



International Science and Technology Institute, Inc.

FOOD AND NUTRITION IN YEMEN

A Review of the Sector with Recommendations
for Strengthening USAID Support for Nutrition
Activities in the Yemen Arab Republic

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EXECUTIVE SUMMARY

Prior to 1962, Yemen was among the poorest countries in the world with extremely low health, economic, and social indices. Stability was established in 1972 after a period of civil war, drought, famine and extreme poverty, and thereafter began a period of astonishing economic and social development. In spite of improvements in health indices brought about by these changes, both rates of infant mortality and malnutrition remain persistently high compared to other developing countries. This report focuses on an analysis of nutritional status in Yemen, economic and social conditions affecting nutrition, food availability, distribution and consumption, and opportunities to incorporate nutrition-related elements in USAID and private sector projects.

Nutritional Status

Yemen's malnutrition and infant death rates rank among the highest in the developing world. Forty-four percent of infants and young children are second and third degree malnourished compared to 28 percent in Haiti and 9 percent in Egypt. Yemen's infant mortality rate (IMR) of 156 per 1,000 live births is well above the average of 99 for Near East and 117 for sub-Saharan African countries. Malnutrition is highest in the rural areas of Yemen, especially the Tihama region, and is most pronounced in the 12 to 18 month old age group.

Anemia, most likely due to iron deficiency, is also a serious problem where 56% of children and 36% of mothers in rural areas are anemic. Moderate levels of Vitamin D deficiency have also been reported.

There are virtually no recent studies of maternal nutritional status or of birthweights. These are important areas for further inquiry since it is quite possible that undernutrition among mothers is playing a key role in low birthweight babies, inadequate breast-milk production and subsequent infant malnutrition and death.

Economic and Social Factors

The period 1972 to present has witnessed massive social and economic changes which have yielded some nutrition benefits. Yemeni migrants, returning from Aden and abroad, brought with them the skills and desires of modern societies. The huge out-migration to Saudi Arabia of between a third to a half of Yemen's male work force has generated an enormous return flow of remittance income into the countryside. An estimated \$1 billion is sent back through recordable channels and perhaps another \$1 billion in cash and goods through unrecorded channels. The country also receives substantial grants from the Arab oil countries which comprise some 35 percent of total YARG receipts. Gross Domestic Product grew at an estimated 12 percent per annum in the mid seventies declining to 8 percent in 1980 and is now 4 percent. Within just half a decade, Yemen has moved from a labor-surplus subsistence economy to a labor-short capital-rich economy.

The phenomenal increase in personal disposable income has fueled very large increases in family consumption for all types of imported goods. USIS estimates that there are over one million T.V.'s in Yemen already and 60 percent of villages have at least one video cassette recorder.

Food Availability, Distribution and Consumption

The general conclusion of most observers in Yemen is that overall food availability and cash income to purchase it is adequate. Average per capita food availability increased from 1990 calories and 65 grams of protein in 1961 to 2179 calories and 74.9 grams of protein in 1981. Local and imported foods are available, and in contrast to other developing countries, local foods are more expensive (sorghum-\$1.00/kg.; imported wheat-\$.25/kg.). Women, overburdened with chores, have replaced the traditional use of goat's or sheep's milk as a supplement to breastmilk with widespread use of time-saving instant weaning foods, formulas and powdered milks.

Causes of Malnutrition

Certain persistent factors combine to create the country's current high rates of disease, death and undernutrition. Although overall food availability and income to purchase it are adequate, intra family distribution and food absorption are not. This is primarily due to deleterious beliefs and practices surrounding infant and child care and mothers' time constraints. These include the following:

- interrelated factors of maternal undernutrition, low birth-weights and inadequate breastmilk production
- improper bottle hygiene and mixing (overdilution, not emptying bottle, not boiling bottle)
- inadequate weaning foods (late introduction and not enough)
- low intake of iron rich foods
- high fertility/close child spacing
- diarrhea, measles, malaria, parasites
- low exposure to sun (swaddling babies and covering children)

In turn, underlying causes of deleterious health practices are Yemen's extremely low literacy levels (7% among women), high demands on women's time in the form of child care, water and fuel gathering and agriculture, and inadequate public and private health care services.

Role for USAID and the Private Sector

USAID/Yemen is already directly addressing nutrition problems through its ongoing Tihama Primary Health Care project and proposed Family Health Services project. These programs should, however, focus more on maternal undernutrition, iron deficiency, anemia and Vitamin D deficiencies as well as disease and protein energy malnutrition. The Education sector and Development Training project could incorporate nutrition components by increasing training, supplies and equipment in communications, audio-visual aids, nutrition and health curriculum development, as well as fellowships and in-service training in public health nutrition and maternal and child health.

Mission agricultural activities offer excellent opportunities to directly attack some of the underlying causes of malnutrition in Yemen. The existing poultry project provides village women with pullet and feed that yield many more eggs than indigenous baladi birds, and most of these eggs are eaten at home. The Ibb Secondary Agricultural Institute (ISAI) is planning to increase female enrollment. This is important so that more female agriculture and home economics extension workers will be available to communicate with large numbers of Yemeni women engaged in agricultural work. In addition, human nutrition and food processing could be incorporated or strengthened in the ISAI curriculum. Applied research, equipment testing and demonstration of appropriate technologies to reduce the most time consuming farm and home tasks of rural women is also of vital importance. These might include such items as water pumps, kerosene and butane stoves, mechanical threshers, butter churns and wet-grain grinders.

The following approach for a private sector food and nutrition initiative would complement existing and planned public sector activities. It would draw on the strengths of Yemen's private sector, high disposable income, relatively inexpensive imported goods and vast potential for mass media communication in a largely illiterate society. Imported milks and infant weaning food products are widely used and available in Yemen. However, these foods are not always used appropriately due to low levels of education, knowledge, hygiene, water and time available for proper child care. Education through the mass media offers real opportunity in Yemen. Furthermore, while most imported foods are fortified with appropriate vitamins and minerals, other foods now being produced or imported into Yemen are not. These include locally produced juices, milk, sorghum and millet and imported wheat flour. Yemeni firms are becoming increasingly involved in food processing, yet there are no existing standards or awareness among food producers of the important role of food processing and fortification in improving nutritional levels.

Thus, a private sector food and nutrition project, organized through the Yemen Chamber of Commerce, would serve to: 1) Sensitize the Yemeni private sector to the nutritional needs of the country and the role of food processing and fortification in meeting these needs; 2) Involve local private sector firms and parent companies of importing firms in the development, production and distribution of films and radio messages on key nutrition problems; and 3) Put U.S. food industry representatives in touch with Yemeni businessmen for assistance in food processing, fortification, feasibility studies and cooperative ventures.

I. ECONOMIC AND SOCIAL CONDITIONS IN THE YEMEN ARAB REPUBLIC¹

Historical Perspective

Prior to 1962, the YAR was among the poorest countries in the world, isolated from without and within, and with the lowest economic and social indices. There were no roads, schools or health services, radios were banned, and much of the population lived in ignorance unmatched anywhere else in the world. The vast majority of the population maintained itself at just below subsistence, and migration to Aden and the world beyond had been the only route out of this system of stagnation and repression.

The 1962 revolution which toppled the Imamate set the trend towards massive change. First, however, there was a civil war that lasted eight years, overlapping onto a drought that lasted seven years, creating conditions of famine and extreme poverty. Not until 1972 was stability established, and thereafter began a period of rapid economic development. The

isolation was broken by the return of many long-term Yemeni migrants from Aden and abroad, including the U.S., bringing with them the skills and desires of modern societies, but particularly by the huge out-migration to Saudi Arabia of between a third to a half of the country's able-bodied men in the 1970's. This is short-term migration that generates an enormous return flow of remittance income into the countryside. In parallel to this cash flow into private households, the YARG also receives substantial grants from the Arab oil countries

for budgetary support and development works; these grants peaked at \$450 million in 1982, 35% of total YARG receipts.²

Recent Economic Development

Economic development in YAR is therefore barely a decade in being, but it has been fast. Although figures in Yemen are not precise, it is estimated that GDP grew as high as 12% per annum in the mid-seventies, subsequently declining to 8% in 1980 and now 4%. In 1982 the official GDP was estimated at \$3.25 billion or about \$500 per capita.³ Gross fixed capital formation grew at an impressive 48% during the period 1976/77-1980/81, the First Five-Year Plan Period. Two-thirds of this investment was by the private sector, in housing, transport, equipment, services and rural infrastructure. Nearly 90% of all private investment was from own resources. Much of the public investment, of which under a third was funded from foreign aid, has gone into economic infrastructure that has done much to open up and integrate the country. Almost as important as the public sector has been the investment by the Local Development Association (LDA's), who are responsible for much rural development, financing their activities 80% from voluntary contributions and 20% from local taxes.⁴ Given a fairly weak central government structure and authority, these LDA's play an important role in Yemen Society, being an integral part of the tribal structure.

The Remittance Phenomenon

The single most important socio-economic element in modern

Yemen is the remittance phenomenon. It is estimated that at any one time around 400,000 men are working in neighboring economies, Saudi Arabia mainly, sending back around \$1 billion cash through recordable channels, and perhaps up to another \$1 billion in cash and goods through unrecorded channels.⁵ Remittance income goes directly to the families in the countryside, and then percolates through the economy. The salient feature of this phenomenon is that it was the rural poor who upped and left for Saudi Arabia, moving out of marginal economic occupations, primarily growing rainfed sorghum that was worth \$100 per year, to a high-paid cash economy that pays \$30 per day at least. Within half a decade, Yemen moved from a labor surplus subsistence economy to a labor-short, capital-rich economy⁶ where the income distribution became vastly improved, i.e. a trickle-up model of development. Labor movement to Saudi Arabia is free, and the only serious restrictions are the denial of passports by the YARG to certain low-status groups, i.e. the Akhdam, and a YR 4,000 fee for a migrant who hasn't done his military service. Yemenis in Saudi Arabia have access to, and take advantage of, all Saudi welfare measures such as free health care and subsidized foods, and in effect there is no administrative barrier between the two countries; even the borderline is mostly undemarcated.

The remittance income, and its multiplier effect through the economy, has enormously boosted family incomes and cash holdings. The labor shortages and the increased cash liquidity

have driven rural wages from \$1 per day to \$10 per day, creating conditions of full employment. And because the origin of the migrants were the villages, the countryside has benefitted more than the cities; even now only 10% of the population resides in urban areas. The phenomenal increase in personal disposable income has fueled very large increases in family consumption, the signs of which are obvious: the whole range of imported consumer goods and foodstuffs, medicines, audio-visual items, vehicles, etc. that are available in towns as well as in villages. It is very evident that consumption has increased in all income groups, so that only a very small segment of society still survives at a low level of subsistence.

Local Food Preferences

The increased availability of imported goods, especially foodstuffs, has had no negative impact on domestic agriculture; in fact, the opposite seems to be the case. Yemen has only been open to outside influences for a decade, so there was no penetration of foreign goods into the economy, and no concept that imports are "superior" to local products as is the case in most developing countries. Furthermore, even while a modern import-based consumer economy has been booming for the last 8-10 years, people's attitude to staple foods has barely changed i.e. preferences for local foods and other products remain very strong. Given this preference, the cash available to families, and the generally low level of domestic farm productivity, it is not surprising that inflation has occurred and boosted prices.

of domestic products. What is surprising is that these prices have remained high despite the abundant availability of cheaper, better-quality imported foods. In Yemen, however, anything local is "better" than anything imported as far as consumer preference is concerned and for this Yemenis are prepared to pay considerable premiums. Currently local sorghum sells for an equivalent of \$1.00 per kg. in rural markets as against \$0.25 per kg. for unmilled Australian wheat;* local beans are selling for about \$1 per kg., more than a tin of imported fouse from Egypt. Local live chicken sells for 50-100% more than imported frozen dressed chicken, and local baladi eggs are twice the price of imported ones.

Impact on Domestic Production

In the case of vegetables and fruits, the high prices of local products have been exacerbated by recent bans on imports, even though local production is nowhere near able to meet demand. While the remittance-fuelled demand and high prices for local goods has spurred local production of most commodities, there has, however, been a decline in local production of sorghum, the staple, and traditional livestock. Up to 1974/75 the traditional economy was operating at its maximum capacity, using surplus labor to build terraces and grow food (sorghum) even on the most marginal lands. Since then, with labor shortages, rising wages but no change in technology, the

*There is no price control on locally-produced foods. However, the YARC sets the price of all imported foods at a level that permits a small margin. Unique for the region, there are no consumer subsidies for basic foodstuffs.

marginal terraces, especially those at the top, had to be abandoned. Traditional livestock, i.e. sheep, goats, cows, donkeys and camels, has declined also because of the male labor shortage, compounded by the unwillingness of some women--who now make up 70% of the rural labor force⁷- to take on herding and other arduous and time-consuming tasks associated with the up-keep livestock when cash is available to purchase powdered milk and imported chickens. This has had a direct impact on infant nutrition, as infant formula and full cream powdered milk have replaced cows' or goats' milk in supplementing breastmilk.

The trend in production of important crops over the past eight years is shown in Table 1.

Table 1. Food Production 1977-1983 - 000 tons

Item	Average 1974/76	1977	1978	1979	1980	1981	1982	1983
Sorghum & millet	763	613	585	627	636	635	581	268
Wheat	71	61	45	63	65	70	67	34
Maize	37	44	43	46	49	53	59	30
Barley	62	42	39	42	48	54	53	30
Vegetables	167	210	226	230	261	291	305	326
Potatoes	70	100	107	116	131	138	150	163
Dry legumes	70	82	77	79	84	80	75	40
Sesame	5	6	6	6	6	5	5	4
Dates	5	6	6	6	6	6	6	6
Grapes	37	47	45	49	56	64	68	72
Other fruits	62	72	77	73	77	81	85	85

Figures rounded

Source: Statistical Year Book 1983, Table 1/3 Central Planning Organization

From Table 1, it can clearly be seen that even disregarding 1983, when a severe drought (which continued into 1984) affected production abnormally, the trend in rainfed production - that is, cereals, dry legumes, sesame and dates - has been declining. However, production of irrigated crops, namely vegetables, potatoes, grapes and other fruits, has been growing rapidly. Vegetable and potato production more than doubled in the period considered, with the incremental production of these two categories more than compensating for the drop in cereal production. These trends indicate that the now scarce labor is shifting its focus from low value cereal production to high value horticulture production, and improving the overall nutrition value of local production.

Table 2 illustrates the trend in the domestic production of meat and fish.

Table 2. Meat and Fish Production - 000 tons

Item	1977	1978	1979	1980	1981	1982	1983
Fish	12.6	14.0	15.9	16.3	17.0	17.3	17.6
Poultry	3.6	3.6	4.4	5.9	7.2	14.5	22.9
Eggs (million)	107	109	111	117	122	122	129
Beef & sheep	18.4	19.2	20.0	19.6	20.4	20.9	21.5
Milk	77.5	82.5	85.0	90.0	95.0	95.8	97.6

Figures rounded

Source: Statistical Year Book 1983, Table 3/3 Central Planning Organization

Fish production rose steadily, thanks to IBRD assisted development of the Red Sea fisheries, and poultry production has

shown dramatic increases. Red meat production seems to have stagnated, but these figures are taken from estimates on local slaughterings, which include imported live animals. Average annual imports in 1979/81 are estimated at 27,665 head of cattle and 130,000 head of sheep and goats. This would indicate that local cattle, sheep and goat numbers have fallen, due to disease outbreaks and reduced numbers in general. The drought in 1983 also needs to be taken into account. Milk production has increased steadily, due to implementation of a few large-scale dairies and rapid rise in the imports of feedstuffs. Milk now is much more available, due to the new UHT process that allows unopened cartons of milk to be stored for up to six months without refrigeration.

II. FOOD AVAILABILITY AND DISTRIBUTION

Table 3 gives the data for production and imports of major foods for the period 1979-81, averaged on an annual basis.

Table 3. Consumption of Major Foods
Annual averages for 1979/81 - 000 tons

Commodity	Production ^{1/}	Imports	Consumption
Sorghum & millet	634.3	-	629.6
Wheat & flour	66.0	348.1	414.1
Maize	50.0	1.0	49.0
Rice	-	22.7	22.7
Barley	49.0	2.7	51.7
Dry legumes	81.3	9.3	90.6
Potatoes	132.0	-	127.0
Vegetables	268.7	33.9	302.6 ^{2/}
Grapes	58.3	9.4	67.7
Other fruits	78.0	228.4	306.4 ^{3/}
Red meats	20.4	1.0	21.4
Poultry meat	7.2	54.3	61.5
Eggs	6.1	7.0	13.1
Milk	84.9	370.1	455.0 ^{4/}

^{1/} Net of seed requirements and storage losses.

^{2/} Imports of vegetables effectively banned in mid-1982 when a 100% customs duty was imposed.

^{3/} All fruit imports were banned in mid-1983.

^{4/} Expressed in whole milk equivalents. Imports averaged 10,000 tons whole milk, 14,700 tons evaporated milk, 4,000 tons butter, 4,000 tons ghee, 11,000 tons dry milk, 800 tons cheese, 40 tons milk by-products.

Source: CID/Ministry of Agriculture and Fisheries. Food consumption in the Yemen Arab Republic. Paper undated, early 1984.

Sorghum is by far the most important food in the country, with per-capita consumption of 72.5 kg. if the population is assumed to be 6.9 million, and 84.8 kg. if 5.9 million is used. Even taking out 1983/84, when a very severe drought reduced domestic cereal production by 60% (USDA estimates), sorghum production in Yemen has been declining, from 650,000 tons in early 1970's, to 550,000 tons average in the 1980's, while wheat production has stagnated at 60,000 tons. However, only 15% of the domestic sorghum was marketed in 1982, so imported wheat and flour are the most important traded foods in Yemen, and imports have been climbing from an average of 444,000 tons in 1978/80 to 546,000 tons in 1982/84.

Since Yemen has recently emerged from a subsistence level and that there is substantial cash purchasing power in rural households, it is not surprising that many other local products are mainly consumed on the farms. Besides sorghum, the estimated marketed portion for other important crops is millet, 5-10%; wheat, 5%; livestock 50%; eggs, 20%; milk, 2%; poultry, 60%; pulses, 60%. Only with fruits and vegetables do marketed volumes reach 75-90% of production.

Because of rural prosperity, much of the marketed produce is consumed locally; only grapes and raisins depend on the urban market for more than 50% of final sales. Marketing is facilitated by the ubiquity of vehicles, especially four-wheel drive pickups, in the countryside. These move produce quickly to consumers, even in areas where roads are mere tracks. A major

feature and strength of the marketing system is the role played by goat distribution. This sector, which may be the largest business in Yemen,⁸ has built up an extensive and efficient distribution system that picks up fresh goat early every morning in the producing areas and delivers it to just about every settlement in the country by 1 p.m. at the latest. The capacity to move other products to and from the mountain villages is therefore considerable.

Food Processing

What processing there is of local foodstuffs is entirely done at home or at urban restaurants. Food processing industries that do exist are almost totally dependent on imported raw materials, be they poultry, dairy products, fruit juices, or biscuits and cookies. The only processing that depends on a high element of local inputs is the soft drinks and mineral water bottling sector. There are many plans for establishing agro-industries in Yemen, but it is doubtful whether the domestic raw material base is there, except perhaps in the case of tomatoes. Their viability depends on cheaper imported raw materials.⁹ The country only has 1,350,000 ha of arable land, or less than 0.2 ha per head, and only 10% of this land is fully irrigated, while over half of the area is good for only arid and semi-arid production of sorghum and millet. Although the area under irrigation is expanding rapidly, thanks to heavy investment in tubewells by farmers, some areas are already running out of water resources, particularly in the central plain around Sana'a

and Dhamar. The water table there has dropped alarmingly, and there are serious thoughts that Sana'a itself will run out of water by 1990 unless exploration is stepped up drastically. So far, the only new significant source of groundwater that has been discovered is in the east of Marib by the Empty Quarter, where oil has been found.

Another reason why local production for processing is unlikely is the Yemeni preference for local fresh products, be they grain, fruits, vegetables, nuts, chicken or meat. This guarantees the farmer a high price for fresh produce, while processing depends on large quantities of fruits and vegetables at prices below those available in the fresh market.

Domestic consumption of fresh vegetables and potatoes grew from 233,000 tons in 1975/77 to 349,000 tons in 1979/81, an increase of 50%. Consumption of processed vegetables in the same period rose from 2,000 tons to 32,000 tons. Many Yemenis still consume very small quantities of a limited range of vegetables, and the past paucity of supply must be the major reason for this low consumption. Anyway, it is likely that fresh fruit and vegetable production will increase substantially, and despite occasional seasonal local gluts, marketing problems not foreseen.

To obtain a nutritionally satisfactory situation, it is hoped that imports of canned or frozen foods, particularly of protein foods, will be permitted without restriction even as domestic production of fresh produce increases.

Fruit consumption increased 81% from 163,000 tons in 1975/77 to 195,000 tons in 1979/81. In 1979/81, domestic supply of fruit, mostly from home gardens, accounted for only 48% of consumption and in that period fruit import in volume was only exceeded by the volume of grain imports, as shown in Table 3. Fruit consumption halved after the YARG banned imports in 1983. Fruit trees are looked after by the women and most fruits are consumed at home; only 10% are sold in the urban markets. Grapes, however, are consumed mainly in the towns; farm and local consumption account for only 30% of production. Grape production is very profitable in Yemen, and production has grown 71% from 43,000 tons in 1978 to 72,000 tons in 1983.

Meat consumption for 1975/77 was estimated at 71,000 tons of which 63% was from goat. In 1979/81, the consumption had risen 24% to 88,400 tons, of which 69.5% was from chicken. Poultry meat imports averaged 7,000 tons in 1975/77, 55,500 tons in 1979/81 and 74,000 tons in 1983. Domestic production rose from 3,600 tons in 1977/78 to 7,200 tons in 1981 and 22,900 tons in 1983, a rise of 536% in five years. The poultry industry is the largest agro-industry in the country, and totally dependent on imported raw materials. It is now almost entirely in the private sector, and although production is concentrated in a few large enterprises, there are many small units in the countryside, especially between Dhamar and Taiz. Egg production is still mainly in the traditional sector, i.e. in the hands of village women. The stage has not yet been reached

to attract large-scale production pace broilers, home production has grown only 20%, from 5,500 tons in 1978 to 6,500 tons in 1983, while imports averaged 7,657 tons in the same period.

Meat consumption in Yemen exhibits the same preference for local production as with other foods. Imported frozen chicken, which is widely eaten in rural areas, sells for YR 12 per kg., while locally produced commercial birds sell for YR 15-18 per bird, and the baladi bird sells for YR 30-50. Similarly, imported frozen beef retails for YR 30 per kg., while local goat and mutton sells for YR 60-80 per kg. Imported eggs sell for YR 0.5 each, while a baladi egg sells for YR 1. High prices for red meat does, however, curtail consumption, especially by women who need it most during pregnancy.

Per Capita Consumption and Calorie Intake

A paper¹⁰ prepared in early 1984 by the CID planning advisor in the Ministry of Agriculture and Fisheries is the latest analysis of per capita food availability in the YAR. It compares estimates made for 1974/76 by the Economic Commission for West Asia, for 1975/77 in the FAO Food Balance Sheet, and draws up estimates for 1979/81 based on best available data. All three studies are limited by the unreliability of data, not only on domestic production and population, but even for imports. Import statistics are prepared on different bases by the Central Planning Organization, the Ministry of Supply and Trade, and by the Central Bank. In addition, no attempt is made to estimate unrecorded flows across the Saudi Arabian border, so all official

figures grossly underestimate the actual availability of food commodities flowing into the country.

Table 4 gives the estimates calculated by ECWA for 1974/76 and FAO for 1975-77. The ECWA study estimated the daily per capita calorie availability in 1974/76 at 2,101, 91.3% of requirements, with carbohydrates contributing 73.6%, protein 12.4% and fats 14.0%. The population estimate for the period was 5,090,000. The FAO Food Balance Sheet used a population of 5,398,000 and estimated daily per capita availability at 2,260 calories, 90.8% coming from plant sources. The FAO's calorie estimate was 7.6% higher than ECWA's, and used slightly higher per capita consumption estimates for most food items, although there was only one year difference between the two studies.

The current consumption estimate is for 1979/81, based on reconciling available data from various official sources and studies made subsequent to the FAO study. The per capita consumption figures, based on two different population figures, are given in Table 5. Daily per capita calorie availability using the higher population estimate of 6,912,000 is calculated as follows:

Table 6. Estimated daily nutrition availability

	Per Day		
	Calories Nos.	Protein Grams	Fats Grams
Population 6,912,000			
Total	1864	64.1	26.5
Vegetable products	1718	55.3	17.8
Animal products	146	8.8	8.7

TABLE 4

Per Capita Consumption Estimates for Major Foods and Food Categories,
Yemen Arab Republic, 1974-76 and 1975-77.

Commodity	1974-76 ^{a/}	1975-1977 ^{b/}
	ECWA STUDY	FAO FOOD BALANCE SHEET
	(Kilograms per capita per year)	
Wheat Flour	31.0	37.6
Rice, Milled	0.8	1.1
Barley Flour	4.9	7.0
Maize Flour	14.9	10.4
Sorghum and Millet Flour	112.6	104.4
Potatoes	9.8	12.2
Sugar, Refined	10.6	16.2
Pulses	11.2	12.6
Vegetables, Fresh	27.5	30.9
Grapes	6.1	7.2
Dates	4.5	14.5
Fruit, Fresh	13.8	5.7
Eggs	0.5	1.9
Fish	2.0	3.1
Milk and Products	59.0	29.5
Edible Oils:		
Vegetable	2.9	2.9
Lard	0.7	0.9
Animal Fats	0.5	0.5
Spices and Condiments	0.4	0.4
Beverages	1.0	1.4

^{a/} See H. K. Maheshir, "The Role of Agriculture in the Long Term Economic and Social Development of the Yemen Arab Republic", United Nations, Economic Commission for Western Asia, October, 1979.

^{b/} Food and Agricultural Organization, United Nations, "Food Balance Sheet for the Yemen Arab Republic", 1978.

Table 5.

Per Capita Food Consumption Estimates for Selected
Foods and Food Groups, Yemen Arab Republic, 1975-81.

Food or Food Group	Total Availability ^{a/} (thousand tons)	Per Capita Consumption based on Population of:	
		6.912 Million ^{b/}	5.912 Million ^{c/} (kilograms per year)
Wheat flour	310.3	44.9	52.5
Maize flour	39.2	5.7	6.6
Sorghum & millet flour	501.1	72.5	84.8
Barley flour	31.9	4.6	5.4
Rice, milled	22.7	3.3	3.8
Potatoes	106.2	15.4	18.0
Sugars & honey	123.7	17.9	20.9
Dry legumes	80.9	11.7	13.7
Vegetables	275.1	39.8	46.5
Grapes	61.5	8.9	10.4
Other fruits ^{d/}	278.5	40.3	47.1
Red meats	19.6	2.8	3.3
Poultry meat	61.5	8.9	10.4
Eggs	12.5	1.8	2.1
Fish	20.8	3.0	3.5
Milk & milk products	455.0	65.8	77.0

Source: Food Balance Sheets for the Yemen Arab Republic: 1975/77, 1979/81.
CID/MCAF Undated paper, early 1984.

With a lower population base of one million less, which is thought to be more realistic, the intake figures come out 16.9% higher, as shown in Table 7:

Table 7. Estimated daily nutrition availability

Population 5,912,00	Per Day		
	Calories Nos.	Protein Grams	Fats Grams
Total	2179	74.9	31.0
Vegetable products	2008	64.6	20.8
Animal products	170	10.3	10.2

USDA¹⁰ uses a different estimate for grain availability in the years 1979/81. Its average works out at 226.4 kgs. per capita on an average population of 5,128,000, equivalent to the other, richer countries in the region. Grain consumption alone of 226.4 kg. per capita would provide daily 2153 calories, including 78.4 grams of protein and 16.8 grams of fats: more than the total intake of all foods calculated by CID/MOAF for its estimate using a population of 6,912,000 and grain consumption of 131.0 kgs. plus other foods. The USDA figure may include wheat that possibly is re-exported to Saudi Arabia, where if it is sold as domestic wheat, it can fetch \$1000 per ton at government procurement centers.

Greiner¹¹ presents the following table on estimates made on per capita calorie and protein availability from 1961 to 1977:

Table 8. Estimated daily nutrition availability 1961-1977

	1961	1964/66	1970	1975/77	1977
Calories per capita	1990	1909	1970	2260	2311
Protein per capita (gr)	64.8	57.8	62.0	67.9	69.4

He quotes Pellett's estimate of per capita requirements to be 2420 calories for the population as a whole, and based on this, the proportion of requirements available increased from a low of 78.4% in 1964/66 (a period of civil war) to 95.5% in 1977. The trend is definitely upward, and with accelerated improvements since 1977 in transport, disposable income and availability of larger quantities and selection of imported foods, it is not unreasonable to assume that overall intake of calories is on the whole approaching adequate levels. In particular, it is evident that nearly all studies on nutrition depend on incomplete data that exclude considerable quantities of food that come unrecorded across the Saudi border, and the fact that the large proportion of Yemeni men who are working in Saudi Arabia have access to ample supplies of basic foods that are subsidized. All this highlights the unreliability of data in Yemen, and the difficulty this presents in doing any exercise where numerical precision is required. The general conclusion of most observers in Yemen is that overall food availability and cash income to purchase it is adequate.

III. NUTRITIONAL STATUS

The combination of the above unique factors in Yemen's development has most likely led to improvements in general levels over the last fifteen to twenty years. Average per capita food intakes increased from 1,990 calories and 65 grams of protein in 1961 to 2,179 calories and 74.9 grams of protein in 1981.^{1,2} A 1972 survey of children age 0 to 5 years old in the Southern Highlands region of Yemen indicated that 13% were severely under-nourished. The 1979 Yemen Arab Republic National Nutrition Survey showed a roughly comparable figure of only 4%. It is difficult, however, to make precise statements about trends in nutritional levels since there are few earlier surveys, and even the one cited in 1972 may be reflecting the conditions of drought just prior to the study. The steady decline in Yemen's infant mortality rate (IMR) is another indicator of improving nutritional status. A recent analysis of the 1979 World Fertility Survey in Yemen indicates that the country's IMR has declined by 39% since 1961.⁵ This percentage decline is second to Jordan (43%) and better than Tunisia (24%) and Egypt (11%). The IMR's reported for this period are as follows:

1961 - 1965	256 per 1,000 live births
1966 - 1970	227 " " " "
1971 - 1975	170 " " " "
1976 - 1978	156 " " " "

Despite these improvements over time, Yemen's malnutrition and infant death rates still rank among the highest in the developing world. The following table compares Yemen's

nutritional status with Haiti and Egypt.⁶

<u>Children 6-60 mos. of age</u>	<u>Yemen</u>	<u>Haiti</u>	<u>Egypt</u>
II and III degree malnutrition (low weight for age)	44%	28%	9%
Stunting (low height for age)	41%	28%	20%

While not the highest IMR among Third World Countries, Yemen's rate of 156 per 1,000 live births ranks well above an average of 99 for the Middle Eastern countries and 117 for sub-Saharan African countries.⁷

There are virtually no recent statistics on the nutritional status of adults and school age children. Reports from 1972, however, indicated that 44 percent of women and 40 percent of men were undernourished according to weight-for-height standards.³ Similarly, school age children were shown to have substantial deficits on all measures of nutritional status in a different study at the same time.⁸

For infants and young children, however, there do exist numerous and relatively recent small-scale clinic and community studies as well as the large-scale national nutrition survey. These reports provide a reasonably good profile of nutritional levels in various regions of Yemen. Based on these studies, the newly-created Technical Unit for nutrition in the YAR the malnutrition Ministry of Health has identified/problems in Yemen as:

1. Protein energy malnutrition (PEM) especially among infants and young children;*

*These age groups are the only ones that have been adequately studied. It is quite possible that adult and school-age children are also suffering from undernutrition and anemia. Despite the lack of data on other groups, it is still appropriate to focus on the identified at-risk groups since it is here that the risk of death from undernutrition is highest.

2. Anemia in infants, young children and mothers, and
3. Vitamin D deficiency among infants, young children and possibly women.

Protein Energy Malnutrition

Protein energy malnutrition can be measured in various ways including laboratory blood tests, evaluation of clinical signs and anthropometric measures of weight, height and arm circumference. The most widely used measures in public health nutrition surveys are those which calculate a child's weight or height as a percent of a reference weight or height (well-nourished population) for the same age. In addition, a child's weight-for-height is used frequently in international studies. This latter measure is an especially useful one since it tells us whether a person is undernourished for his or her height, regardless of age. This is helpful for analyses in Yemen since the population is generally much shorter for their age in comparison to Western populations. This is likely due to years of adaptation to harsh living conditions with marginal food intakes and high disease rates, as well as the possibility (albeit slight) of genetic differences in height. Low weight-for-height (a measure of thinness) is called "wasting" and low height-for-weight is called "stunting".

The 1979 YAR National Nutrition Survey showed wasting among 6.7 percent of 0-5 year old rural infants and young children. A much lower rate of 2.1 percent was found in the urban Sana'a population. Sana'a also had lower rates of stunting than the

combined rural areas studied. The following table shows by region the percentages of undernutrition in infants and young children according to three measures of nutritional status: wasting, stunting and II/III degree undernutrition (low weight for age).

Regions	Wasting (< 80% Wt/ht)	Stunting (< 90% Ht/age)	II and III Degree Undernutrition (< 75% Wt/age)
Tihama	15.9%	31.9%	51.2%
Southern Highlands	5.4%	39.4%	45.5%
Northern Highlands	3.9%	50.6%	47.1%
Combined Rural	6.7%	42.1%	47.0%
Urban Sana'a	2.1%	33.0%	22.8%

The Tihama has by far the highest levels of wasting and II and III degree undernutrition, 15.9% and 51.2% respectively. Among the rural regions, the Northern Highlands has the lowest rate of wasting. With regard to stunting, the opposite is true, with infants and young children from the Tihama region less stunted than those from both the Northern and Southern Highlands. Thus, Tihama children are generally taller and thinner than the other rural regions and urban Sana'a. Wasting is a higher public health priority than stunting since wasted or thin children are known to have higher mortality rates. Stunting, on the other hand, reflects a chronic undernutrition or the result of repeated bouts of disease and marginal food intakes. The association of stunting with higher mortality rates is less serious than with wasting. Thus, from the above data, we can conclude that the Tihama region

is most at risk for the serious consequences of undernutrition and that the rural areas are generally worse off than urban Sana'a.

When we examine undernutrition by age groups, the highest levels of both wasting and stunting are found in the 12- to 18-month age group. There was little difference in nutritional status between girls and boys in the national survey.

There are other smaller scale surveys in various parts of Yemen which were undertaken around the time of the 1979 national survey.^{9,10,11,12} While there are some differences as would be expected when small areas are studied by themselves, the rates of undernutrition are generally comparable to the national survey.

Two small surveys done in the Dhamar (1982) and Tihama (1983) regions provide some information on nutritional status since the various surveys in the late 1970's.^{13,14} In the 1982 Dhamar study, among 250 children ages 3-60 months old, five percent were "...critically malnourished" or wasted. This is roughly comparable to the 5.4 percent reported for the entire Southern Highlands region in the 1979 national survey. It is interesting that only a fraction (.01%) of these were infants less than 12 months old. In the 1983 Tihama study, some 258 children 3-60 months old were surveyed from the town of Abs and five surrounding villages. Wasting was found to be 12 percent, which is lower than the 15.9 percent reported in 1979 for the entire Tihama region. Again, the percent of children "critically malnourished" or wasted in the youngest age group (less than 12

months old) was miniscule (only one infant).

While it is not possible to state with any certainty that undernutrition in Dhamar has remained constant, or in Abs has decreased since 1979, these more recent studies provide a general indication that undernutrition has not increased dramatically, especially for infants, and it may have decreased in the Abs area in Tihama.

There is little known about maternal protein energy malnutrition in Yemen. There appears to be no recent information on birthweights, which can serve as an indicator of maternal undernutrition. From a study in Taiz in 1972, an estimate of average birthweights for boys was 2,850 grams and 2,600 grams for girls.³ Another report in 1977 from the Mokha/Manza area indicated that average birthweights were 2,800 grams.¹⁵ While this very limited information indicates that these average birthweights are above the less than 2,500-gram definition of low birthweight, we do not know the range of birthweights and thus whether a high percentage falls below this cut-off point.

The above analysis shows that protein energy malnutrition among young children is a serious problem in Yemen and is significantly higher than other Middle Eastern countries. It is concentrated in the rural areas and most seriously in children 12-24 months old. While undernutrition does not appear to be increasing dramatically, there are insufficient data to know whether it is steadily declining. As mentioned, Yemen's high infant death rates corroborate the seriousness of malnutrition

in the country. According to an analysis of the 1979 Yemen World Fertility Survey, the overall IMR was 156.5 per 1000 births.¹⁶ When broken down by region, the rates were as follows:

West	- 171.3
North	- 169.1
South	- 135.6
East	- 105.8

There were dramatic differences between urban and rural, father's occupation and mother's education. The rates for these categories were:

<u>Mother's Education</u>	<u>IMR</u>
Literate	110.5
Illiterate	171.8
 <u>Father's Education</u>	
Agriculture	184.0
Transitional	172.9
Blue collar	159.5
White collar	104.2
 <u>Place of Residence</u>	
Urban	128.2
Rural	176.8

These rates tend to support the information on nutritional status with respect to higher malnutrition in rural areas where more mothers would be illiterate and more fathers in agricultural occupations.

Anemia

Anemia can be caused by iron deficiency due to overall low intakes, especially from animal sources, low intake of Vitamin C with plant sources of iron, high intake of tea which may

inhibit absorption, malaria, parasitism and high blood losses during childbearing. While it is possible that most of the anemia in Yemen is due to overall low intakes, especially from animal sources, the other factors should be examined, particularly if anemia among pregnant women is due to folic acid deficiency as well as iron deficiency. Anemia results in fatigue, low productivity and can exacerbate disease. The following data from the national survey indicate that anemia is highly prevalent in Yemen:

Low Hemoglobin (< 11 g/dl)	Tihama	Southern Highlands	Northern Highlands	Combined Rural	Sana'a
Children - 0-60 months	82%	54%	47%	56%	17%
Mothers	72%	31%	27%	36%	5%

There is no difference in anemia between boys and girls, and the problem is most serious among children 6-24 months old. As can be seen, the rural areas have significantly higher rates than urban Sana'a.

Vitamin D

Various researchers have reported the occurrence of rickets in Yemeni children.^{3,10,11,12} It is difficult to compare small studies from different regions, especially when clinical diagnosis might have differed. The 1979 national survey reported a "moderate prevalence" of clinical signs of Vitamin D deficiency. By region these results were:

Most Common Clinical Sign	Tihama	Southern Highlands	Northern Highlands	Combined Rural	Sana'a
Frontal Bossing					
Children - 0-60 months	14%	9.3%	13.7%	11.7%	5.8%

While there are no adequate data for women, osteomalacia and difficulties during childbirth due to contracted pelvis have been reported.¹⁷ It would be useful to have more information on the prevalence and consequences of Vitamin D deficiency in Yemeni women.

Other Vitamins and Minerals

There have been earlier reports of night blindness due to Vitamin A deficiency among Yemeni children, especially in the Tihama area where fewer fruits and vegetables may have been consumed. Clinical eye signs of Vitamin A deficiency have rarely been reported, however. In 1980 during a survey by WHO, some early clinical signs were found, especially in the Tihama, but these were not severe.¹⁸ Signs of angular stomatitis (redness and cracking at the mouth) suggestive of Vitamin B₂ or Riboflavin deficiency were rare in the national survey and ruled out as a public health problem. Nor is there evidence of goitre due to iodine deficiency in Yemen. It is unknown whether zinc deficiency is prevalent in the Yemeni population. Thus, while little is known about these other possible deficiencies, there may be marginal intakes among the vulnerable groups.

IV. FOOD CONSUMPTION AND ABSORPTION

The apparent causes of undernutrition among infants, young children and mothers are numerous and interrelated. The previous section indicated that overall food availability and purchasing power are not serious constraints to the main nutritional problems in Yemen. For the vast majority of families, adequate food is available. Thus, the problem appears to fall into two areas:

1. Intrafamily Food Distribution

Who gets what to eat is affected by deleterious beliefs and practices surrounding infant and young child feeding and care, high fertility, close child spacing and low consumption of either appropriate iron food sources or iron tablets during pregnancy when requirements are increased. Mothers' low literacy levels and extremely heavy workloads figure into the intrafamily food distribution equation.

2. Absorption of Food in the Body

Even if adequate food is ingested, the utilization of nutrients can be adversely affected by infant and child nutrition-related diseases of diarrhea, malaria, measles and parasites. These diseases can be both cause and effect of undernutrition. Poor water and sanitation, inadequate health care (especially lack of immunizations) and food contamination are, along with undernutrition, ^{are} very likely the leading candidates for poor food utilization.

Beliefs and Practices - Infant/Young Child Feeding and Care

Breastfeeding is a common mode of feeding Yemeni infants.

Most mothers initiate breastfeeding several days after the birth of their child, and the majority are still breastfeeding when their child is 6 months old. Results of the percentage of babies being breastfed at various ages from both the 1979 National Nutrition Survey and the World Fertility Survey are shown below:

National Nutrition Survey			World Fertility Survey		
Age of child (Mos.)	Rural	Urban	Age of child (Mos.)	Rural	Urban
3 through 5	83.1%	61.2%	4 mos.	79%	61%
6 through 8	69.7%	39.2%	6 mos.	73%	49%
9 through 11	64.4%	26.4%			

Smaller-scale studies have also shown that breastfeeding is initiated by most, and that average durations are generally beyond six months with even longer breastfeeding in the rural areas.^{10,11,12,14,17,19,20,21,22}

While most mothers initiate breastfeeding and many continue past six months, very few are breastfeeding exclusively. Various studies have shown that artificial milk feeding as a supplement to breastmilk begins on average at about two months in urban and rural areas.^{4,10,11,12,14,19} Mothers will frequently cite "insufficient milk" as the reason for introducing formula or powdered full-cream milks fed by bottle. Traditionally, nutritious foods have been prescribed for and eaten by mothers in the 40-day period after childbirth. Whether Yemeni mothers in general have adequate diets and fluid intakes for sufficient

breastmilk production is unknown, although observations by health workers indicate this is a problem. In addition, various researchers have commented on the infrequency of breastfeeding during the day. These factors, along with beliefs about physical and emotional properties being passed on ^{the} to/child through breastmilk may be reasons for mothers' frequent reports of insufficient milk.

Even before the influx of bottles, infant formula, powdered milks and supplementary foods (fortified cereal mixes), Yemeni mothers would begin mixed feeding (both breast and other liquids) early on by introducing small amounts of butterfat and water to the baby. After the 40-day rest period following childbirth, many mothers would return to their field work and leave their infant at home to be fed boiled cow's, goat or sheep milk by cup and spoon or gourds shaped for infant feeding.

As bottles and milk products became more available and were promoted by both health professionals and companies, they replaced the traditional mixed feeding as a more convenient and modern way of feeding their infants.* Although unknown for sure, there may well have been more exclusive breastfeeding before the influx of modern infant products since it was simply

*One report cites a nine-fold increase between 1976-1979 in the import category of "milk and cream, preserved and concentrated."²³ Another report states that in 1979, five out of seven infant formula agents used radio for advertising.¹

not so convenient to feed babies animal milks.

One anthropologist writes that the spread of bottlefeeding was gradual in the Ahjur area of the Northern Highlands.²⁴ In 1978 and 1979 she states that only a few mothers supplemented breastmilk with artificial milks in bottles but by 1983 roughly half of the mothers had used bottles. In other areas in the late 1970's, higher mixed feeding was reported.

In addition to convenience, modern image and promotion, other reasons for artificial feeding by bottle have been proposed by various researchers.^{23,24,25} With increasing cash incomes from emigrant worker remittances, mothers were able to afford it. These workers were exposed to modern medical services, a wide range of consumer goods and modern infant feeding methods as well. Even before the 1970's, many Yemeni men had been working in Aden and had begun the gradual process of introducing new ways of doing things to their long-isolated and underdeveloped homeland. Milks and wheat or rice flour weaning foods were eminently suitable to Yemeni mothers' concepts of "light" foods for infants. One researcher reported that animal milk had become harder to obtain.²⁵ The breastfeeding of one's baby by another woman was generally not acceptable since mothers believed that it established sibling relationships and would thus widen the incest category. It was, and still is, widely believed that pregnancy will poison a mother's milk.

Finally, the sheer burden of women workloads made affordable conveniences - food or otherwise - widely accepted.

While one anthropologist believes women's workloads are lighter than before because of electric grinders for cereal preparation and more land going into less labor-intensive qat production, still Yemeni women do have heavy workloads. Daily estimates of three hours in food preparation, two hours in infant feeding and care, and three to five hours collecting fuel and doing farmwork have been cited. For those families with cows, an extra 4-6 hours may be required for the laborious hand-feeding involved.

Some factors associated with short and long breastfeeding have been studied in Yemen. One study showed no relationship between breastfeeding and income level and only a slight effect of mothers' education.²⁶ The National Nutrition Survey, however, indicated that length of breastfeeding was less among families with literate fathers and those with electricity. The World Fertility Survey suggested that there was little effect of factors traditionally associated with low breastfeeding such as higher education levels. Interestingly, this same study found that working women (either at home or away) breastfed longer than those who did not work at all. The picture of exactly who breastfeeds more or less in Yemen is not clear, probably because it is atypical of developing countries. In Yemen illiteracy can be found alongside high cash incomes. In general, however, the more rural and poorer women tend to breastfeed longer and mixed breast and bottle-feeding is practiced by all.

Unhygienic bottle preparation and improper mixing of artificial milks have been cited by many as important causes of disease and undernutrition in Yemen. There are little data available on the actual practices of mothers in preparing the bottle and milk or formula for artificial feeding. Several researchers reported that mothers boil the water before mixing it with the milk but that bottles are not boiled because mothers do not think they could withstand boiling.^{13,24} In most cases milk is left in the bottle between feeds so that proliferation of bacteria and contamination are likely. One of the reports stated that some mothers were careful to empty the bottle between feeds.

While one study found that the milks were mixed in the recommended proportions,²⁴ another study in Sana'a found that 12 percent of mothers prepared less than one-half the proper concentration, 64 percent overdiluted the milk somewhat and 17 percent underdiluted milk.²¹ While the milk concentration was worse in the lowest income group, both literate and illiterate mothers made mistakes in preparation. Milk powders with small measuring scoops tended to be more diluted than those with larger scoops.

There are different results with studies which have looked at the relationship between malnutrition and bottlefeeding. Among the studies reviewed, all found the most malnutrition among exclusively bottlefed babies.^{10,11,12} Several found

worse malnutrition among those fed both breast and bottle versus those who received only breastmilk.^{10,11,12} One, however, in young adults showed virtually no difference in undernutrition between the babies who were fed by both breast and bottle, versus those fed only by breast.²¹ There was also no difference after 6 months of age. In the World Fertility Survey, non-breastfed babies less than 6 months old had higher mortalities than breastfed, although the difference was not significant. After 6 months of age, there was no difference in mortality between breastfed or nonbreastfed babies..

From these limited studies we can say with some certainty that babies less than 6 months old who are exclusively bottlefed are more malnourished and possibly have higher death rates. We do not know from the available studies whether the deaths were caused by bottlefeeding per se or by disease, prematurity, or congenital defect which may have forced the baby to be artificially fed. When an infant has passed the age of 6 months, there appears to be no difference in nutritional status or death rates between breastfed and bottlefed babies.

Exclusive artificial feeding is a problem primarily among young infants. Mixed feeding of young infants has resulted in lower nutritional status in some cases and similar nutritional status to breastfed in other cases. These variable results among the babies who are fed both breast and bottle may be because exclusive breastfeeding, as practiced in Yemen, is not adequate. Thus, the additional food needed by the infant and given, even somewhat diluted, in the bottle, may outweigh the

effects of bottle contamination and disease on balance. In addition, mothers seem to know some of the requirements for hygienic bottle preparation, although this is far from adequate.

It is indeed important to actively promote exclusive breastfeeding along with the proper diet for mothers and the importance of feeding frequently to build up milk supplies. The current pervasive bottlefeeding and the attendant health risks suggest that mothers should be educated on how to do it properly. Najwa Adra writes, "Those women who insist on using bottle milk should be taught its proper use." The concern by some that such instruction would thereby condone bottlefeeding has not been proven. Virtually all mothers say that breastfeeding is best, but vast numbers are still using the bottle as well. The fact is, mothers have already condoned artificial feeding as a means of supplementing breastmilk for a wide and complicated set of reasons, not the least of which is a tradition of mixed feeding. In a recently published article on Yemen, a U.S. physician wrote, "The militant stance against the bottle on the part of the health center's staff did not prevent widespread bottlefeeding by a majority of families attending the center but may have contributed to their lack of understanding of proper bottle feeding."²¹

As important to malnutrition and possibly even more so is the practice of late introduction of semi-solid foods (weaning foods) in insufficient amounts to babies being fed with both breast and bottle. While some studies report

introduction of semi-solids at the appropriate time^{10,11,12,13} (between 4 and 6 months of age), others report unduly late introduction.^{13,14,17,19} But virtually all agree that infrequent feeding is the rule and that infants and young children are not getting enough to eat.

Also, some researchers have commented on the fact that there is no general concept of special foods (outside of milks) for infants. Foods for infants are regarded as good if they are "light" and "cool" such as wheat flour and rice. Foods are considered bad if they are too "heavy" and "hot" such as the sorghum porridge assid, meats, eggs and beans. There are several traditional weaning foods. Shabeeza is a combination of various grains and pulses ground up and fried in butterfat and then boiled with sugar and water. This is reported to be used infrequently now because it is too time-consuming to make and pulses are not always available. Another weaning food called rghuda is a mixture of finely-ground wheat or maize flour, cooked in butterfat and mixed with boiled water. In the mountain area where this had been traditionally prepared, many have now replaced it with Cerealac (an imported wheat and milk cereal fortified with vitamins and minerals).²⁴ There appears to be fairly widespread distribution and purchase by mothers of this imported product, even in the rural areas. Various investigators have commented that Cerealac is overdiluted and fed to babies in a bottle instead of cup and spoon as it should be.

It seems clear that education on the timing, appropriate

mixing and feeding of supplemental foods to breastmilk is needed. While it is unknown whether cerelac, prepared with water in bottles, is a serious source of contamination, it is possible, as has been found in various developing countries, that contamination may be present in even traditional weaning foods. Thus, generally late introduction, overdilution and too little food are very likely the main reasons why rates of undernutrition are highest among children 12-24 months old rather than younger infants. In, addition, death rates are higher among 0-12 months old infants which reduces the average rates of undernourished survivors.

Swaddling of babies and thereby limiting their exposure to sunlight is frequently cited as a main cause of Vitamin D deficiency. Mothers believe strongly in protecting their babies from the elements as well as, in some cases, the evil eye. There are some reports that mothers cover babies to prevent dark skin coloration. It is possible that actual Vitamin D intakes are sufficient, especially since milk formulas and powders are fortified with Vitamin D, and that the excessive covering of infants is the main cause. Among women it is unknown whether veiling in young girls may be contributing to Vitamin D deficiency during their growth period and thus resulting in some reported cases of osteomalacia and contracted pelvis among Yemeni women. Education efforts and food fortification are certainly needed to promote adequate intakes and sufficient exposure to sunlight among infants, children and mothers.

High fertility and close child spacing in Yemen are also factors in undernutrition. Mothers generally abandon breast-

feeding when they become pregnant. Lower breastfeeding duration lessens the contraceptive effect of breastfeeding as well. Close child spacing can deplete maternal stores of nutrients, especially iron. While red meat, the best iron source, is eaten more in urban areas, it is consumed much less frequently in rural areas. Iron tablets appear to be readily available and at reasonable cost throughout the country, but it is unlikely that many mothers take them regularly.

Illiteracy and the sheer burden of women's workloads are also factors in Yemen's malnutrition problems. While the chewing of qat by women has been mentioned as a possible factor in reducing mother's milk supply, there is no direct evidence to this effect.¹⁷ One study found a relationship between high qat use and lower nutritional levels of children.^{10,11} However, the author stated that it was unknown whether this represented a direct physiological mechanism or because high use of qat was a drain on family income. It is known that qat contains Vitamin C, iron and calcium; however, it also causes lack of appetite. Thus, its net contribution to nutritional status is unknown. Qat use is apparently not widespread among women and children. The National Nutrition Survey found that 38% of women used it.

Nutrition-Related Diseases, Water and Sanitation

Other factors affecting undernutrition in Yemen include the nutrition-related diseases of diarrhea, malaria, measles and parasites. These diseases can produce malnutrition by

decreasing appetite, lowering absorption of nutrients, losing nutrients from the body and increasing nutrient requirements through fever. In turn, undernutrition can make a child more susceptible to infection (especially diarrhea) and even death.

The lack of adequate health care delivery, especially immunizations and rehydration therapy, are also factors in disease and undernutrition in Yemen. The underlying cause of most nutrition-related diseases is the lack of sufficient potable water and sanitary facilities. According to a World Bank report, urban water supplies served about 49 percent of the 1981 population of the three largest cities.²⁷ In rural areas only 14 percent of the population was served. Water is often stored in clay containers and then poured into a variety of pans without covers. Dirt can enter and animals may have access as well. There are various standards of personal and domestic hygiene, and strict rules about washing after certain events and before prayers.²⁸ The rules are not applied to young children, however. One report emphasizes that the open air living makes it difficult to provide and maintain potable water supplies.²⁹

While there was no piped sewerage in urban areas in 1981, construction is now underway as a result of various donor projects. Both wet/dry and pour/flush excreta disposal systems are in use in Yemen as well as the use of fields, roofs and behind houses.²⁹ These methods, as well as the use of excreta for fertilizer, can result in flies feeding on excreta before

it can dry as well as pathogens entering the soil.

In addition to immunizations and oral rehydration therapy to help prevent and control disease and undernutrition, adequate and potable water supplies are essential. Sanitary systems that are appropriately used and maintained are crucial as well.

In summary, the report so far has addressed the nature of undernutrition in Yemen, i.e. who is malnourished (infants, young children and mothers) and what kind of malnutrition (protein/energy, anemia and Vitamin D deficiency). Why there is malnutrition has also been discussed, i.e. overall food availability and demand are generally adequate, yet intra-family distribution and food absorption are not. This is primarily due to deleterious beliefs and practices surrounding infant and young child health and nutrition care and mother's time constraints. The nature and causes of malnutrition in Yemen as well as areas for action programs are illustrated in the Chart in Annex C.

V. YARG ORGANIZATION AND CAPABILITIES IN NUTRITION

In 1982 a National Permanent Committee for Nutrition Programs was established under the directorship of the Secretary General of the Confederation of the Yemeni Development Association. The Committee is composed of various Ministries including Finance, Foreign Affairs, Health, Education and Social Affairs. Its duties include developing an annual plan for nutrition programs, coordinating YARG and donor assistance in nutrition and making decisions regarding participation in international conferences. In reality, the Committee has no staff and no regular meetings so that its impact on nutrition policy and programs is minimal.

The entity with primary responsibility for nutrition programs in Yemen is the newly created (1983) Technical Nutrition Unit within the Ministry of Health (MOH). This Unit was established under a larger World Bank funded health project which has provided advisors, training and project funds to various Ministry of Health divisions. For a variety of technical and administrative reasons, many of these advisors have left and the continuation of the project, including the support to the Nutrition Unit (one expatriate advisor and funds for training and materials) is uncertain.

Despite numerous start-up difficulties, the Nutrition Unit is a functioning group with a staff of seven persons. Three of these are attending short-term nutrition training courses at present, and there are plans for one of the members to

receive long-term graduate training. To date the unit has conducted seminars and in-house training in nutrition, presented papers at various nutrition conferences, and strengthened its nutrition library resources. The Nutrition Unit is presently cooperating with a project by the World Food Program (WFP) to introduce nutrition screening and education into health centers where WFP food will be distributed. The effectiveness of the unit in conducting research and programs has been limited by its relatively new status in the MOH, the overall management problems with the World Bank project and the inherent bureaucratic delays and problems in the Ministry of Health.

There are other governmental entities with nutrition activities. The Health Manpower Institute includes nutrition in its curriculum for most health worker training. The Ministry of Municipalities and Housing has authority for food quality control units, and the Ministry of Trade and Supply has control over food imports and weights and measures. In the Development Authorities some extension agents have been trained in home economics. In the Primary Teacher Training Institutes (PTTI) under the Ministry of Education, students are apparently required to take home economics, and textbooks and other curricula on mother and child nutrition were observed in the Hodeidah PTTI. In most of these Ministries, however, the level of activity is minimal, impeded by lack of qualified personnel and funds. Nutrition training and curriculum development has been inadequate, and teaching materials poor.

Up - to - date audio visual aids to take advantage of the large number of televisions and videotape players in Yemen are virtually nonexistent.

The YARG is assisted by numerous bilateral and multilateral donor agencies as well as private voluntary organizations. It is not possible within the scope of this assessment to list in detail all these activities. Instead, a brief summary will provide a general idea of the nature of nutrition work by these groups.

Various private organizations such as the different country branches of the Save the Children Fund have been active in nutrition education, food demonstrations, weighing children, oral rehydration therapy and nutrition survey work. It is largely through the work of these and other voluntary organizations in health clinics throughout the country that there is an array of nutrition data available in Yemen. The International Center for Rural Development (CIDR) and British volunteers have also been involved in similar nutrition activities in both urban and rural areas. OXFAM has recently established an office in Yemen, and they are involved in four primary health care and midwifery projects as well as supporting an American Peace Corps volunteer in the Technical Nutrition Unit.

The German, Dutch and British governments have all supported nutrition activities directly in clinics, through primary health care projects, women's extension programs in agriculture and water supply programs.

The international donor organizations have provided support through feeding programs, technical assistance, training and equipment. The World Food Program (WFP) has distributed food in Yemen for some 20 years. They are presently providing food-stuffs to the Ministry of Social Affairs for some 20,000 needy recipients at social welfare centers throughout Yemen. Through the Ministry of Education the WFP provides food for some 13,000 students at Technical Institutes. Under a new project with the Ministry of Health, food will be provided for mothers and children attending health centers. A nutritionist from the Food and Agriculture Organization (FAO) will assist in the design of a program of nutritional screening through weighing and nutrition and health education.

FAO has played a leading role in nutrition planning activities. In 1983 the organization sponsored an intergovernmental conference on nutrition which was attended by representatives from numerous YARG Ministries. A set of recommendations was developed, and FAO has followed up on one of them by providing technical assistance in food quality control. The plan is to assess current YARG needs in this area and to develop a long-term strategy for YARG and other donor funding. In addition, FAO supported an assessment of the impact of the 1983-1984 drought and has provided the services of a nutritionist who instructs groups of mothers in several villages in the Tihama region.

UNICEF is currently involved in supplying materials and equipment such as medicines, oral rehydration salts, vitamins,

scales and growth charts to health centers and other primary health care projects in Yemen. The World Health Organization (WHO) provides advisors to the Ministry of Health, fellowships and salary support in various areas of primary health care including nutrition. The World Bank is funding elements of the Technical Nutrition Unit. Additionally, they support efforts in the Southern Uplands Rural Development Unit (SURDU) which has trained some female agricultural extension agents in home economics.

VI. STRENGTHENING NUTRITION IN USAID PROGRAMS

Health and Population

The Tihama Primary Health Care Project has accorded nutrition along with immunizations high priority. Primary health care workers will receive refresher training courses in weighing children and using the WHO growth chart, in Arabic. Although children are weighed during mobile team vaccination visits, there is no indication that primary health care workers are following up on nutrition education and referral. The project team is in the process of designing a system for training, supervision and evaluation of all primary health care worker duties, including nutrition. This will be essential in knowing whether children are weighed and appropriate nutrition advice is given. The contractor has submitted a proposal for an oral rehydration therapy (ORT) program. This is an important nutrition intervention as well and efforts should be made so that it complements the ORT component of the Family Health Services Project. While overall project funds are limited to conduct much needed research in anemia, Vitamin D and maternal under-nutrition, there are AID centrally-funded programs and funds which might be of assistance in addressing some of the key questions. For example, technical assistance under the AID/S&T International Nutritional Anemia Group (INAG) could be sought to survey mothers for iron and folic acid deficiencies and precisely determine the nature of anemia and effectiveness of iron therapy. The MOH Technical Nutrition Unit is interested in

assessing maternal undernutrition and Vitamin D deficiency as well. AID/W funding can be explored for assistance in these areas as well. In addition, the Nutrition Unit would like to determine whether a simple early warning nutrition surveillance system is feasible in the Tihama region which is the poorest and most malnourished area, as well as being most vulnerable to drought. Assistance from the AID/W/S&T Nutrition Surveillance Project could be requested for an exploratory visit.

The planned Family Health Services project is designed to directly affect the main nutrition problems in Yemen. All the areas for trial demonstrations - nutrition, ORT, contraceptives and vaccinations - if successfully implemented on a wider scale - will have a major impact on malnutrition and infant mortality in Yemen. A possible constraint to project success is the lack of YARG experience in family planning and maternal child health programs as well as the underdeveloped state of primary health care in general. To take advantage of the private sector distribution system, the project could incorporate training for drug distributors and enlist the cooperation of pharmaceutical and food companies in distributing educational materials such as posters and videocassettes. Sensitizing the Yemeni pharmaceutical importers to the nutrition and health problems affecting infants, young children and mothers might encourage them and parent companies to be innovative and competitive in the production and marketing of commodities appropriate to Yemen's health and nutrition problems.

Education

In the area of education, the emphasis should be on audio-visual materials. Strengthening the Ministry of Education audio-visual department could focus on developing appropriate health and nutrition materials for schools and teaching institutes. Equipping schools and Primary Teacher Training Institutes (PTTI) with televisions and videocassettes could be considered. While there appears to be some basic nutrition and health curriculum in the PTTI's, efforts might be made to evaluate, update and distribute teaching materials. Assistance to the Faculty of Education and Faculty of Science at the University of Sana'a could be provided in the form of fellowships, in-service training and field operations research programs in nutrition and health. Efforts should be made to link university research to some of the numerous clinic-based and primary health care projects in Yemen. Similarly, the planned Faculty of Preventive Medicine could be encouraged to engage its students in field research and epidemiological surveys of Yemen's main nutritional problems.

Development Training

Under the Development Training project, scholarships in communications, public health, maternal child health and family planning would assist in strengthening the limited Yemeni expertise in these areas. Private sector food technology and food processing training needs could be assessed under this project as well as conducting in-service training in these same areas.

Water and Sanitation

In the area of water and sanitation it is safe to say that USAID efforts in urban and rural water supply and sanitation are basic to achieving any long-term and sustained results in nutrition and health. Water supply has been shown to be cost-effective in achieving better health not only by providing sufficient and safe water which will reduce water-borne diseases but also through the savings in time for women who must fetch water daily from long distances.¹ The conclusion of the workshop "Women in Poverty" was that, "Saving time is development, for time saved from humdrum tasks is time to invest in human capital."² Indeed, the main interventions of primary health care - breastfeeding, oral rehydration therapy, clinic-based and other feeding and nutrition programs and weaning food preparation from locally available foods - are all very time consuming activities for overburdened mothers. In this respect both the Taiz Water and Sewerage and the Small Rural Water Project have affected and continue to directly affect nutrition and health in Yemen. The hygiene training component in the Small Rural Water project is a promising effort to help improve basic hygiene and health. While the Rural Water Division in the Ministry of Public Works cannot be tasked with providing all or even most health, nutrition and environmental sanitation knowledge to its rural constituents, consideration could be given to incorporating a few key messages with respect to the preparation of weaning foods and bottle hygiene.

Agriculture

All AID activities in agriculture are carried out through the Consortium for International Development (CID), a grouping of 12 western land grant universities. CID is implementing a long-term Agricultural Development Support Program that currently accounts for 48% of the USAID/Sana'a development expenditures. The basic aim of the program is to build up the institutional capacity of the Ministry of Agriculture through participant training and provision of technical assistance through four specific subprojects. These subprojects are:

1. Core provides 2-3 advisors to the MOAF, as well as being responsible for program administration and logistics.
2. PETS (Poultry Extension and Training Subproject) raises pullets (6000 in 1983) that are sold to village women. The pullet production facility also trains MOAF extension workers.
3. HITS (Horticultural Improvement and Training Subproject) runs two small fruit nurseries producing planting stock for sale to farmers, and where MOAF extension workers receive some training.
4. ISAI (Ibb Secondary Agricultural Institute) is a three-year agricultural high school that prepares students for mid-level positions in the public sector. The top graduates are sent to university.

Only PETS considers nutrition as an important subject of attention, although it is animal nutrition and not human nutrition that is taught. However, the CID experts involved

realize that it is somewhat incongruous to get across the notion of poultry health, hygiene and nutrition when the beneficiaries themselves cannot relate to such concepts with regard to their own persons. Be that as it may, PETS alone among USAID activities directly contributes to improved nutrition of vulnerable groups, as it provides village women with pullets and feed that yield many more eggs than the indigenous baladi birds, and most of these eggs are eaten at home. A few that are sold fetch a high price, YR 1 each, and most of the income realized so is believed to go towards additional food purchase.

For the ISAI, nutrition is of minor importance, and again only in the context of animal production. The incongruity is probably not as obvious as with PETS since the trainees are high school students, not illiterate village women. The ISAI Chief of Party is aware of the need for better nutrition education for the students, who will after all become extension agents or perhaps technicians in private sector food processing plants. Nutrition courses are already being taught to some 22 female home economists and extension workers from the Southern Uplands Regional Development Project (SURDP). These women come from Taiz every day, and are taught by the ISAI staff at the Ibb girls' high school. By 1986, the ISAI hopes to have regular, segregated women's classes.

The present low priority given to human nutrition in the ADSP can be corrected quickly. A TDV nutrition expert can be brought in to advise on course content, particularly if nutrition

is closely linked with food processing technology, beginning with very basic principles, and giving family nutrition the same level of teaching effort as is given to animal husbandry; after all, the two are linked. A more difficult problem that needs to be tackled at the same time, is the common misconception that nutrition is a "female subject," which given the very small number of women cadres being trained in health, education and agriculture in Yemen, cannot be taken seriously until sufficiently large numbers of such cadres are available. This thinking misses the basic point that in a country like Yemen, where infant mortality rates are among the highest in the world, nutrition awareness is vital to everybody, particularly the men. They are vitally concerned with the health and well-being of their families, particularly the children, and if made aware of the elemental measures they can take to enhance family well-being, they will respond. Up to now, men have not been able to help in the area of infant and nursing mother issues because in their ignorance they believe these problems to be natural afflictions over which they have no control. Herein is a basic educational challenge.

The ISAI subproject is the most important activity in Yemen in formal agricultural education. The Ministry of Education is pleased with the subproject, and has asked USAID to fund New Mexico State University, the ISAI operator, to take over the other two secondary agricultural schools in the country. USAID is sympathetic to this suggestion, and whatever expense is incurred in developing a nutrition component for the ISAI would have equal effect in the other schools.

Another effort that is well worth undertaking is an applied research and equipment testing and demonstration of appropriate technologies with the view to reducing the most burdensome and time-consuming farm and home tasks that rural women have to endure all the time. Extension agents, made aware of potential solutions, would then have something of great value to show the villagers; no one is averse to suggestions on reducing work, especially the boring tasks. The obvious tasks for reduced effort are (a) fetching water, (b) collecting firewood, (c) threshing sorghum and chopping stalks for animal feed, and (d) preparing food. The immediate aids that come to mind are water pumps, kerosene and butane stoves, mechanical threshers, imported animal feeds, butter churns and wet-grain grinders for millet, which with other aids and improved practices can be demonstrated at these agricultural high schools. This, together with nutrition education, can be incorporated into the curriculum of the proposed Faculty of Education, which ADSP will help staff and train once YARG mobilizes the necessary construction funds.

In summary, nutrition education in Yemen, where the social indices are among the worst in the world, deserves the highest priority in any USAID funded activity in agricultural education and training, which basically should aim at improving levels of living of the farm families, not merely on technical matters relating to crop and livestock production. As the nutritional analysis of this report points out, it needs a very small but strategic enhancement in hygiene and nutrition (boiled water and

supplementary intake of essential foods and micronutrients), to achieve dramatic improvements in the survival rates of infants and mothers. Such a goal is well worth serious attention in any USAID training or education activity in Yemen.

VII. PRIVATE SECTOR ACTION AND OPPORTUNITIES IN NUTRITION

For a variety of reasons, some of which have been discussed throughout this report, the involvement and use of the private sector in nutrition efforts offer a promising avenue that complements USAID public sector activities. In brief, these include:

- Weak central government structure
- High cash incomes and ability to afford imported goods
- Well-developed private sector distribution networks
- High ownership or access to television sets and radios
- Interest of Yemeni family private firms in the welfare of their country
- Interest of private firms in increasing use of their products and in the advertising potential of fortified foods
- Influence of the private sector in overcoming obstacles in the use of mass media for educational purposes
- Low marketed supplies of local foods selling for higher prices than for imported foods.
- Availability of affordable safe, nutritious imported infant and young child foods

In most developing countries the option of buying safe, nutritious and time-saving instant products is available only to the upper classes. In Yemen the availability and demand for these foods, particularly fortified milks and weaning foods, help to eliminate two of the key constraints to undernutrition. Yet, as has been discussed, these foods are not always used appropriately due to low levels of education, knowledge, hygiene, water and time available for proper child care among Yemeni families.

In the United States food processing and the fortification

of such items as milk, juices, breakfast cereals and infant foods has contributed to the elimination of vitamin and mineral deficiencies as well as assuring inexpensive sources of calories and protein (e.g. peanut butter, cheeses, yoghurt). Many Yemeni infants and children now benefit from some of these imported products. On the other hand, inappropriate use or misuse is of concern to all and can quite possibly be effectively addressed through the private sector.

The following outlines an approach which involves both the Yemeni and United States private food sectors in helping to solve the main nutritional problems of the country. The approach essentially involves sensitization of the Yemeni private sector to nutritional needs, the use of mass media - T.V.'s, radio, videocassettes - (for nutritional education), industry marketing approaches and food technology and processing in local production. A likely organization for coordinating such an effort is the Yemen Chamber of Commerce which represents and serves over a thousand Yemeni private companies. USAID has recently signed an agreement with the Chamber to provide technical assistance and funds for feasibility studies in all sectors of industry. This small gesture of support to the private sector has been enthusiastically received by local business leaders who are keen on greater involvement with U.S. business. Thus, a good precedent has been set for working directly with the private sector.

Sensitization and Education

In most Western countries private pediatric and nutrition

societies play a strong role in defining nutritional problems and recommending guidelines for fortification of foods and general infant feeding. Thus, a tradition of voluntary or self-regulation by industry has evolved over the years. In Yemen no such private organizations exist nor is the government capable of performing this role.*

A first step in sensitizing the private sector to its role and responsibilities in nutrition improvement might be to bring various U.S. food industry and pediatric nutritionists together with Yemeni food producers and importers to discuss nutritional problems in Yemen and the role of the food industry in solving them. Appropriate YARG Ministries should also be included, but the lead role should be the Yemen Chamber of Commerce and private sector specialists in the field. This could be done through a series of small seminars, larger conferences or individual visits whichever seem preferable.

One possible and desirable outcome of such sensitization would be the development of films, radio tapes and videocassettes on the various nutritional problems in Yemen. The mass media approach takes advantage of the high levels of illiteracy and wide access to television in Yemen.

In the 1981 Demographic Survey, the national literacy rate was estimated at 25.1%, 42.1% for men and only 7.5% for women.

* The YARG has, however, been involved in some regulation of industry promotional practices, e.g. prohibiting the advertising of drugs and cigarettes on T.V. as well as the advertising on TV of infant formulas and weaning foods used in bottles.

The number of rural women who are literate adults is not thought to exceed 50,000. USIS estimates that there are over 1 million T.V.'s in the country already, and every village (50% of the total) that has electricity has T.V.'s, and at least one VCR. Watching T.V. is the most prevalent leisure activity in the YAR, as it is everywhere else, and T.V. is the most powerful medium, given the low level of education and literacy. The electronic media far exceeds literacy in importance and influence.

Nutrition media programs might include such areas as breastfeeding, proper supplemental feeding, exposure to sun, food sanitation (bottle milk preparation and weaning food storage and use), ways to increase iron intake and oral rehydration therapy. Such educational materials should be of top-notch calibre utilizing the talent and resources of Yemeni creative artists and the best in U.S. video and film production and marketing expertise. The production work, to be done entirely in Yemen, using Yemeni personalities, settings and materials, could be funded in a variety of ways - exclusively AID, multinational and U.S. firms exporting to Yemen, Yemeni private firms - or various combinations of these groups.

The dissemination of these films as videocassettes could be undertaken by the various Yemeni importing firms and local producers who already have extensive and effective distribution networks throughout the country. These same firms would be involved in ensuring the broadcasting of the same creative nutrition and health films on television and tapes on radio.

It must be stressed here that, unique in the Middle East region, the Yemeni private sector does not play a subservient or minor role in relation to the public sector. Private sector is not discriminated against, and parastatal corporations do not in general (the exception being the military corporations) enjoy preferential treatment. Heads of prominent business houses are often shayks or closely allied to them, and thus important elements of the power elite.

Because of the importance of such messages to infant health and survival, careful pretesting using industry marketing approaches and evaluation is critical.

Food Technology and Processing

Most of the imported infant foods are nutritionally balanced and fortified with appropriate vitamins and minerals for infants and young children. Indeed, the fortification of imported milk powders may have helped prevent vitamin deficiencies from being worse in Yemen. Other food products consumed by children and mothers are not fortified. There is apparently no fortification of locally canned juices and milk and imported wheat flour. Most wheat consumption is of imported whole wheat which is then milled locally. Sorghum and millet are still the major staples, and since these are produced and milled locally, they are not fortified.

There is good potential for fortifying more foods in Yemen so that iron and other marginally consumed nutrients (Riboflavin B₂, Vitamin A and D and Zinc, for example, would be assured in Yemeni

foodstuffs. For example, a group of prominent Yemeni businesses is promoting the construction of an industrial scale flour mill in Yemen with a capacity of 1000 tons per day. This mill will be capable of processing 60 percent of current wheat imports with the potential of fortifying the majority of wheat flour consumed in Yemen. It is estimated that this wheat flour will supply 25-30% of the average family's consumption of grain and grain products. With a large central mill reaching a significant proportion of the population, iron and other nutrient fortification would be a cost-effective approach in helping to reduce nutrient deficiencies. The firm involved has expressed interest in fortification. Various other firms are either contemplating or in the process of developing locally-processed weaning foods, dairy products, and pastas. They, too, appear to be open and receptive to fortification as a means of providing a good product and promoting its extra-added nutritional value in their sales programs.

In addition to assistance in fortification, Yemeni local producers can benefit from U.S. food and other nutrition-related industry assistance in feasibility studies and cooperative ventures. Already, one U.S. pharmaceutical firm is discussing the local production of an oral rehydration solution. Another pharmaceutical firm has expressed interest in a collaborative effort with AID to market and distribute oral rehydration salts. Such private sector initiatives could be supported and encouraged through the avenue outlined above.

Other areas such as a marketing and educational campaign on the use of iron tablets for women could be explored with various U.S. pharmaceutical houses. U.S. pharmaceutical firms exporting to Yemen already have their own resident representatives in Taiz and Sana'a.

The above approach for a private sector initiative in nutrition reflects only preliminary thinking during a three-week assignment in Yemen. Clearly more information is needed on the constraints to such an approach as well as the receptivity of the Yemeni private sector. More thinking on the mechanisms for funding and identification of U.S. private sector interest would also be required if USAID/Sana'a is interested in exploring the concept more fully.

Both public and private sector involvement in Yemen's nutrition and health problems is needed. Through many of its existing programs, USAID is either directly or indirectly helping to address undernutrition in the most vulnerable groups. This report has suggested how these activities might be strengthened, given overall program priorities and budget levels as well as the rather unique characteristics of Yemen in terms of disposable income, imported goods and the potential for mass media communications in a largely illiterate society. In addition, the report has outlined a possible private sector approach in nutrition which could complement public sector activities; in short, do more with other resources which draw on the unusual economic and social conditions in Yemen as well as the strengths of its private sector.

ANNEX A
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CHAPTERS I, II. REFERENCES

ECONOMIC AND SOCIAL CONDITIONS AND FOOD AVAILABILITY AND DISTRIBUTION

- ¹ One of the most comprehensive surveys on the YAR economy is the USAID Agricultural Sector Assessment, December 1982. Much of the material in this section is drawn from this survey, which the author helped prepare.
- ² World Bank. YAR Second Five Year Plan, Public Investment Program Review. December 16, 1983, p. 4.
- ³ However, this excludes the contribution of qat, which could be up to \$1 billion, and of unrecorded flour across the border with Saudi Arabia, much of it coming in as remittance income in kind, since nearly all goods are cheaper in Saudi Arabia than in Yemen.
- ⁴ World Bank. Yemen Arab Republic Economic Memorandum, Oct. 23, 1981. pp 4-6. In 1975-78, Gross Fixed Capital Formation totalled YR 6480 million, of which 64% was by the private sector, 21% by the public sector and 15% by the Local Development Association.
- ⁵ The Agricultural Sector Assessment estimated that the average Yemeni earned around \$7,500 per year, of which \$2,500 was remitted home in cash.
- ⁶ The emigration of unskilled Yemenis has been partially offset by short-term migration of skilled foreigners, of whom 17,000 are in the public sector, mainly Egyptian teachers, and 11,000 in the private sector, mainly from Asia.
- ⁷ Najwa Adra. The Impact of Male Migration on Women's Roles in Agriculture in the Yemen Arab Republic. October, 1983.
- ⁸ Various unofficial estimates of the value of qat production range from \$0.5 to \$1 billion per year.
- ⁹ In September 1984, the USAID/CID Poultry project was selling compounded layer feed, entirely imported, for YR 2-2.5 per kg., excluding transport cost from Sana'a to the project area, where local sorghum grain was selling for YR 3-4 per kg. If transport costs were included, the feed would still under-sell the sorghum.
- ¹⁰ See Annex B.
- ¹¹ Greiner, T. The planning, implementation and evaluation of a project to protect, support and promote breastfeeding in YAR. University Microfilm International. Ph.D. Thesis Cornell University, 1983. p.110.

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ANNEX B

USDA ESTIMATES OF PRODUCTION AND CONSUMPTION
OF GRAINS IN THE YEMEN ARAB REPUBLIC

USDA Estimates of Grain Availability in the YAR

(in 000 tons and kgs per capita)

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84
<u>Sorghum</u>							
Production	660	564	632	636	635	580	248
Imports	--	--	--	--	--	--	--
Nonfeed use	550	564	602	609	607	562	330
Kg/capita	112.2	112.3	117.4	116.0	112.9	102.1	58.4
<u>Wheat</u>							
Production	51	44	63	65	70	67	27
Imports	275	446	440	348	466	533	560
Nonfeed use	326	470	478	458	536	590	597
Kg/capita	66.5	93.8	93.3	87.3	99.7	107.2	105.7
<u>Barley</u>							
Production	54	50	45	48	54	53	10
Imports	--	--	--	--	--	--	--
Nonfeed use	30	30	29	29	29	29	17
Kg/capita	6.1	6.0	5.7	5.5	5.4	5.3	4.8
<u>Corn</u>							
Production	90	54	48	48	49	59	32
Imports	0	30	25	20	15	10	19
Nonfeed use	55	56	58	53	54	55	51
Kg/capita	11.2	11.2	11.3	10.0	10.0	10.0	9.0
<u>Rice</u>							
Production	--	--	--	--	--	--	--
Imports	5	9	19	19	38	27	27
Nonfeed use	5	9	19	19	30	29	31
Kg/capita	1.0	1.8	3.7	3.6	5.6	5.3	5.5
<u>All Grains</u>							
Production	855	712	788	797	808	759	317
Imports	280	457	469	376	511	570	594
Nonfeed use	966	1129	1186	1168	1256	1265	1026
Kg/capita	197.1	225.8	231.1	222.5	233.7	230.0	181.7

*Calories/capita/day available

1970	2258	2311	2225	2337	2300	1817
Population 000	4900	5010	5126	5249	5375	5647

*Inserted here purely for illustrative purposes, using a crude conversion factor of 1 kg per annum grain consumed = 10 calories per day.

Source: USDA 1983 FANA Project.

ANNEX C

CHART ILLUSTRATING NATURE AND CAUSES
OF UNDERNUTRITION IN YEMEN ARAB REPUBLIC

WHO IS MALNOURISHED?

Infants/Young Children/Mothers

WHAT KIND OF MALNUTRITION?

Protein/Energy - Anemia (Iron Deficiency) - Vitamin D

Why is There Malnutrition

What To Do

How To Do

Food Availability and Demand	Food Consumption	Food Absorption	Education/Training	Economic and Social Conditions
<p>Generally adequate -High cash incomes support high imports -Equitable income distribution</p>	<p>Low intakes among vulnerable groups basically due to injurious beliefs/practices & mother's time constraints -Little exclusive breastfeeding (infrequent & poor diet) -Improper bottle hygiene & mixing (overdilution, not emptying bottle, not boiling bottle) -Inadequate weaning foods (late introduction & not enough) -Low intake iron-rich food sources & iron tablets -High fertility/close child spacing</p>	<p>Food not utilized well once ingested due to injurious beliefs/practices & low immunizations, poor disease treatment -Diarrhoea, measles, malaria, parasites -Low exposure to sun (swaddling, veiling)</p>	<p>-Mass media, video-cassettes -Schools -PHC -Literacy <u>Labor Saving</u> -Agriculture technology/training for women -Water supplies <u>Health/Population</u> -Contraceptives -Immunizations -ORT <u>Fortification (Iron, B₂, A, D, Zn, C)</u> -Wheat flour -Baby foods -Juices/milks</p>	<p>-High cash incomes -Good distribution networks -Highly-developed communications system <u>Public Sector Actions</u> <u>Private Sector Actions & Opportunities</u></p>

ANNEX D

LIST OF PERSONS CONTACTED

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AID/WASHINGTON

Charles Johnson	NE/TECH/HPN
Pam Johnson	NE/TECH/HPN
Art Braunstein	NE/TECH/HPN
Dick Williams	NE/PD
Judd Williams	NE/PD
Janice Weber	NE/TECH/HRST
Carolyn Coleman	NE/TECH/HRST
Mona Hamam	NE/TECH/HRST
Archie Hoagan	NE/TECH/AD
Thomas Chapman	NE/TECH/HRST
Emily Leonard	PPC/P&B
John McKigney	S&T/NUTRITION
Charles Gormley	PEB
Larry Brown	PEB
Mel Novins	PEB

OTHERS/WASHINGTON

Julie Weissman	IBRD
Andrew Steinfeld	NEA/ARP
Christine Ansel	Small Rural Water Project
Rod Crowley	USDA/Nutrition Unit

USAID and Contractors/YEMEN

Charles F. Weden, Jr.	Director
Thomas Rose	Deputy Director
Howard Thomas	GDO
Lynn Carter	GDO
G. Tracy Atwood	AGR
Frank Mertens	AGR
Karl Schwartz	E/HRD
David Fredrick	PROG
Geraldine Donnelly	PROG
Patricia Oliver	E/HRD
Robert Rose	GDO
William Emmett	MSH
Rachel Fielding	MSH
Claude LeTarte	TransCentury
Rich Samonte	EMU
Royal Brocks	CID
Milton Snodgrass	CID
Everett I. Edington	CID
Mendrick Williams	CID

Persons Contacted - Cont'd

James Soriano	U.S. Embassy - Economic/Commercial
Frank Ward	USIS
Dickinson Miller	Fulbright Scholar

YEMENI GOVERNMENT AND INT'L ADVISORS

Khaled Khaleen Salah	MOH/Dep. Director Technical Nutrition Unit
Mona Ghames	MOH, Technical Nutrition Unit
Ted Greiner	MOH/Nutrition Unit (IBRD)
Sandra Loli	MOH/Technical Nutrition Unit (Peace Corps)
Dr. Fahmy	WFP
Elisabeth Gascoigne	OXFAM
Naimi Naomi	Hodeidah Women's Association
Mrs. Nadira	FAO
Abdul Karim Al-Juneid	Director of Regional Health Office, Hodeidah
Omar Salah Ahmed	FAO Representative
Abdul Haleem	Director, Tihama PHC Project, Hodeidah
Orsalan Abdo	Tihama PHC Project
Mohamed Taha	Tihama PHC Project
Mrs. Hawa	Midwife, Tihama PHC Project

YEMENI PRIVATE SECTOR

S. T. Rajan	Industrial Consultant
Akil Omar Shihab	Shihab Insurance & Trading Agencies
Liaquat Jamal	National Cold Storage Company
A. P. Noman	Yemen Trade & Development Company
Ahmed Amin Sultan	Amin Kassem Sultan Co. Ltd.
Mohamed Abdo Saeed	Hayel Saeed Anam & Co. Ltd.