underweight of more than 20 percent and wasting of more than 10 percent as high prevalence (Epi-info Manual), indicating the level of public health significance. In India, all three nutritional anthropometric measures are still at high levels. In the Philippines, stunting and underweight are classified as high, while wasting has fallen to less than 10 percent. In the other case study countries, prevalence levels of stunting, underweight and wasting are classified as medium or low, at least at the nationally aggregated level. Nationally aggregated data hide disparities within regions and among different ethnic and socio-economic groups. For example, in poor, rural areas of China, stunting prevalence is 29 percent. In Mexico, it is more than 30 percent for children aged one to four years in rural areas, the south region and the lowest socio-economic bracket. Clearly, child growth remains an important public health problem.

The use of resources to ensure appropriate foetal and early child growth is justified, not only by the direct cost of undernutrition in terms of loss of life and diminished mental and physical potential, but also by more recent evidence of links between suboptimal foetal and early child growth and later problems with NCDs, particularly cardiovascular disease (CVD), type-2 diabetes and hypertension (Delisle, 2002).

Overweight in children is an emerging concern in many of the case study countries. In Egypt, prevalence of overweight among children is higher than prevalence of underweight and stunting, signalling an urgent need for Egypt to develop strategies to address this new problem. Increasing rates of overweight and obesity in children signal a very alarming trend. Half of the children who are obese at six years of age will go on to become obese adults (Georgetown University Center for Aging, 2002). Obesity is a risk factor for a range of chronic health problems, including type-2 diabetes, coronary heart disease, hypertension and some types of cancers (WHO, 1997). Early onset of obesity confers higher risk of developing these obesity-related chronic diseases.

TABLE 9
Trends in child anthropometry

	China		Egypt		India		Mexico		Philippines		South Africa	
	1992	2000	1990	2000	1991/ 1992	1998/ 1999	1988	1999	1989/ 1990	1998	1986	1999
Stunting	31.4	14.2	30.0	18.7	61.2	44.9	22.8	17.7	37.2	32.1	24.5	24.9
Under-weight	17.4	10.0	10.4	4.0	61.0	46.7	14.2	7.5	33.5	31.8	8.4	11.5
Wasting	3.4	2.2	3.5	2.5	18.9	15.7	6.0	2.0	5.6	6.5	1.8	3.4
Over-weight	4.3	2.6		11.7		2.2	3.7	5.3		1.0		6.2
Age range	0–4.99 yrs		0–4.99 yrs		0–4.99 yrs	0–2.99 yrs	0–4.99 yrs		0–4.99 yrs		0–4.99 yrs (rural only)	1–4.99[1] yrs

[1] Oversampling of low socio-economic groups
Source: WHO Global Database on Child Growth.

Trends in nutritional status of adults

The prevalences of under- and overweight among adults are strikingly different from those of children (Table 10). Overweight is more prevalent than underweight in adults in China, Egypt, Mexico and the Philippines. Overweight prevalence has been increasing in all countries, while underweight is on the decline.

Data presented at the national level hide large disparities in prevalence rates among regions and socio-economic classes. For example, in India, 23.5 percent of women 15 to 45 years of age living in urban areas have a body mass index (BMI) ≥ 25, and in Delhi more than 40 percent of women have a BMI above 25. In the highest socio-economic classes, obesity rates of more than 50 percent for females and 32 percent for males have been reported (Shetty, 2002). In Mexico, there are important differences between northern and southern regions; 31 percent of adults living in the north are obese (BMI > 30), compared with 24 percent in the south.

TABLE 10
Trends in adult anthropometry

	Underweight (%)		Overweight (%)		Comments
	Female	Male	Female	Male	
China					
1998	8.9	8.4	11.5	6.5	
2000	7.1	6.4	24.1	21.1	
% Δ	- 20	-24	+109	+224	
Egypt					
1995	1.6		51.8		
2004	0.4	2.0	89.3	66.9	
% Δ	-75		+72		
India					
1989/90	49.3	49.0	4.1	2.6	Rural only
2000/01	39.3	37.4	8.2	5.7	
% Δ	-20	-24	+100	+119	
Mexico					
1994	1.5	1.9	59.5	52.0	
2000	1.7	1.8	67.6	62.3	
% Δ	+13	-5	+14	+20	
Philippines					
1993	16.1	11.5	18.6	14.4	
2003	14.2	10.6	27.3	20.9	
% Δ	-12	-8	+46	+45	
South Africa					
1980	18.0			14.7	Whites only
2000	25.5			20.8	
% Δ	+42			+41	

Micronutrient deficiencies

In addition to the double burden of under- and overnutrition, which is demonstrated principally in differences in the prevalence of undernutrition among preschool children and of overweight in adults, many of the case study countries continue to have high prevalence rates of micronutrient deficiencies. Approximately one-third of women and children in China and the Philippines are anaemic, and a staggering 90 percent of women and children in India are diagnosed with anaemia (Table 11). Persistently high levels of anaemia in the

Philippines are attributed to poor child feeding and weaning practices and poor compliance with iron supplementation programmes (Philippines case study). In India, the dietary intakes of iron and folate are low, and there are high rates of blood loss from malaria and parasitic infections (India case study).

TABLE 11
Prevalence of anaemia in women and children (last available year)

	Women (%)	Children (%)	Comment
China	18.8	24.2	Rural women, children 0–2 yrs (2002)
Egypt	26.3	29.9	Women 15–49 yrs, children 6–71 months (2000)
India	88	90	Pregnant women, preschool children (2002/03)
Mexico	20.8	27.2	NPNL women 12–47 yrs, children 0–5 yrs (1999)
Philippines	43.9	29.1	Pregnant women, children 1–5 yrs (2003)
South Africa		11	Children 6–71 months (1994)

Large percentages of the populations in the case study countries are also suffering from vitamin A deficiency (VAD). Few countries have trend data for VAD, but the Philippines recorded a higher prevalence of children with VAD in 2003 compared with ten years earlier. VAD among children in China differs according to residence. The prevalence of low serum retinol among children aged three to 12 years is 3.0 percent in urban and 11.2 percent in rural areas.

TABLE 12
Prevalence of vitamin A deficiency[1] in children and adults

	Adults (%)	Preschool children (%)	School-age children (%)	Comment
China			9.3	Children 3–12 yrs
Egypt	20.5		26.5	Adults 20+ yrs, children 11–19 yrs (2004)
Philippines	17.5	40.1		Adults, pregnant women only, children 6–60 months
South Africa		39		0–71 months (1994)

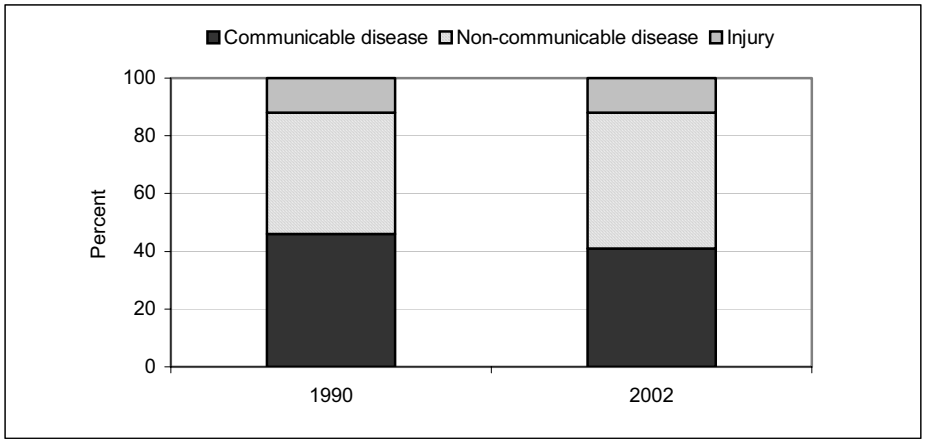
[1] Serum retinol < 20 µg/dl.

BURDEN OF DISEASE

Although the classic definition of the double burden of malnutrition is concerned primarily with the dual burden of over- and undernutrition, it is also useful to examine morbidity and mortality trends given the close links among disease, disability and under- and overnutrition.

Disability-adjusted life years (DALYs) report on the time lived with a disability and the time lost because of premature mortality. Globally, the proportion of DALYs lost to NCD has been increasing, while DALYs from communicable disease, including nutritional disorders, are declining (Figure 3).

FIGURE 3
Trends in DALYs by disease category



In its annual publication *State of the world's health,* the World Health Organization (WHO) reports data on DALYs from specific diseases by region and mortality stratum (Table 14). The double burden of disease is most clearly evident in the proportional DALYs of the Southeast Asia and Eastern Mediterranean regions, with high DALYs lost from both communicable and non-communicable diseases. The regions of the Americas and Western Pacific are moving away from high levels of communicable disease, while malaria, HIV and respiratory infection remain high in the Africa region.

TABLE 13
DALYs lost from communicable and non-communicable diseases and injuries

	World	Africa	Americas	Southeast Asia	Eastern Mediterranean	Western Pacific
Communicable diseases	**41.0**	**74.8**	**20.0**	**45.6**	**52.1**	**21.5**
Tuberculosis	2.3	2.7	.62	3.0	2.5	2.4
HIV	5.7	24.5	2.0	2.9	1.2	.92
Diarrhoeal diseases	4.2	5.8	1.8	5.2	7.0	2.7
Malaria	3.1	10.3	.11	.62	1.9	.18
Respiratory infections	6.3	8.3	2.3	8.6	8.9	3.3
Nutritional deficiencies	2.3	2.6	1.3	2.9	3.4	1.7
Non-communicable conditions	**46.8**	**17.3**	**63.5**	**41.4**	**36.8**	**64.3**
Malignant neoplasms	5.1	1.3	5.6	2.9	2.5	8.9
Diabetes mellitus	1.1	.29	2.2	.98	.73	1.2
Hypertensive heart disease	0.5	.16	.71	.31	.56	.89
Ischaemic heart disease	3.9	.78	3.3	4.9	3.4	2.7
Cerebrovascular disease	3.3	.95	3.1	2.4	1.7	6.5
Injuries	**12.2**	**7.9**	**16.4**	**13.0**	**11.1**	**14.2**
Traffic accidents	2.6	1.8	3.2	2.1	2.4	3.5
Intentional (violence, war, self-inflicted)	3.3	2.9	8.1	2.6	2.6	3.5

Data estimates from 2002. Africa: high child/very high adult mortality stratum; Americas: low child/low adult mortality stratum; Southeast Asia: high child/high adult mortality stratum; Eastern Mediterranean: high child/high adult mortality stratum; Western Pacific: low child/low adult mortality stratum.
Source: WHO. *World Health Report 2004*. Geneva.

NCDs and NCD risk factors

In addition to obesity, diabetes, CVD and some cancers are also related to diet and lifestyle (WHO/FAO, 2003), as are certain risk factors including high blood pressure, increased cholesterol and elevated blood sugar.

For most of the case study countries, monitoring the incidence and prevalence of NCDs and associated risk factors is relatively new, so examination of trends is not possible. Some of the case study countries do not yet have nationally representative monitoring systems in place, and data on the magnitude of the problem of NCDs have to be inferred from various small studies.

In the four case studies with data, more than 20 percent of adults have high blood pressure, a risk factor for CVD. In Egypt and Mexico, prevalence of diabetes is nearly 10 percent (Table 14). In China, prevalence rates of diabetes in people over 60 years of age reach as high as 17 percent.

TABLE 14
Prevalence of hypertension and diabetes

	Hypertension	Diabetes	Comment
China	20.2/18.0	2.6	Adults male/female (2002)
Egypt	26.3	9.3	Adults > 25 yrs (1995)
Mexico	39.2/30.9	7.6/8.3	Adults male/female(2000)
Philippines	22.5	3.4	Adults > 20 yrs (2003)

Physical activity

Trend data on physical activity are weak or non-existent in most of the case study countries. China is the exception, and has information from 1989 to 2000 on light, moderate and heavy physical activity. The data show a 20 percent decrease in people reporting heavy activity and a 46 percent increase in people reporting light physical activity.

Double burden of malnutrition

The data presented in this section clearly demonstrate that most countries in the study are struggling to some degree with the double burden of malnutrition. The countries were classified into the following three typologies based on predominant health and nutrition problems.

Typology one: (India and the Philippines)

- High prevalence of undernutrition in both children and adults.
- Emerging problems of overnutrition, diabetes and high blood pressure, mainly in urban areas.
- High prevalence of micronutrient deficiencies.

Typology two: (South Africa)

- Stunting at levels of public health significance, but declining underweight and wasting.
- In adults, overweight/obesity more of a problem than underweight.
- Rising incidence of NCD, particularly CVD, diabetes and cancer.
- Rise in some infectious diseases, notably TB and HIV.
- High prevalence of micronutrient deficiencies.

Typology three (China, Egypt and Mexico)

- Both stunting and overweight appear as public health problems in children.
- Low prevalence of underweight and wasting in children.
- Underweight in adults no longer of public health significance, but prevalence of overweight high and/or rapidly increasing.
- Iron and vitamin A deficiencies remain public health problems.
- Diabetes and coronary heart disease are increasing, while infectious disease is decreasing (although certain diseases such as TB and HIV remain high in China and Egypt).

In many of the case study countries there is a striking discrepancy in anthropometric outcomes between children and adults. For example, in the Philippines, 27 percent of children under five years of age are underweight, while 27 percent of women are overweight or obese. It seems that there are environmental and biological factors leading to such extreme outcomes. There is also evidence of increased risk of adult obesity when undernutrition occurs during childhood (Delisle, 2005). Poverty is a main driver of stunting (UN Millennium Project, 2005), but the inverse is not necessarily true for overweight. In many countries, the urban poor and undereducated have high prevalence rates of overweight (Mendez and Popkin, 2004).

The different typologies suggest that country programmes should focus on different areas. For example, in India and the Philippines, reducing child and adult undernutrition and micronutrient deficiencies should remain a top priority, and efforts to limit the rise of overweight/obesity and diet-related chronic diseases should be initiated. In Egypt, Mexico and, to a lesser degree, China and South Africa, overweight and obesity among adults is already widespread and the problem is becoming more significant among children. In these countries, in addition to prevention efforts, more focus needs to be directed to early detection and treatment.

CONCLUSIONS

Noticeable changes in dietary patterns have occurred in all of the case study countries; these changes have not necessarily corresponded to increased intakes of total dietary energy, but have corresponded to increased fat content of diets. The most striking changes have been increases in pork, poultry and beef, sugar and sweet products, and – in most countries – fats and oils.

Some of the dietary changes have brought welcome improvements to nutritional status, contributing to reduced child undernutrition and improved micronutrient intake in some countries. However, the combination of an energy-dense diet with low physical activity has contributed to an increasing prevalence of overweight adults. This pattern will probably continue, given that current economic and social trends are conducive to widespread changes in lifestyle.

Although some progress has been made in reducing undernutrition of children, national and regional efforts to improve child growth need to continue and should not be overshadowed by the need to address NCD among adults. It is worth bearing in mind the continuing evidence generated by the Barker hypothesis, which links undernutrition in foetal and early life to greater risk of NCD in adulthood.

Dietary and lifestyle choices, including food choice, smoking, physical inactivity and alcohol consumption, are some of the most strikingly modifiable risk factors. The challenge is to develop effective programmes and policies aimed at both prevention and

control. Developed countries have attempted to tackle these problems for many years, but with little success. Ideally, strategies that are effective in ameliorating both under- and overnutrition should be identified and developed. In the shorter term, priority should be given to preventive action by addressing undernutrition of infants, children and pregnant women, thereby circumventing the risks predicted by the Barker hypothesis.

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The double burden of malnutrition in China, 1989 to 2000

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INTRODUCTION

Twenty-five years ago, China introduced sweeping structural reforms to the rural economy, family planning programme and financial accountability of its enterprises and service sector organizations. A rapid rise in economic productivity has resulted in continuing increases in income and changes to the traditional Chinese diet. These changes have been accompanied by shifts in the patterns of mortality and disease risk factors, and are occurring at markedly different rates across the country. A post-reform China in the new millennium faces a range of challenges in health, nutrition and family planning. Income disparities have increased as coastal areas have become wealthier, while the 300 poorest counties – most of which are in western China – suffer stagnation. The ageing of the population and increased life expectancy have contributed to an inevitable increase in the demand for long-term care.

This case study assesses trends in the Chinese dietary intake and reviews changes in nutritional status, morbidity and mortality.

Demographic and health indicators

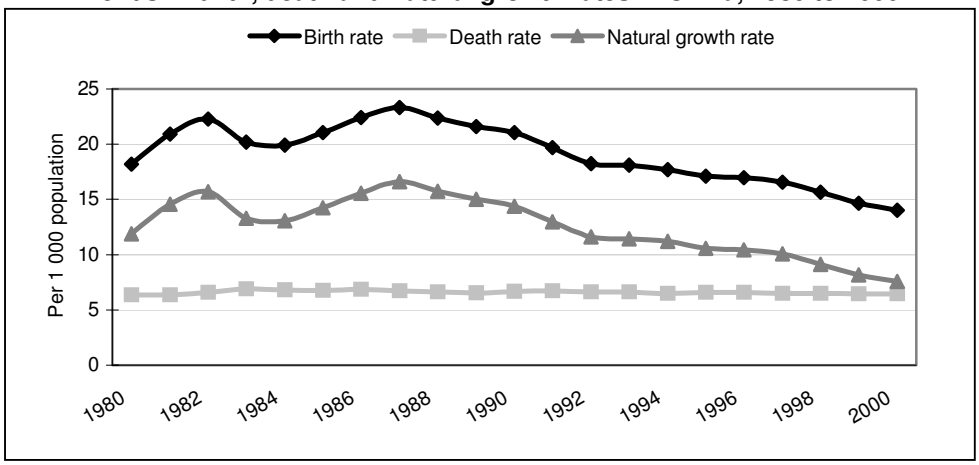
Over the past three decades, the Chinese population has expanded from 987 million to 1.267 billion (Table 1). There has also been an increasing trend towards urbanization, with the urban proportion of the population growing from 19 to 36 percent. Birth and death rates have been declining, while the natural growth rate has remained relatively stable (Figure 1). Additional demographic and development indicators are presented in Table 2. The declining birth and death rates of the past 20 years are causing the Chinese population to become older, with a decreased percentage in the 0 to 14 years age group and increases in the percentages of adults (15 to 64 years) and elderly (65 years and more). Population health indicators have improved over the past 30 years, and 90 percent of Chinese adults are literate. Although the proportion of population with access to safe sanitation has increased, it remains low, at less than 50 percent (State Statistical Bureau, 2002).

TABLE 1
Trends in population by residence and gender, 1980 to 2000

Year	Total population, millions (at year-end)	By sex		By residence	
		Male (%)	Female (%)	Urban (%)	Rural (%)
1980	987	51.45	48.55	19.39	80.61
1985	1 058	51.70	48.30	23.71	76.29
1990	1 143	51.52	48.48	26.41	73.59
1995	1 211	51.03	48.97	29.04	70.96
2000	1 267	51.63	48.37	36.22	63.78

Data include military personnel of the Chinese People's Liberation Army, but not the populations of Hong Kong, Macao and Taiwan.
Source: State Statistical Bureau, 1980 to 2002.

FIGURE 1
Trends in birth, death and natural growth rates in China, 1980 to 2000



Source: State Statistical Bureau, 1980 to 2002.

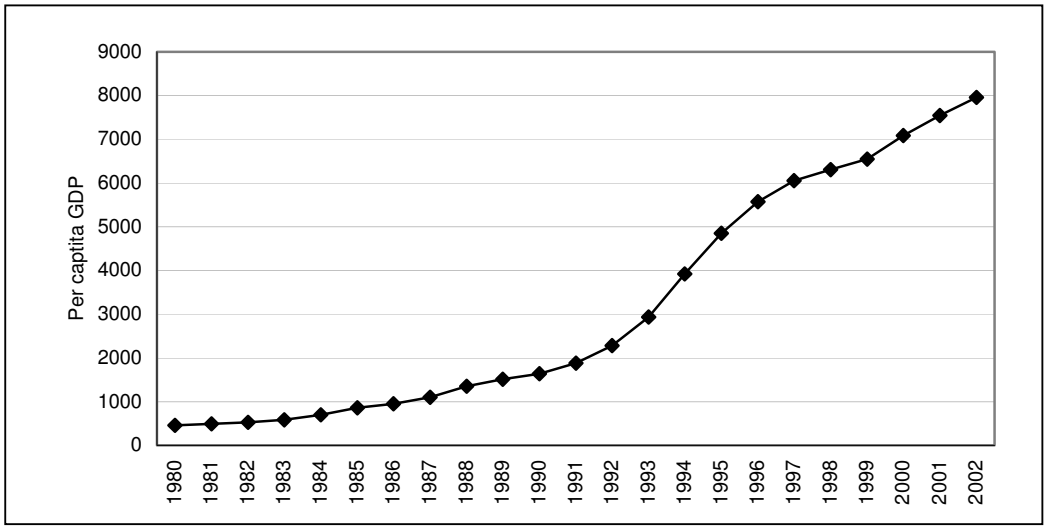
TABLE 2
Trends in population structure and selected health and education indicators, 1980 to 2000

Indicator	Year			Source
	1980	1990	2000	
Population 0–14 years (%)	35.5	27.7	22.9	UNESCAP, 2004
Population 15–64 years (%)	59.8	66.9	70.2	UNESCAP, 2004
Population ≥ 65 years (%)	4.7	5.4	7.0	UNESCAP, 2004
Annual population growth rate (%)	1.2	1.4	0.8	UNESCAP, 2004
Infant mortality rate (per 1 000 live births)	41	33	28	UNESCAP, 2004
Overall life expectancy (years)	67.8 (1981)	68.6	71.4	Chinese population census
Female life expectancy (years)	69.3 (1981)	70.5	73.3	Chinese population census
Male life expectancy (years)	66.4 (1981)	66.9	69.6	Chinese population census
Adult literacy (%)		78.3	90.9 (2002)	UNDP, 2004
Population with access to improved sanitation (%)		29	40	UNDP, 2004
Population with access to an improved water source (%)		71	75	UNDP, 2004

Employment and economy

The Chinese economy has experienced exponential growth in the past decade, with per capita gross domestic product (GDP) rising from 460 yuan in 1980 to 7 084 yuan in 2000 (Figure 2). Since 1990, per capita GDP has grown by an average of 8.6 percent per year (UNDP, 2004). Although the number of employed people has been rising in the past decade, the number and percentage of unemployed people indicate a need for increased focus on job creation (Table 3) (State Statistical Bureau, 2002).

FIGURE 2
Trends in per capita GDP (yuan), 1980 to 2002



Source: State Statistical Bureau, 1980 to 2002.

TABLE 3
Trends in unemployment in China, 1991 to 2001

Indicator	1991	1995	2000	2001
Total number of employed people (10 000s)	58 360	67 947	72 085	73 025
Number of registered unemployed people in urban areas (10 000s)	288	520	595	681
Registered unemployment rate in urban areas (%)	2.3	2.9	3.1	3.6

Source: State Statistical Bureau, 1990 to 2002.

DATA SOURCES FOR DIETARY INTAKE, NUTRITION AND HEALTH INDICATORS

Three main data sources were used to analyse the trends in diet, nutritional status and disease burden in the Chinese population. The primary source of data on dietary intake is the China Economic, Population, Nutrition and Health Survey (CHNS), which was conducted in 1989, 1991, 1993, 1997 and 2000. The National Nutrition Survey (NNS) was conducted in 1992 and 2002 – this report uses only the data on chronic disease risk factors from NNS. The third data source is the China Disease Surveillance System. An outline of each of these sources is given in the following subsections

China Economic, Population, Nutrition and Health Survey

CHNS covers nine provinces that vary substantially in geography, economic development, public resources and health indicators (Figure 3). It is not nationally representative however. A multistage, random cluster sample is used to draw the sample surveyed in each of the provinces. Counties in the nine provinces are stratified by income (low, middle and high) and a weighted sampling scheme is used to select four counties randomly in each province. The provincial capital and lower-income cities are selected when feasible. Villages and townships in the counties and urban and suburban neighbourhoods in the cities are selected randomly. From 1989 to 1993, there were 190 primary sampling units; a new province (and its sampling units) was added in 1997, and currently there are about 3 800 households in the overall survey, representing 16 000 individuals of all age groups. The data can be stratified by region, gender and province.

Follow-up levels are high, but families that migrate from one community to another have not been followed.

CHNS collects information on all the individuals living in a household. A complete household roster is used as a reference for subsequent blocks of questions on time allocation at home (e.g., child care, elderly care and other key home activities) and on economic activities. Questions concerning income and time allocation aim to take into account all the activities that each person could have engaged in during the past year, both in and out of the formal market. Information on water sources, construction and housing conditions and ownership of consumer durables is gathered from respondents. Three days of detailed food consumption information is collected by combining household- and individual-level data. Household food consumption is determined by a detailed examination of changes in inventory between the start and end of each day for three consecutive days, in combination with a weighing technique. Dietary intake at the individual level is surveyed by 24-hour recalls for the same three consecutive days by asking individuals to report all their food consumption for each day, both away from and at home.

Recent CHNS have used food composition tables from 1992 to determine the nutrients consumed. In addition, individual dietary intake is collected for each household member for three consecutive days, irrespective of age or relationship to the household head. Adults and children receive detailed physical examinations that include weight, height, arm and head circumference, mid-arm skin fold and blood pressure (adults only) measurements. Limited clinical nutrition and physical functioning data were collected in 1993, 1997 and 2000. In 1997, the survey added daily living activities, related information for older adults and a new set of physical activity and inactivity data for all respondents.

FIGURE 3
Map of the CHNS survey regions[1]

[1] Light shaded regions included in CHNS

National Nutrition Survey (NNS) of China

The third NNS of China was conducted in 1992 and the fourth in 2002. In 1992, a stratified multi-stage cluster random sampling method was used. The survey covered the residents of sample units selected from 30 provinces. The sample size was 32 sites, including 960 households for each province, metropolis and autonomous region. Adjustments were made in some provinces to provide a total sample of 28 000 households in 30 provinces.

The fourth NNS of 2002 was China's first comprehensive nutrition and health survey. It systematically integrated several previous, separately organized surveys on nutrition, hypertension, diabetes, etc. into one survey and included some new indicators related to social and economic development. Cities were classified as large, medium or small according to their level of economic development. Beijing, Shanghai, Tianjin and Chongqing were included in the total of 18 large cities. Rural areas were classified as first, second, third or fourth class, based on economic level and population size. First class rural areas were the richest, and fourth class the poorest.

A stratified multi-stage cluster random sampling method was adopted to sample 71 971 households (24 034 urban and 47 937 rural) chosen from 132 counties in the 31 provinces, autonomous regions and municipalities directly under the central Government of China. The data can be stratified by urban and rural residence, gender and age. The survey covered diet, nutrition and a range of diet-related non-communicable disease (DR-NCD) risk factors, including hypertension, diabetes, obesity and abnormal blood lipid levels.

China Disease Surveillance System

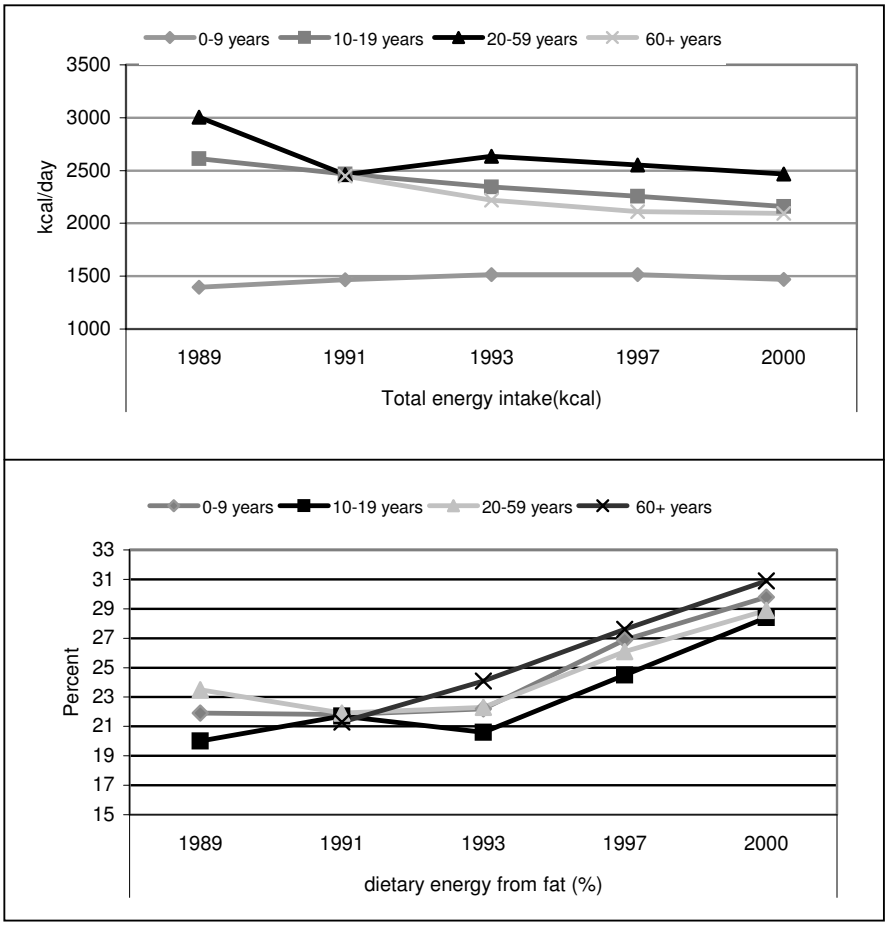
The China Disease Surveillance System was established in 1989. A multistage, randomized cluster process was used to draw the sample. The first layer was based on geographic representation, the second on urban and rural areas, and the third on economic and development levels and demographics. Cities were classified as large, medium and small. Rural areas were classified into four classes according to socio-economic status, population and the index of death, which were obtained from the Chinese population census of 1982. The four classes were (a) the richest rural areas, (b) the richer rural areas, (c) the poor rural areas, and (d) the poorest rural areas.

The survey covered 10 million people, about 1 percent of China's population. In 1989, 9 261 436 people were chosen for the sample, 2 253 963 from the cities and 7 007 473 from rural areas. A survey was conducted on this sample every year to collect data on demographics, births and deaths, infectious disease, smoking and other lifestyle factors. This report uses data from the period 1990 to 2002 to describe trends in the burden of disease.

TRENDS IN DIETARY INTAKE

This case study uses data from NNS and CHNS to identify trends in the food consumption of the Chinese population. In the period 1989 to 2000, total dietary energy intake decreased for all age groups – in adults 20 to 59 years of age by 39 kcal per day. However, the percentage of dietary energy derived from fat increased for all age groups, reaching 30.9 percent in people aged 60 years and over and 29.8 percent in children under nine years.

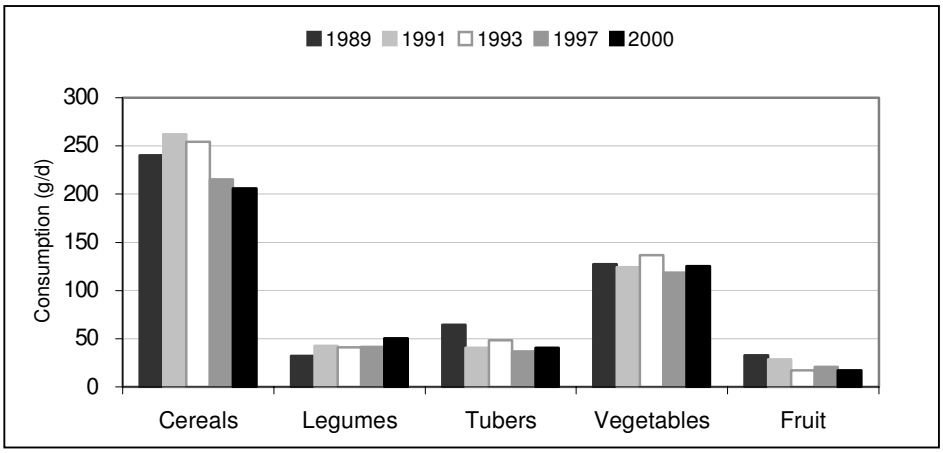
FIGURE 4
Total energy intake and dietary energy from fat in China, 1989 to 2000



TRENDS IN THE INTAKES OF CHILDREN AGED TWO TO FIVE YEARS

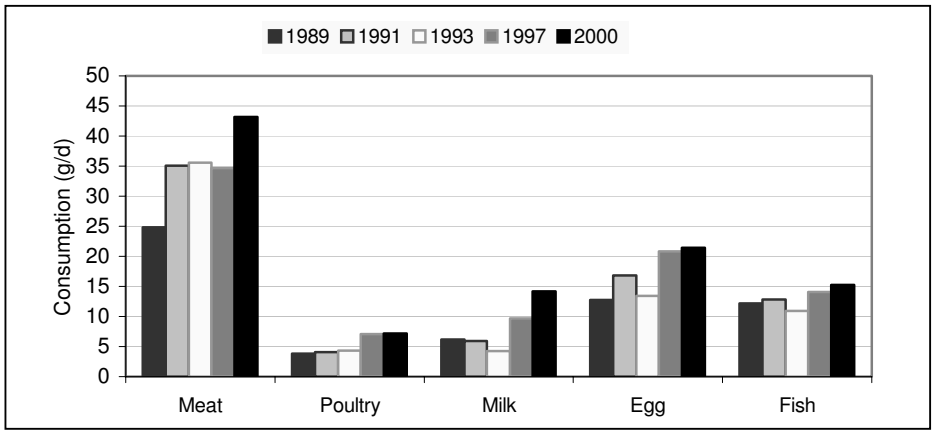
Over the past ten years, children's intakes of cereals and tubers declined from 240 to 205 g and from 64 to 40 g per day, respectively (Figure 5). The intake of vegetables remained relatively stable, while fruit intake decreased from 33 to 17 g per day. During the same period, the consumption of animal food increased – meat by 80 percent, and eggs by 75 percent (Figure 6). From 1997 to 2000, the consumption of milk increased from 10 to 15 g, which may signal an increasing trend in dairy consumption. Total energy intake decreased slightly, but the diet became proportionately richer in fat, which rose from providing 22 percent of dietary energy in 1989 to 31 percent in 2000 (Table 4). These trends generally represent positive developments in children's diets, indicating greater dietary variety, intake of high-quality protein sources and increases in essential micronutrients, including calcium, iron and zinc. However, in addition to the rapidly escalating percentage of dietary energy derived from fat, two other alarming trends are decreasing intakes of vitamins A and C, most likely resulting from decreased intake of fruits, which are good sources of these nutrients.

FIGURE 5
Trends in per capita intakes of vegetable products among children aged two to five years, 1989 to 2000



Sample sizes: 1989, 1 009; 1991, 1 086; 1993, 982; 1997, 514; 2000, 437.
Source: CHNS.

FIGURE 6
Trends in per capita intakes of animal products among children aged two to five years, 1989 to 2000



Sample sizes: 1989, 1 009; 1991, 1 086; 1993, 982; 1997, 514; 2000, 437.
Source: CHNS.

TABLE 4
Trends in intakes of nutrients in children aged two to five years, 1989 to 2000

Year	Nutrients									
	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Zinc (mg)	Vitamin A(ug)	Vitamin B1(mg)	Vitamin B2(mg)	Vitamin C(mg)
1989	1 240	36.8	30.1	212.5	11.2	5.7	304.9	0.6	0.4	56.5
1991	1 363	41.6	37.1	215.5	12.8	6.3	286.5	0.7	0.5	47.0
1993	1 264	39.4	32.5	209.8	11.7	6.1	268.8	0.6	0.4	52.3
1997	1 179	36.1	37.5	220.4	11.8	5.9	243.3	0.5	0.4	39.8
2000	1 225	38.3	42.8	246.3	13.2	6.3	298.7	0.6	0.5	44.9

Sample sizes: 1989, 1 009; 1991, 1 086; 1993, 982; 1997, 514; 2000, 437.
Source: CHNS.

Trends in the dietary intake of adults

The shift in the Chinese diet follows a classic pattern of Westernization. Economic progress, linked in part to the liberalization of food production controls and the introduction of a free market for food and food products, is connected to these important shifts in diet. Both the NNS and CHNS data show that intakes of cereals and tubers have decreased considerably during the past two decades, in both urban and rural areas and among all income groups. The results are shown in Tables 5 and 6 and Figure 8. The total intake of vegetables decreased and the intake of fruits remained stable over these years. At the same time, the daily intake of animal foods showed a large increase, with pork and eggs increasing far more rapidly than the others. Urban residents' per capita daily intake of animal foods was higher than rural residents' (Table 5). The intake level of animal foods for the high-income group was almost twice that for the low-income group (Figure 9).

Over the past decade, the proportion of dietary energy derived from fat in the adult diet increased dramatically from 19 to 28 percent, mainly owing to the replacement of dietary energy from carbohydrates (Figure 7). The food group changes that accompanied this trend in increasing fat intake included an increased consumption of meat, especially pork, poultry and milk. Surprisingly, the consumption of animal fats and vegetables oils did not increase, in either urban or rural areas (Table 5). However, about one-half of dietary fat came from edible oil, while the consumption of refined animal fat decreased. The pace of this trend is alarming and signals a need to slow the population's intake of fats, which will soon exceed recommended levels. Decreasing consumption of vegetable oil, pork and pork products is critical in controlling the fat intake in the Chinese diet.

An analysis of current trends in intakes of the major food groups, stratified by income and urban/rural residence, provides some interesting insights. Certain trends in intake (e.g., increased fruit, vegetables and milk) seem to be dominated by residence location, with urban consumers more likely to have increased intakes of fruit and milk, and rural consumers more likely to consume more vegetables. Income can be seen as driving the intake of sugar, while a combination of residence location and income seems to be significant in meat consumption trends.

FIGURE 7
Trends in shares of macronutrients in total dietary energy intake, 1989 to 2000

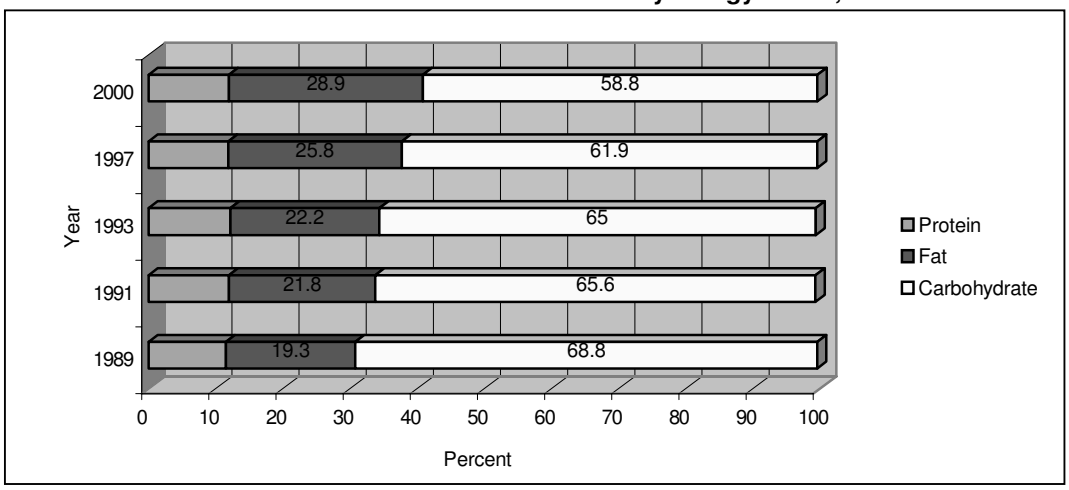


TABLE 5
Trends in intakes (g/day) of food groups among adults (18 to 45 years) by residence, 1989 to 2000

Food	Total					Rural					Urban				
	1989	1991	1993	1997	2000	1989	1991	1993	1997	2000	1989	1991	1993	1997	2000
Cereals															
Rice	348	337	320	297	274	362	338	335	312	290	316	336	284	262	237
Wheat	190	196	199	181	152	193	196	211	193	154	183	194	169	153	146
Maize	44	25	21	20	14	60	28	27	25	16	10	18	6	6	7
Other	19	10	11	8	6	26	9	12	9	6	5	11	6	6	7
Tubers															
Potato	18	26	23	28	27	22	28	27	32	30	9	23	12	19	19
Sweet potato	58	24	13	10	6	75	26	16	13	7	21	18	6	4	3
Other	71	44	53	45	40	77	41	55	46	41	58	50	48	44	48
Meat															
Beef	3	4	6	7	7	2	4	5	5	5	5	5	10	11	11
Pork	52	59	62	60	69	44	59	52	49	60	71	59	89	86	91
Poultry	7	7	9	12	14	4	7	6	10	12	12	7	14	17	19
Eggs	11	14	15	24	26	9	13	12	20	23	16	15	22	33	32
Other	2	1	1	2	2	2	1	1	1	1	2	1	2	5	4
Fish	24	21	22	28	26	22	21	20	25	25	27	22	28	35	30
Dairy															
Fresh milk	1.2	1.8	2.1	1.5	3.8	0.1	1.3	0.8	0.5	1.7	3.5	2.9	5.3	3.9	9.3
Powdered milk	0.1	0.2	0.1	0.3	0.3	0.1	0.2	0.1	0.1	0.0	0.3	0.3	0.2	0.8	0.8
Legumes															
Pulses	79	80	77	81	96	78	80	77	79	96	80	80	78	87	95
Nuts	3	3	2	2	4	3	3	2	3	4	5	3	3	2	3
Vegetables															
Green leafy	227	181	178	172	159	242	181	188	183	169	182	151	148	133	163
Vegetables	53	84	94	98	98	53	86	102	98	100	53	79	76	97	92
Other	16	13	12	10	8	19	16	13	11	8	8	8	10	9	7
Fruit															
Citrus	2	1	1	2	1	1	1	1	1	1	3	2	2	3	2
Other	12	8	11	8	11	13	7	10	5	7	11	10	14	17	20
Fats and oils															
Animal fat	18	13	10	10	12	19	14	11	10	12	15	12	9	9	12
Vegetable oil	32	22	22	31	30	30	22	21	30	30	37	22	26	34	30
Sugar															
Soft drinks	0.1	0.1	0.1	0.4	0.3	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	1.1	0.4
Confectionary	2.6	1.8	2.0	2.5	2.0	2.3	1.8	1.4	2.3	1.9	3.5	1.8	3.3	3.0	2.3
Other foods	54.1	32.8	31.4	38.5	39.8	51.1	33.6	31.0	38.3	40.1	60.8	31.2	32.2	39.0	38.8

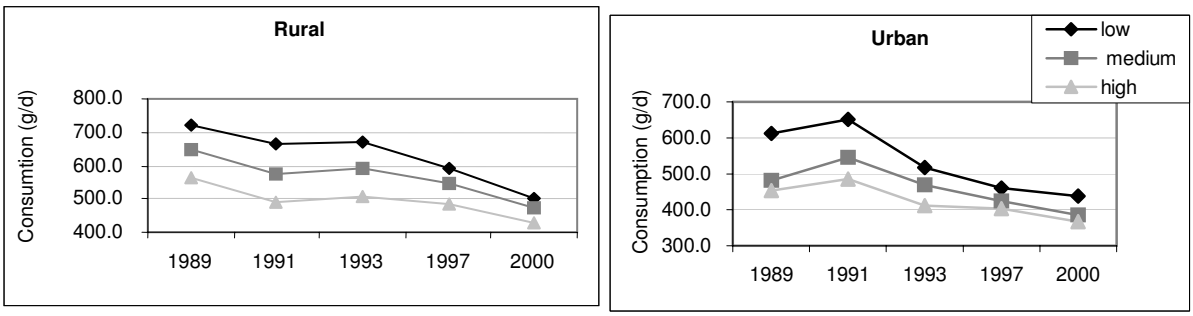
Sample sizes: 1989, 5 789; 1991, 5 838; 1993, 5 468; 1997, 5 334; 2000, 4 831.
Source: CHNS.

TABLE 6
Food consumption in rural and urban areas of China (g/day), 1992 and 2002

Foods	Total		Rural		Urban	
	1992	2002	1992	2002	1992	2002
Rice	226.7	238.3	255.8	246.2	223.1	217.8
Wheat	178.7	140.2	189.1	143.5	165.3	131.9
Other cereals	34.5	23.6	40.9	26.4	17.0	16.3
Tubers	86.6	49.1	108.0	55.7	46.0	31.9
Green leafy vegetables	102.0	90.8	107.1	91.8	98.1	88.1
Other vegetables	208.3	185.4	199.6	193.8	221.2	163.8
Fruit	49.2	45.0	32.0	35.6	80.1	69.4
Nuts	3.1	3.8	3.0	3.2	3.4	5.4
Meat	58.9	78.6	37.6	68.7	100.5	104.5
Eggs	16.0	23.7	8.8	20.0	29.4	33.2
Fish	27.5	29.6	19.2	23.7	44.2	44.9
Dairy	14.9	26.5	3.8	11.4	36.1	65.8
Vegetable oil	22.4	32.9	17.1	30.1	32.4	40.2
Animal fat	7.1	8.7	8.5	10.6	4.5	3.8
Sugar and starch	4.7	4.4	3.0	4.1	7.7	5.2
Salt	13.9	12.0	13.9	12.4	13.3	10.9
Sauce	12.6	8.9	10.6	8.2	15.9	10.6

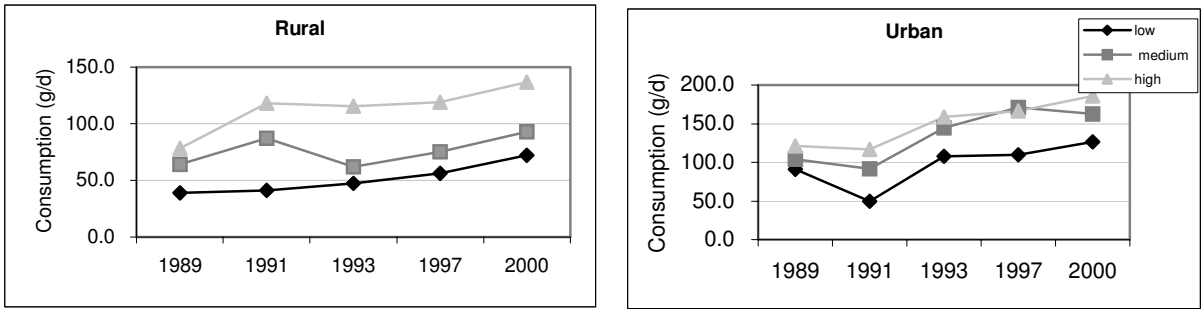
Source: NNS.

FIGURE 8
Trends in cereal consumption in adults (18 to 45 years) by income group and residence, 1989 to 2000



Sample sizes: 1989, 5 789; 1991, 5 838; 1993, 5 468; 1997, 5 334; 2000, 4 831.
Source: CHNS.

FIGURE 9
Trends in consumption of meat in adults (18 to 45 years) by income group and residence, 1989 to 2000



Sample sizes: 1989, 5 789; 1991, 5 838; 1993, 5 468; 1997, 5 334; 2000, 4 831
Source: CHNS.

Trends in the achievement of various population nutrient intake goals are shown in Table 7. The percentage of dietary energy derived from fat increased in all age groups. The dietary fat intake in suburban and town areas increased rapidly. The proportion of energy from fat reached 30 percent in suburban and town areas, and 35 percent in urban ones. The percentage of people consuming at least 400 g of fruits and vegetables a day dropped for all age groups, while those consuming less than 5 g of sodium chloride also decreased. In 1997, urban adults' intake of cholesterol reached 361.6 mg/d, exceeding the recommended daily allowance (RDA) of 300 mg/d. The cholesterol intake of 54 percent of urban adults was more than 300 mg/d. The cholesterol intakes of suburban and town residents increased to 250 mg/d and 270 mg/d, respectively, but that of rural residents remained stable at a lower level of 150 mg/d. High intakes of dietary fat, sodium and cholesterol increase the risk of chronic diseases such as obesity, diabetes, cardiovascular disease (CVD) and some cancers, especially in middle-aged and elderly populations.

TABLE 7
Achievement of population nutrition intake goals

Age (yrs)	Year	% energy intake from fat			55–75% energy intake from carbohydrate (%)	< 5 g sodium chloride per day (%)	< 10 % energy intake from sugars (%)	≥ 400 g/day fruit and vegetables
		< 15	15–30	> 30				
10–19	1989	43.0	35.5	21.5	52.7	37.0	100.0	23.1
	1993	34.8	45.4	19.8	57.1	22.5	99.9	23.1
	2000	12.3	45.7	42.0	57.1	18.6	97.7	15.3
20 – 59	1989	28.1	43.9	28.0	56.3	27.9	99.6	29.3
	1993	28.3	47.9	23.8	57.6	17.0	99.9	26.0
	2000	11.3	44.3	44.4	54.8	13.9	97.8	21.3
≥ 60	1991	29.4	51.1	19.5	60.8	16.6	99.8	18.8
	1993	23.3	47.1	29.6	58.1	22.7	99.7	16.2
	2000	9.2	37.7	53.1	46.9	14.6	98.4	15.4

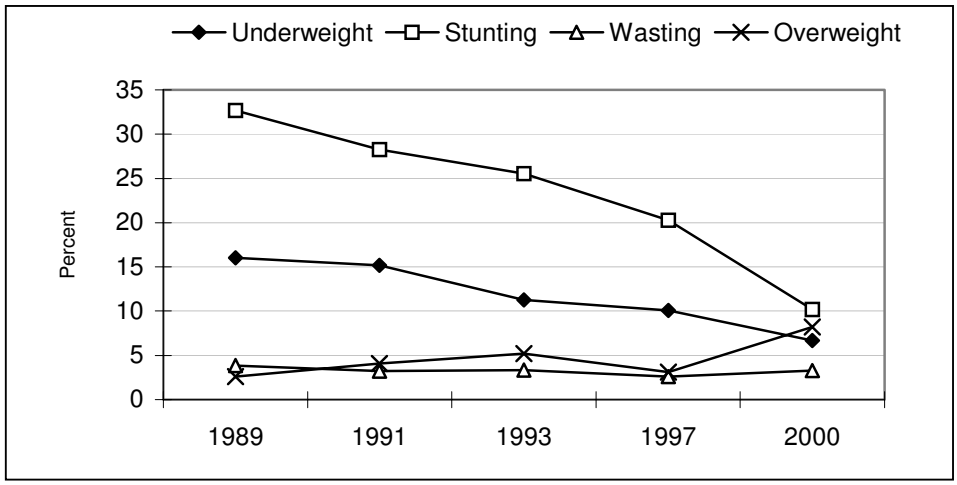
TRENDS IN NUTRITIONAL STATUS

This case study used the CHNS and NSS data to describe trends in the nutritional status of children and adults in China. Data from CHNS are preferred as they cover five points in time from 1989 to 2000. Unfortunately, CHNS surveyed very few children under two years of age and so cannot be used to provide information about trends in the prevalence of malnutrition for children in that age group. NNS, which provides data for 1992 and 2002, was used to examine changes in prevalence of stunting and underweight among children up to five years of age.

Trends in the nutritional status of children aged two to five years

The analysis results of CHNS showed that dramatic improvements in the nutritional status of Chinese children aged two to five years occurred between 1989 and 2000 (Figure 10). The prevalence of stunting decreased from 33 to 10 percent overall, from 17 to 3 percent in urban areas, and from 30 to 14 percent in rural ones. The height for age Z-score also increased, from –0.72 to 0.54 in urban areas, and from –1.28 to –0.27 in rural ones. There was also a sustained decrease in the prevalence of underweight children, from 16 to 6 percent overall, 11 to 3 percent in urban areas and 15 to 7 percent in rural ones. The weight-for-age Z-score increased from –0.36 to 0.32 in urban areas and from –0.71 to –0.35 in rural ones. Over the same period, the prevalence of overweight children increased from 2.6 to 8.2 percent.

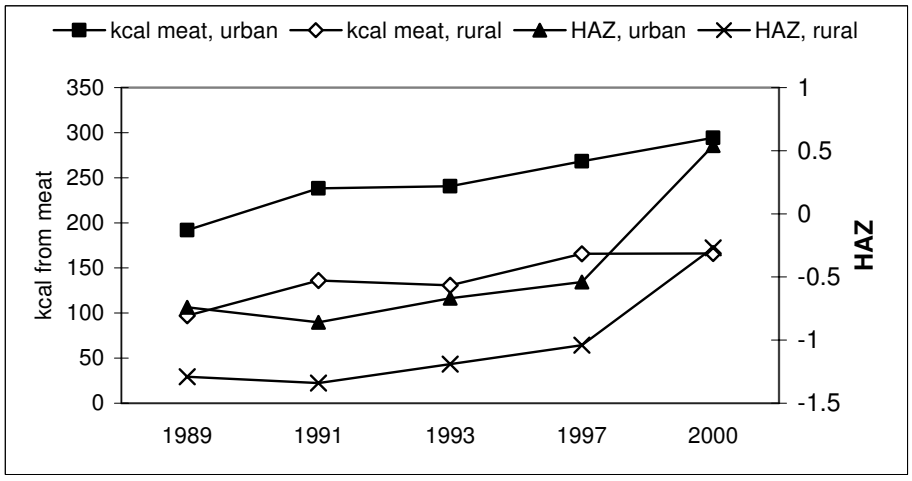
FIGURE 10
Trends in the nutritional status of children aged two to five years, 1989 to 2000



Sample sizes: 1989, 699; 1991, 721; 1993, 651; 1997, 325; 2000, 451.
CHNS growth references: underweight = weight-for-age < -2SD; wasting = weight-for-height < -2SD; stunting = height-for-age < -2SD; overweight = weight-for-height > 2SD.
Source: CHNS.

The results of many investigations have shown that in developing countries, energy intake plays an important role in the long-term development of children (Zhai *et al.,* 2004; Chang *et al.,* 1996). When nutritional status and energy intake improve, the increase in the percentage of energy intake from animal protein becomes a key contributor to child development. The data from CHNS show that the height gain of children is positively correlated with the percentage of energy they derive from animal food (Figure 11).

FIGURE 11
Trends in energy supply from animal foods and mean height-for-age Z scores, 1989 to 2000



Sample sizes: 1989, 699; 1991, 721; 1993, 651; 1997, 325; 2000, 451.
Source: CHNS.

Trends in the nutritional status of children up to five years of age

Tables 8 and 9 show data for stunting and underweight by age and residence. In rural areas, stunting prevalence is 17.3 percent, compared with 4.9 percent in urban ones. The prevalence of

underweight is lower than that of stunting, but differences by residence remain. A further disaggregation by economic status and residence (not shown) indicates that the prevalence rates of stunting and underweight in poor rural areas in 2002 were 29.3 and 14.4 percent, respectively. The prevalence of stunting and underweight were lowest among the one-year age group, at 8.0 and 2.6 percent, respectively. The highest prevalence of stunting in 2002 was in the 12 to 23-month age group, after which age prevalence decreased slightly.

TABLE 8
Trends in prevalence of stunting (percentage) by age and residence, 1992 and 2002

Age	Urban		Rural		Total	
	1992	2002	1992	2002	1992	2002
0–11 months	10.7	3.9	15.2	9.2	14.4	8.0
12–23 months	19.9	8.6	37.3	20.9	33.8	18.0
24–35 months	17.2	8.0	33.0	17.3	30.3	15.1
36–47 months	19.0	3.3	41.0	19.0	36.6	15.2
48–59 months	24.8	4.9	40.6	19.6	37.4	16.1
Overall	19.1	4.9	35.0	17.3	31.9	14.3

Reference: WHO Growth Reference.
Source: NNS.

TABLE 9
Trends in prevalence of underweight (percentage) by age and residence, 1992 and 2002

Age	Urban		Rural		Total	
	1992	2002	1992	2002	1992	2002
0–11 months	8.7	1.7	10.0	2.9	9.7	2.6
12–23 months	9.8	4.6	21.8	9.6	19.3	8.4
24–35 months	10.6	5.1	21.0	11.2	19.2	9.8
36–47 months	8.5	2.4	23.8	11.7	20.7	9.4
48–59 months	12.4	3.4	19.5	11.5	18.1	9.6
Overall	10.1	3.1	20.0	9.3	18.0	7.8

Reference: WHO Growth Reference.
Source: NNS.

Trends in the nutritional status of adults

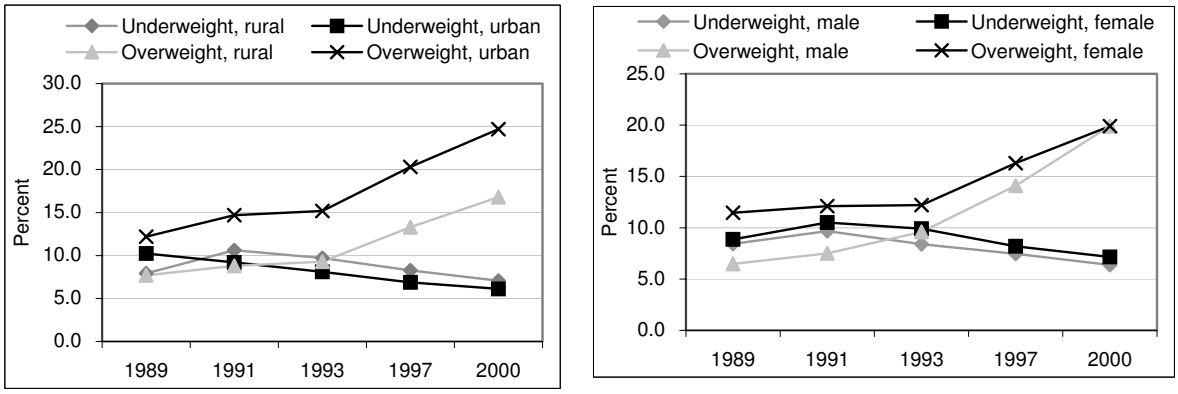
CHNS and NNS provided detailed anthropometric data that made it possible to analyse the trends in adult nutritional status. The CHNS data were used to describe the trends in body mass index (BMI) distribution among adults aged 18 to 45 years. The World Health Organization (WHO)-defined cut-offs were used to classify adults as underweight, normal weight or overweight. Underweight was defined as BMI less than 18.5 kg/m^2. BMI of more than 25 kg/m^2 was classified as overweight/obese.

Figures 12 and 13 show trends in the BMI distribution of males and females aged 18 to 45 years. The shape of the BMI distribution curves of males and females changed over the 11 years from 1989 to 2000. The main characteristic of the change is a shift to the right for both the male and the female curves. For males, mean BMI increased from 21.3 to 22.4 kg/m^2; for females, it increased from 21.8 to 22.5 kg/m^2. At the same time, the dispersion

of BMI distributions widened. For males, the standard deviation increased from 2.3 to 3.1, for females, from 2.7 to 3.2. When the male and female BMI distribution curves from 1989 to 2000 are compared, the mean BMIs for females in 1989 and 1997 are significantly higher than those for males. The difference in BMI distribution between genders disappeared in 2000, because the change was significantly higher in males than in females.

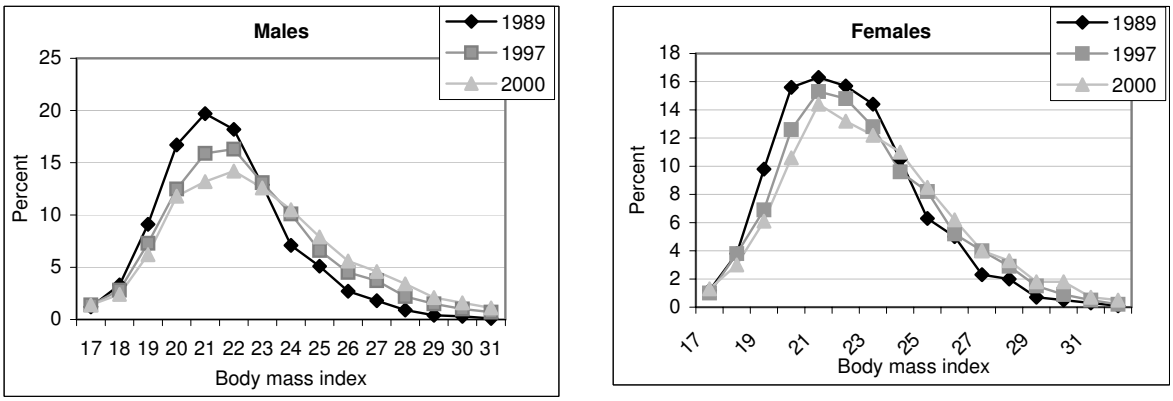
In 2002, the total prevalence of overweight and obesity was 22.7 percent; however, 6.8 percent of adults aged 18 to 45 years were underweight. The prevalence of adult obesity was 7.1 percent. It is estimated that 200 million Chinese adults are overweight, and 60 million obese. The prevalence rates of overweight and obesity among adults in large cities were 30.0 and 12.3 percent, respectively.

FIGURE 12
Trends in under- and overnutrition in adults (18 to 45 years) by residence and gender, 1989 to 2000



Sample sizes: 1989, 4 527; 1991, 7 204; 1993, 7 621; 1997, 7 969; 2000, 7 862.
Source: CHNS.

FIGURE 13
Changes in BMI distribution curves for males and females, 1989 to 2000



Survey population: adult males 18 to 45 years; adult females 20 to 45 years.
Sample sizes: 1989, 4 527; 1991, 7 204; 1993, 7 621; 1997, 7 969; 2000, 7 862.
Source: CHNS.

TABLE 10
Prevalence of overweight and obesity in China (percentages), 2002

Age (years)	Overweight	Obesity	Overweight and obesity
0–6	3.4	2	5.4
7–17	4.2	1.8	6
18 and over	18.9	2.9	21.8
Overall	14.7	2.6	17.3

Sample size: 209 849.
Reference: WHO reference.
Source: NNS.

Trends in micronutrient deficiencies

Although the prevalence rates of micronutrient deficiencies, including iron and vitamin A, have declined in the past ten years, they are still common problems in China.

Anaemia

The NNS data from 1992 and 2002 were used to analyse changes in the prevalence of anaemia among the Chinese. The WHO and United Nations Children's Fund (UNICEF) cut-offs of 2001 were used to define the prevalence of anaemia. The results showed that prevalence decreased slightly in the period 1992 to 2002 (Table 11). In adults, the prevalence of anaemia in urban males declined from 15.2 to 12.0 percent, and in urban females it declined from 25.8 to 20.1 percent. The prevalence among rural males remained at 18 percent, and among rural females at 24 to 25 percent. The prevalence rates of anaemia among infants and children under two years of age, people over 60 years of age and child-bearing women were 24.2, 21.5 and 20.6 percent, respectively. Anaemia is still a public health problem in China.

TABLE 11
Changes in the prevalence of anaemia (percentages) by gender and residence, 1992 and 2002

Age (years)	Urban male		Rural male		Urban female		Rural female	
	1992	2002	1992	2002	1992	2002	1992	2002
0–1	23.0	29.9	29.5	33.9	28.8	24.5	30.0	32.8
2–4	13.3	7.2	18.1	15.6	12.8	5.8	16.9	13.3
5–11	14.8	8.4	14.7	14.0	15.7	9.0	17.0	13.3
12–17	12.9	11.2	16.5	16.2	22.7	13.0	16.3	19.0
18–44	11.9	10.9	14.4	14.6	26.5	23.7	24.7	27.2
45–59	16.3	13.1	20.6	21.5	29.1	21.1	27.2	28.0
60 and more	26.2	18.3	34.1	31.9	31.5	20.9	32.9	31.3
Overall	15.2	12.0	17.8	18.0	25.8	20.1	23.3	24.9

Source: NNS.

Vitamin A deficiency

In 2002, the prevalence of vitamin A deficiency (VAD) (measured as serum retinol < 20 µg/dl) among children aged three to 12 years was 9.3 percent, in urban areas it was 3.0 percent, and in rural ones 11.2 percent. The prevalence of marginal VAD (measured as serum retinol between 20 and 29µg/dl) was 45.1 percent, with a prevalence in urban areas of 29.0 percent and in rural areas of 49.6 percent.

Iodine deficiency

The prevalence of goitre among children eight to ten years of age declined from 20 percent in 1995 to 6 percent in 2002; in 2002 it was less than 5 percent in 12 provinces, between 5 and 10 percent in 14 provinces, and more than 10 percent in five provinces.

TRENDS IN CHRONIC DISEASE RISK FACTORS

Hypertension

The 2002 NNS data and the 1991 National Sample Hypertension Survey data were used to study the prevalence of hypertension. Hypertension was defined as a mean systolic blood pressure of ≥ 140 mm Hg, mean diastolic blood pressure of ≥ 90 mm Hg, or both, when taken at two ambulatory visits five to 14 days apart. The prevalence of hypertension in people over 18 years of age increased from 11.9 percent in 1991 to 18.8 percent in 2002. It is estimated that more than 160 million people in China have hypertension. Compared with 1991, the prevalence of hypertension increased by 31 percent, and there have been more than 70 million new hypertension patients in the past decade. The prevalence of hypertension in rural areas also increased rapidly; there is no significant difference between urban and rural prevalence rates.

TABLE 12
Trends in the prevalence of hypertension in adults, 1991 and 2002

Gender	1991	2002
Male	12.3	20.2
Female	11.5	18.0
Overall	11.9	18.8

Sources: NNS, 2002; National Hypertension Survey, 1991.

Diabetes

It is estimated that there are more than 20 million diabetic patients in China. In 2002, the prevalence of type-2 diabetes among adults over 18 years of age was 2.6 percent, and among those over 60 years of age living in large cities it was 16.97 percent. The prevalence of diabetes is significantly higher in urban than in rural areas; in 2002, the prevalence in large cities was three times as much as it was in rural areas.

There are insufficient history data on diabetes to allow the change in prevalence of type-2 diabetes in China to be described. However, data from urban areas in the National Diabetes Survey in 1996 and the NNS in 2002 can be compared (Table 13). The prevalence of type-2 diabetes in large cities increased from 4.58 to 6.07 percent during the 1996 to 2002 period.

TABLE 13
Trends in the prevalence of type-2 diabetes among adults in China, 1996 and 2002

Age (years)	1996		2002		
	Large city	Small city	Large city	Small city	Rural
18–44			3.13	1.45	0.98
45–59			9.88	6.88	2.96
≥ 60			16.97	11.37	4.41
Overall	4.58	3.37	6.07	3.74	1.83

Sources: NNS, 2002; National Diabetes Survey, 1996.

Blood lipids

The 2002 NNS was the first survey to provide national information about abnormal blood lipid levels in China. Hypercholesterolaemia was defined as blood cholesterolaemia of ≥ 5.72 mmol/l, while blood cholesterolaemia between 5.20 and 5.71 mmol/l was defined as borderline high cholesterol. Low serum HDL cholesterol was defined as serum HDL ≤ 0.91 mmol/l, and hypertriglyceridaemia as serum triglyceridaemia ≥ 1.70 mmol/l. A person who has one of these conditions is regarded as being in the abnormal blood lipids group.

The results show that the problem of abnormal blood lipid levels in China requires close attention. The prevalence of abnormal blood lipid levels among adults over 18 years of age was 18.6 percent – 22.2 percent among males and 15.9 percent among females. In 2002, it was estimated that 160 million people suffered from abnormal blood lipid levels. The prevalence rates of various types of abnormalities were: hypercholesterolaemia, 2.9 percent overall, 2.7 percent in males, and 2.9 percent in females; hypertriglyceridaemia, 11.9 percent overall, 14.5 percent in males, and 9.9 percent in females; and low blood HDL cholesterol, 7.4 percent overall, 9.3 percent in males, and 5.4 percent in females. An additional 3.9 percent of survey subjects had borderline high cholesterol levels. There was no significant difference in the prevalence of abnormal blood lipid levels between middle-aged and elderly subjects, nor any significant difference between urban and rural populations.

Physical activity levels

Large changes in technology at the workplace and in leisure activities are linked to rapid declines in physical activity. Economic activities are shifting towards the service sector, particularly in urban areas.

Data from CHNS for the last decade show a remarkable downward shift for the proportion of adults aged 18 to 45 years whose daily activity profile (based on occupation) would put them into a heavy activity category, compared with those in the light and medium categories.

The ownership of television sets has increased considerably over the past 20 years, especially in rural areas and among lower-income groups. In 2000, more than 90 percent of Chinese households owned a television. Television ownership represents a major potential source of inactivity.

TABLE 14
Trends in physical activity levels among Chinese adults (percentages), 1989 to 2000

Activity level	1989	1991	1993	1997	2000
Light	16.5	16.2	16.2	13.8	24.1
Moderate	18.9	19.0	18.9	21.3	25.2
Heavy	64.6	64.8	64.9	65.0	50.7

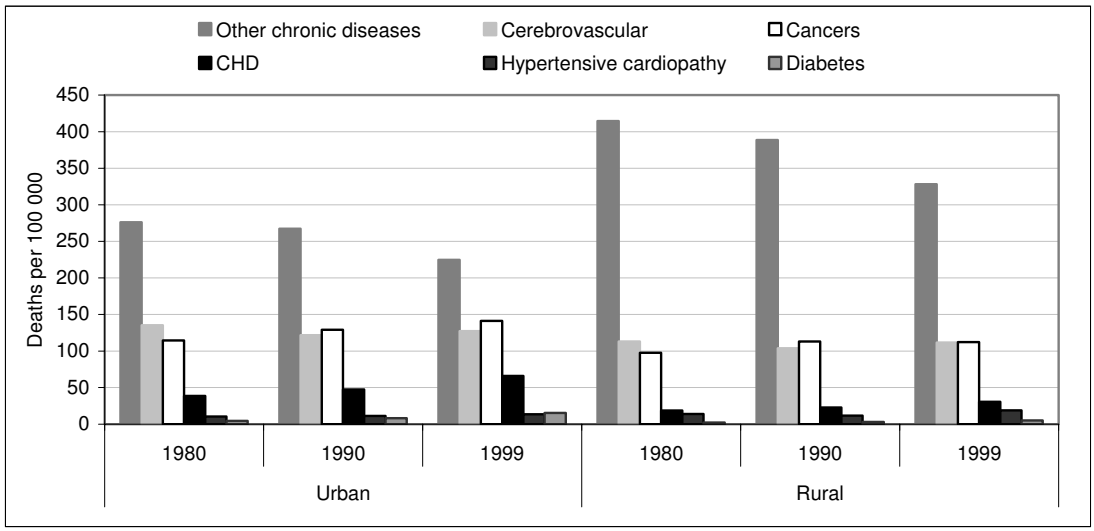
Classifications: light physical activity = working in standing position (e.g., office worker, watch repairer, salesperson, laboratory technician, teacher); moderate physical activity (e.g., student, driver, electrician, metal worker); heavy physical activity (e.g., logger, miner, stonecutter, farmer, dancer, steelworker, athlete).
Source: CHNS.

TRENDS IN MORBIDITY AND MORTALITY FROM CHRONIC AND INFECTIOUS DISEASE

In the past 20 years, the prevalence rates of chronic diseases have increased rapidly in China, while mortality from infectious disease has declined (Figure 14 and Table 15). China has shifted from infections and malnutrition to diseases related to hypertension, coronary heart disease

(CHD) and cancers. Chronic diseases have become the main cause of death in China. In 2000, the leading cause of death was cancer, followed by cerebral-vascular disease and CHD. Although infectious diseases are no longer the main causes of death, the morbidity levels from hepatitis, tuberculosis and dysentery remain high, and the burden of infectious diseases is still very high.

FIGURE 14
Trends in mortality from chronic disease in urban and rural areas, 1980 to 1999



Source: Ministry of Health of China.

TABLE 15
Trends of morbidity and mortality rates to infectious disease (per 100 000 population), 1990 to 2002

Year	Hepatitis		Tuberculosis		Dysentery		Malaria		HIV	
	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality rate
1990	117.57	0.16			127.44	0.17	10.56	0.00		
1991	116.87	0.14			115.58	0.10	8.88	0.00		
1992	109.12	0.12			79.55	0.06	6.40	0.00		
1993	88.77	0.10			54.50	0.04	5.05	0.00		
1994	73.52	0.09			74.84	0.02	5.29	0.00		
1995	63.63	0.09			73.30	0.04	4.19	0.00		
1996	63.41	0.08			66.31	0.03	3.08	0.00		
1997	66.05	0.09	39.21	0.07	59.69	0.03	2.87	0.00	0.15	0.00
1998	65.78	0.07	34.69	0.07	55.34	0.03	2.67	0.00	0.10	0.00
1999	71.68	0.06	41.72	0.07	48.30	0.02	2.39	0.00	0.18	0.00
2000	64.91	0.07	43.75	0.03	40.79	0.01	2.02	0.00	0.20	0.00
2001	65.46	0.06	44.89	0.03	39.86	0.01	2.15	0.00	0.30	0.00
2002	66.10	0.08	43.58	0.08	36.23	0.02	2.65	0.00	0.33	0.00

Source: China Disease Surveillance.

POLICIES AND PROGRAMMES

China is undergoing a remarkably – and undesirably – rapid transition towards a stage of the nutrition transition characterized by high rates of DR-NCDs. Some public sector organizations in China have combined their efforts in the initial stages of systematic attempts to reduce these

problems. Such efforts, which focus on both under- and overnutrition, include the new Dietary guidelines for Chinese residents, the Chinese Pagoda and the National Plan of Action for Nutrition in China, which has been issued by the highest body of the government – the State Council. Apart from some activities in the agriculture sector, few systematic efforts are having an impact on behaviour. In the health sector, efforts to reduce hypertension and diabetes are increasing, but limited work is being done in the nutrition sector. There is a need for nutrition education activities and dissemination to promote the principles of the Dietary guidelines for Chinese residents, as well as more guidance on increased physical activity and its benefits (Zhai *et al.,* 2002b).

CONCLUSION

The nutrition and health status of Chinese people has improved significantly in the past 20 years. China is one of the world's most rapidly developing countries. Over the past two decades, the annual gross domestic product (GDP) growth rate was more than 8 percent, the highest in recent world history (World Bank, 2002). As a result, the proportion of the absolutely poor population in China decreased sharply from 80 percent in 1978 to less than 12 percent in 1989; the proportion of the extremely poor decreased from 20 to 6 percent over the same period (State Statistical Bureau, 2002). China has achieved remarkable economic progress and high levels of education, and a rapid evolution of the Chinese diet has accompanied these economic shifts and related social changes.

Historically, the Chinese diet has been primarily plant-based. The classic diet includes cereals and vegetables, with few animal foods. Many experts consider such a diet to be very healthy when adequate levels of intake are achieved (Du *et al.,* 2002; Campbell, Parpia and Chen, 1998). The fat intake of the Chinese population remained at a low level for a relatively long time. Since the 1990s, however, there have been noticeable changes in the Chinese dietary pattern resulting from rapid economic development, an adequate food supply and changes in consumption patterns. With income increases, the consumption of animal food – particularly meat and eggs – has grown dramatically, while consumption of cereals and tubers has decreased.

The quality of the average diet in China has improved significantly. Energy and protein intakes among both urban and rural populations have been basically satisfactory, consumption of meat, poultry, eggs and other animal products has increased significantly as has the percentage of good-quality protein in the diet. In general, the changes have improved the quality of the Chinese diet, but there are some alarming trends in the proportional intake of energy from fat, the increased consumption of saturated fat and cholesterol and the decreasing consumption of fruits and vegetables. Many, but not all, of these changes are more pronounced in urban areas (Du *et al.,* 2002; Campbell, Parpia and Chen, 1998; Zhai *et al.,* 2002a; Wang *et al.,* 2003; Popkin and Du, 2003; Popkin, Lu and Zhai, 2002), and dietary patterns among urban residents are not entirely satisfactory. Meat and oil consumption is too high, and cereal consumption is at a relatively low level. Low consumption of dairy products remains a common problem in China.

China is facing simultaneous challenges of malnutrition and overnutrition. The growth of children and teenagers has improved steadily. The prevalence of malnutrition and nutrition deficiencies such as stunting and underweight in children under six years of age, has decreased continuously (UNESCAP, 2004; UNDP, 2004; Du *et al.,* 2002; Campbell Parpia and Chen, 1998; Chang *et al.,* 1996; Zhai *et al.,* 2004; Wang, Monteiro and Popkin, 2002). Deficiencies of micronutrients such as iron and vitamin A are still important public health problems in both urban and rural populations. The prevalence of malnutrition is still

high: in 2002, 14.3 percent of preschool children were stunted, while 7.8 percent of preschool children and 6.8 percent of adults were suffering from underweight (NNS, 2005). On the other hand, the prevalence of overweight and obesity has risen at a relatively high degree, and stood at 22.7 percent for the overall population in 2002 (NNS, 2005).

Mortality from infectious diseases such as hepatitis, dysentery and malaria has been controlled in the past 20 years. Meanwhile, however, China is shifting remarkably quickly to a stage of the nutrition transition dominated by high intakes of fat and animal food, and an increasing prevalence of DR-NCDs such as obesity, diabetes mellitus, cardiovascular disease and cancer. The overweight and obesity prevalence and the morbidity to NCDs such as hypertension and type-2 diabetes have increased significantly in the past 20 years (Popkin *et al.,* 2001; Wang *et al.,* 2004). High dietary energy, high dietary fat and reduced physical activity are closely related to the occurrence of overweight, obesity, diabetes and abnormal blood lipid level. High salt intake increases the risks of hypertension. It should be emphasized that those with higher levels of fat intake and lower physical activity are at the highest risk of these chronic diseases (Popkin, 2001). Overweight, obesity and related chronic diseases have increased in both children and adults in the past 20 years and are now a major public health problem in China. In view of China's rapid nutrition transition, it is necessary to provide better guidance to the public to enable them to make rational dietary choices and take measures to control their high intakes of dietary fat and cholesterol – factors that are very significant in the prevention and control of chronic diseases.

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Assessment of dietary changes and their health implications in countries facing the double burden of malnutrition: Egypt, 1980 to 2005

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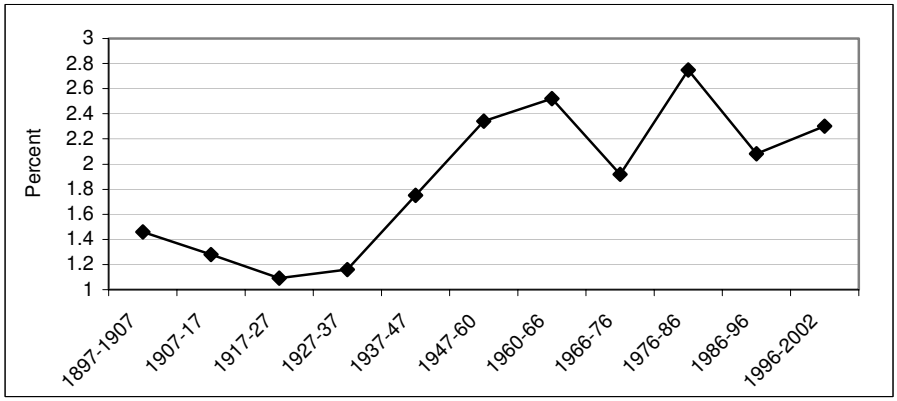
INTRODUCTION[1]

Egypt lies in the northwest corner of Africa and has the largest population of the Arab countries – 68.6 million people – according to population estimates made in 2004 (CAPMAS, 2004). The total land area is approximately 1 million km^2, only 6 percent of which is inhabited. Population density in the inhabited areas (primarily the Nile valley and delta) is therefore very high

DEMOGRAPHY AND URBANIZATION

The Egyptian population is estimated to have increased from 40.5 million in 1980 to 68 million in 2003. The average annual growth rate during the period 1976 to 1986 was 2.75 percent, decreasing to 2.08 percent in 1986 to 1996, and then increasing slightly again to 2.3 percent (Figure 1).

FIGURE 1
Average population growth rates (percentage), 1897 to 2002



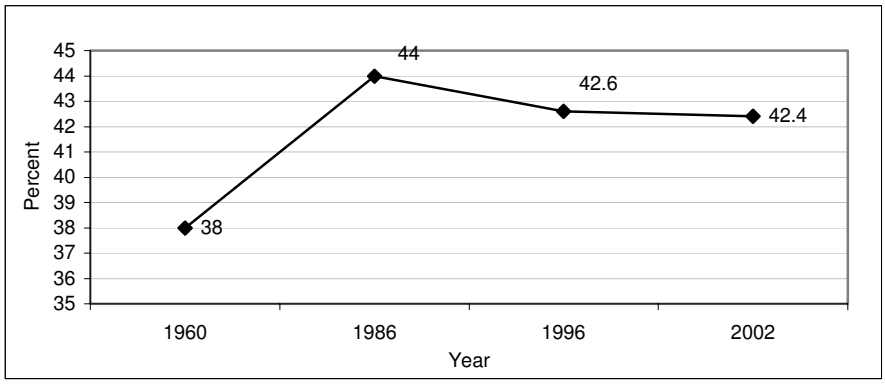
Sources: CAPMAS, 2004; EHDR, 2004.

The urban population has been growing rapidly since the early and mid-1980s, and now constitutes somewhat more than 40 percent of the total, with a decreasing growth rate that the most recent estimates put at 1.8 percent per annum (Figure 2). The declining growth rate of the urban sector may reflect the greater success of family planning efforts in urban than in rural

[1] This section was investigated by A. El-Hady Abbas, S. Khairy and M. Shehata.

areas. However, the urban population density has increased as a result of internal migration and the transformation of many villages into semi-urban areas (EHDR, 2004).

FIGURE 2
Urban population (as percentage of total), 1960 to 2002



Source: EHDR, 2004.

Economy

The government adopted an Arab socialist orientation during the period 1960 to 1970, which resulted in a fairly closed economy until 1974, when Egypt moved to an open market economy. The economy expanded rapidly during the 1990s, with gross national product (GNP) almost doubling between 1993 and 1997 and the rate of inflation decreasing to 3.6 percent (EDHS, 2000).

Gross domestic product (GDP) was 354 563.6 million Egyptian pounds (LE) in 2001/2002, increasing to 365 541.1 million LE in 2002/2003, with an annual growth rate of 3.1 percent. Over the last decade, there has been a gradual increase in annual per capita income, from 4 822.4 LE in 1998/1999, to 5 537.6 LE in 2000/2001 and 5 652.8 LE in2002/2003 (CAPMAS, 2004).

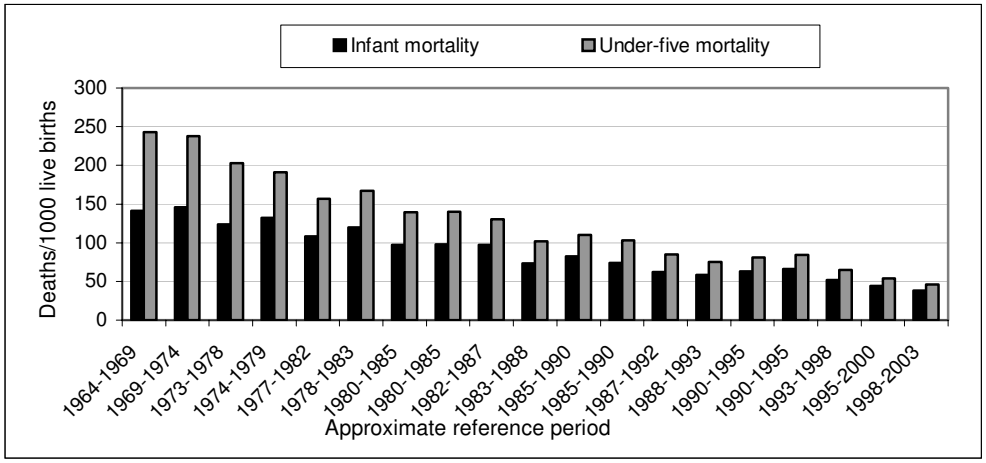
Indicators of quality of life in Egypt

Health indicators

Egypt was one of the first countries in the region to set up a comprehensive, nationwide health system with a relatively well-established network of health facilities in rural and urban areas. Nearly all of the Egyptian population has access to health care services. An illustrative indicator is the current complete immunization rate for children of 88 percent.

Childhood mortality rate. The 2003 Egypt Interim Demographic and Health Survey (EIDHS, 2003) estimates that childhood mortality is becoming increasingly concentrated in early infancy. For the five-year period before the survey, the under-five mortality rate was 46 per 1 000 births, and the infant mortality rate 38 per 1 000 births. More than 80 percent of early childhood deaths in Egypt were occurring in infants under the age of one year. Neonatal and post-neonatal mortality rates (23 and 15 per 1 000, respectively) show that three-fifths of infant deaths occur within the first month of life. Estimates of childhood mortality trends over the last 40 years (1964 to 2003) show a substantial decrease. Overall, the probability of dying before the age of five years has fallen by about 80 percent, from 243 deaths per 1 000 live births in the period 1964 to 1969, to 46 in the period 1998 to 2003 (Figure 3).

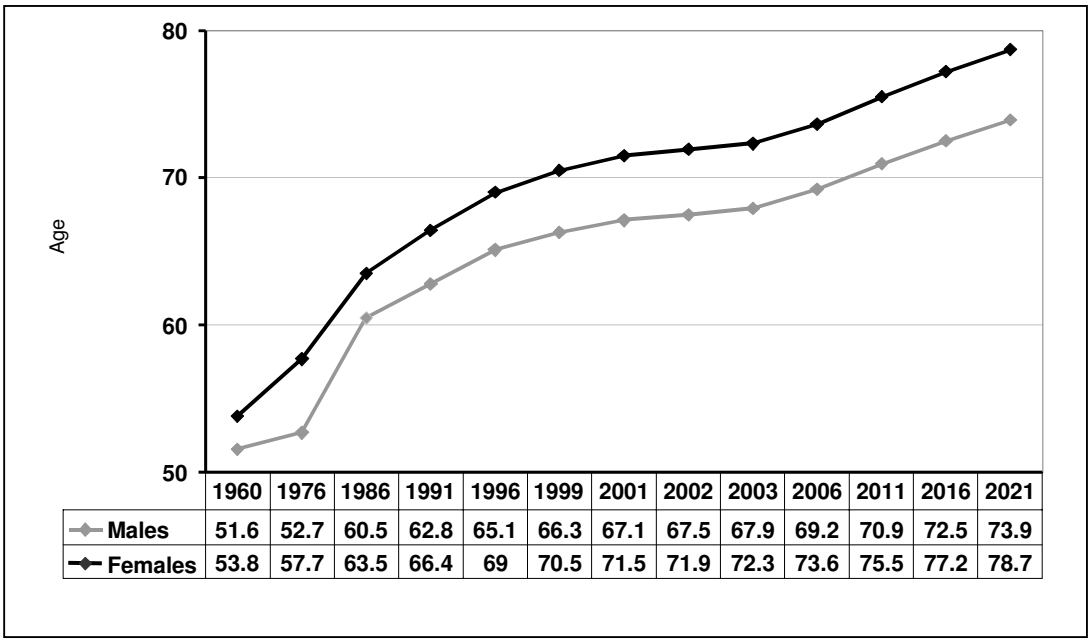
FIGURE 3
Trends in early childhood mortality rate, 1964 to 2003



Source: EIDHS, 2003.

Life expectancy. Life expectancy increased for males from 52.7 years in 1976 to 67.9 in 2003, and for females from 57.7 years in 1976 to 72.3 in 2003 (Figure 4). Life expectancy is anticipated to reach 73.9 and 78.7 years for males and females, respectively, in 2021 (CAPMAS, 2004).

FIGURE 4
Life expectancy at birth by gender, 1960 to 2021



	1960	1976	1986	1991	1996	1999	2001	2002	2003	2006	2011	2016	2021
Males	51.6	52.7	60.5	62.8	65.1	66.3	67.1	67.5	67.9	69.2	70.9	72.5	73.9
Females	53.8	57.7	63.5	66.4	69	70.5	71.5	71.9	72.3	73.6	75.5	77.2	78.7

Education and literacy

Enrolment in secondary education rose from 42 to 86 percent between 1960 and 2001. A similar trend also occurred in primary school enrolment, which increased from 68.6 to 91.4 percent during the same period. Literacy in the adult population (aged 15 years and over) grew from 25.8 percent in 1960 to 65.6 percent in 2001 – a significant increase that demonstrates the relative success of the government's education policy to eliminate

illiteracy; this is one of the major factors in Egypt's transition into the "medium level of development" category.

Water and sanitation

More than eight out of ten Egyptian households have access to piped water, mainly within their dwellings. Urban households have almost universal access to safe drinking-water; 99 percent of them have piped water in their residences, and most of the remaining households obtain water from a public tap. In rural areas, access to safe water is less widespread, with 74 percent of rural households having access to piped water, 6 percent obtaining drinking-water from public taps and the remaining 20 percent obtaining drinking-water from covered wells (EIDHS, 2003).

Two out of five households have modern flush toilets, with significant differences according to residence. More than two-thirds (68 percent) of urban households have modern flush toilets, compared with only 13 percent of rural households. In Upper Egypt, 80 percent of households in the urban governorates have modern flush toilets, compared with 8 percent in rural areas (EIDHS, 2003).

DIET AND DIETARY TRENDS[2]

There are two main sources of national-level food consumption data for Egypt. The first of these is a series of national surveys conducted by the National Nutrition Institute (NNI). In the early 1980s, a national food consumption survey was conducted in urban and rural areas of six governorates – Cairo, Alexandria, Sharkia, Souhag, Fayoum and Beheira; this covered 6 300 households, representing 35 334 individuals (Aly *et al.,* 1981). In 1995, an assessment of vitamin A status was conducted on children aged six months to six years. In 2000, another national survey was carried out to obtain up-to-date information on the national food consumption pattern; this covered 1 669 households, representing 9 134 individuals, which were randomly selected from the governorates that were studied in 1981 (Hassanyn, 2000). In 2004, a national survey was carried out to assess osteoporosis among adolescents and adults in Egypt (Hassan *et al.,* 2004). Dietary data for these surveys were collected by the food frequency of households method, and 24-hour recall and sample weighing of individuals' food intakes (Annexes 1 and 2). In the 1981 and 2000 surveys, 24-hour recall was used to calculate the mean daily per capita energy and protein intakes. For this case study, dietary data for the 1981 and 1995 surveys were derived from tables presented in the final reports, while those for the 2000 and 2004 surveys were reanalysed.

The second source of food consumption data is a series of surveys conducted by the Food Technology Research Institute, Agriculture Research Centre (FTRI/ARC) of the Ministry of Agriculture. These were first made in 1993/1994 (Khorshed, Ibrahim and Galal, 1995; Khorshed *et al.,* 1998), with subsequent rounds in 1999 and 2001/2002 (ARC, 2001/2002; Ibrahim, Youssef and Galal, 2002). The FTRI/ARC surveys were designed to create a system for monitoring the food consumption of Egyptian populations. With the exception of Khorshed *et al.,* 1998 – which is published in English and summarizes the first round of the FTRI/ARC surveys – the results of these surveys are available only in the form of final reports, and some are in Arabic only.

The NNI and FTRI/ARC surveys used different methods for analysing food intake data. In NNI surveys, data were converted into nutrient intake using Egypt's Food Composition Table, which is maintained by NNI and was compiled in 1996. To analyse the adequacy of nutrient

[2] This section was investigated by A. Tawfik, M. Mattar and D. Shehab.

intake, the NNI surveys use the recommended dietary allowances (RDAs) from FAO, the World Health Organization and the United Nations University (FAO/WHO/UNU, 1985) for protein and energy, from WHO (1989) for iron and from FAO/WHO (1975) for vitamins A and C, except the 2004 survey data, for which the FAO/WHO (2002) recommendations were utilized for vitamins and minerals.

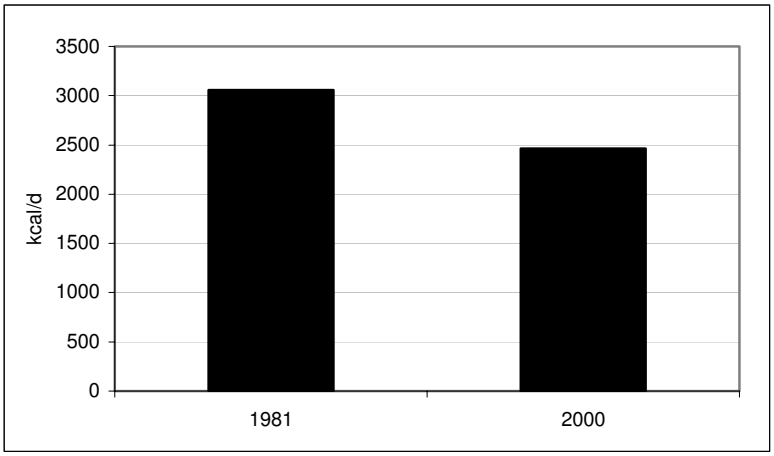
The FTRI/ARC surveys conducted since 1993 used a rotating sampling scheme. The first and largest round drew its sample from rural and urban areas in Cairo, Aswan, New Valley, Ismalia and Dakhalia governorates. Subsequent rounds utilized some overlapping and some different governorates, which were selected to include a large urban centre and governorates representing the Nile Delta and Upper Egypt. Data on adult women and on children aged two to six years were collected by the household food frequency method and quantitative 24-hour recall, with collection of detailed household recipes for prepared foods and the modelling survey methodology or that used in the United States National Nutrition Monitoring System surveys. Food intake data were converted to nutrient intakes using a modification of the United States Department of Agriculture's (USDA) standard reference database (Food Intake and Analysis System, Version 2.3, University of Texas), which was adjusted to remove the influence of enrichment/fortification and to include more than 1 000 Egypt-specific recipes (Khorshed *et al.,* 1998). Nutrient intake adequacy was expressed using the extant versions of the United States RDAs (published by the National Academy Press since 1989). The quality of the first round of these data was investigated with regard to completeness and underreporting (Harrison *et al.,* 2000) and it was found that the degree of apparent underreporting was far lower than it was in surveys of adult American women conducted with a similar methodology.

Because of important methodological differences between the surveys conducted by NNI and by FTRI/ARC, this case study presents each separately. However, both used internally consistent methodology so that trends over time in the data are reliable.

Trends in dietary energy and macronutrient intake

Data from NNI national surveys conducted in 1981 and 2000 show that the mean per capita calorie intake decreased from 3 057 kcal in 1981 to 2 460 kcal in 2000 (Aly *et al.,* 1981; Hassanyn, 2000) (Figure 5).

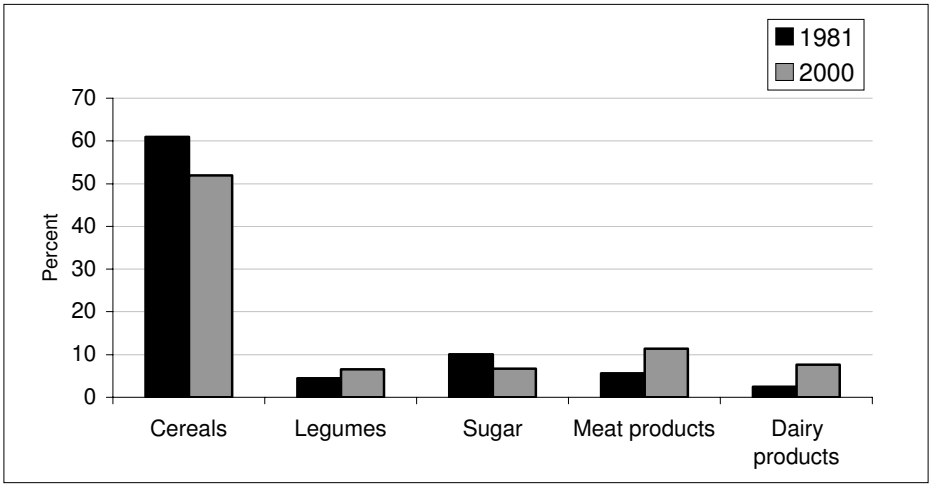
FIGURE 5
Mean per capita calorie intake, 1981 and 2000



Sources: Aly *et al.,* 1981; Hassanyn, 2000.

The changes in consumption patterns of Egyptian populations shown in the data from these two surveys can be explained by changes in socio-economic status, feeding habits, urbanization and globalization. The per capita consumption of cereals decreased from 1 980 kcal in 1981 to 1 266 kcal in 2000; cereals accounted for 61.2 percent of the total energy intake in 1981, and only 52 percent in 2000. Sugar's share of total consumption also decreased, from 10.1 percent of total energy intake in 1981 to 7.7 percent in 2000. Over the same period, per capita consumption of items in the meat group increased from 163 kcal, representing 5.6 percent of total energy intake, to 298 kcal – 10.9 percent of total energy intake. The per capita consumption of items in the milk group increased from 74 kcal and 2.5 percent of total energy intake, to 177 kcal and 7.0 percent of total energy intake. This means that the percentage contribution of animal protein to total energy increased from 8.1 percent in 1981 to 19 percent in 2000 (Figure 6).

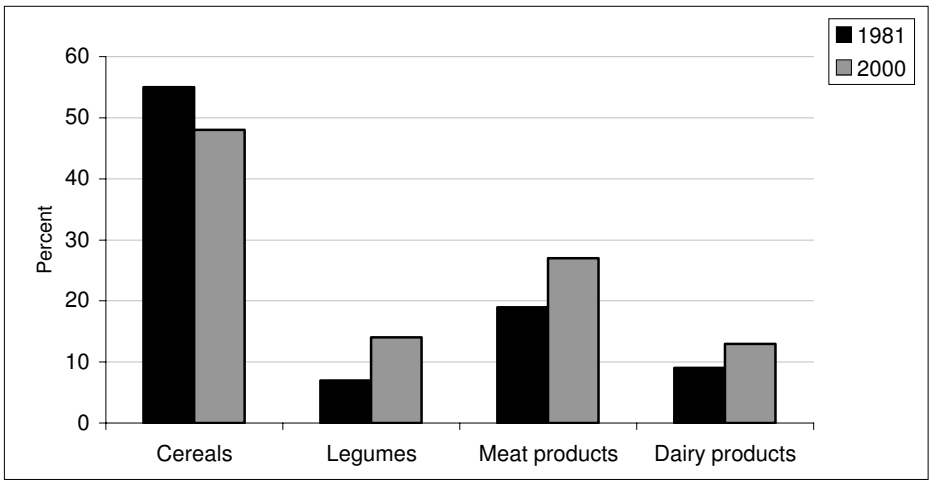
FIGURE 6
Percentage contributions of selected food groups to total energy intake, 1981 and 2000



Sources: Aly *et al.,* 1981; Hassanyn, 2000.

Regarding the per capita consumption of protein, the protein intake from cereals decreased from 61.2 g/day and 54.9 percent of total protein intake in 1981, to 52 g/day and 48.2 percent of total protein intake in 2000. Per capita consumption of protein from meat increased from 16.3 g/day and 18.8 percent of total protein intake, to 25.5g/day and 26.8 percent of total protein intake (Figure 7).

FIGURE 7
Percentage contributions of selected food groups to total protein intake, 1981 and 2000



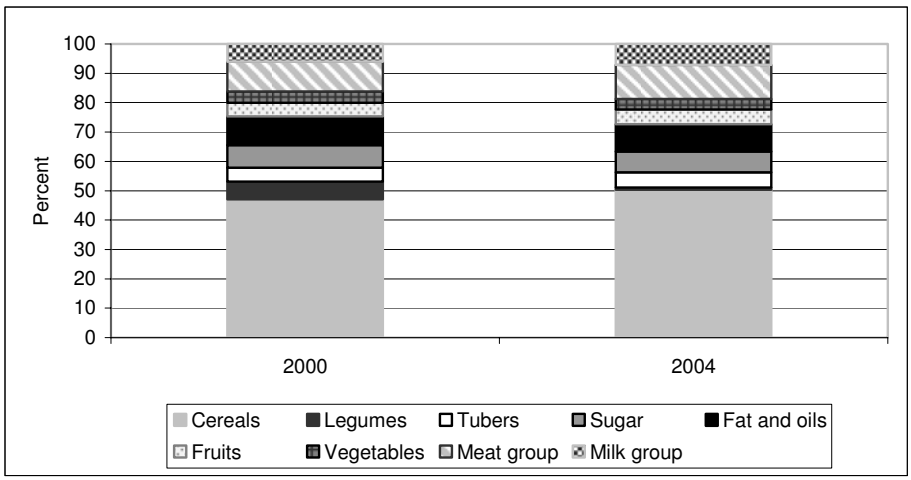
Sources: Aly *et al.,* 1981; Hassanyn, 2000.

In order to compare the national dietary surveys conducted in 2000 and 2004, the dietary intakes of mothers were reanalysed to provide more comprehensive results. Table 1 and Figure 8 show the contributions of different food groups to the total energy intakes of mothers in 2000 and 2004. The total energy intake of mothers decreased from 2 602 kcal in 2000 to 1 995 kcal in 2004. The contribution of cereals to the total energy intake of mothers decreased from 1 349 to 1 066 kcal.

TABLE 1
Contributions of selected food groups to the total energy and protein intakes of mothers, 2000 and 2004

Food group	Energy (mean kcal/day)		Protein (mean g/day)	
	2000	**2004**	**2000**	**2004**
Cereals	1 349	1 066	41.4	32.7
Legumes	173.8	152	12.6	10.9
Tubers	134	110	2.0	1.7
Sugar	222	150	0.0	0.0
Fat and oils	280	195	0.0	0.0
Fruits	134	106	1.5	1.3
Vegetables	110	77.0	5.8	4.0
Meat group	291	245	23.5	21.9
Milk group	173	151	10.8	9.7
Total	**2 602**	**1 995**	**91.5**	**73.5**
Median	**2 442**	**1 944**	**88.3**	**71.5**
Number	**835**	**1 090**	**835**	**1 090**

FIGURE 8
Percentage contributions of selected food groups to the total energy intake of mothers, 2000 and 2004



Source: NNI surveys.

Dietary adequacy

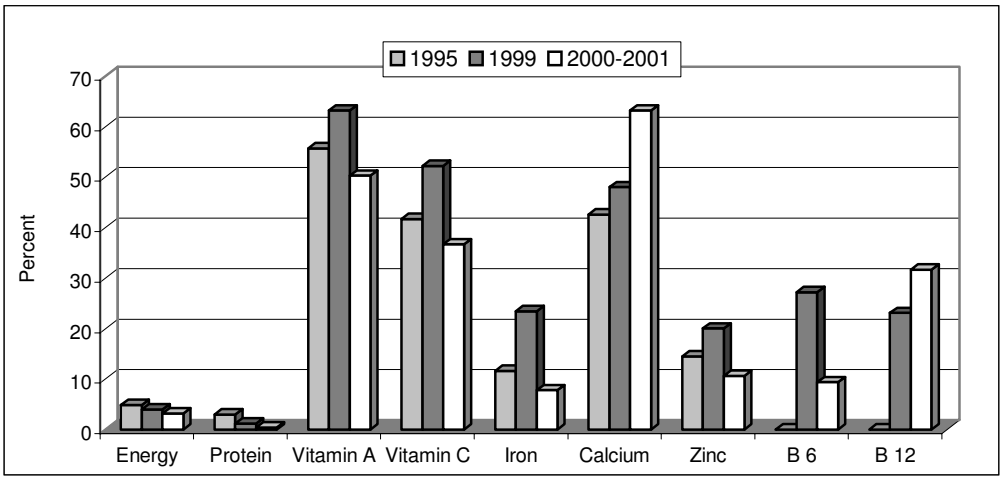
Table 2 shows the mean and median intakes of energy and nutrients for mothers in the NNI 2000 and 2004 surveys. As well as a decrease in their mean energy intakes, mothers' intakes of all macro- and micronutrients also decreased, especially those of plant protein, animal fat and calcium.

TABLE 2
Mean intakes of macro- and micronutrients among mothers, 2000 and 2004

Nutrient	2000 (n = 835)		2004 (n = 1 090)	
	Mean ± SD	Median	Mean ± SD	Median
Energy (kcal)	2 602 ± 985.9	2 442.3	1 995 ± 670.9	1 943.5
Protein (g)	91.5 ± 31.3	88.3	73.5 ± 26.7	71.5
Animal source (g)	27.4 ± 20.6	24.2	24.2 ± 18.3	21.3
Plant source (g)	64.1 ± 23.8	60.9	49.3 ± 20.9	47.1
Fat (g)	70.6 ± 53.9	64.0	53.3 ± 25.1	50.1
Animal source (g)	32.5 ± 50.5	24.5	23.5 ± 20.9	19.7
Plant source (g)	38.1 ± 23.3	33.2	29.8 ± 17.3	26.9
Iron (mg)	27.8 ± 14.7	24.0	21.1 ± 9.8	19.4
Animal source (mg)	3.2 ± 4.8	2.2	2.8 ± 3.1	2.0
Plant source (mg)	24.6 ± 13.6	21.3	18.3 ± 9.4	16.7
Vitamin A (µg)	517.3 ± 415.6	416	483.8 ± 380.2	384.1
Vitamin C (mg)	98.5 ± 102.9	72.3	92.8 ± 73.4	73.8
Calcium (mg)	626 ± 407	510.1	494.9 ± 292.3	432.8
Iodine (µg)	59.2 ± 33.3	52.8	51.1 ± 35.1	45.3

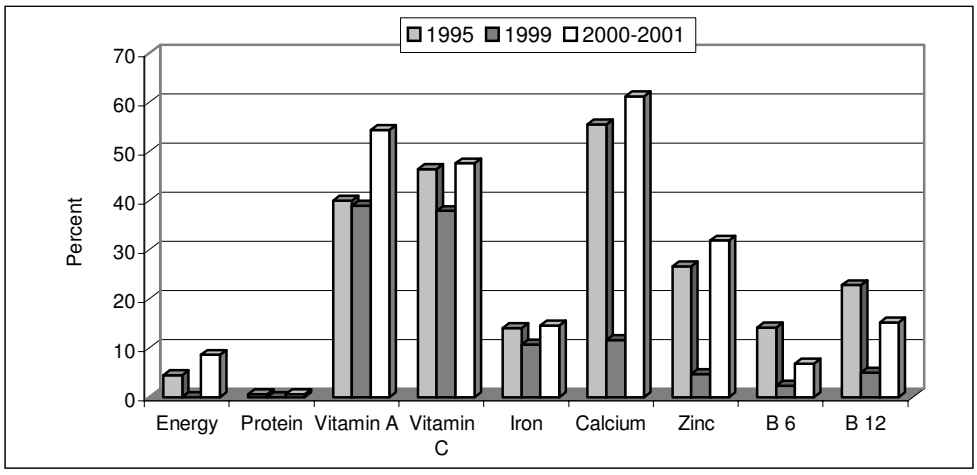
Data from ARC surveys conducted between 1995 and 2002 show the percentages of mothers and children aged two to five years who consumed less than 50 percent of the United States RDAs of selected macro- and micronutrients (Figures 9 and 10). The percentage of mothers with inadequate intakes of several nutrients decreased over time, but there are still notably high percentages of women with low intakes of vitamins A and C and calcium. The iron intake data shown here are not adjusted for bioavailability.

FIGURE 9
Percentages of mothers consuming < 50 percent of RDA of selected nutrients, 1995 to 2002



Source: ARC surveys.

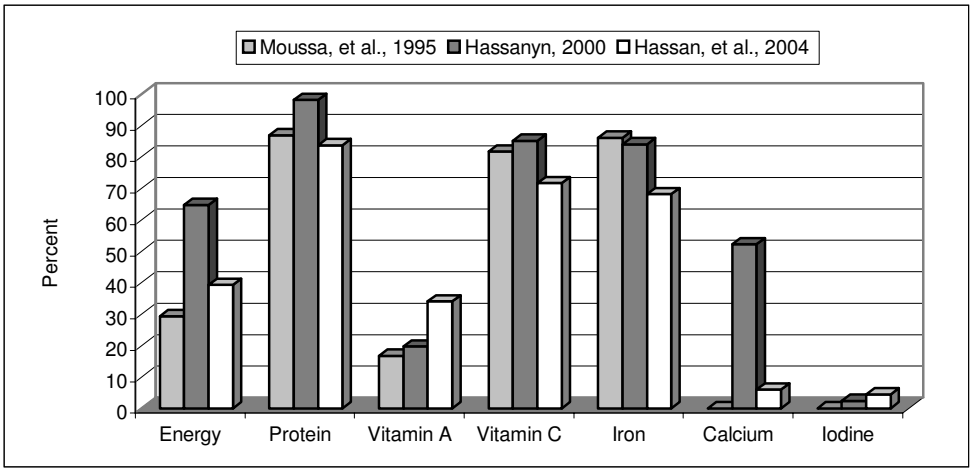
FIGURE 10
Percentage of children consuming < 50 percent of RDA of selected nutrients, 1995 to 2002



Source: ARC surveys.

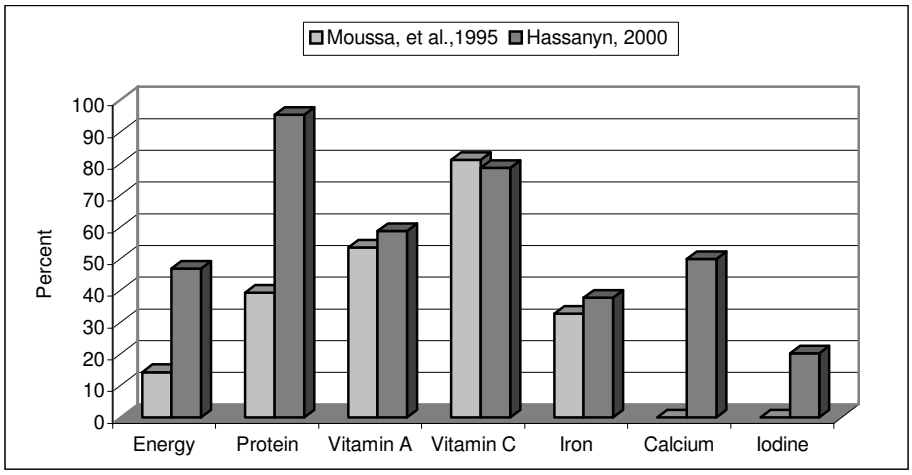
ARC used the truncated method of data analysis, whereby all the data that contain consumption of more than 100 percent of RDAs are removed. NNI did not use this method, and its findings regarding the percentages of mothers and children consuming at least 100 percent of the RDAs for selected macro- and micronutrients are shown in Figures 11 and 12.

FIGURE 11
Percentages of mothers consuming ≥ 100 percent of the RDAs for macro- and micronutrients, 1995 and 2004



Iron requirements in 1995 and 2000 are based on WHO, 1989; and in 2004 on FAO/WHO, 2002.
Source: NNI surveys.

FIGURE 12
Percentages of children aged two to six years consuming ≥ 100 percent of the RDAs for macro- and micronutrients, 1995 and 2000



Iron requirements in 1995 and 2000 are based on WHO, 1989; and in 2004 on FAO/WHO, 2002.
Source: NNI surveys.

The special case of iron should be given separate attention. In Egyptian dietary data, the intakes of iron appear to be relatively high and do not take bioavailability into account; however, the prevalence of anaemia is also high in vulnerable populations, and is even increasing. When bioavailability is considered, iron intakes become lower. Table 3 compares the iron intake and the available iron intake calculated from the data of the 1995 FTRI/ARC survey of women. Available iron was calculated using the method of Monsen *et al.,* in which the proportion of iron absorbed is estimated from the amounts of meat, fish, poultry and ascorbic acid – all of which enhance iron absorption – in the diet. It is evident that although the average intake of iron meets or exceeds the RDA, the intake of absorbable iron is insufficient to meet average requirements. Iron bioavailability is compromised by relatively high amounts of fibre, phytate and other inhibitors in the diet, as well as by the even more significant lack of absorption enhancers.

TABLE 3
Total and available iron intakes of Egyptian women, 1995

Governorate	Total Fe (mg)	Available Fe (mg)
Cairo	14.2 ± 6.8	1.2 ± 1.3
Ismailia	15.1 ± 6.3	1.2 ± 1.2
Dhakahlia	15.8 ± 5.3	1.0 ± 1.0
New Valley	20.2 ± 7.3	1.1 ± 1.5

RDA = 15 mg.
Requirement = 1.5 to 2.5 mg.
Source: Harrison, 2000. Calculated from Ministry of Agriculture/FTRI, 1995.

Food intakes in relation to population dietary guidelines

FAO/WHO (2002) provide guidance on population nutrient intake goals for fat, sugar, sodium, fruits and vegetables and fibre, among other foods. These goals include achieving a fat intake that accounts for between 15 and 30 percent of total dietary energy. Between 1995 and 2004, the percentage of total energy provided by fat showed a modest decrease in low-fat intake groups (those for whom fat accounts for < 15 percent of dietary energy) and no change in high-intake groups (for whom it accounts for > 30 percent of dietary energy). In 2004, about 20.5 percent of mothers and more than 30 percent of young children had fat intakes that accounted for more than 30 percent of total energy intake.

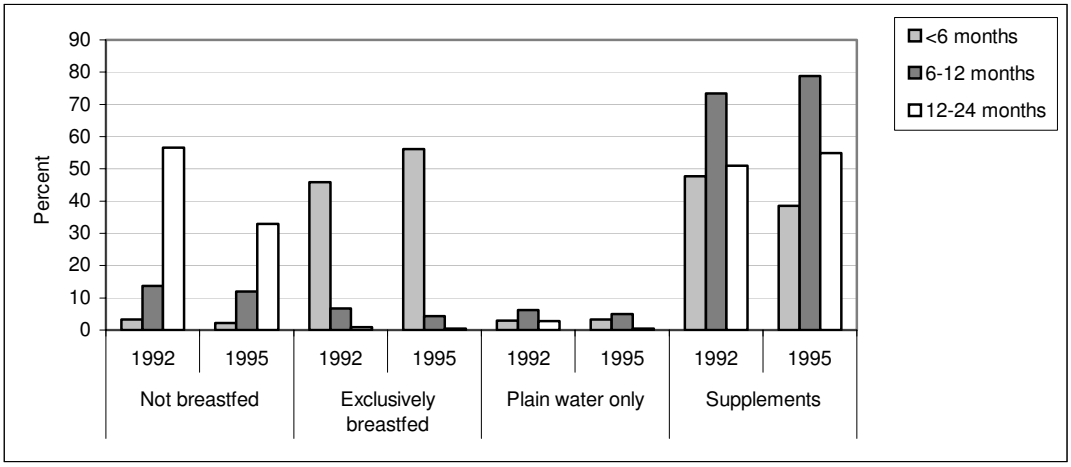
The FAO/WHO recommendation on sugar indicates that less than 10 percent of total dietary energy should be derived from free sugars. The intakes of free sugars in more than half of the mothers surveyed in Egypt accounted for less than 10 percent of their total energy intakes. Most of these women lived in urban governorates (Cairo and Alexandria). High sugar intakes, accounting for 10 to 20 percent or ≥ 20 percent of total energy, were markedly more frequent in rural than urban areas and in Upper Egypt than in Middle and Lower Egypt; this is mostly owing to the habit of drinking heavily sweetened strong tea in rural areas (Hassanyn, 2000).

Almost half the survey sample (48.2 percent) reported excess intakes of animal fat (accounting for ≥ 10 percent of total energy). On the other hand, almost three-quarters of mothers consumed less than 300mg/day of cholesterol in their diets, which matches the FAO/WHO population nutrient goal recommended (Hassanyn, 2000).

Infant feeding practices

Infant feeding patterns have important impacts on the health of children. According to the Egypt Demographic and Health Surveys (EDHS) of 1992 and 1995, almost all Egyptian children (about 92 percent) are breastfed for some period, and there was no significant change in this figure between the two studies. Among the children who are breastfed, the percentage of those for whom breastfeeding begins within the first day after birth increased. Exclusive breastfeeding of children up to six months of age also increased between 1992 and 1995, as did the number of children over six months of age who received complementary foods (Figure 13). These positive trends imply that nutrition education programmes for mothers have been well received. The complementary foods that are given along with breastmilk to infants of six to 24 months usually include cereals, cow's milk and products, eggs, meat, vegetables and fruits.

FIGURE 13
Breastfeeding status of children less than 24 months, 1992 and 1995



Sources: EDHS, 1992 and 1995

Intra-household food distribution

In Egypt, the prevalence of malnutrition among certain sectors of the population raises concern about intra-household food distribution. A survey studied the intra-household food distribution of 1 470 Egyptian families in three governorates – Cairo, Qualyobia and Beheria – which represent an urban, a semi-urban and a rural community, respectively. The survey included 5 431 target individuals: fathers, mothers, preschool children (aged two to six years), schoolchildren (aged six to 12 years), and male/female adolescents (aged 12 to 19 years). Dietary assessment was carried out on each target individual (using 24-hour recall and the sample weighing method), and a special method of assessing intra-household food distribution was adopted. In this method, the target individual's intakes of energy, protein and selected nutrients (iron, vitamins A and C and calcium) were recorded as percentage shares of the respective total household intake, and then compared with the recommended share for the target individual.

The results showed that fathers' share was almost equal to that recommended; mothers' was much higher than that recommended, especially in urban areas; and preschool and schoolchildren had lower than recommended energy intakes. Fathers consumed more than the recommended shares of iron, vitamin C and calcium, and the recommended share of vitamin A. All other target individuals except mothers consumed less than the recommended shares of calcium. These results were more pronounced in rural than urban communities. (Shaheen and Tawfik, 2000).

Household food security

Khorshed, Ibrahim and Galal (1995) implemented a national food consumption survey in 1994, including 6 000 households in five governorates – Cairo, Ismailia, Dhakahlia, Aswan and New Valley. One of the objectives of this survey was to identify food-insecure households, which were defined as those spending more than three-quarters of their income on food. Food-secure households were defined as those spending less than half of their income on food.

Results of the study revealed that the prevalence of food-insecure households ranged from 4.7 percent in Ismailia to 21.6 percent in Dhakahlia, with New Valley registering a prevalence of 8 percent and Aswan a relatively high 18.6 percent.

Effects of food prices and decreased food subsidies on consumption

Consumers have been affected by increases in food prices resulting from the removal of food subsidies. Galal (2002) reports that when subsidies were removed between 1990 and 1994, food prices increased sharply and at a higher rate than general inflation – three- to tenfold while wages less than doubled. Household food consumption dropped dramatically by about 20 percent during this period. A study by Ibrahim and Eid (1996) to predict the effect of removing food subsidies and applying free market prices concluded that free market prices for cereals, legumes, oils and sugar would increase the cost of energy for the population and reduce the consumption of animal protein, particularly in vulnerable groups.

Hussein *et al.,* (1989) conducted a study of families' behaviour in response to increasing food prices. A sample of 350 households in Cairo, Assuit, Beheira and industrial areas was selected. Results revealed that the rise in income could not cope with that in food costs. Less expensive foods were substituted, and the frequency of meat consumption in particular declined.

In 1994, Khorshed, Ibrahim and Galal (1995) found that 60 percent of surveyed households had changed their pattern of consumption over the previous year, owing to rising food prices. The range went from 35 percent of households in Cairo to more than 85 percent in Aswan and New Valley. About 21 percent of households indicated that they would spend additional income on improving their dietary quality by purchasing more meat, fruit and vegetables.

TRENDS IN NUTRITIONAL STATUS IN EGYPT, 1985 TO 2005[3]

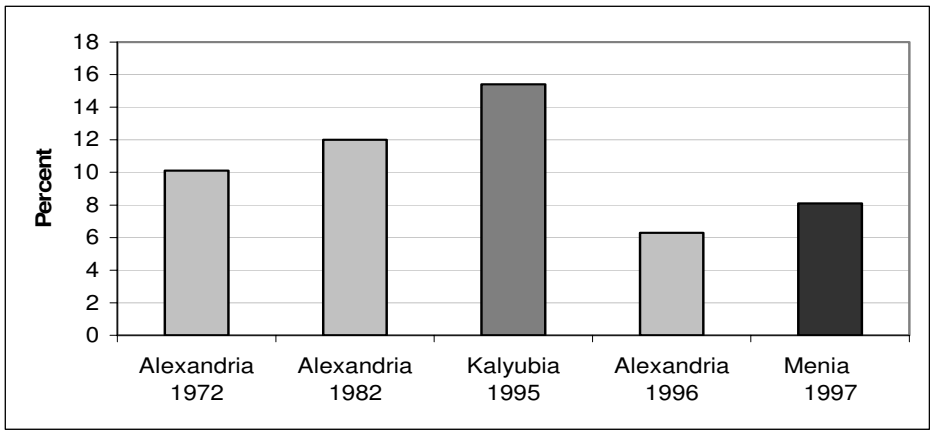
Nutritional status based on anthropometry

Low birth weight

Low birth weight (LBW) is defined as weight at birth of less than 2 500 g, irrespective of gestational age. Prematurity (infants born before 37 weeks gestation) and intrauterine growth retardation (IUGR) are the two main causes of LBW: most LBW in developing countries is the result of IUGR, while in industrialized countries it is caused by pre-term birth. Most of the studies of LBW in Egypt are small-scale or depend on hospital data. The first national study was carried out in 1995 to 1997 and revealed a LBW rate of 12.6 percent of live births (El-Sahn, 2004). This is lower than the average estimated rates of 18 percent for the East Mediterranean Region (EMR) and 15 percent for the Middle East and North Africa. Among countries in the EMR, Egypt's LBW prevalence is lower than the estimated rates in Yemen (32 percent) and the Sudan (31 percent), but higher than those in the Syrian Arab Republic and Lebanon (6 percent) (UNICEF, 2003). It is also higher than the WHO estimate for Egypt (10 percent) and than most of those reported in other surveys (Figure 14). LBW is a significant public health problem in Egypt, and requires considerable attention (El-Sahn, 2004).

[3] This section was investigated by A. Tawfik, M. Mattar and D. Shehab.

FIGURE 14
Trends in prevalence of LBW in Egypt, 1972 to 1997



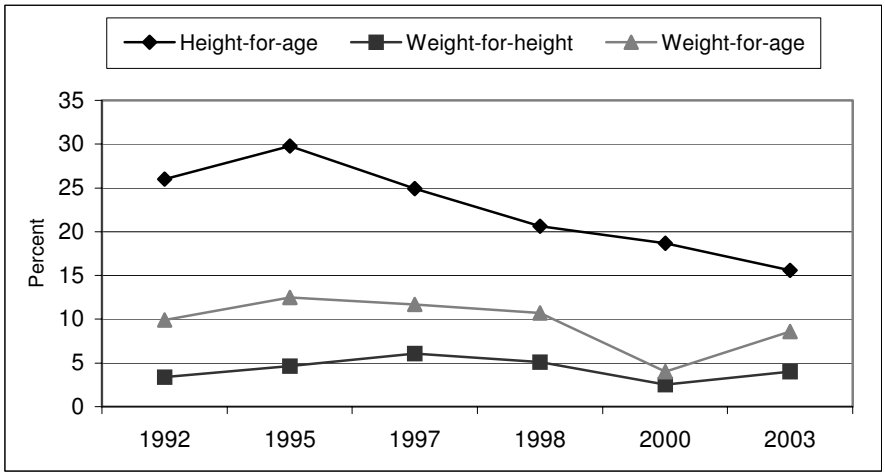
Source: El-Sahn, 2004.

Children under five years of age – Undernutrition

WHO recommends that evaluations of nutritional status be based on three indices: weight-for-age, weight-for-height and height-for-age, using Z-scores in comparison with the reference population median (WHO, 1983; 1995). The reference population of well-nourished children used by most surveys is the international reference population of the National Center for Health Statistics (NCHS), accepted by WHO as the international growth reference.

Since 1978, Egypt has been experiencing decreasing trends in the prevalence of stunted, wasted and underweight children. Between 1978 and 2004, stunting decreased from 40 to 15.8 percent, and underweight from 20.6 to 18 percent. These time series trends should be regarded cautiously as the age range of the children is not consistent across all surveys. Using more recent data from EDHS surveys conducted in 1995 and 2003 (EIDHS, 2003) on children up to 59 months of age, there have been declines in stunting (from 29.8 to 15.6 percent), underweight (12.4 to 8.6 percent) and wasting (4.6 to 4.0 percent) (Figure 15). Boys have a slightly higher prevalence for all indicators. In EDHS 1995, the percentage stunted varied from 18 percent in urban governorates to 40 percent in rural Upper Egypt, while in EDHS 2000 it ranged from 9 percent in urban governorates to 27 percent in rural Upper Egypt. This urban/rural variation is mostly caused by variation in development indicators, particularly education. The general improvement in nutritional status can mainly be attributed to improving socio-economic status, which is reflected in improved health care and quality of food consumed. Nutrition education programmes directed at mothers are contributing factors and are discussed in a later section of this case study.

FIGURE 15
Trends in prevalence of undernutrition among children under five years of age, 1992 to 2003



Source: EIDHS, 2003.

Children under five years of age – Overnutrition

Shaheen, Hathout and Tawfik (2004) conducted a national survey to assess prevalence of obesity in children under five years of age. The survey covered a sample of nearly 4 154 children (2 165 males and 1 969 females) in eight governorates – Cairo, Gharbia, Quena, Beni-Suef, Beheira, Suez, Matrouh and El-Wadi El-Gadid – representing six geographic areas: metropolitan, Lower Egypt, Upper Egypt, coastal, canal and frontier. It revealed that almost 8 percent of preschool children were wasted, 3.6 percent were overweight and 2 percent were obese. Obesity was more prevalent in girls (2.6 percent) than boys (1.5 percent). Frontier governorates had the lowest proportions of obese preschool children, followed by the coastal and canal regions. Metropolitan governorates and Lower Egypt had higher proportions of obese preschool children. This could be explained by changes in dietary habits leading to more energy-dense fast food and beverages with high sugar content. Although overweight among children under five years of age cannot yet be considered a public health problem in Egypt at this time, the trend is clearly toward increasing prevalence.

School-age children and adolescents (six to 18 years)

Moussa (1989) reported on the growth of school-age children using data obtained during the Health Examination Survey (HES) of the Health Profile of Egypt (HPE). The sample included at total of 6 004 school-age children (3 119 boys and 2 885 girls) aged six to 18 years from different governorates. The mean weight of boys aged six to eight years is just below the WHO reference mean; among boys of 11 to 18 years it deviates down to lie almost midway between the reference mean and 1 SD below it. The mean weight of girls is close to the reference mean at six years of age, deviates down until the age of 11 – when it is almost 1 SD below the standard mean – then improves and approaches the reference, reaching its closest point at 16 years of age before continuing below the reference mean until 18 years of age. The weights of girls are therefore better than those of boys in the six to 18 years age group. On the other hand, the curves representing mean height for boys and girls are both located below the reference mean, at close to –2SD. Boys show somewhat more relaxation in linear growth than girls, indicating chronic undernutrition.

Between 1998 and 2004, the prevalence of stunting among schoolchildren was essentially stable: 14.5 percent in 1998 and 13.2 percent in 2004. Wasting decreased from 7.8 to 4.1 percent, but underweight increased from 6.65 to 8.8 percent. Thus, the situation with regard to this age group does not seem to be improving noticeably. Underweight and stunting were more prevalent in rural than urban areas, but wasting was more prevalent in urban areas (Hassan *et al.*, 1998). Prevalence of overweight and obesity was slightly higher among school-age than preschool children, so the problem appears to be emerging rapidly in children (Shaheen, Hathout and Tawfik, 2004).

Weight status based on percentile body mass index for age (PBMI) (WHO, 1995) and prevalence of obesity were studied among 6 190 adolescents aged 12 to 19 years (Shaheen, Hathout and Tawfik, 2004). Results revealed that the prevalence of overweight is twice that of obesity among both male and female adolescents. For males the figures are 10.6 percent overweight and 5.8 percent obesity, and for females they are 19.9 and 9.7, respectively. Obesity was observed to be more prevalent in metropolitan areas (Cairo). Results are illustrated in Table 4. The trend is for prevalence of underweight to decrease and overweight and obesity to increase among female adolescents. Clearly, overweight and obesity (combined) are prevalent among Egyptian adolescents of both sexes, and at least for girls the prevalence has increased in the last few years.

TABLE 4
Anthropometric data on adolescents

Source and year of survey	Location	Sample			Underweight/ PBMI	Overweight/ PBMI	Obesity PBMI
		Size	Sex	Age (years)	< 5th	85 ≥ 95	≥ 95
Shaheen and Tawfik, 2000	Cairo, Qualyobia and Beheira	382	Male	10–19	11.8	15.2	5.5
		482	Female	10–19	11.6	17.9	7.6
Shaheen, Hathout and Tawfik, 2004	National	2 702	Male	12–19	10.5	10.6	5.8
		3 488	Female	12–19	3.1	19.9	9.7
Hassan *et al.*, 2004	National	2 039	Male	10–19	14.4	9.9	4.8
		2 021	Female	10–19	5.4	15.7	7.8
Ismail, 2005	National	6 018	Total	10–19	7.3	13.4	7.1
		2 969	Male	10–19	10.2	11.5	6.5
		3 049	Female	10–19	4.6	15.2	7.7

Adults

Several studies obtained information on the heights and weights of female adults as shown in Table 5. Underweight, defined as BMI < 18.5, which denotes chronic energy deficiency (WHO, 1995), is almost non-existent among the adult female population. Prevalence of chronic energy deficiency fell from 3.4 percent in 1995 (Moussa, El-Nehry and Abdel Galil, 1995) to 0.4 percent in 2004 (Hassan *et al.,* 2004). However, there is a trend for increasing prevalence of overweight and obesity among female adults in Egypt. From the earliest available survey year (1995) to the latest (2004), overweight among women decreased from 31.3 to 26.9 percent, while obesity increased from 20.5 to 48.2 percent.

Overweight and obesity prevalence among adults in Egypt is among the highest in the world, and there is evidence that the prevalence is still increasing, at least in women. There is a trend of increasing prevalence of overweight and obesity among female adults in Egypt (Figure 16). Between 1995 and the latest survey year 2004, overweight decreased from 31.3 to 26.9 percent among women, while, obesity has increased from 20.5 to 48.2

percent. Among urban women, data collected on large samples indicated that by 1998 the average BMI for women was in the obese range (30.08) (Galal, 2000). Furthermore, almost 5 percent of women were classified as "severely obese", i.e., BMI > 40. Men have been less studied, but 1998/1999 survey data indicated that 65.3 percent of urban Egyptian men and 34.1 percent of those in rural areas were overweight or obese. These trends can likely be attributed to changes in dietary habits towards higher consumption of energy-dense foods, together with a tendency to sedentary lifestyle particularly in urban areas. Continuous snacking between meals among housewives has been mentioned as another causal factor (Galal *et al.,* 1987). Hussein, Moussa and Shaheen (1993) demonstrate that obesity is a problem in both privileged and underprivileged areas. However, the co-morbidities of obesity are more common among the privileged, which is attributed to the quality of diet. The main source of energy among the rich is animal fat (meat and pastries), while among the poor it is carbohydrate (bread and sugar in tea) and vegetable oil (fried vegetables and tubers). Efforts to reduce weight were more common among the rich than the poor (Hussein, Moussa and Shaheen, 1993).

In the national survey by Shaheen, Hathout and Tawfik (2004), a nationally representative sample of 19 021 adults (aged 20 years and over) was used to assess the prevalence of obesity in Egypt. Results of this study revealed that women had higher overall rates of obesity than men (48.2 and 18.7 percent, respectively), although men had higher rates of overweight (34.5 percent) than women (26.9 percent). Frontier governorates and Upper Egypt had the lowest proportions of overweight and obesity. However, Lower Egypt and the metropolitan region, followed by the canal and coastal regions, had the highest percentages of overweight and obesity. This is also documented by Moussa, El-Nehry and Abdel Galil (1995), who record the highest rates of overweight and obesity in Cairo (70 percent) and the lowest in Upper Egypt (39 percent). Urban areas had higher rates of overweight and obesity than rural ones.

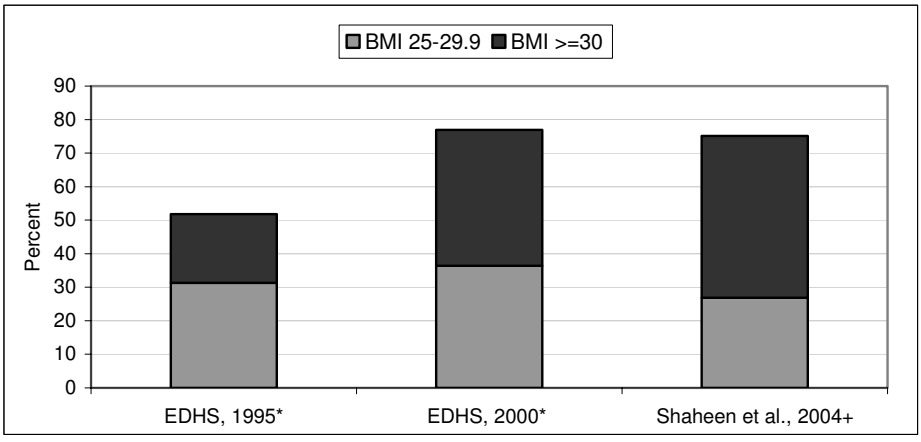
According to Shaheen, Hathout and Tawfik (2004), the prevalence of overweight and obesity among adults aged 20 to 80 years differs according to age. The lowest proportions of overweight and obesity were among the 20 to 30 years age group (27.8 and 8.1 percent, respectively). Prevalence gradually increased with age to reach a peak between the ages of 50 and 60 years, when overweight and obesity among men were 37.2 and 29 percent, respectively, and among women 21.8 and 66.1 percent. After the age of 60 years, the prevalence of overweight and obesity decreased slightly among men; among women obesity decreased, but overweight increased, to reach 35.7 percent at 80 years of age. These findings reflect the behaviour of the population, as consumption of extra quantities of food is usual at younger ages, and low levels of physical activity increase with age.

Although overweight and obesity are still increasing in prevalence in Egypt, and the problem is now receiving attention owing to the global emergence of obesity as a public health problem, the phenomenon has been evident in Egypt for at least 20 years. The 1981 national food consumption survey included measurements of the mothers and fathers of sampled children and reported 63.1 percent of mothers and 14.5 percent of fathers were overweight or obese (i.e., > 110 percent of the standard weight at that time) (Galal, 2000). Thus recent trends toward urban living and an abundant food supply do not by themselves totally explain the phenomenon in Egypt. However, there are many physical and cultural barriers to a physically active lifestyle in Egypt, and there is significant opportunity for the development of effective health promotion programmes to encourage physical activity.

TABLE 5
Anthropometric data on adults

Source and year of survey	Location	Sample			BMI (kg/m²)		Anthropometric status according to BMI (%)				
		Size	Gender	Age (years)	Mean	Median	Chronic energy deficiency			Over-weight	Obesity
							< 16.0	16.0–16.9	17.0–18.5	25.0–29.9	≥ 30.0
EDHS, 1995	Egypt (total)	6 314	Mothers	15–49	26.3		0.2	0.3	1.1	31.3	20.5
Moussa, El-Nehry and Abdel Galil, 1995	Egypt (total)	1 629	Mothers	20–45	26.8	26.1	1	0.4	2.0	33.0	25.5
Hassan, 2000	Egypt (total)	835	Mothers	20–48	30.4	28.7	0.2	0.1	0.7	31.3	42.1
Shaheen and Tawfik, 2000	Sub-national sample	187	Fathers	30–65	26.7	26.4			2.7	41.1	21.1
		1 470	Mothers	20–48	30.6	29.9			0.5	27.7	50.4
EDHS, 2000	Egypt (total)	13 624	Mothers	15–49	29.3		0.0	0.0	0.5	36.4	40.8
Shaheen, Hathout and Tawfik, 2004	National	8 136	Males	≥ 20	23.6	21.4	-	-	2.8	35.4	18.7
		10 885	Females		25.8	24.5	-	-	2.0	26.9	48.2
Hassan *et al.*, 2004	National	2 028	Males	≥ 20	-	-	-	-	2.0	38.3	28.6
		2 446	Females		-	-	-	-	0.4	24.0	63.5

FIGURE 16
Trends in overweight and obesity among females, 1995 to 2004



* Women 15 to 49 years in EDHS surveys
\+ Women ≥ 20 years in Shaheen *et al., 2004*

Central obesity among adults

Alternative methods to the measurement of BMI are valuable in identifying individuals at increased risk from obesity-related illness owing to abdominal fat accumulation (WHO, 2000). A high waist-to-hip ratio (WHR) (≥ 1 in men and ≥ 0.85 in women) has been accepted as the clinical method of identifying patients with abdominal fat accumulation.

Findings of Shaheen, Hathout and Tawfik (2004) demonstrate that abdominal obesity (high WHR) exists among 20.8 percent of men and 45.3 percent of women. There were significant differences ($p = 0.000$) in the prevalence of abdominal obesity between men and women in the total sample and between urban and rural areas ($p = 0.000$), with 41.6 percent of adults in urban and 20.4 percent in rural areas affected. There were also significant differences ($p = 0.000$) in prevalence of high WHR among different governorates of Egypt.

Recent evidence suggests that waist circumference alone – measured at the midpoint between the lower border of the rib cage and the iliac crest – provides a more practical correlate of abdominal fat distribution and associated ill health (WHO, 2000). This is an approximate index of intra-abdominal fat and total body fat. Furthermore, changes in waist circumference, mainly associated with overweight and class 1 obesity, reflect changes in risk factors for cardiovascular disease (CVD) and other forms of chronic disease. Waist circumferences ≥ 88 cm in women and ≥ 102 cm in men are considered above normal (WHO, 2000).

Results of Shaheen, Hathout and Tawfik (2004) revealed that there was correlation between waist circumference levels and overweight and class 1 obesity in the total sample and in the studied governorates ($p = 0.000$). Nearly three-quarters of those with class I obesity had central obesity (high waist circumference), except in Beni-Suef where the figure was even higher, at 85 percent. The majority of class 1 obese women (at least 80 percent) in the study governorates and the total sample had high waist circumference, while about one-third of overweight females had high waist circumference. The percentages were lower among men than women.

Stunting and obesity

Many studies document the relation between stunting (< -2 SD height for age) as an indicator for long-standing chronic malnutrition and overweight or obesity (> +2 SD weight for height) due to inadequate intervention programmes early in childhood. There is considerable evidence, mostly from developed countries, that intrauterine growth retardation is associated with an increased risk of coronary heart disease (CHD), stroke, diabetes and raised blood pressure.

Results of Shaheen, Hathout and Tawfik (2004) revealed that 2.3 percent of stunted male and 3.7 percent of stunted female preschool children (aged two to six years) were obese; this is nearly double the prevalence of obesity in children of normal height (1.2 percent of males and 2.1 percent of females). About 6 percent of stunted male and female preschool children were overweight, compared with 2.3 percent of male and 2.9 percent of female normal-height children. This finding also holds true for school-age children: 6.1 percent of stunted male and 5.7 percent of stunted female children were obese, compared with 1.9 and 3.4 percent, respectively, for male and female children of normal height. Nearly 6 percent of stunted male and 8 percent of stunted female school-age children were overweight, while the respective percentage among normal-height school-age children was 3.8 percent for both males and females. There were significant differences in the weight status of both preschool and school-age male and female children depending on their stature levels ($p = 0.000$).

There was no significant difference in the weight status of either male or female adolescents (12 to 18 years) between the different stature levels. About 5 percent of stunted male and 9.2 percent of stunted female adolescents were obese, compared with 5.3 and 8.5 percent of normal-height male and female adolescents, respectively.

Micronutrient status

Iron deficiency anaemia (IDA)

Table 6 presents a summary of results from different studies on IDA in Egypt. A national survey to assess vitamin A status (Moussa, El-Nehry and Abdel Galil, 1995) recorded haematocrit values for 1 623 preschool children (aged six months to six years) and 762 mothers. Preschool children and pregnant mothers with haematocrit values equal to or less than 33 (11 gm Hb/100 ml) were considered anaemic, as were non-pregnant mothers with haematocrit values equal to or less than 36 (12 gm Hb/100 ml) (WHO, 1989).

EDHS 2000 included direct measurement of haemoglobin levels in a sub-sample of half of all EDHS households for three groups: women aged 15 to 49 years who were or who had been married; children under six years of age; and boys and girls aged 11 to 19 years. Anaemia is classified as mild, moderate or severe depending on the concentration of haemoglobin in the blood. Mild anaemia corresponds to haemoglobin concentration levels of 10 to 10.9 g/dl for pregnant women and young children; 10 to 11.9 g/dl for non-pregnant women, girls aged 11 to 19 years and boys aged 11 to 13 years; and 10.0 to 12.9 g/dl for boys aged 14 to 19 years. For all the tested groups, moderate anaemia corresponds to levels of 7 to 9.9 g/dl, and severe anaemia to levels less than 7 gm/dl.

EDHS 2000 revealed that about three out of ten young children suffer from some degree of anaemia. This is similar to the level that was found among women. Some 11 percent of young children had moderate levels of anaemia, and less than 1.0 percent were classified as having severe anaemia. Children under two years of age were more likely to be anaemic than older children, and rural children were more likely to be anaemic than urban children (33 and 24 percent, respectively). The highest anaemia prevalence (38 percent) was among children aged six to 59 months in rural Upper Egypt and the Frontier governorates, and the lowest (23 percent) was in urban Lower Egypt.

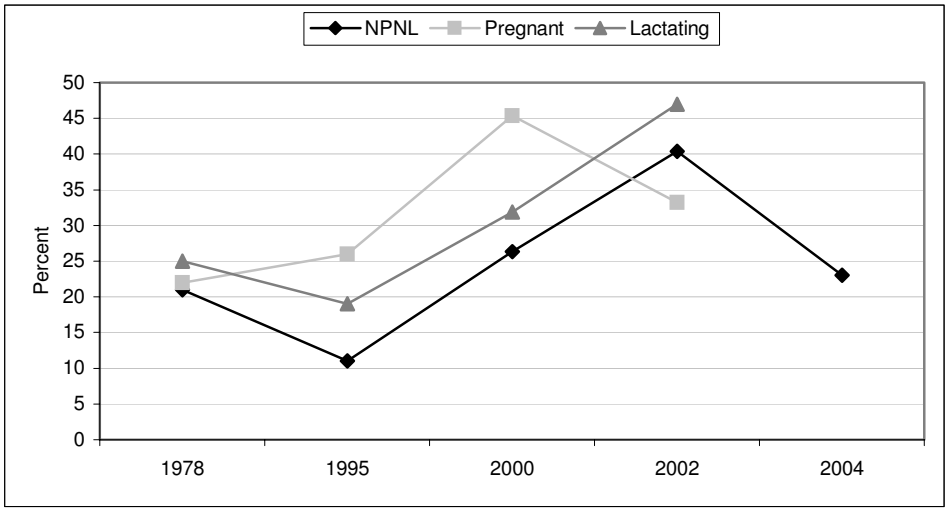
IDA among mothers, whether pregnant, lactating or non-pregnant and non-lactating (NPNL) increased significantly between 1978 (Nassar *et al.,* 1992) and 2000 (EDHS, 2000) (Figure 17).

TABLE 6
Prevalence of IDA in different age groups

Age group	Year	Site	Gender	N	Prevalence (%)			Source
					< 11g %	< 12 g %	< 13 g %	
6–71 months	1978	Universe I	Both	176	37.0			Nassar *et al.,* 1992; NNS
	1980	Universe I	Both	176 175	39.0 49.0			Nassar *et al.,* 1992; NNS
	1995 and 1997		Boys[1] Girls[1] Total	852 771 1 623	25.2 23.7 48.9			Moussa *et al.,* 1997
	2000		Both	4 708	29.9			EDHS
6–12 years	1988		Both	3 203		45.0		(Moussa, 1989) HES of HPE
	1998	Primary school	Both	750		42.0		Hassan *et al.*
11–19 years	2000		Both Boys Girls	9 237 4 835 4 402		 28.9	 30.7	EDHS
	2004		Both Boys Girls	3 721 1 896 1 825		 23.0	 39.5	Hassan, Abdel Galil and Moussa
20+ years	1978	Community	NPNL Pregnant Lactating Total	 1 478	 22.0 	21.0 25.0		Nassar *et al.,* 1992; NNS
	1995	MCHC	NPNL[2] Pregnant[1] Lactating[2] Total	 803	 26.0 	11.0 19.0		Moussa, El-Nehy and Abdel Galil
	2000	Community	NPNL Pregnant Lactating Total	 7 684	 45.4 	26.3 31.9		EDHS
	2002		NPNL Pregnant Lactating Total	 2 961	 33.2 	40.4 47.0		El-Sayed *et al.,* 2002
	2004	Urban	Adults M. adults F. adults	 692 811		 23.0	 9.6	Hassan, Abdel Galil and Moussa
		Rural	M. adults F. adults	297 324		 22.9	13.9	
		Total	M. adults F. adults	989 1 135		 23.0	12	
65+ years	2001	Upper Egypt	M. elders F. elders Total	275 356 631		 31.5	46.9	Hassan *et al.*
		Lower Egypt	M. elders F. elders Total	298 406 704		19.7	36.9	
		Urban governorates	M. elders F. elders Total	1 310 2 062 3 372		22.7	33.9	
		Urban sites	M. elders F. elders Total	1 190 1 948 3 138		24.9	32.8	
		Rural sites	M. elders F. elders Total	363 561 924		26.2	47.1	
		Overall total	M. elders F. elders Total	1 883 2 824		25.2	36.1	

[1] HCT < 33 percent.
[2] HCT < 36 percent.

FIGURE 17
Trends in prevalence of IDA among pregnant, lactating and NPNL women, 1978 to 2004



Sources: Nassar *et al.,* 1992 ; Moussa *et al.,* 1997; EDHS, 2000; El-Sayed *et al.,* 2002; Hassan *et al.,* 2004.

Vitamin A deficiency

Values of plasma retinol were available for 1 577 preschool children (aged six to 71 months) in Moussa, El-Nehry and Abdel Galil, 1995 and Moussa *et al.,* 1997. Results denoted that vitamin A deficiency (VAD) is a moderate sub-clinical public health problem in Egypt. In 2002, a national survey to assess the prevalence of vitamin A status after implementation of a vitamin A supplementation programme among children of nine and 18 months revealed that the prevalence of VAD among preschool children (six to 71 months) was 7.2 percent, implying that the vitamin A status of those children had improved.

Results of the survey to assess micronutrient deficiency among primary schoolchildren showed that a higher percentage of girls had low serum retinol levels (< 20 µg/dl) than boys.

A national survey for the determination of bone mass density among adolescents and adults in Egypt (Hassan, Abdel Galil and Moussa, 2004) showed that the prevalence of VAD among adolescents was higher in rural than urban areas. Results for adults showed a similar pattern. Findings are higher than those reported by Moussa, El-Nehry and Abdel Galil (1995) (Figure 22).

TABLE 7
Prevalence of VAD in different age groups

	Year	Site	Gender	N	Serum retinol < 20 µg/dl (%)	Source
6–71 months	1995	Urban Rural Both	Both Both Total	957 620 1 577	11.4 12.7 11.9	Moussa, El-Nehry and Abdel Galil (national)
6–11 years	1998	Urban	Boys Girls Total	272 228 500	10.3 11.0 10.7	Hassan, Abdel Galil and Moussa (national)
		Rural	Boys Girls Total	122 128 250	8.2 18.0 13.1	
		Both	Boys Girls Grand total	394 356 750	9.3 14.5 11.9	
6–71 months	2002	Urban Rural Both	Both Both Total	803 2 024 2 827	8.2 6.8 7.2	El-Sayed *et al.* (national)
11–19 years	2004	Urban	M. adolescents F. adolescents Total	1 283 1 381 2 664	19.7 21.5 20.0	Hassan, Abdel Galil and Moussa (national)
		Rural	M. adolescents F. adolescents Total	613 444 1 057	36.0 27.0 31.5	
		Both	M. adolescents F. adolescents Total	1 896 1 825 3 721	28.0 24.5 26.5	
20+ years	1995	Urban Rural Total	F. adults (mothers)	455 299 754	11.0 9.0 10.0	Moussa, El-Nehry and Abdel Galil
	2004	Urban	M. adults F. adults Total	692 811 1 503	17.5 18.4 18.0	Hassan *et al.* (national)
		Rural	M. adults F. adults Total	297 324 621	23.7 22.1 22.9	
		Total	M. adults F. adults Total	989 1 135 2 124	20.6 20.3 20.5	
65+ years	2001	Upper Egypt	M. elders F. elders Total	139 162 301	11.5 12.3 12.0	Hassan, Abdel Galil and Moussa (national)
		Lower Egypt	M. elders F. elders Total	106 144 250	19.8 16.0 17.6	
		Urban governorates	M. elders F. elders Total	448 595 1 043	12.3 11.8 12.0	
		Urban sites	M. elders F. elders Total	351 470 821	12.3 9.6 10.7	
		Rural sites	M. elders F. elders Total	161 242 403	13.7 15.3 14.6	
		Overall total	M. elders F. elders Total	512 712 1 224	13.0 12.5 13.3	

TABLE 8
Trends in prevalence of IDD in different age groups

Age group	Year	Site	Gender	No.	Iodine status			Source
					TGR %	Urinary Iodine (< 100 mg/L)	TSH < 0.39 Mlu / L	
3–<6 years	1995			593				Moussa, El-Nehry and Abdel Galil
		Urban	Boys		7.0			
		Rural	Girls		6.0			
		Total	Both		6.5			
6–11 years	1992	Primary schools		9 538				Hussein *et al.*
			Boys		4.5			
			Girls		6.0			
			Both		5.2			
	1998	Urban schools	Boys	272		27.9		Hassan *et al.*
			Girls	228		27.9		
		Rural schools	Total	500		27.9		
			Boys	122		30.3		
		Both	Girls	128		34.4		
			Total	250		32.4		
			Boys	394		29.1		
			Girls	356		31.2		
			Total	750		30.2		
11–19 years	1992	Preparatory	Both	21				Hussein *et al.*
			Boys	320	4.4			
			Girls	4.6	9.5			
11–14 years		Secondary	Total	8.0	7.0			
		school	Boys	6.3				
			Girls	4.2				
			Total	11.0				
(14–17 years				7.6				
	2004	Urban	M.	1 283			7.0	Hassan, Abdel Galil and Moussa.
			adolescents	1 381			5.5	
			F.	2 664			6.3	
		Rural	adolescents	613			10.2	
			Total	444			12.7	
			M.	1 057			11.5	
		Both	adolescents	1 896			8.6	
			F.	1 825			9.2	
			adolescents	3 721			8.9	
			Total					
			M.					
			adolescents					
			F.					
			adolescents					
			Total					
20+ years	1995	Urban	Mothers	1 629	20.2			Moussa, El-Nehry and Abdel Galil
		Rural			23.1			
		Total			21.4			
	2004	Urban	M. adults	692			7.8	Hassan, Abdel Galil and Moussa
			F. adults	811			4.9	
			Total	1 503			6.4	
		Rural	M. adults	297			11.4	
			F. adults	324			10.5	
			Total	621			11.0	
		Both	M. adults	989			9.6	
			F. adults	1 135			7.7	
			Total	2 124			8.7	

Iodine deficiency disorders

The national survey conducted by NNI in collaboration with WHO (Hussein *et al.,* 1992) found a high prevalence of iodine deficiency disorders (IDDs) manifested by a total goitre rate (TGR) of 6.5 percent. Older adolescents (aged 15 years and over) had a TGR of 7.8 percent, which was higher than the 6.4 percent among younger adolescents (aged 12 years and over). Children of primary school age were the least affected, with TGR of 5.2 percent.

Moussa, El-Nehry and Abdel Galil (1995) also revealed a TGR of ≥ 5 percent among 23.0 percent of mothers in rural and 20.0 percent in urban sites, and in 6.5 percent of children aged six to 71 months. Both surveys denoted the existence of a public health problem among different age groups, particularly older females. Using a cut-off level of < 100 mg/l for urinary iodine excretion, Hassan *et al.* (1998) reported that 30 percent of children in primary schools had iodine deficiency.

Based on serum TSH value < 0.39 ml U/l, the national survey of osteoporosis revealed that nearly 9 percent of adolescents and adults had iodine deficiency (Hassan, Abdel Galil and Moussa, 2004).

Zinc and other micronutrients

Results of the national survey of micronutrient deficiencies among primary schoolchildren (Hassan *et al.*, 1998) showed an overall serum zinc deficiency rate of 15.5 percent, with higher prevalence among boys in rural areas (19.7 percent).

Hassan, Abdel Galil and Moussa's (2004) national survey to determine bone mineral density among Egyptians found that 8.5 percent of adolescents and 5.6 percent of adults had low serum zinc levels, with no significant gender- or area-based differences.

Regarding serum selenium levels, 8.8 percent of primary schoolchildren had low levels (Hassan *et al.*, 1998). Adolescents and adults suffered more from this problem, with low serum selenium rates of 26.0 and 25.0 percent, respectively. Females had higher prevalence than males, regardless of area of residence (Hassan, Abdel Galil and Moussa, 2004).

Calcium, phosphorus and vitamin D data reflect that the problem was mainly related to calcium, with more than 20 percent of adolescents and nearly one-third of adults having low serum calcium. Rural sites showed greater deficiency, particularly among adults, with no apparent gender-based differences. This was mainly related to the higher prevalence of obesity among females on the one hand, and of smoking among males on the other (Hassan, Abdel Galil and Moussa, 2004).

The burden of low serum magnesium (Mg) levels was found to be far higher among adolescents than adults; 22.0 percent of adolescents and 10 percent of adults had low serum Mg. This was mainly explained by the effect of growth on skeletal health and mineral metabolism (Hassan, Abdel Galil and Moussa, 2004) (Table 9).

TABLE 9
Percentage distribution of studied populations according to serum cut-off of micronutrients

Source	Vitamin D (< 14 ng/dl) %	Calcium (< 8.4 mg/dl) %	Selenium[2] (< 9.6 µg/dl) %	Zinc[1] (< 80 µg/dl) %	No.	Gender	Site	Year	Age group
Hassan			11.0	12.0	500		Urban	1998	6–11
et al.			6.6	10.7	272	Boys			years
			15.4	13.2	228	Girls			
			6.6	18.9	250		Rural		
			6.6	19.7	122	Boys			
			6.6	18.0	128	Girls			
			8.8	15.5	750		Total		
			6.6	15.2	394	Boys			
			11.0	15.6	356	Girls			
Hassan,	4.2	21.6	25.0	8.6	2 664		Urban	2004	>11–19
Abdel	5.1	23.2	18.2	7.4	1 283	M. adolescents			years[3]
Galil	3.3	20.0	31.9	9.8	1 381	F. adolescents			
and	3.3	23.4	27.3	8.3	1 057		Rural		
Moussa,	4.8	24.5	26.7	7.9	613	M. adolescents			
	1.7	22.3	27.8	8.7	444	F. adolescents			
	3.8	22.5	26.2	8.5	3 721		Total		
	5.0	23.9	22.5	7.7	1 896	M. adolescents			
	2.5	21.2	29.9	9.3	1 825	F. adolescents			
	2.0	25.7	24.6	4.6	1 503		Urban	2004	20+
	0.9	25.1	18.6	4.3	692	M. adults			years[3]
	3.1	26.2	30.6	4.8	811	F. adults			
	3.8	32.6	26.0	6.6	621		Rural		
	5.2	33.5	16.4	7.5	297	M. adults			
	2.4	31.6	35.8	5.7	324	F. adults			
	2.95	29.1	25.4	5.6	2 124		Total		
	3.1	29.3	17.5	5.9	989	M. adults			
	2.8	28.9	33.2	5.3	1 135	F. adults			

[1] WHO/FAO, 1996 cut-off.
[2] Nelson, 1996 cut-off.
[3] Cut-off of serum zinc is >70 µg/dl, and of serum selenium <7.5 µg/dl (Hassan Abdel Galil and Moussa, 2004).

DIET-RELATED CHRONIC DISEASES[4]

Non-communicable diseases (NCDs) are the primary cause of mortality and morbidity in countries of the Eastern Mediterranean Region (EMR). NCDs are emerging as a major health problem in Egypt, where 41 percent of all deaths are caused by chronic diseases. As life expectancy increases and the elderly population continues to grow, chronic diseases will place an ever-greater burden on society (WHO, 2004).

This section provides a brief overview of trends in the major NCDs (hypertension, diabetes, CVD, cancer and osteoporosis) in Egypt over the last 20 years. Consecutive national surveys are lacking for most diseases, and available data spotlight only the present situation. Data sets on NCDs are shown in Annex 3, and in the tables and figures throughout this section.

Hypertension

Hypertension is considered a major risk factor for CHD, cerebrovascular disease and chronic renal failure. HPE-HES 1987 estimated that the overall prevalence of hypertension among Egyptians over six years of age was 15.8 percent. Systolic hypertension (above 150 mm Hg) was found among 11.3 percent, and diastolic hypertension (above 90 mm Hg)

[4] This section was investigated by F. Soliman.

among 4.7 percent of Egyptians. Systolic hypertension was more frequent among urban residents (Said, 1987).

The National Hypertension Project (NHP) of 1995 estimated the overall prevalence of hypertension among Egyptians ≥ 25 years of age at 26.3 percent (Figure 18). High systolic blood pressure (≥ 140 mm Hg) was reported among 17.2 percent, while 13.9 percent had high diastolic blood pressure (≥ 90 mm Hg). Hypertension increased progressively with age, and was slightly more common in women than men. However, younger age groups have shown progressive increases of hypertension over the past 20 years. The NHP results indicated that hypertension is highly prevalent in Egypt, and that awareness, treatment and control of hypertension are relatively limited (Ibrahim *et al.,* 1995).

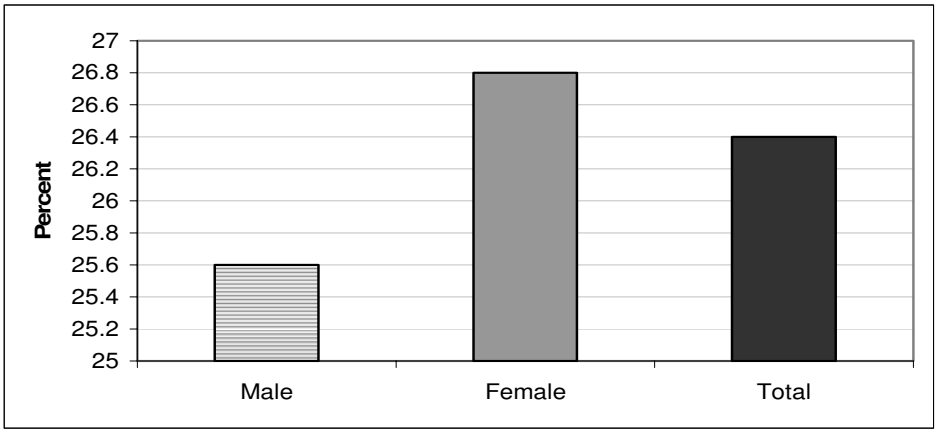
Adults with high normal blood pressure (130 to 139 mm Hg systolic blood pressure or 85 to 89 mm Hg diastolic blood pressure) are considered to be at high risk of developing hypertension; this group represented 17.5 percent of adults in 1995. The prevalence of hypercholesterolaemia and high levels of LDL-cholesterol was found to be higher among hypertensives than others (Ibrahim *et al.,* 1995).

Preliminary data from a diet, nutrition and prevention of chronic NCDs survey (Ismail, 2005) showed that the crude prevalence of hypertension among adolescents aged ten to 18 years is 1.4 percent (Table 10), with higher prevalence in Upper Egypt than Lower Egypt for both types of hypertension. Females in rural areas reported the lowest prevalence rates of both systolic and diastolic hypertension, while females in urban areas reported the highest prevalence of diastolic hypertension, followed by males of both areas. Generally, males in all age groups had higher systolic hypertension than females (Figure 19), especially in the older age group (16 to 18 years). Females had higher diastolic hypertension, except for in the older age group where both genders were equal. Findings on adolescents with high normal blood pressure denoted that about one-quarter of Egyptian adolescents would develop hypertension over the following few years.

This case study uses studies of the status of hypertension among Egyptians covering the period from 1987 to 2005. They represent different age groups and use different cut-offs for hypertension, so it is not possible to derive trends from them.

Increasing prevalence of overweight and obesity among Egyptians constitutes a risk factor for hypertension. Increasing intakes of animal protein and low intakes of dietary calcium and magnesium probably contribute to the early development of hypertension in Egypt.

FIGURE 18
National estimate of hypertension among Egyptians aged 25 years and more, 1995



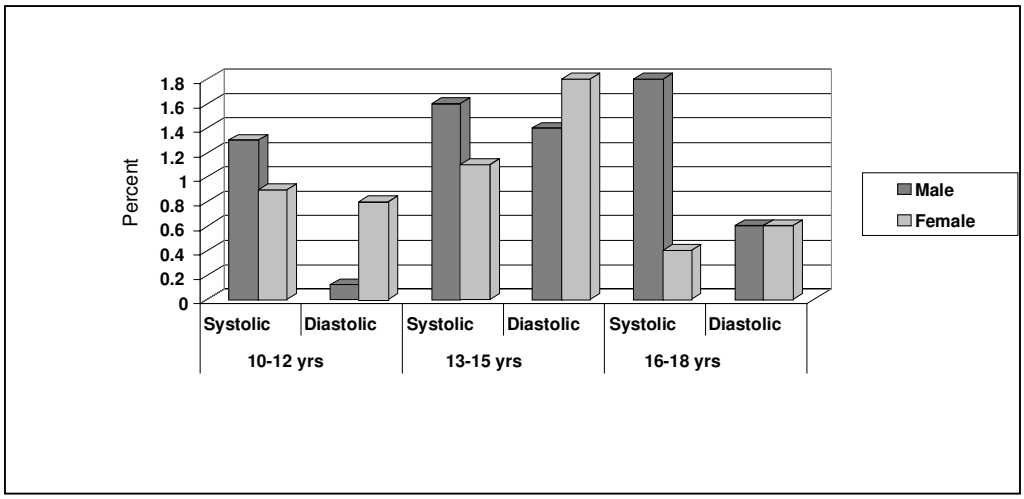
Source: Ibrahim *et al.,* 1995.

TABLE 10
Status of systolic blood pressure and diastolic blood pressure by area and gender among Egyptian adolescents, 2005

	Systolic blood pressure		Diastolic blood pressure	
	% high normal[1]	% high[2]	% high normal[1]	% high[2]
Urban				
Male	13.3	1.6	24.7	1.4
Female	10.7	1.5	28.9	1.7
Rural				
Male	10.5	1.5	22.3	1.6
Female	12.4	0.9	28.4	0.8
Total				
Male	12.0	1.5	23.8	1.2
Female	11.5	1.2	28.7	1.3
Overall total	**11.8**	**1.4**	**26.1**	**1.4**

[1] High normal blood pressure: 90th to < 95th percentile for age.
[2] High blood pressure: 95th to > 99th percentile for age.
Source: Ismail, 2005.

FIGURE 19
Hypertension prevalence among Egyptian adolescents by age group and gender, 2005



Source: Ismail, 2005.

Diabetes

Diabetes is considered a risk factor for CVD, renal impairment and blindness. In 1987, 1.3 percent of the people interviewed in a survey were aware that they had diabetes. Of these aware diabetics, 19.4 percent in both urban and rural areas were current smokers, and more male than female diabetics smoked. Regardless of area and sex, about half of the smokers smoked ten to 20 cigarettes a day (Said, 1987). In 1992, the overall prevalence of diagnosed diabetes among Egyptians over ten years of age was 4.3 percent, with higher rates among urban populations (Figure 20). Rural desert areas reported the lowest prevalence rate (Moursi, 1992).

In 1995, the combined prevalence of diagnosed and undiagnosed diabetes in the Egyptian population ≥ 20 years of age was estimated to be 9.3 percent (Figure 21). Approximately half of these people were already known to have diabetes, while the other half were discovered to have

diabetes during the survey; 9.6 percent had impaired glucose tolerance (IGT). IGT was more prevalent in rural than urban areas and in lower than higher socio-economic groups. As a group, diabetics represent the most obese segment of the population and have the highest WHRs (Hermann *et al.,* 1995).

In 2005, the total prevalence of diabetes among children aged ten to 18 years was 0.7 percent (Table 11). The prevalence was higher among females than males, and equal in urban and rural areas. Children with fasting blood glucose (FBG) levels between 100 and 125 mg/dl were considered pre-diabetic; they represented 16.4 percent of the total sample. Males were more likely than females to be pre-diabetic. The rate differed according to age group, with the older age group (16 to 18 years) showing higher percentages for both sexes. Pre-diabetic males were equally prevalent in urban and rural areas, while there were more pre-diabetic females in rural than urban areas (Ismail, 2005). The high prevalence of pre-diabetic adolescents is an alarming signal for an increase in the incidence of diabetes among Egyptians in the future.

Increasing central obesity among adults (Shaheen, Hathout and Tawfik, 2004) and adolescents (Ismail, 2005) could partially explain the apparent increase in the prevalence of type-2 diabetes.

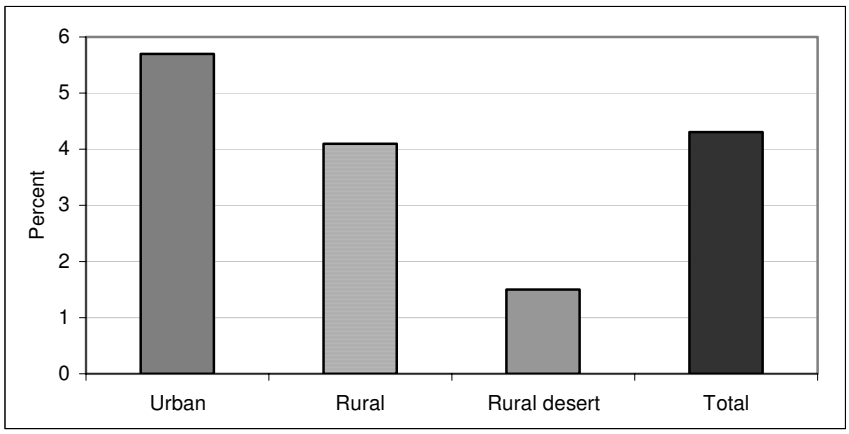
The National Diabetic Institute of Egypt, in collaboration with the Ministry of Health and Population (MOHP) and WHO, is carrying out a national survey on diabetes in Egypt. Data have not yet been published.

TABLE 11
Prevalence of diabetes and pre-diabetes among adolescents, by age and gender

Age group (years)	Male		Female		Total	
	Diabetic[1] (%)	Pre-diabetic[2] (%)	Diabetic[1] (%)	Pre-diabetic[2] (%)	Diabetic[1] (%)	Pre-diabetic[2] (%)
10–12	0.9	14.9	1.1	15.9	1.0	15.5
13–15	0.5	18.6	0.5	13.7	0.5	16.2
16–18	0.5	21.8	1.2	20.8	0.9	21.1
10–18	0.6	17.9	0.8	15.5	0.7	16.4

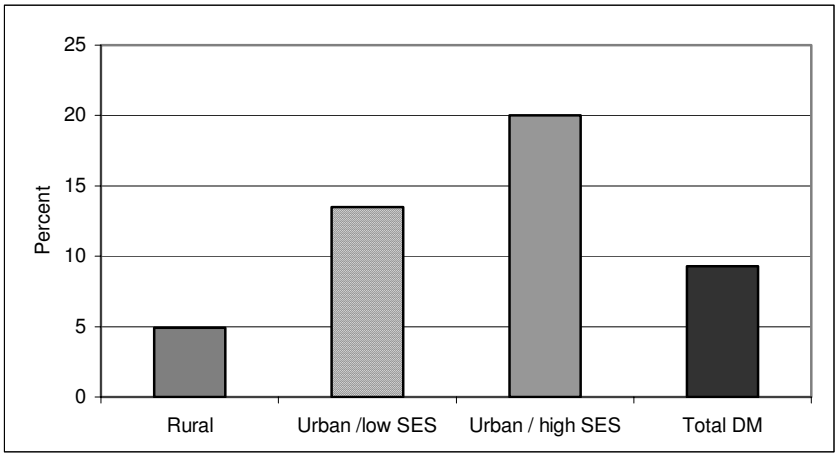
[1] FBG ≥ 126 mg/dl.
[2] FBG 100 to 125 mg/dl.
Source: Ismail, 2005.

FIGURE 20
Prevalence of diabetes by area at ten years of age and over, 1992



Source: Moursi, 1995.

FIGURE 21
Prevalence of diabetes by area and socio-economic status (SES) at 20 years of age and over, 1995



Source: Hermann *et al.,* 1995.

Cardiovascular disease

In Egypt, the prevalence of CVD has multiplied over the last two decades. The possible causes of this increase are the progressive ageing of the population, urbanization, dietary changes, sedentary lifestyles, smoking and stress. Among elderly Egyptians, CVD is the most prevalent chronic disease, followed by rheumatic diseases and diabetes (Hassan *et al.,* 2001).

In September 2000, the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS) released a report showing that CVD was responsible for 42.6 percent of all deaths. Hospital records of the reasons for admission to the cardiac department of Cairo University in 1984 and 1998 show that the prevalence of CVD increased from 6.9 to 32.9 percent over that period.

NHP data from 1991 to 1994 show that the following cardiovascular risk factors are more frequent in urban than rural Egyptians: hypertension, hypercholesterolaemia, low HDL-cholesterol, obesity, hypertriglyceridaemia, elevated LDL-cholesterol, increased fasting and post-prandial blood sugar, and cigarette smoking (Ibrahim *et al.,* 1995).

The Lipid Profile among Egyptians (LPE) of 1997 to 1999 is Egypt's first national survey of lipid profiles and ischaemic heart disease (IHD) based on a strict probability sample (Abdel-Aziz, 2000). Data from LPE reveal that risk factors varied among geographic areas, between urban and rural sites and between males and females. Lack of exercise and the threateningly high incidence of smoking should receive much attention from all health authorities. The apparently low incidence of smoking among females may not be reliable, as many women who smoke deny doing so. Results from LPE showed that 6 percent of men and 4.7 percent of women had IHD. Almost 40 percent of the whole population have cholesterol levels that are higher than the upper limit of normal (Table 12). There have been gradual increases in serum total cholesterol and LDL-cholesterol, which peak between the ages of 45 and 65 years, and a coincident decline in HDL-cholesterol (Abdel Aziz, 2000).

The Diet, Nutrition and Prevention of Chronic Non-Communicable Disease Survey (Ismail, 2005) is the first national survey to assess risk factors for the development of chronic diseases among Egyptian adolescents. Preliminary data from this survey indicate that the overall proportion of adolescents with high total cholesterol is 6.0 percent; the proportion with high

LDL-cholesterol is 7.0 percent, with high triglycerides 7.8 percent, and with low HDL-cholesterol 40.0 percent (Table 13).

Increasing hypertension, diabetes and central obesity, in addition to dyslipidaemia, should be considered among the risk factors leading to the increase of CVD in Egypt. Decreased intakes of cereals over the last 20 years, with increased consumption of animal protein and trans fat and low intakes of omega 3 fat (Hassanyn, 2000), together with inactivity and smoking (Abdel Aziz, 2000) may all be co-factors for hypercholesterolaemia, which is a leading cause of atherosclerosis and vascular diseases.

TABLE 12
Distribution of total cholesterol, LDL-cholesterol and triglycerides among Egyptian adults

Lipid parameter	Male %	Female %	Total %
Total cholesterol (mg/dl)			
< 200	55.1	53.0	53.8
200–300	39.2	38.1	38.8
> 300	7.7	7.2	7.4
LDL-cholesterol (mg/dl)			
< 150	84.1	78.2	81.6
150–200	16.2	14	15.1
> 200	3.6	3.1	3.3
Triglycerides (mg/dl)			
< 200	83.2	85.0	84.1
200–300	10.5	11.6	11.3
> 300	4.7	4.5	4.6

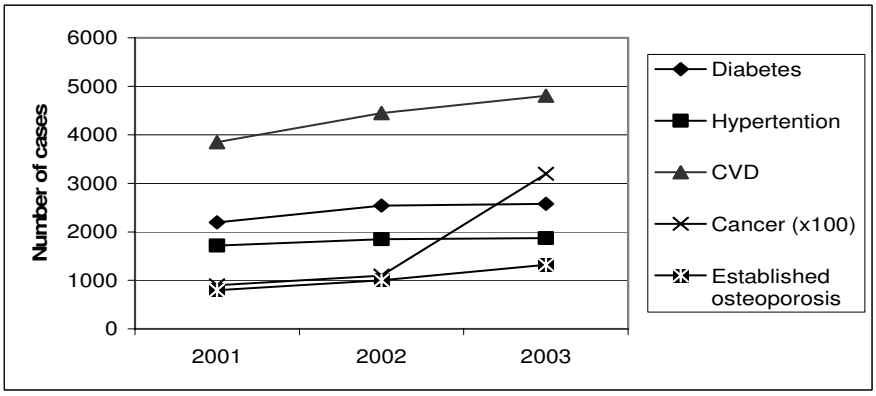
Source: Abdel Aziz, 2000.

TABLE 13
Distribution of total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides among Egyptian adolescents

Lipid parameter	Male %	Female %
Total cholesterol (mg/dl)		
Acceptable: < 170	79.7	73.7
Borderline: –199	14.9	19.2
High: >= 200	5.4	7.1
LDL-cholesterol (mg/dl)		
Acceptable: < 110	85.0	80.9
Borderline: –129	8.6	10.9
High: >= 130	6.9	8.1
HDL-cholesterol(mg/dl)		
Normal: >= 35	60.0	62.2
Risky: < 35	40.0	37.8
Triglycerides (mg/dl)		
Normal: >= 150	91.1	93.3
High: > 150	8.9	6.7

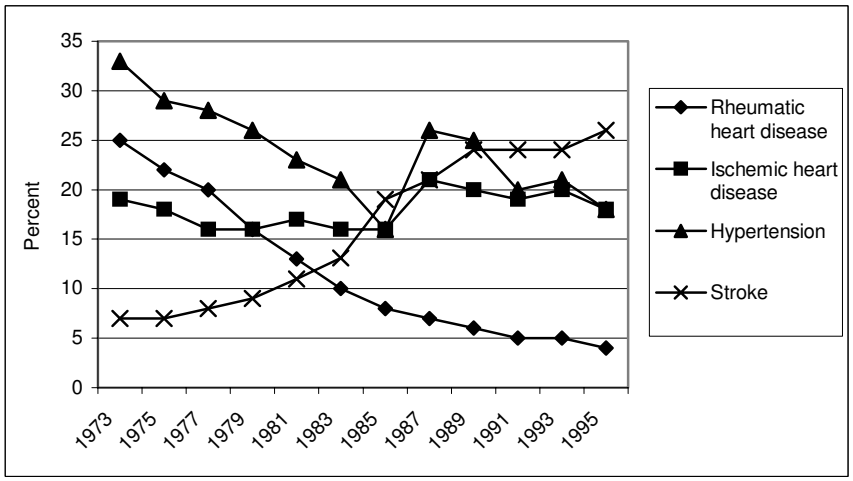
Source: Ismail, 2005.

FIGURE 22
Numbers of cases of NCDs, 2001 to 2003



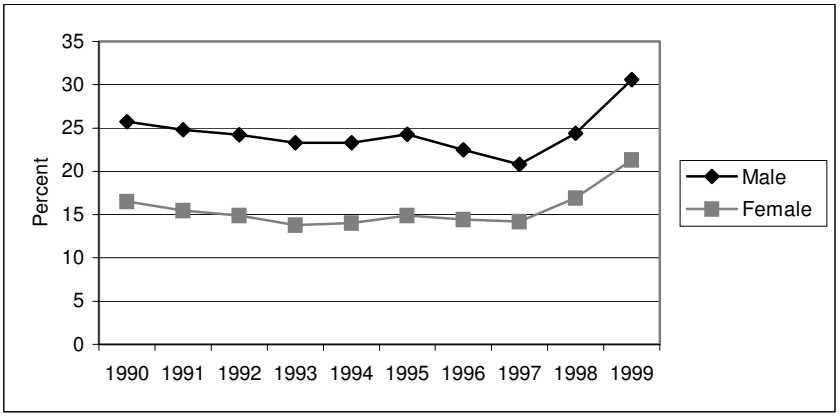
Source: National Centre of Health and Population Information, 2005.

FIGURE 23
Trend in CVD mortality rate in Egypt, 1973 to 1995



Source: National Centre of Health and Population Information, 2005.

FIGURE 24
CHD crude death rate by gender, 1990 to 1999



Source: CAPMAS, 2004.

Cancer

In developing countries, cancer is the third most frequent cause of death, after infectious diseases and diseases of the circulatory system; in developed countries it ranks second, after diseases of the circulatory system (WHO/FAO, 2003). Dietary factors account for about 30 percent of all cancers in Western countries, and for up to about 20 percent in developing countries; diet is second to tobacco as a preventable cause. Approximately 20 million people suffer from cancer; a figure that is projected to rise to 30 million within 20 years.

Since 1998, MOHP and the Middle East Cancer Consortium (MECC) have been sponsoring the National Cancer Institute (NCI), which is part of MECC's Joint Cancer Registry. The NCI registry in Cairo is the largest hospital-based cancer registry in Egypt (GPCR Board, 2002).

According to NCI cancer statistics from 2003, the leading cancers in Egyptian patients are those of the breast, gastrointestinal tract, lymphoma and urinary bladder (Table 14). There is male predominance in cancer incidence, with a male–female ratio of 1.4: 1.0 (El-Bolkiny, Nouh and El-Bolkiny, 2005). The increasing prevalence of obesity among females is one of the reasons for increasing rates of breast cancer.

Liver cancer increased markedly from 0.2 percent in the mid-1970s to 7.5 percent in 2003, most probably owing to higher prevalence of hepatitis C infection. Observational data from NCI reveal that lung cancer is increasing, probably because of an increase in smoking. Mesothelloma (cancer of the pleura) is also increasing, which may be owing to asbestos inhalation.

Paediatric cancers are relatively common in Egypt and account for about 10 percent of all cancer cases. In 2003, the most common types of cancer among Egyptian children and adolescents up to 19 years of age where leukaemia (34 percent of cases) followed by lymphoma (17 percent of cases) (El Attar, in press).

TABLE 14
Most common diagnosed types of cancer, 1970 to 2003

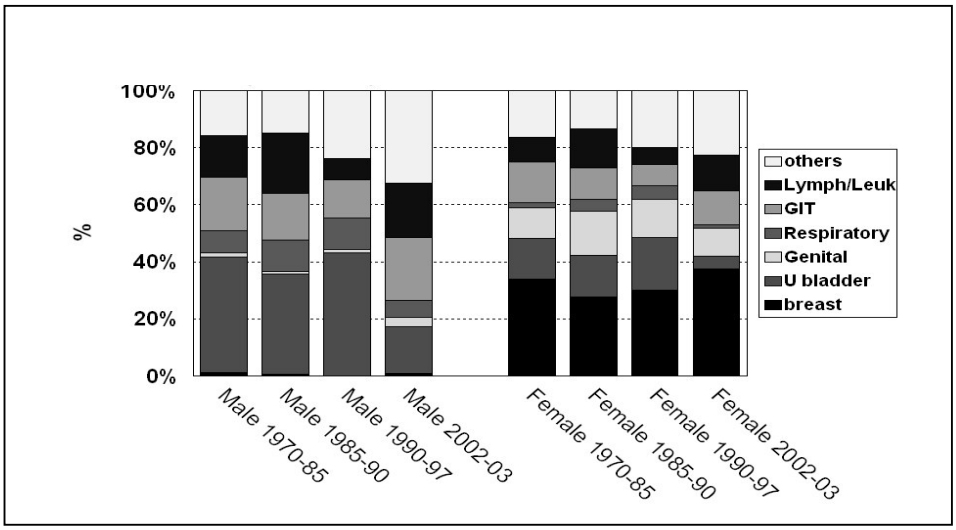
Site/type	1970–1985 (%)	1985–1989 (%)	1990–1997 (%)	1997–2001 (%)	2002–2003 (%)
Gastrointestinal tract	17.2	14.3	22.2	18.4	17.0
Urinary bladder	29.9	27.1	32.2	18.2	10.4
Breast	14.0	11.3	13.5	24.3	19
Lymphoma/ leukaemia	12.2	19.2	7.1	9.8	15.6
Data obtained from	In-patient records	Pathology registry records	Pathology registry records	Hospital data base	Hospital data base
Source	Sherif and Ibrahim, 1987	Mokhtar, 1991	El-Bolkiny, Nouh and El-Bolkiny, 2005	NCI, Cancer Statistics, 2002	El Attar, in press

TABLE 15
Most commonly diagnosed types of paediatric cancer, 1997 and 2001

Site/type	NCI, 1997 (%)	NCI, 2001 (%)
Leukaemia	36.7	20.9
Lymphomas	32	15.7
Neuroblastoma	1.6	3.7
Wilm's	3.7	1.6
Soft tissues	9.2	9.4
Bone	8.8	4.9
Liver	0.2	2.5
CNS, brain	1.6	5.5
Retinoblastoma	1.3	3.1

Sources: NCI, Cancer Statistics, 1997; El Attar, in press.

FIGURE 25
Trends in cancer diagnosis among Egyptian adults, 1970 to 2003



Data obtained from: in-patient records, 1970 to 1985; pathology registry records, 1985 to 1989 and 1990 to 1997; hospital data base, 1997 to 2001 and 2002 to 2003.
Sources: Sherif and Ibrahim, 1987; Mokhtar, 1991; El-Bolkiny, Nouh and El-Bolkiny, 2005; NCI, Cancer Statistics, 2002; El Attar, in press.

Osteoporosis

Osteoporosis is a disease of progressive bone loss associated with an increased risk of fractures. The disease often develops unnoticed over many years, with no symptoms or discomfort until fractures occur (AAOS, 2000). Diagnosis of osteopenia and osteoporosis in this case study is based on WHO 1994 classifications. Data from NNI national surveys to determine bone mass density (BMD) among adolescents and adults in 2004 (Table 16), and among the elderly in 2001 revealed that osteoporosis is a major health problem in Egypt.

About half of male adolescents (aged ten to 19 years) and more than one-quarter of females in the same age group were relatively osteopenic. The prevalence rates of relative osteoporosis were 16.7 and 0.9 percent for males and females, respectively, with no statistical difference between urban and rural areas. There was a statistically significant difference between male and female adolescents, but as age advanced the bone status of male adolescents improved, so that by the age of 18 years only 13 percent still had relative osteopenia. It is reported that nearly 70 to 80

percent of adult BMD is attained by the age of 18 years (Hassan, Abdel Galil and Moussa, 2004).

In the 40 to 50 years age group, 42 percent of females and 43 percent of males had low BMD. At the age of 60 years, about half of the males had osteoporosis, and half of the females had osteopenia, while a third of the elderly population (65 to over 80 years of age) are osteoporotic (Hassan, Abdel Galil and Moussa, 2001).

The unexpectedly high prevalence of low BMD among Egyptians, especially adult men, could be explained by increased smoking, reduced physical activity and increased consumption of soft drinks, in addition to low calcium intake, low omega 3 fat in diets and increasing animal protein intakes.

TABLE 16
Prevalence of osteopenia and osteoporosis among adults, by age and gender

Age group (years)	Gender	Osteopenia[1] %	Osteoporosis[2] %
20–30	Male	0.0	12.5
	Female	5.0	8.6
30–40	Male	11.8	9.5
	Female	5.2	10.6
40–50	Male	13.7	11.8
	Female	7.0	13.8
50–60	Male	15.9	21.9
	Female	11.4	21.3
≥ 60	Male	11.1	55.6
	Female	50.0	0.0
Overall	Male	14.1	14.9
	Female	6.5	12.6

[1] BMD > 1 -< 2.5 SD reference mean.
[2] BMD ≥ 2.5 SD reference mean.
N.B. Osteopenia and osteoporosis are relative in adolescents.
Source: Hassan, Abdel Galil and Moussa, 2004.

COMMUNICABLE DISEASE BURDEN[5]

Table 17 provides numbers of reported cases of the most serious communicable diseases. It is clear from the available data that hepatitis has been the most widespread and serious communicable disease in Egypt over the last 25 years, followed by pulmonary tuberculosis and meningococcal meningitis. There is also high mortality among patients with tuberculosis (TB), meningitis and hepatitis, but the compulsory vaccination programme against hepatitis B and the new prophylactic and therapeutic measures to control the spread of hepatitis C might have diminished the mortality among hepatitis patients (WHO, 2005).

In contrast, the relatively high mortality rate among AIDS patients, which does not correspond to the total of reported cases, may be due to difficulties in identifying cases before they reach their terminal phases when patients are quarantined in fever hospitals. In addition, a high mortality rate for a specific year may include AIDS patients who were infected and diagnosed over many of the previous years.

It is worth mentioning that the success of the Egyptian vaccination programme against diphtheria and poliomyelitis was the main cause of decreases in reported cases over recent years; the programme aims to eradicate these diseases completely (Figure 35).

[5] This section was investigated by A. El-Hady Abbas, S. Khairy and M. Shehata.

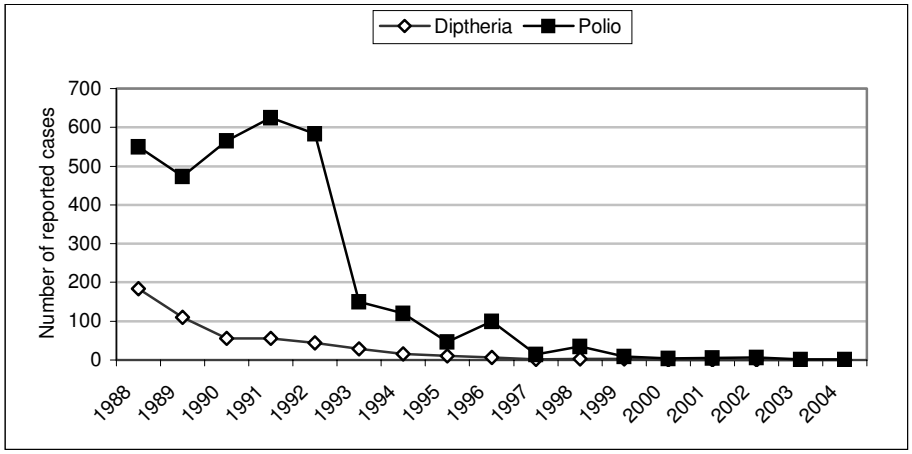
Malaria is the most widespread and serious communicable disease in the world, and Egypt is among a group of countries with some remaining areas of transmission. The specific target for this disease is to eliminate the few remaining foci of malaria by 2006 (WHO, 2004).

TABLE 17
Numbers of reported cases of communicable diseases in Egypt, 1980 to 2004

Year	Malaria (P)[1]	Diphtheria	Meningococcal meningitis	Poliomyelitis	Pulmonary tuberculosis	HIV/AIDS	Hepatitis
1980	370	333	296	2 006	1 381		
1981							
1982	365	809	2 061	2 113	1 596		18 188
1983							
1984							
1985	72	663	848	564	1 143		17 185
1986							
1987							
1988	225	184	3 327	550	1 231		15 188
1989	192	110	3 894	474	1 394		14 009
1990	75	59	3 976	565	2 740	7	14 209
1991	24	55	1 210	625	1 531	12	
1992	16	44	1 165	584	8 876	23	15 108
1993	17	29	896	150	3 416	29	
1994	527	18	800	120	3 223	22	
1995	313	10	671	47	9 708	16	
1996	25	6	661	100	10 236	14	
1997	11	1	167	14	11 040	25	
1998	13	3	489	35	9 650	33	13 340
1999	61	2	419	9	8 878	34	
2000	17	0	278	4	7 919	44	14 671
2001	11	0	201	5	7 900	33	
2002	10	0	130	7	8 223	47	
2003	45	0		1			
2004	14	0	135	1	5 378		

[1] Malaria P = parasitological confirmed malaria.
Source: WHO, 2005.

FIGURE 26
Numbers of reported cases of diphtheria and poliomyelitis in Egypt, 1988 to 2004



The prevalence of antibody to hepatitis C virus (anti-HCV) was determined in a cross-sectional survey of a village in Upper Egypt (Medhat *et al.,* 2000). Prevalence was higher among males than females, at 11.3 and 6.5 percent, respectively, $p < 0.001$. It was greater among those over 30 years of age than among those up to 30 years of age (20.0 percent versus 3.6 percent, $p < 0.001$). Hepatitis C virus RNA was detected in 62.8 percent of the anti-HCV-positive subjects, without significant variation by age, gender, education or marital status.

Abd El-Aziz *et al.* (2000) conducted a cross-sectional survey of the prevalence of anti-HCV in a rural community in the Nile Delta. Overall, 973 (24.3 percent) out of 3 999 residents were anti-HCV-positive, and the age- and gender-adjusted seroprevalence was 23.7 percent. Anti-HCV prevalence increased sharply with age, from 9.3 percent in those aged 20 years and under to more than 50 percent in those over 35 years. Of the 905 anti-HCV-positive samples tested, 65 percent were also positive for HCV-RNA. Active schistosomal infection was not associated with anti-HCV status, but a history of antischistosomal injection therapy was reported by 19 percent of anti-HCV positives.

The population of Egypt has a heavy burden of liver disease, mostly due to chronic infection with HCV. The overall prevalence of anti-HCV in the general population is about 15 to 20 percent. Egyptian parenteral antischistosomal therapy (PAT) mass-treatment campaigns discontinued only in the 1980s, and show a very high potential for transmission of blood-borne pathogens. A cohort-specific exposure index for PAT was calculated and compared with cohort-specific HCV prevalence rates in four regions. The data suggested that PAT had a major role in the spread of HCV throughout Egypt (Frank *et al.,* 2000).

Infections among children

The morbidity load in Egypt, particularly in preschool children, is due mainly to diarrhoea and respiratory tract infections, as shown by statistics from MOHP, as well as many community-based research studies. Detailed studies of urban children under the age of three years revealed that diarrhoea was the cause of morbidity in 37.7 percent of cases in underprivileged areas in Cairo, and of 24.7 percent of cases in Alexandria; respiratory tract infections were responsible for 29.4 and 36.4 percent of cases in the two cities, respectively (Moussa *et al.,* 1983).

Similar studies in rural areas (Galal*,* 1987) revealed that infants from birth to six months of age were ill for 25 percent of the time observed. Gastrointestinal and respiratory infections constituted, respectively, 37.9 and 31.8 percent of all infant illness. In the same study, toddlers aged 18 to 30 months fell ill an average of almost ten times a year, the total time span of illness averaging 11 percent of the year, but reaching as high as 30 percent. Approximately 40 percent of ailments were gastrointestinal in nature, and one-third respiratory infections.

The National Diarrhoeal Disease Control Programme reported that cases admitted to Bab El-Shaeiria hospitals with acute diarrhoea and dehydration were reduced by 71 percent in 1984 and by up to 75 percent in 1990. Existing data indicate that acute respiratory infection and diarrhoeal diseases were responsible for 30 and 16 percent, respectively, of infant deaths in 1999 (UNICEF, 2003).

Parasitic infestation

Moussa (1989) studied the relation between parasite infestation and malnutrition among schoolchildren aged six to 12 years in different nutritional grades, based on weight-for-age categories. The results revealed that urinary bilharziasis and ancylostoma were most prevalent among the group with third degree undernutrition; ascariasis was highest among the overweight group (but did not exceed 15 percent). Amoebiasis was least prevalent

among the group of normal weight-for-age, and most prevalent among the overweight group.

The results of a survey to assess micronutrient deficiencies among primary schoolchildren in three governorates – Cairo, El-Sharquia and Quena – revealed that the highest prevalence of ascaris infestation was among rural boys in El-Sharquia governorate (14.3 percent). Oxyuris infestation was prevalent in the three governorates, with the highest prevalence in El-Sharquia (15.6 percent), followed by Cairo (11.1 percent) and Quena (6.9 percent). The highest prevalence of *Schistosoma hematobium* (urinary bilharziasis) was 10 percent among rural boys in Quena governorate (Hassan *et al.*, 1998).

POLICIES AND STRATEGIES TO IMPROVE NUTRITIONAL STATUS[6]

Ministry of Health and Population strategies

Health strategies

In order to improve the health status of the Egyptian population, MOHP has developed several strategies, including the following:

- *Preventive care system:* the specific areas of intervention are immunization, quarantine measures, safe water supply, food hygiene, public cleanliness, environmental hygiene and infestation control.
- *Primary health care:* through which medical services are provided to the general population and to vulnerable groups (pregnant and lactating mothers and children under five years of age).
- *Curative care services:* where sick people find medical treatment.

Nutrition strategies

Before 1992, ad hoc programmes addressed the problem of malnutrition. Following the International Conference on Nutrition (ICN), held in Rome in December 1992 and sponsored by FAO and WHO, nutrition programmes in Egypt have been enhanced.

Egypt presented a country paper at the conference and took part in post-ICN condensed nutrition activities. A ministerial decree of 1994 formulated a high-level inter-ministerial committee representing the ministries of agriculture, health, planning, information, supply, education and academia. The outcome was the development of the Egyptian National Strategy for Nutrition, which has nine main policy areas. Each policy area includes a problem statement, a goal, measurable objectives, actions, authorities responsible for undertaking the different activities, resources, legislation (if required), and monitoring and evaluation indicators.

The main policy areas are:

- incorporating nutrition objectives, considerations and components into development policies and programmes;
- improving household food security;
- protecting consumers through improved food quality and safety;
- preventing and managing infectious diseases;
- promoting breastfeeding;
- caring for the socio-economically deprived and nutritionally vulnerable;
- preventing and controlling specific micronutrient deficiencies;

[6] This section was investigated by A. Gohar and I. Ismail.

- promoting appropriate diets and healthy lifestyles;
- assessing, analysing and monitoring nutrition situations.

Most of the programmes directed at improving the nutritional status of the population fell under the umbrella of this national strategy.

Programmes to improve food security

In addition to health/nutrition care, the availability of food items is also very important in efforts to improve nutrition status. The following are some of the main programmes aimed at increasing food availability in Egypt.

Food ration and subsidy programmes

The main objective of the food subsidy programme was to improve household food security and to prevent malnutrition and chronic energy deficiency. The current food rationing programme was established more than 50 years ago. In addition to price subsidies, specific forms of price intervention include market interventions in the form of subsidized food imports sold through the existing cooperative system. The most recent examples of this are meat imports from the Sudan, which are sold at less than half the price of locally produced meat. According to the present rationing programme, each individual receives – through the family card – a monthly ration of sugar, tea, oil, lentils, broad beans, rice and macaroni that meets a significant proportion of the family's needs. The subsidy of wheat bread is the most important component of this programme, but the food subsidy programme has several drawbacks and constraints as the cost of food price subsidies represents a serious drain on Egypt's national economy and constitutes a major block to the development programme.

Programmes to increase food production

As part of a national land reclamation project, the government has initiated projects all over Egypt. These include the Toshka project in Upper Egypt, which was started in January 1997 and aims to double the area of arable land in Egypt within a period of 15 years. The project's estimated cost was about US$86.5 billion to cover the 20 years from 1997 to 2017.

Programmes to improve nutritional status and to prevent and control malnutrition and morbidity

Programmes to prevent diet-related NCDs

Many programmes have been directed at improving the nutritional status of the Egyptian population and preventing NCDs. These programmes included the following strategies:

- *Nutrition education:* Community nutrition education was carried out through health facilities, schools, non-governmental organizations (NGOs) and the media with the aims of increasing the population's awareness of the programme, enhancing its knowledge and modifying its nutritional behaviours.
- *Food-based dietary guidelines:* With support from the United Nations Children's Fund (UNICEF), NNI produced food-based dietary guidelines for Egypt. These guidelines are directed at educated people, nutrition educators in the health sectors, NGOs and others. They include simple practical messages for healthy eating and lifestyles.

- *Nutrition capacity building:* NNI and MOHP are building capacity through training programmes for health providers, physicians, nurses and community workers.
- *Specialized clinics:* NNI has set up specialized clinics for the prevention, early detection and management of nutritional diseases, particularly obesity, its co-morbidities and stunting.

Programmes for improving nutritional status

Many programmes directed at improving the nutritional status of Egyptian populations have been carried out over the last 20 years. The following paragraphs describe some of these.

The national programme for supporting breastfeeding practices: Exclusive breastfeeding for the first six months of age, continuing breastfeeding up to two years of age, and healthy complementary feeding practices were the main thrusts of breastfeeding promotion activities. Among the many activities implemented to achieve these aims were the formulation of a national committee for the promotion of breastfeeding practices, the establishment of a national policy to support and encourage breastfeeding, implementation of the Baby-Friendly Hospital Initiative in 120 maternity health facilities, and implementation of the international code for the marketing of breastmilk substitutes.

Child Survival and Integrated Management of Childhood Illness: MOHP conducted many projects to improve the health and nutrition status of children under five years of age; these included the Control Diarrhoeal Diseases Programme, Child Survival (1985 to 1995) and Integrated Management of Childhood Illness (1995 to 2005).

The national programme for improving the nutritional status of school-age children: The Ministry of Education implemented school feeding programmes to enhance schoolchildren's physical and mental development. The programmes include the following:

- Iron-fortified biscuits: one packet of 80 g biscuits fortified with iron salt is given to each child in primary schools.
- The School Pie Programme: the ministries of education and agriculture provide pies on 110 days a year to half a million primary schoolchildren in seven governorates (Fayoum, Monofia, Behaira, Port Said, North Sinai, Damitta and Beni Swef). The World Food Programme (WFP) contributes to this programme by extending the period of meal distributions to 150 days.
- Cooked meals: The main target groups for this are handicapped students.
- Cold/dry meals: The main target groups for these are students in secondary, industrial, agricultural, technical and sports schools.

The number of students involved in these programmes increased from 3 019 130 in 1991/1992 to 11 210 258 in 2004/2005. Government contributions and external aid increased from LE 35 806 594 in 1991/1992 to LE 353 600 000 in 2004/2005.

Programmes for the prevention and control of micronutrient deficiencies

The National Programme for the Prevention and Control of IDA: Among MOHP's activities directed at preventing and controlling IDA are:

- health and nutrition education;
- iron supplementation to pregnant women;
- iron supplementation to adolescents and schoolchildren (primary and secondary);
- programmes to prevent and control infection and infestation.

The National Programme for the Prevention and Control of IDD: With support from UNICEF, MOHP and NNI have implemented many programmes to prevent IDD, which is a public health problem in Egypt. These programmes include:

- iodized oil supplementation in New Valley governorate (which has the highest IDD prevalence);
- formation of the National IDD Committee in1993;
- the universal salt iodization programme, launched by MOHP in 1996 with the support of UNICEF;
- four social marketing campaigns to promote iodized salt, which were conducted by NNI, MOHP and UNICEF with the aim of increasing household-level use of iodized salt in governorates where this was low – Gharbia, Fayoum, Quena and Assuit. As a result, household-level use of iodized salt rose from 56 percent in 2000 to 79 percent in 2003 (EIDHS, 2003);
- early detection of neonatal hypothyroidism through a neonatal screening programme that aims to test every child before it reaches one week of age.

The National Programme for the Prevention and Control of Vitamin A Deficiency: After NNI had conducted its national survey of vitamin A status, a national plan to eliminate VAD was implemented. This plan involved the following activities:

- nutrition education and dietary modification;
- the Vitamin A Supplementation Programme for postpartum women;
- vitamin A supplementation to children at ages nine and 18 months.

CONCLUSION[7]

Egypt is a developing country that is facing the double burden of malnutrition. Over recent years, annual per capita income has increased from LE 4 822.4 in 1998/1999, to LE 5 537.6 in 2000/2001 and to LE 5 652.8 in 2002/2003.

Health indicators have also improved over the last 25 years. The under-five mortality rate decreased from 102 per 1 000 live births in 1980 to 1985, to 46 in 1998 to 2003. With infant mortality decreasing from 73 to 38 over the same period. These data indicate that childhood mortality is becoming concentrated in early infancy. Overall, 88 percent of children are immunized against all major preventable childhood diseases. Life expectancy has increased, for males from 52.7 years in 1976 to 67.9 in 2003, and for females from 57.7 years in 1976 to 72.3 in 2003.

The changed consumption patterns of the Egyptian population during the last two decades can be explained as reflecting changes in socio-economic status, changes in feeding habits, urbanization and globalization. The dietary changes that have occurred in Egypt have been associated with increasing proportions of energy-dense foods and saturated fat. Food patterns

[7] This section was investigated by A. Gohar and I. Ismail.

have changed towards increasing intakes of fats and oils, high-fat products, sugar, meat and refined carbohydrates, and decreasing cereal consumption.

The total energy intake declined from 3 057 kcal in 1981 to 2 460 kcal in 2000, and the mean protein intake increased from 88.7 g to 91.5 g. In 1981, cereals contributed 61.2 percent of total energy intake, and animal protein only 8.1 percent. In 2000, cereals' contribution had declined to 52.0 percent, while animal protein's had increased to 20 percent. Animal protein's contribution to total protein intake also increased, from 27.7 percent in 1981 to 35.5 percent in 2000. This represents a significant increase in consumption of animal protein, while the contributions of vegetarian food groups to energy and protein intakes are decreasing; this may play a role in the emergence of diet-related chronic diseases in Egypt.

Although mothers' total energy intake decreased from 2 602 kcal in 2000 to 1 995 kcal in 2004, this did not seem to have any influence on the prevalence of obesity among females. This can be explained by the complexity of obesity pathogenesis. Most of the mothers – more than 90 percent – did not practice any regular physical activity.

Food prices and availability have influenced the food consumption of Egyptian populations. Increased income leads to people increasing their consumption of meat and animal protein; after prices increased rapidly following devaluation of the Egyptian pound in 2001, the consumption of all food groups decreased in 2004.

The food adequacy data from NNI national surveys show that the percentage of children receiving more than 100 percent of their energy RDAs increased from about 14 percent in 1995 to about 46.9 percent in 2000. These data, when added to the decrease in physical activity, explain the high prevalence of obesity in adolescence.

Although data show that about 90 percent of children and 70 percent of mothers consume more than 100 percent of the RDA for iron, the prevalence of anaemia in Egypt is still very high. This could be because most of the iron consumed is of plant origin, which decreases the bioavailability of iron.

Changing life styles, with more psychological stress, less physical activity and more high-density food, and changing eating habits, such as eating heavy meals late at night, are leading to increased prevalence of overweight and obesity among Egyptian populations. This in turn is leading to increased prevalence of diet-related chronic NCDs – diabetes, hypertension and certain types of cancer. The alarming results are that diet-related diseases are becoming more prevalent among younger age groups.

It is evident that future surveys should standardize their methodologies, have unified guidelines and be implemented regularly. This will make it easier to analyse, compare and track changes over time.

Changing the conceptual framework for implementing nutrition education programmes so that more attention is paid to raising Egyptians' nutrition awareness could help the prevention of diet-related diseases and their consequences. Such programmes must target adolescents and young adults, especially females, in order to reduce the high prevalence of NCDs in Egypt. Micronutrient deficiencies, especially IDA, still need strategies such as food fortification and nutrition education to increase the bioavailability of iron in foods. It is also recommended that distribution and application of the existing food-based dietary guidelines be strengthened.

Obstacles and constraints faced by this report

The following challenges were encountered during the preparation of this report:

- Raw data from most NNI and ARC surveys were not available, so data had to be obtained from the published reports.

- The NNI and ARC surveys used different types of analysis as regards RDAs, food composition tables and use of the truncated method (removing data pertaining to consumption of > 100 percent RDA). Differences in methodology made it very difficult to compare both sets of data.
- The dietary consumption surveys conducted by NNI had differing objectives and target groups, making it difficult to derive trends in food consumption patterns.

SUMMARY OF THE CAPACITY BUILDING NEEDED TO IMPROVE NUTRITIONAL STATUS IN EGYPT

Institutional needs

National nutrition policy

There is a great need to implement a national nutrition policy with objectives that are modified according to changes in food patterns and food habits. Healthy eating and healthy lifestyles should be addressed in all health facilities and school curricula.

New component in primary health care to address obesity and diet-related NCDs

The role of the primary health care unit in preventing and treating obesity and NCDs must be addressed over the coming years, as the prevalence of diet-related diseases is increasing.

Strengthening of the nutrition surveillance system

A nutrition surveillance system was established in Egypt between 1995 and 1997. There is a great need to redesign and strengthen this system for the early detection and proper management of malnutrition disorders.

Capacity building and training needs

Improving nutrition status requires a well-trained health staff who are capable of communicating with communities to spread information about healthy food and to educate people on the prevention of NCDs. There should be continuous training programmes for health staff, with emphasis on intra- and intersectoral collaboration.

Communication, education and advocacy activities

- Communication programmes are important in supporting strategies to prevent nutrient deficiencies. Information on causes, consequences and measures to control and prevent IDA, IDD and VAD should be disseminated through mother-and-child health centres, primary and secondary schools and the mass media.
- Education and communication programmes are needed to raise awareness of the risks of obesity and diet-related NCDs and to change the health and nutrition behaviour of women. Such programmes should be implemented for adolescent girls in schools and at mother-and-child health centres.

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ANNEXES

The NNI and FTRI/ARC surveys used different methods for analysing food intake data. In NNI surveys, data were converted into nutrient intakes using the Food Composition Table of Egypt, which is maintained by NNI and dates from 1996. To analyse the adequacy of nutrient intake, the NNI surveys used the RDAs from FAO/WHO/UNU (1985) for protein and energy, WHO (1989) for iron and FAO/WHO (1975) for vitamins A and C, except in the 2004 survey, for which FAO/WHO (2002) recommendations for vitamins and minerals were used.

The food intake data of ARC/FTRI surveys were converted into nutrient intakes using a modification of the USDA standard reference database (the Food Intake and Analysis System, Version 2.3, University of Texas), which was adjusted to remove the influence of enrichment/fortification and to include more than 1 000 Egypt-specific recipes (Khorshed *et al.,* 1998). Nutrient intake adequacy was expressed using current versions of the United States RDAs (published by the National Academy Press from 1989 onwards).

Because of these important methodological differences between the surveys conducted by NNI and FTRI/ARC, each set is presented separately in these annexes. However, both used internally consistent methodology, so trends over time in the data are reliable.

ANNEX 1:FOOD INTAKE AND NUTRITIONAL STATUS

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
National Food Consumption Survey	1981	6 300 households	2–6 years 10–19 years Adults ≥ 20 years	National	Dietary[1] Anthropometry[2]	NNI	Aly *et al*., 1981
Effect of increasing food cost on families' behaviour regarding feeding their members	1989	2 022 363	Individuals Households	Regional (Cairo – Assuit, El-Behera)	Dietary[1]	NNI	Hussein, *et al*., 1989
Household food budget survey	1990/ 1991	1 500 82 109	Households Individuals	National	Questionnaire	CAPMAS	
Assessment of IDD status among schoolchildren	1992	9 538 11 466 9 854	6–11 years 12–14 years 15–18 years	National (22 governorates)	Total goitre rate Lab[3] - urinary iodine	NNI	Hussein *et al*., 1992
Assessment of vitamin A status in Egypt	1995	1 628 855 M 775 F 1 629 F	0.5–5.99 years	National (five governorates representing different regions of urban and rural Egypt)	Dietary[1] Anthropometry[2] Lab[3] - haemoglobin - plasma retinol	NNI	Moussa, El-Nehry and Abdel Galil, 1995

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
EDHS	1995	9 766 M/F 265 F 6 314 F	0–5 years 15–19 years 15–49 years	National (26 governorates)	Anthropometry[2]	National Population Council	EDHS, 1995
Development of food consumption monitoring system	1995	3 186 households	2–6 years Mothers	National (five governorates representing urban and rural areas: Cairo, Ismalia, Dhakahlia, Aswan, New Valley)	Anthropometry[2] Dietary[1]	Food Technology Research Institute	Khorshed, Ibrahim and Galal, 1995
Household food budget survey	1995/ 1996	14 805 73 939	Households Individuals	National	Questionnaire	CAPMAS	
Child well-being in Egypt	1997	814 M 815 F	0–5 years	National (six governorates: Alexandria, Assuit, Aswan, Great Cairo, Quena, Sohag)	Anthropometry[2]	American University in Cairo, Social Research Center	El-Tawela, 1997

ANNEX 1: FOOD INTAKE AND NUTRITIONAL STATUS (CONTINUED)

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
EDHS	1997	3 328	6–60 months	National (26 governorates)	Anthropometry[2]	National Population Council	EDHS, 1997
Assessment of protein energy malnutrition, iron deficiency anaemia and vitamin A deficiency in Menia, Assuit and Sohag governorates	1997	2 700 2 700	Mothers Children 6–71 months	Regional (Menia Sohag, Assuit)	Anthropometry[2] Dietary[1] Laboratory[3] - haemoglobin - plasma retinol - stool analysis	High Institute of Public Health Alexandria	El-Sayed, 2002

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
Nutritional deficiencies among primary schoolchildren	1998	3 000	6–12 years	Regional (three governorates: Cairo, Quena, Sherkia)	Anthropometry[2] Dietary[1] Laboratory[3] - haemoglobin - serum ferritin - serum zinc - serum retinol - serum selenium - urinary iodine - stool analysis	NNI	Hassan *et al.*, 1998
Transition to adulthood: national survey of Egyptian adolescents	1999	9 128 13 271	10–19 years Households	National (21 governorates)	Anthropometry[2] Dietary[1] Laboratory[3] - haemoglobin	Agriculture Research Centre	ARC, 2001/ 2002
Household food budget survey	1999/2000	47 949 226 107	Households Individuals	National	Questionnaire	CAPMAS	
Egyptian adolescent anaemia prevention programme	1992/2000	700	Schoolchildren	Regional (Aswan)	Questionnaire	Ministry of Health, health insurance organization	

ANNEX 1: FOOD INTAKE AND NUTRITIONAL STATUS (CONTINUED)

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
Intra-household food distribution among Egyptian families	2000	720 885 532 M 554 F 1 270 M 1 470 F	2–6 years 6–12 years 12–19 years 20–65 years 20–48 years	Subnational: Cairo, Kalyobia and Beheira	Dietary[1] Anthropometry[2]	NNI	Shaheen and Tawfik, 2000
Food consumption pattern and nutrition intake among different population groups	2000	9 134 M/F 384 M/F 1 151 M/F 942 M/F 3 047 M/F 4 562 M/F	< 24 years 2–6 years 6–10 years 10–18 years ≥ 18 years	National (six governorates representing urban and rural areas: Cairo, Alexandria, Sharkia, Beheria, Fayoum, Sohag)	Anthropometric measurement[2] Dietary assessment[1]	NNI	Hassanyn, 2000
EDHS	2000	15 573 M/F	0–5 years 5–10 years 10–20 years 20–65 years ≥ 65 years	National (26 governorates)	Anthropometry[2] Laboratory[3] - haemoglobin	National Population Council	EDHS, 2000

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
Iron supplement distribution system: A trial for primary schoolchildren	2000	1 950 girls 1 250 boys	11–14 years	Regional (Giza)	Laboratory[3] -haemoglobin Focus group discussions	NNI/MOHP	Shaheen *et al.*, 2000
School-based delivery system for iron supplement programme in Egyptian primary schools	2000	7 256	Schoolchildren (11–14 years)	Regional (Sharkia, Kafr El sheikh)	Focus group Laboratory[3] - haemoglobin	NNI/MOHP	Shaheen *et al.*, 2000
Health and nutritional status of the elderly	2001	4 876	≥ 65 years	National (six governorates representing urban and rural areas: Cairo, Alexandria, Port Said, Garbia, Fayoum, Aswan)	Anthropometry[2] Dietary[1] Laboratory[3] - haemoglobin - fasting blood sugar - serum retinol - total cholesterol - liver enzymes - renal function Tests - plasma oestrogen - urinary calcium	NNI	Hassan *et al.*, 2001

ANNEX 1: FOOD INTAKE AND NUTRITIONAL STATUS (CONTINUED)

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
Survey to assess current status of anaemia and vitamin A deficiency	2002	3 000 3 000	F adults 2–6 years	National (Alexandria, Beheria, Garbia, Assuit)	Anthropometry[2] Laboratory[3] - haemoglobin - plasma retinol	High Institute of Public Health/MOHP/ Health Care Department/ UNICEF	El Sayed *et al.*, 2002
EDHS	2003	5 761 3 014 M 2 748 F 8 078 F	< 5 years 15–49 years	National (26 governorates)	Anthropometry[2] Laboratory[3] - haemoglobin	National Population Council	EDHS, 2003
Social marketing campaign for iodized salt	2003/ 2004	1 208 3 114	Market Household	Regional (Quena)	Focus group discussion	NNI	Hassan, Abdel Galil and Moussa, 2004

Survey name	Year	Sample size	Age range	Representation	Method of analysis	Institution	Source
Prevalence of obesity in Egypt	2004	31 798 4 154 2 433 6 190 19 021	Individual 2–6 years 6–12 years 12–19 years ≥ 20 years	National (eight governorates representing urban and rural areas: Cairo, Gharbia, Quena, Beniswef, Marsa Matrouh, El wadi El Gadid, Beheria, Swey)	Anthropometric measurement[2]	NNI	Shaheen, Hathout and Tawfik, 2004
Determination of bone mass density among adolescents and adults in Egypt	2004	2 520 2 446 2 028 2 039 2 021	Households 20–60 years F adults 20–60 years M adults 20–60 years M adolescents 10–19 years F adolescents 10–19 years	National (Cairo, Red Sea, Sohag, Sharkia)	Dietary[1] Anthropometry[2] - BMD (DXA densitometry) Laboratory[3] - haemoglobin - calcium - phosphorus - alkaline phosphates - osteocalcin - oestrogen - testosterone - cholesterol - retinol - vitamin D - zinc/selenium - TSH	NNI	Hassan, Abdel Galil and Moussa, 2004

[1] Method used for dietary analysis was 24-hour recall, comparing the raw composition of the diet in the analysis with the NNI food composition tables.
[2] Anthropometry analysis was according to age: for two to 12 years – weight, height z-score (weight-for-age, weight-for-height, height-for-age); for 12 to 19 years – BMI for age, height for age; ≥ 20 years – BMI.
[3] The laboratory method used was selected according to the objectives of the study.

ANNEX 2: DIETARY ASSESSMENT

The methods used to measure the food consumption of the families surveyed can be classified into two major categories: dietary pattern methods, for example, those that use food frequency questionnaires; and quantitative daily consumption methods, which are based on recall or records of the quantities of foods and beverages consumed over a one-day period – the 24-hour recall method.

Dietary pattern: food frequency questionnaire

This method obtained qualitative descriptive information about the usual frequency of food and beverage consumption for the whole family per day or per week; food items were categorized according to whether they were consumed – for example – fewer than three times a week, or at least three times a week.

The food groups included in this questionnaire were:

- cereals and starchy roots;
- legumes and pulses;
- oils and fats;
- meat, fish and poultry;
- milk and dairy products;
- vegetables and fruits;
- sugar.

24-hour recall method

In this method, every surveyed person was asked to recall his or her exact food and beverage intake for the previous 24-hour period. Quantities of foods and beverages consumed were estimated in household measures and grams.

The information obtained covered all eating events, in sequence, beginning with the first of the day; each event was classified as major or minor and all the food items consumed were recorded.

Each food and beverage consumed was described in detail, including cooking methods and the amounts of each ingredient used. Household measures were converted into grams by referring to a list of weights of commonly used household measures in Egypt, which was developed by NNI. NNI's food composition tables were used to determine the energy and nutrient intakes of each individual.

Adequacy of the diet consumed was assessed by comparing the energy and nutrient intakes of each person with his or her RDAs (FAO/WHO/UNU, 1985; WHO, 1989).

A food coding system was used, in which the first two digits denoted the food group, the second two digits denoted the food item, and the third two digits denoted the preparation method.

Weights of foods and beverages were converted into energy and nutrient intakes by a computer program developed from an energy and nutrient database.

Analysis was based on:

- energy and nutrients as percentages of RDAs (< 50 percent, 50 to 75 percent, 75 to 100 percent, and ≥ 100 percent);
- iron bioavailability was assessed according to the daily quantity of haem iron sources consumed – meat, poultry and fish – in grams, or of ascorbic acid in milligrams:
  - low bioavailability: < 30 g of haem iron sources, or < 25 mg of ascorbic acid;

  - intermediate bioavailability: 30 to 90 g of haem iron sources, or 25 to 75 mg of ascorbic acid;
  - high bioavailability: ≥ 90 g of haem iron sources, or > 75 mg of ascorbic acid;
- the vitamin A content of the diet was based on the retinol activity equivalent, which is equivalent to 1 µg of all trans retinol, to 6 µg of all trans betacarotene, and to 12 µg of other provitamin A carotenes.

ANNEX 3: DIET-RELATED CHRONIC DISEASES, DATA SETS

Survey name and source	Year	Sample size	Age range	Representation	Method of analysis used
Health Profile of Egypt–Health Examination Survey (HPE–HES) Said, 1987	1987	14 151 48.0% F 52.0% M	> 6 years	National 33.7% urban areas 66.3% rural areas	Measurement of blood pressure Questionnaire, self-reported treatment with antihypertensive medication
National Hypertension Project (NHP) Ibrahim *et al*., 1995	1991	6 733	25–95 years	National (six governorates: Cairo, Bani Sweif, Aswan, Sharkia, Port Said, El Wadi El Gedid)	Measurements of blood pressure (average of four) Hypertension defined as average systolic blood pressure ≥ 140 mmHg, and/or diastolic ≥ 90 mmHg, and/or self-reported treatment with antihypertensive medication
Prevalence of Hypertension in Adolescents Abdel Fattah, Abd-Alla and Al-Saeid, 2000	2000	5 133 2 660 M 2 473 F Most primary and secondary schools	14–20 years	Regional (Qalyubia governorate)	Measurements of blood pressure (average of three) Blood pressure classified according to Fifth Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNCV) (1993) for the young age group, as a percentile correlated with height
Diet, Nutrition and Prevention of Chronic Non-Communicable Diseases Ismail, 2005	2003/ 2004	6 000	12–18 years	National, urban and rural areas (seven governorates: Giza, Kalyubia, Kafr al Shekh, Al Sharkia, Aswan, Suhag, Al Menia)	Full medical history Dietary history Anthropometric measurement (weight and height) for BMI Blood pressure measurement Blood pressure classified according to Fifth Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNCV) (1993) for the young age group, as a percentile correlated with height Blood sugar: fasting and post-prandial Serum lipids: cholesterol, LDL-ch, HDL-ch and triglycerides

ANNEX 3: DIET-RELATED CHRONIC DISEASES, DATA SETS (CONTINUED)

Survey name and source	Year	Sample size	Age range	Representation	Method of analysis used
Diabetes Mellitus in Egypt Hermann *et al.*, 1995	1991–1994	4 620	≥ 20 years	Regional (Cairo, Giza, Kaliubia)	Height, weight, WHR Random capillary glucose For individuals at risk: - fasting blood glucose - glucose 2 hours after 75 g glucose load - diabetes and impaired glucose tolerance (IGT) classified according to WHO (1993) criteria
Focusing on the Health Requirements and Style of Living to Improve the Health of Elderly People in Different Cultural Sectors in Egypt Hassan *et al.*, 2001	2001	4 876	≥ 65 yrs	National, rural and urban areas (six governorates: Cairo, Alexandria, Port-Said, El Garbia, El Fayoum, Aswan)	Full medical history BMD measured by DXA densitometer acting peripherally on calcaneous site Assessment of BMD status based on WHO (1994) diagnostic categories Anthropometric measurements (weight and height) for BMI Dietary history (24-hour recall) Laboratory measurement: liver function, kidney function and heartbeat
National Survey for the Determination of Bone Mass Density (BMD) among Adolescents and Adults in Egypt. Hassan, Abdel Galil and Moussa, 2004	2004	2 520 families	10–19 years 20–60 years	National, rural and urban (six governorates: Cairo, Sohag, Red Sea, Sharkia, Dhakahlia, Beheira)	Full medical history BMD measured by DXA densitometer acting peripherally on calcaneous site Anthropometric measurements (weight and height) for BMI Dietary history (24-hour recall) Laboratory measurement of haemoglobin, calcium, phosphorus, alkaline phosphates, osteocalcin, oestrogen, testosterone, cholesterol, retinol, vitamin D, zinc, TSH, and selenium Assessment of BMD status based on WHO (1994) diagnostic categories