AGRICULTURAL DEVELOPMENT SYSTEMS EGYPT PROJECT

UNIVERSITY OF CALIFORNIA, DAVIS

WORKING PAPER

ADS/EGYPT

PAPERS AND PROCEEDINGS: WORKSHOP ON EGYPTIAN NUTRITION PROBLEMS AND PROGRAMS

Assistance from the Agricultural Development Systems Project of the University of California, Egyptian Ministry of Agriculture, and USAID, is gratefully acknowledged, but the author is soley responsible for the views expressed in this paper.

Economics
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No. 80

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June, 1982

Agricultural Development Systems:
Egypt Project
University of California
Davis, Ca 95616

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ADS EGYPT - CALIFORNIA PROJECT

ECONOMICS WORKSHOP

" EGYPTIAN NUTRITION PROBLEMS AND PROGRAMS"

JUNE 14, 1982

PROGRAM

First Session 9:30 - 12:00 AM

Moderator: Dr. Sylvia Lane.

Introduction and Opening Remarks: Dr. Yehia Mohieldin, Co-Director, Egypt

Presentations: Dr. Amin I. Abdou: "Major Features of the Food Problem in Egypt: An Overview of Influential Factors and Measures of Treatment".

Dr. Osman Galal : "Prospects of Nutritional Intervention Programs in Egypt".

Dr. Ahmed Goueli and Dr. I. Soliman: "Food Security in Egypt: The Socio-Economic Implications of Dietary Protein-Energy Interrelationships".

Dr. Sabry R.Morcos: Dr. Gamal N.Gabrial "Protein Rich Food Mixtures for Feeding the Young in Egypt".

Lunch Break: 12:00 - 12:30 PM

Second Session: 12:30 - 3:00 PM.

Moderator: Dr. Carlos Benito

Presentations: Dr. Afaf A. Mohamed: Dr. Mohamed A.El-Shennawy: Dr. Isis Nawar: "Pattern of Food Consumption and Nutritiv Value of Human Diets in Four Egyptian Villages of the Rice Zone: A - Food Consumption and Caloric Intake; B-Protei Intake; C-Iron Intake.

Dr. Amin Abdou: "Sources of Food Supply and Consumption Patterns in Rural Areas".

Dr. Hatim M. Ali: Impact of Small Scale Poultry Sector on the Nutritional Status of Inhabitants".

Discussant: Dr. Ahmed Goueli

Recorder of Proceedings: Dr. Carlos Benito

Agricultural Development Systems - Arab Republic of Egypt -
University of California Project

ECONOMICS WORKSHOP

"EGYPTIAN NUTRITION PROBLEMS AND PROGRAMS"

June 14, 1982

SUMMARY

If one only looks at the national average of per capita intake of energy it appears Egypt has no nutrition problems. Average per capita consumption of cereals and hence calorie and protein intake are generally adequate (Abdou and Mohomed, El-Shennawy and Nawar). In fact, the food consumption pattern of a large part of the population is characterized by excess intakes of food (Goueli and Soliman).

The averages, however, conceal a myriad of nutritional problems (Galal). Its appears malnutrition is caused by maldistribution of food rather than by a shortage in aggregate supply (Abdou). It is also caused by poor food habits (Nawar). The average Egyptian diet is below nutritional requirements. It is unbalanced, short of protective foods containing high quality protein and poor in mineral and vitamin content (Abdou).

The problem is more critical among the poor and in rural areas despite the relatively high proportion of income spent on food (reaching 55 percent in 1974), food price subsidies and the quantity of nonpurchased foods consumed. Village surveys in 1981-1982 have revealed low consumption levels for legumes, animal products and fruit. About 83 percent of the rural landholders had relatively low intakes of animal protein. Average per capita consumption of meat was less than 12 percent of the American level and dairy products consumption (milk equivalent) was less than 18 percent of the Dutch level (Abdou). The food consumption gap between those in the higher income bracket

and those in the lowest income brackets (mainly the landless) in rural areas was found to be extremely wide (Abdou). Protein intakes in rural areas are grossly inadequate among the lower income groups (Goueli and Soliman). The salient deficiency is the animal protein deficiency (Abdou).

The magnitude of Egyptian nutritional problems may be estimated by looking at the findings of the nutritional status survey conducted in 1978 by the Nutrition Institute. They found 21.2 percent of the children studied, in a representative sample, suffered from retarded linear growth, an indicator of chronic malnutrition. This portends one million Egyptian children from the age of six months to six years are stunted. The same study indicated .6 percent of the same sample suffered from acute undernutrition resulting in wasting, i.e. stunted growth and low weight for their height. The overall presence of anemia was estimated to be 38.4 percent of the sample. Rickets has shown an estimated prevalence ranging from 10 to 20 percent of the child population. The incidence of small-for-date babies in Egypt is in the range of 15 percent (Galal). The major nutrition problems in Egypt appear to be iron deficiency, low-calorie intake and low-calcium intake. There are also indications that Egyptian food intake is low in some trace elements such as zinc. (The percentage of calories derived from lipids in four world villages in the rice zone appears to be particularly low (Mohamed, El-Shennawy and Nawar)).

Food consumption patterns are largely determined by agricultural production patterns in rural areas. Prices and incomes are lesser determinants of what foods are consumed. Many farmers consume what they produce themselves and therefore consumption of rice, maize and dairy products, in particular, very across regions according to what and how much is produced (Abdou). In the case of wheat, which is freely marketed, the wheat grain and even the wheat straw is being introduced into animal feed. Farmers are increasingly selling all the wheat they produce and purchasing bread and flour at subsidized prices. The larger landholders tend to produce more of what their households consume. Smaller landholders sell most of their production and purchase food and other consumption goods. This is especially true in the case of animal products. Farm produced food and food rationing, however, made for remarkably similar consumption levels among land holders even though sizes of landholdings vary widely. The distribution of food consumption is far wider in urban areas (Abdou).

Proposed measures that have been suggested to help solve nutritional problems in Egypt have been:

(1) Supplementary feeding. . . which consists of supplementing normal diets of vulnerable groups with foods or pharmaceuticals needed to aleviate nutritional deficiencies. Iron pills have been used for this purpose for pregnant mothers and school children and distributed locally in different areas.

(2) Nutrition education. . . efforts by the Nutrition Institute to implement such programs are going forward.

(3) Formulated food . . . which consists mainly of formulating highly nutritious weaning foods to overcome the accute malnutrition crisis that occurs during the weaning process. Fifteen years ago Supramine was introduced for this purpose with the help of UNICEF, but it is not available to all of the children who need it. Recently ten foods have been formulated at the Nutrition Institute and their value assessed. They are effective, low-cost and easily used in popular recipes.

(4) Price subsidies . . . this is a method used in Egypt to increase low income families' access to basic staples since it increases their effective purchasing power. The problem is subsidies do not impact vulnerable groups very effectively and they are costly means of improving nutrition.

(5) Fortification . . . an introduction of missing nutrients into commonly consumed foods when they are processed in order to overcome specific nutrient deficiences in the diet. Fortification has not been widely used in Egypt.

(6) Programs aimed at increasing agricultural output . . . These have been implemented in Egypt on a very large scale in recent years but their nutritional impact has not always been taken into consideration. No integrated plans have been put forth which had as their purpose the improvement of nutrition.

Some of the proposed measures are being implemented. Integrated rural development to raise the income of small rural landholders should result in improved diets (Galal). The More and Better Food project of the National Research Center is one attempt to implement a rural development project, in this case, the poultry raising project, that is meant to both increase farmers' incomes and improve their nutritional status (Galal and Ali). It appears they have been successful. Increasing animal product production by small farmers, particularly by instigating poultry raising programs and by increasing their meat production in general, appears to be an effective means of solving animal protein deficiency problems in farm households.

Some target oriented programs for vulnerable groups such as infants and pregnant women, for example, the supplementary food program, are in place. Recently ten protein-rich food mixtures which can be fed to children to prevent and illeviate protein-deficiency have been formulated and their nutritive value assessed. These mixtures are now available in local markets at low prices and can be used in popular dishes easily prepared at home. They should help alleviate some protein-deficiency problems among children.

The major program affecting food availability in Egypt is the price subsidy program. Dr. Goueli indicated its high cost and questions concerning its effectiveness warrant further investigation of the program.

The fortification of foods has been considered and nutrition institute scientists are working with food industry firms in designing such programs, but there is still a quesion about the role of food technology and the alleviation of malnutrition and the costs of such programs are relatively high.

If the nutritional status of the rural poor is to be improved through an increase in agricultural production, it is important that appropriate technologies be used. Otherwise, programs to solve nutritional problems may not be effective. Small farmers can raise poultry profitably and they do consume more poultry meat when they are poultry raisers (Ali). Members of households who produce meat and milk, eat more meat and drink more milk (Abdou). If programs are to be effective they must take local habits and resources into consideration (Abdou, Gamal, Ali, Gabrial and Morcos). Whether a program solves nutritional problems can only be determined by assessing its effects on the nutritional content of the diets of the target groups (Mohamed, El-Shenawy, Nawar, Gamal).

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Morcos, R. and Gabrial, G.N. "Protein Rich Food Mixtures for Feeding the Young in Egypt."

MAJOR FEATURES OF THE FOOD PROBLEM IN EGYPT:
AN OVERVIEW OF INFLUENTIAL FACTORS AND MEASURES OF TREATMENT

by

Amin I. Abdou

Major Features of the Food Problem in Egypt: An Overview of Influential Factors and Measures of Treatment

Nature and Scope of the Food Problem:

Although average per capita consumption of cereals, and hence caloric and total protein intakes among the Egyptian population are generally reasonably sufficient, the costs of providing these intakes are very high. Imports of wheat and wheat flour in particular are at a relatively high level and increasing. They will reach 5.3 million metric tons in 1988, which is almost 2.5 times the tonnage imported in 1970 (Ross et al., 1979). Additionally, imports of maize which were nil up to 1970, reached 800,000 metric tons in 1978, and animal product imports increased by 50 percent over the same period. On the other hand, exports of rice dropped to 100,000 metric tons, from more than double that figure two years earlier. Citrus exports also fell from 200,000 metric tons in 1970 to 130,000 metric tons in 1978. These shifts have led to a fast growing deficit in the balance of trade.

Despite the rapidly growing volume of wheat and maize imports, the average Egyptian diet (not even that of the lowest income groups) is nutritionally below requirements. It is unbalanced, short of protective foods containing high quality protein, and poor in mineral and vitamin content (Shalabi, 1972). Compared to the best diet, the poor Egyptian's diet consists of double the amount of bread, half that of meat, fats and dairy products and a quarter of that of fruit (Abd El-Salam, 1956).

The problem is more critical in rural areas despite the relatively high proportion of income spent on food (reaching 55 percent in 1974), food price subsidies and the quantity of nonpurchased foods consumed (The National Bank Report, 1978). Village surveys have revealed low consumption levels for legumes, animal products and fruit, especially for the poor villagers

(Abdou, I., et al., 1965). About 83 percent of the rural landholders had a relatively low intake of animal protein since average per capita consumption of meat was less than 12 percent of the American level and dairy products consumption (milk equivalent) was less than 18 percent of the Dutch level (Goueli, et al.). Average deficiencies existed along side a strongly apparent maldistribution. Whereas, no less than 16 percent of landholders' family members suffered from inadequate caloric intake, about 10 percent overconsumed, some consuming almost 360 percent of their caloric requirements (Goueli, et al.). The consumption gap between the high income classes and the lowest income classes (mainly the landless) in rural areas was found to be extremely wide (Abdou, A., et al., 1980).

It would seem, in view of the relatively high level of grain imports, that malnutrition is, most likely, caused by maldistribution rather than by a shortage in aggregate supply (Waterbury, 1974; Pinstrup-Anderson, 1976; Selowsky, 1979). On the other hand, a shortage in aggregate supply can be regarded as the major cause of the low animal protein intake.

Factors Influencing Food Consumption:

Consumption surveys reveal the positive impact of income upon consumption patterns. It was found that length of pay periods inversely affects food consumption (West et al., 1976). The income effect may be suppressed by the existence of nonpurchased foods and/or exclusion of very low income classes from study samples (Ibid.). Size of landholdings and production patterns also influence consumption because of consumption from producers' own crop or animal products, affecting the consumption of cereals and dairy products in particular (Goueli, et al.). Food consumption responds inversely to price changes (Timmer, et al., 1979). Social factors also influence consumption patterns. The negative impact of the size of households on per capita share of consumption and immigration to urban districts affecting consumption patterns in favor of semi-luxury foods have been noted (Salathe, 1979). Level of education is another factor that affects both the level of and pattern of food consumption.

Measures of Treatment for the Food Problem:

Readjustment and Development of Agricultural Production:

It is generally believed that an integrated plan for the development of agricultural production is required to meet the food crisis (Marie, 1976; Bakr, 1978; Dawood, 1979).

Second, the deficit of 3 million metric tons of concentrated feeds can be met by increasing the production of maize interplanted with soybeans and specifying the area of the latter (about 140,000 feddans) relative to other fodder. Third, the 300,000 feddans developed at Lake Nasser, if devoted to fodder, may be sufficient to produce 360,000 metric tons of meat (Radwan, 1980). Fourth, the total sacrifice of the cotton area to corn and rice (1.7 million feddans) may raise corn and rice production by 1.9 and 1.8 million metric tons, respectively (West, et al., 1976). Fifth, introduction of agricultural and industry by-products (such as rice straw, bran, flax, etc.) into animal feed may be an effective means of treatment for the animal production problem (Mekki, 1979).

Credit and Input Subsidies:

Increasing credit to farmers and input subsidies were found to be the most cost-effective measures for the improvement of nutritional status for poor Mexican farmers, who are in conditions similar--to a great extent--to those of Egyptian poor fellahin (Benito, 1979). Moreover, providing aid to small farmers for animal production is expected to improve their animal product consumption levels and solve the problem of the deficiency of high quality protein intake (Goueli, et al.,).

Income and Price Readjustments:

Income redistribution in favor of the poor is considered an effective means for general elevation of nutritional status (Waterbury, 1974; Pinstrup-Anderson, 1976; Selowsky, 1979). Such action may result in low-income persons modifying their diets so that they are of higher nutritive value and similar to those is higher income classes (Boehm, 1974). Conversely, it was recommended that prices of high quality foods be raised, favoring producers, while keeping staple necessary foods, as the main suppliers of the calories and protein, at low prices (Timmer, et al., 1979).

In addition, economic analysis has shown that food stamp programs (with no resale of stamps) are more cost-effective than cash-transfer programs, group-oriented site-feeding programs or food price subsidies in increasing food consumption (Selowsky, 1979, Alter and Lane, 1980).

Food Enrichment and Cheap Food Mixtures:

On the basis of international prices it was concluded that the cheapest means of meeting protein requirements was a mixture of legumes, rice and bread (Abdou, A., 1980). Additionally, wheat flour enrichment with iron, calcium, and dried fish protein has been considered to be one of the effective methods of overcoming deficiencies in the Egyptian diet (Dakruri, 1975).

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PROSPECTS OF NUTRITIONAL INTERVENTION

PROGRAMS IN EGYPT

by

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Prospects of Nutritional Intervention Programs in Egypt

Malnutrition in developing countries is depressingly pervasive. Problems of implementation are among the greatest constraints to more progress in alleviating malnutrition in affected populations. Efforts to develop national nutrition policies and intervention programs have been one of the main concerns of the health authorities in Egypt during the last decade. The reason is that Egypt as a developing country is in no better position than the rest of the developing countries. It is a country where its population is now in excess of 40 million, 42.9 percent of whom are below 15 years of age. Nearly half of the population is still in need of a better environment if it is to have the opportunity of attaining ideal growth potentialities and mental capabilities in order to turn in a better performance and enhance its activities.

Forty-four point one percent of the population live in urban areas. Fifty-five point nine percent live in rural areas. The overall population density in inhabited areas of 923/km^2. The death rate in Egypt is in the range of 11.8 (1977) per thousand. The infant mortality rate, as recorded, is 98 per thousand.

The magnitude of nutritional problems in Egypt has been assessed in the recent Nutritional Status Survey conducted in 1978 by the Nutrition Institute. The results showed 21.2 percent of children studied in the representative sample suffered from retarded linear growth which is an indicator of chronic malnutrition. Extrapolating from this figure yields an estimate of 1 million Egyptian children from 6 months to 6 years of age who are stunted. The same study indicated that 0.6 percent of the sample suffered from acute undernutrition in the form of wasting (low weight for height).

The overall prevalence of anemia was estimated to be 38.4 percent in the total representative sample. Extrapolating from this figure to the total population of Egypt yields an estimate of 1.4 million Egyptian children in this same age range (6 months - 6 years) who are anemic. Rickets in various other reports showed a prevelance ranging from 10 to 20 percent of the child population. The preliminary results from a recent study done at the National Research Center indicate that the incidence of small-for-date babies is in the range of 15 percent. This high incidence was attributed to malnutrition among pregnant mothers.

These data give you an idea about the magnitude and the nature of nutritional problems in Egypt. They are essentially iron-deficiency, low-calorie intake and low-calcium intake. In addition, there is some data available indicating that our food intake is low in some trace elements such as zinc which also has adverse effects on human health.

Hence, it is very important to consider nutrition intervention programs to accelerate nutritional improvement, and they should be especially targeted on the most vulnerable groups in the society, i.e., children and pregnant women. During the last two decades various intervention programs were implemented either on a local or national scale. The effectiveness of these programs was in many instances questionable and data were imperfect or, rather, did not answer the specific questions answers to which were needed if one were to estimate the impacts (direct and indirect) of such intervention programs. In particular, their impact on infant and child nutrition was not thoroughly assessed.

The various types of nutrition programs which have been implemented in Egypt mainly fall into one of the following categories:

1) Supplementary Feeding. This consists of supplementing the normal diets of vulnerable groups with the types of food needed to alleviate nutritional deficiencies. Iron pills have been used for this purpose and given to pregnant mothers and school children. This type of intervention have been used locally in different areas in Egypt.

2) Nutrition Education. This type of intervention often accompanies a feeding program and is aimed at improving the utilization of existing good-quality food for the improvement of nutritional status of vulnerable groups in the population. This type of intervention is being carried out by the Nutrition Institute.

3) Formulated Food. This intervention consists mainly of creating new highly nutritious weaning foods to overcome the acute malnutrition crises that occur during the weaning process. On a national level this type of intervention started about fifteen years ago when Supramine was introduced with the help of UNICEF. Nutrition education has been coupled with the distribution of Supramine to babies in rural areas.

4) Price Subsidies. This is a common way to increase low-income families' access to basic staples--by increasing their effective purchasing power. Price subsidies are used in Egypt but they do not impact vulnerable groups very effectively.

5) Fortification. This type of intervention attempts to overcome specific nutrient deficiencies in the diet by adding the missing nutrient to a commonly consumed food when it is processed. It has not widely been used in Egypt and then is still a question concerning the role of food technology in alleviating malnutrition. Recently scientists at the National Research Center have begun to be

engaged in scientific research projects aimed at finding the best carriers for various nutrients such as iron, vitamin A and amino acids (lysine, etc.) that may be added to food. They are working in conjunction with the Food Industry Sector in designing fortification programs.

6) Agricultural Production. Programs aimed at increasing agricultural output have been implemented in Egypt on a very large scale during recent years. But, still, we as human nutritionists think that policies aimed at increasing agricultural production did not take their nutritional impact into consideration. The actual nutritional problems which face vulnerable groups were not addressed in a rational way by people responsible for agricultural production. In other words, no integrated plans were put forth for this purpose. If one thinks of increasing agricultural production as a nutrition intervention program, three major differences would become apparent if comparisons with other intervention programs were to be made:

1. The majority of malnourished people may not be members of farm families, and would therefore only be affected indirectly.
2. Increasing agricultural production is the intent of many policies whose outcomes can in certain instances conflict with the goals of nutrition policies.
3. If improving agricultural technology is the only nutrition intervention program its impact would depend mainly on the macroeconomic environment, particularly agricultural price formation.

This short review of the various intervention programs implemented in Egypt poses the question of how to address malnutrition problems in a more integrated fashion. Fusion and combination of various types of interventions should be looked upon as a process which economizes on resources and should be part of a broader development plan. The pivot of such a plan should be increasing agricultural production and rural development programs aimed at income and employment generation. This will also in the long run reduce the need for direct nutrition programs.

In summary I would like to put emphasis on two important issues:

1. When increasing agricultural production one should take into consideration the nutritional status of the population and in particular the vulnerable groups.
2. Outcome indicators for programs to increase agricultural production should be set up and agreed upon so as to enable study of the effect of increased agricultural production, i.e., the increase in the quality and quantity of food, and so as to monitor beneficial impacts on the society.

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PROTEIN RICH FOOD MIXTURES FOR FEEDING THE YOUNG IN EGYPT
II--CHEMICAL AND BIOLOGICAL EVALUATION

by

S. R. Morcos and G. N. Gabrial

One of the major nutritional problems facing the world today is the limited availability of protein to children (1). As a consequence, a relatively high percentage of children suffer from protein deficiency. Energy deficiency contributes to this deficiency by altering the ultimate chemical picture of protein. Protein-energy malnutrition with all its varients has been recognized as one of the most serious health problems prevalent among children in most of the developing countries. In Egypt, as in many areas of the world, milk production is not sufficient to supply the needs of the population. Therefore, efforts have been made to use protein-rich vegetables for feeding infants and preschool children (2-6).

Being aware of food habits and the food pattern in the country, we prepared ten formulated protein-rich food mixtures, that can be used in popular dishes, easily prepared at home (7). They are free from harmful ingredients, available in the local market at low prices, and accord with our food habits.

Our current project was designed to evaluate the nutritive value of the mixtures using both biochemical and the biological techniques. The percentage composition of these mixtures is shown in Table 1.

Experimental

The following analyses were made of the ten formulated food mixtures that had been prepared previously (7).

Estimation of the amino acids

The amino acids content of the mixtures were estimated after they were hydrolised with 6N-HCl, using the ... and Baker Techniques (8). Measured amounts of the acid hydrolysates were spotted on Whatman No. 1 filter paper. The ascending paper chromatography technique was used employing the buffered method of Levey and Chung (9). Cystine and Methionine were oxidized with performic acid, and their quantity estimated using Jamalian and Pellet's method (10). The colorimeteric method of Blauthi, Charezinsl and Berbec (11) was followed in the estimation of the quantity of tryptophan in the alkali hydrolysates.

Determination of Net Protein Utilization NPU

The NPU of the ten formulated food mixtures were estimated using the Miller and Bender method (12), involving weanling Sprague-Dawely albino rats. The equation utilized in the analysis was:

$$N.P.U. = \frac{B - (B_k - I_k)}{I}$$

Where B and B_k are the total body nitrogen of the groups of animals fed the test diet and nonprotein diet, respectively. Similarly, I and I_k are the intake of nitrogen in the two groups. The composition of the nonprotein diet is shown in Table 2.

The digestibility D. was also determined according to the fact that:

$$D. = \frac{\text{Protein absorbed}}{\text{Protein intake}} = \frac{\text{Protein intake} - \text{Protein excreted}}{\text{Protein intake}}$$

The Biological value $= \frac{N.P.U.}{D.} \times 100.$

The Net Dietary Protein Energy Percent (N D_p E %), which is a function of protein and energy was also estimated for each of the ten formulated mixtures.

$$\text{Where, N P U} = \frac{\text{Nitrogen retained}}{\text{Nitrogen intake}} = \frac{\text{Protein energy retained}}{\text{Protein energy intake}} = \frac{\text{N } D_p \text{ E \%}}{P}$$

Then, N D_p E % = N P U x P.

P is the percentage of protein energy in the diet (13-15).

Results

Table 1 shows the percentage composition of the ten formulated baby food mixtures named An_{70}, AN_{71} . . . An_{79}, which were formulated before (7). They are composed in the main of mixtures of cereals and legumes. Most of the mixtures contain skim milk and defatted sesame flour. Table 2 shows the composition of the nonprotein diet used for estimation of N.P.U. Table 3 shows the proximal analysis of the ten formulated mixtures. They contain protein levels ranging from 17.7 to 23.2 g. percent. The essential amino acid content and pattern of the proteins of these mixtures, which were calculated on the basis of mg./g. N., are shown in Table 4. They are also compared with the provisional amino acid pattern recommended by the FAO (16), and with the amino acids of egg protein. Total quantities sulphur-containing amino acids of the proteins in all the mixtures were found to be a little bit lower than those recommended by the FAO, and than those in egg protein. Either lysine or tryptophan levels are slightly lower than the recommended values in some of the formulated mixtures as are the sulphur containing amino acids, as shown in Table 5. Table 6 shows the NPU, D, BV, and N D_p E % for the ten mixtures. AN_{73}, AN_{76} and AN_{77} gave higher values than any of the other mixtures.

Discussion

We were already aware from our earlier analyses (7), that the ten formulated food mixtures contained high levels of protein ranging from 17.7 to 23.2 g. percent which is in conformance with WHO standards (7). The most recent analysis showed that the essential amino acids pattern for all the formulated mixtures, as shown in Table 4, contain the levels of most of the amino acids recommended by the FAO (16), except for the sulphur containing amino acids whose levels are a little bit lower than those recommended by the FAO. The deficit in the sulphur containing amino acids cannot be balanced unless authentic amino acids are added because the sources of proteins in all the prepared mixtures are mainly legumes and cereals. It is already known that most of their proteins are poor sources of sulphur containing amino acids. Although we added sesame, which is a rich source of sulphur containing amino acids in comparison to the other vegetable sources used in our mixtures, to most of the mixtures, the levels of the sulphur containing amino acids are still a little bit below those recommended by the FAO. In some mixtures, either the lysine or tryptophan levels are slightly lower than the values recommended by the FAO, but these differences are very small and so they can be neglected. Their effect on the biological values were slightly detectable. All these problems may be minor, since our formulated mixtures are not the only food given to children. They are supplements to the food containing natural sources of protein normally given to children.

When the amino acid content of our mixtures was compared to that of other food mixtures, it was found that the levels of sulphur containing amino acids in the ten formulated mixtures were higher than those of supramine, which is produced in Egypt by the El-Nil company for the pharmaceutical and chemical industries with the cooperation of the World Food Program (WFP), the FAO and UNICEF; those of the improved supramine (18) and than those of other food mixtures that have been formulated in Egypt (19-20). They were also found to be higher than those of FAFFA, which is a baby food mixture that was formulated in Ethiopia (21).

When our formulated food mixtures were fed to rats to study their biological values, it was found that their NPU values were above 50 (they ranged from 60 to 73) as shown in Table 6. Their digestibility values were more than 90 percent which means that they are easily digested. The biological values ranged from 64 to 80, near to that of casein which is an animal protein. The Net Dietary protein Energy percent, ($ND_pE.\%$), which is a function of both quality and quantity of protein, was found to range from 8.6 to 10.1, that is to say, two above 8.

Such mixtures can be fed to children safely. They can easily be made into porridge, either sweetened or salted, or biscuits and salty sticks.

Summary

Ten protein rich baby food mixtures were formulated mainly from vebetable protein sources. They were prepared using the same methods of preparation used for popular dishes commonly served in Egypt. Such mixtures can be easily prepared at home from locally-produced crops. They are free from harmful ingredients, their ingredients are available in markets at low prices and accord with our food habits.

The nutritional analyses of the mixtures, showed they are rich in protein (17.7-23.2 g. percent) and they contain all the essential amino acids, although in some instances at levels that are a little bit lower than those recommended by the FAO. Biological analyses indicated they have high

biological values and can be fed to the children safely. Such food mixtures are not expensive and they are within the reach of low socio-economic groups of the population in Egypt.

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TABLE 1. Formulated Protein Rich Food Mixtures

No.	Mixture	Ingredients	g./100g.
1	AN_{70}	Polished rice	40
		Decorticated lentils, cooked	30
		Defatted sesame flour	20
		Skim milk powder	10
2	AN_{71}	Polished rice	35
		Roasted chick peas, dehulled	30
		Maize flour	10
		Defatted sesame flour	10
		Skim milk powder	15
3	AN_{72}	Parboiled wheat	60
		Roasted chick peas, dehulled	18
		Dry yeast	2
		Defatted sesame flour	10
		Skim milk powder	10
4	AN_{73}	Fayesh	60
		Roasted chick peas, dehulled	20
		Defatted sesame flour	10
		Skim milk powder	10
5	AN_{74}	Fayesh	70
		Defatted soy flour	10
		Defatted sesame flour	10
		Skim milk powder	10
6	AN_{75}	Parboiled wheat	50
		Cooked chick peas	20
		Defatted sun flower kernels	10
		Defatted sesame flour	10
		Skim milk powder	10
7	AN_{76}	Fayesh	30
		Cooked decorticated lentils	15
		Cooked polished rice	20
		Cooked chick peas	15
		Defatted sesame flour	20
8	AN_{77}	Cooked dried potato flakes	40
		Cooked chick peas	20
		Defatted sesame flour	30
		Skim milk powder	10
9	AN_{78}	Maize bread containing 5 percent fenugreek flour	50
		Defatted soy flour	25
		Dry yeast	5
		Skim milk powder	20
10	AN_{79}	Kisk	50
		Maize flour baked with fenugreek flour	3
		Cooked decorticated lentils	35
		Skim milk powder	10

TABLE 2. The Composition of the Basic Nonprotein Diet[a]

Ingredients	g./100g.
Cooking fat	7.5
Maize cil	7.5
Potato starch	10.0
Glucose	15.0
Vitaminized carbohydrate mixture[a]	5.0
Salt mixture	5.0
Maize starch	50.0

[a]According to S. S. Morcos (1967). British Journal of Nutrition, 21:269.

TABLE 3. Macronutrients Present in Food Mixtures g. per 100g. (after supplementation)

Nutrients	AN70	AN71	AN72	AN73	AN74	AN75	AN76	AN77	AN78	AN79
g./100g.										
Moisture	6.8	6.2	6.6	5.1	5.6	5.8	6.2	5.4	6.8	6.3
Nitrogen	3.2	3.0	3.1	3.0	2.8	3.3	3.1	3.1	3.6	3.3
Protein	20.5	19.1	19.8	19.1	17.7	20.6	19.5	19.8	23.2	20.7
Fat	5.4	5.6	6.1	5.9	6.3	7.1	7.2	5.1	5.2	8.4
Ash	2.6	2.8	2.3	2.9	2.7	3.0	2.2	3.4	2.8	4.0
Fibre	2.1	1.8	2.0	1.9	2.3	2.2	2.1	2.6	2.0	2.3
Carbohydrates[a]	62.6	62.5	63.2	65.1	65.4	66.3	62.2	63.7	60.0	58.3
mg./100g.										
Calcium	219	350	342	515	318	405	231	428	438	364
Phosphorus	320	414	500	705	612	425	231	433	458	331
Iron	5.1	5.4	6.1	6.8	3.2	4.8	4.8	6.7	4.1	5.2
cal./100g.										
Food energy, Cals.[b]	389	384	395	399	386	427	400	389	388	401

[a] differences

[b] calculated: g. carbohydrates = 4 Cals.
g. protein = 4 Cals.
g. fat = 9 Cals.

TABLE 4. Amino Acid Content of Formulated Mixtures (mg./100g.)

Amino Acids	AN_{70}	AN_{71}	AN_{72}	AN_{73}	AN_{74}	AN_{75}	AN_{76}	AN_{77}	AN_{78}	AN_{79}	FAO	Egg
Leucine + Isoleucine	752	811	587	799	721	725	712	912	916	1054	576	968
Lysine	355	362	298	341	330	296	288	361	367	391	270	403
Phenyl alanine	316	325	321	345	331	297	314	425	298	315	180	365
Tyrosine	245	253	263	243	472	205	205	492	327	298	180	262
Cystine	110	112	105	115	105	103	110	100	109	102	126	149
Methionine	138	141	145	134	130	138	138	169	131	141	144	197
T. S. Amino acids	248	253	250	249	235	241	248	269	240	243	270	346
Threonine	241	225	183	217	252	225	234	317	262	255	180	317
Tryptophan	90	88	85	92	90	88	91	110	80	90	90	100
Valine	354	317	273	343	324	320	324	326	359	372	270	454

TABLE 5. The Chemical Score of the Ten Formulated Mixtures

Mixture	Chemical Score Based on Lysine	Chemical Score Based on Sulphur Containing Amino Acids	Chemical Score Based on Tryptophan	First Limiting	Second Limiting
AN_{70}	100	89	100	Sulphur Containing Amino Acids	----------
AN_{71}	100	90	95	Sulphur Containing Amino Acids	Tryptophan
AN_{72}	100	97	100	Sulphur Containing Amino Acids	----------
AN_{73}	100	89	100	Sulphur Containing Amino Acids	----------
AN_{74}	95	80	100	Sulphur Containing Amino Acids	Lysine
AN_{75}	98	94	100	Sulphur Containing Amino Acids	Lysine
AN_{76}	98	95	100	Sulphur Containing Amino Acids	Lysine
AN_{77}	84	80	100	Sulphur Containing Amino Acids	Lysine
AN_{78}	92	80	99	Sulphur Containing Amino Acids	Lysine
AN_{79}	98	77	100	Sulphur Containing Amino Acids	Lysine

TABLE 6. Biological Values of the Ten Mixtures

Mixtures	N.P.U.	D.	B.V.	ND_pE %
AN_{70}	62.2	94.4	65.9	8.8
AN_{71}	60.3	93.2	64.7	8.6
AN_{72}	66.5	92.8	71.7	9.4
AN_{73}	71.1	95.7	73.2	9.8
AN_{74}	67.8	94.3	71.9	9.0
AN_{75}	70.4	95.2	73.9	9.6
AN_{76}	73.7	91.6	80.5	10.0
AN_{77}	70.3	96.9	72.5	10.1
AN_{78}	63.6	92.8	68.5	9.0
AN_{79}	67.4	96.5	69.8	9.8

N.P.U.: Net Protein Utilization
D. : Digestibility
B.V. : Biological Value
ND_pE %: Net Dietary Protein Energy Percent

PATTERN OF CONSUMPTION AND NUTRITIVE VALUE OF HUMAN DIETS IN FOUR EGYPTIAN VILLAGES OF THE RICE ZONE

by

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PATTERN OF CONSUMPTION AND NUTRITIVE VALUE OF HUMAN DIETS IN FOUR EGYPTIAN VILLAGES OF THE RICE ZONE

For various reasons, agricultural performance has failed to keep pace with growing food requirements in Egypt. The rapid growth of the population in recent decades, the prospects of its continuation in the future and the decline in land/per capita ratio from 0.3 feddan/person in the 1950's to 0.15 feddan/person in the 1980's, along with the desire for improved and satisfactory levels of nutrition, has brought food and nutrition problems once again to the center of attention.

Increased food production cannot be achieved through improving physical agricultural inputs alone. The human factor is important in any kind of development, since it is the people themselves who largely determine the rate and direction of development. Factors which contribute to family well-being are often interdependent with agricultural production, and are always related to economic and social progress, as agricultural production is frequently limited by malnutrition and disease in the rural family. Moreover, food shortages could be overcome if farmers were able to work more efficiently. Health and good nutrition are important in determining working capacity.

Studies throughout the world have indicated that inadequate energy intake may have health implications. Inadequate dietary protein affects the health and efficiency of future generations since it may have grave deleterious effects on infants and young children. Malnutrition is widely prevalent throughout the world, particularly in developing countries.

Dietary studies are often conducted to explain the state of health and nutrition for a population, and to investigate whether there is some correlation between health problems, nutritional intake and socio-economic

Egypt: Major Constraints to Increasing Agricultural Productivity (USAID). The rice zone was chosen for this study at the beginning of the program because its population represents 40 percent of the total study sample.

This particular investigation was conducted in four villages of the rice zone. The one hundred families chosen at random from the four villages were distributed as follows: 25 from El Arimon, 15 from Kamha, 35 from Manshaat El Gamal, and 25 families from Shenou. Information was gathered on: a) relevant socio-economic factors and, b) foods consumed by the family for 24 hours over four days in different seasons of the year. The nutritive value of foods was computed from _Food Composition Tables for Use in the Middle East_ (Pellet and Shadarevian, 1970), and _The Amino Acid Content of Foods_ (FAO, 1970).

For each individual in the sampled households in each of the four villages data were obtained on average food consumption for each of nine food groups. The caloric content of each food and the total number of calories were then calculated and classified as being from: a) separated or unseparated fats of animal or plant origin, b) carbohydrates (distinquishing between starch and sugar), and/or c) animal and plant protein. These values were then expressed as percentages of the total caloric intake. In addition household food intakes were analyzed to assess dietary adequacy and ascertain whether they resulted in desirable levels for energy sources (Perisse, _et al._, 1969, Passemare, _et al._, 1979). Intakes of dietary protein were evaluated using the method described in 1973 by the FAO/WHO Committee on protein requirements. The amino acid content of the foods consumed and the resulting amino acid content of the mixed protein were compared using egg protein as a benchmark. The percentage of absorbable iron in the diet was calculated using the method described by Monsen _et al._, 1978.

RESULTS AND DISCUSSION

1. Food Consumption

Table 1 summarizes mean food intakes in grams for the nine main food groups for the four villages. The data show consumption levels for the food groups differ and are not consistent for the four villages. In general, mean consumption levels for legumes, sugar, and fat are in agreement with values reported by Nawar (1974, 1979) and the Arab Organization for Rural Development (1975), but average consumption levels in the remaining groups are higher than corresponding values in the aforementioned studies.

a. Milk and Milk Products

The mean intake for this group of foods ranged from 109 gm/person-day in Kamha to 75 gm/person-day in Manshaat El Gamal. Consumption of milk, as a drink, was relatively lower than consumption of cottage cheese. This might be due to the general belief that milk is a food for infants and sick people (Nawar, 1974). Also, people prefer to remove the milkfat for butter production, and process the remaining skim milk into cottage cheese for marketing.

b. Animal Protein Group

This group is made up of meat, poultry, fish, and eggs. The highest average consumption level of 221 gm/day was found in Shenou, while the lowest, 103 gm/day, was found in Manshaat El Gamal. In general, consumption is relatively high compared to the levels reported in other studies. Fish constitutes a major animal protein group food in three of the villages and poultry in the other.

c. Legume Group

This group consists mainly of broadbeans, lentils and beans. Average consumption levels ranged from 62 gm/day in Manshaat El Gamal to 26 gm/day in Kamha. Though the major legume in Egypt is broadbeans, no broadbean consumption was reported in El Arimon.

d. Grain and Grain Product Group

This group consists mainly of wheat, maize, and rice as grains, and macaroni as a grain product. Consumption of bread was relatively low in the four villages. This is not surprising since this is the rice zone. Consumption levels ranged from 865 gm/day in Shenou to 620 gm/day in El Arimon and Manshaat El Gamal.

e. Starchy Food Group

This group is mainly composed of potatoes and colcasia. Consumption ranged from 73 gm/day in Shenou to 56 gm/day in El Arimon.

f. Fruit and Vegetable Group

This group consists of citrus fruits, as the major group and tomatoes and onions as the major vegetables. The highest level of consumption of fruits and vegetables was found in Shenou, while the lowest was in Kamha and Manshaat El-Gamal, respectively.

g. Sugar Group

Sugar was consumed mainly in beverages such as tea and coffee. The joint report of FAO/WHO (1973) states that consumption of sugar in eastern Mediterranean countries is largely linked to tea drinking. The highest consumption level (73 gm/day) was found in Manshaat El Gamal, while the lowest was in Kamha.

h. Fat Group

This group consists mainly of oil among the plant fats, and butter, ghee and other fats of animal origin. The latter are mainly consumed on special occasions during the year. The highest consumption of oil was found in Shenou, while El Arimon was highest for animal fat. The lowest consumption level for lipids in general, was found in Manshaat El Gamal.

2. Caloric Intake

The data in Table 2 illustrate intakes and patterns of consumption of energy producing nutrients in the four villages. The results reveal that the mean individual energy intake in the rice zone is relatively high as compared to levels recommended by FAO/WHO (1974). Energy intakes ranged from 4,317 calories/day in the village of El Arimon to 2,789 calories/day in the village of Manshaat El Gamal. Nawar, (1979) reported values of 2,112 calories/day in the Abis zone in the newly reclaimed areas of Egypt.

Average intakes of lipids, sugar, protein, and starch differed among and were not consistent for the four villages. The village of El Arimon had the highest intakes of lipids and starch, while the lowest intakes of both of these food components were found in Manshaat El Gamal. The highest intakes of sugar and protein were found in Manshaat El Gamal and Shenou, respectively. The lowest intakes of sugar and protein were found in Kamha.

Perisse et al. (1969), using food balance sheets for Egypt for 1962, reported values of 30.1 gm/day for lipids, 38 gm/day for sugar, 12.1 gm/day for animal protein, and 66.6 gm/day for plant protein. The Egyptian food balance sheets for 1976 showed higher consumption values than those reported in the last decade. Values from the food balance sheets in 1979 were 3,774 calories, 68.5 gm/day for lipids and 106.1 gm for protein. The mean daily consumption of separated animal and plant fats were 11 and 17.2 gm/day, respectively, and it was 39.8 gm/day for unseparated fat. Values for animal and plant protein were 13 and 93.1 gm, respectively. Nawar (1979) reported values of 57.5 gm for total calories with 44 gm for sugar, 61.3 gm for total protein, and 293.4 gm for starch.

Dietary intakes were then studied according to landholding class, using the groupings: a) less than one feddan, b) 1-4 feddans, c) and greater than 4 feddans. Results are shown in Table 3. They indicate that the variation in consumption levels is not consistent with the variation in landholdings.

3. The Share of Nutrients in Energy Supply

The contributions of the three main energy sources are shown in Table 4. The data shows some differences in the share of carbohydrates (starch and sugar), lipids and protein in the total energy supply among the four villages. The percent of calories that are from lipids, protein and carbohydrates (starch and sugar) are 19.3 percent, 12 percent, and 68.7 percent, respectively. These values are in agreement with those reported by Francois (1968) and Perisse, et al. (1969), and other studies throughout the world. The developed countries, however, tend to derive more of their calories from fats (Table 4). In Britain, Passmore, et al. (1979) report values of 10.8 percent for protein, 38 percent for lipids, and 51.2 percent for carbohydrates.

In Egypt, Nawar (1979) reported values of 11.6 percent for protein, 24.1 percent for lipids, and 64.3 percent for carbohydrates. In this study, the percentage of calories derived from lipids differed slightly among three of the villages (20.8-21.9 percent), with Manshaat El Gamal being considerably lower at 11.9 percent. This was due to the low consumption level of lipids, from both plant and animal sources.

Consumption of the milk and meat groups, in general, was relatively low (Table 1). Consumption of milk and meat is required for good health for they are dietary sources of high quality protein. In addition, milk is a good source of calcium. Consumption of oil is needed to furnish the body with the essential fatty acids. These acids have a structural function in cell membranes and are substrates for biosynthesis of prostaglandins which play a regulatory role in many cellular processes. Furthermore, fats that are rich in unsaturated fatty acids are correlated with a decreased degree of atherosclerosis (Vergroensan, 1975).

It is generally advised that a balanced diet provide approximately 25-30 percent of the energy intake in the form of fat with at least 2 percent of the total as essential fatty acids.

Like lipids, the proportion of calories supplied by carbohydrates differed slightly among the villages with values ranging from 66.2 percent to 74.5 percent. This relatively high percentage of calories derived from carbohydrates is due to the relatively high consumption of sugar (Table 1).

Consumption of carbohydrate foods is important as they provide a filling material and are an economic source of energy. In addition, if dietary protein is to be used in the most economic way, it should be accompanied by carbohydrates in the same meal (Davidson and Passmore, 1975).

Carbohydrate is a more efficient fuel for muscular exercise than either protein or fat (Wohl and Goodhart, 1968). Carbohydrates are also needed for complete oxidation of lipids to prevent ketosis. One carboydrate, specifically glucose, is the principal source of fuel for the nervous system (Nawar, 1976). A starch diet has a lowering effect on plasma lipid, while a high sugar diet has a lipemic effect (Anter and Olson, 1965). The substitution of sugar for starch in a diet alters the blood lipids and it has been reported that the increased consumption of sucrose may have led to increased arteriosclerosis, diabetes, and is almost certainly an important cause of dental caries (Wohl and Goodhart, 1968). It has been recommended that the diet should contain carbohydrates that furnish from 50 percent to 65 percent of the caloric need of the human body.

The amount of calories derived from total protein ranged from 10.7 percent to 13.6 percent. The results are in agreement with those reported by Howe and Jansen (1964), Francois (1968), Perisse et al. (1969), and Nawar (1974 and 1979). As proteins are needed for growth and maintenance they should be present in the diet to furnish from 10 percent to 12 percent of the total caloric need. The data in Table 5 illustrates mean calories supplied by nutrients as percentages of total calories as compared to other studies reported by Perisse et al. (1969) and Nawar (1979).

The structure of the human diet is partly a function of income. However, each country's diet also differs in ways partly due to its history and dietary heritage. The consumption habits of the developed world should not necessarily be the goal for poorer countries. Passmore, et al. (1979) in Britain recommended that for a better diet 11.3 percent, 34.9 percent and 53.8 percent of total calories should be derived from protein, lipids, and carbohydrates, respectively. They advised people to reduce their consumption of fats, oils, and sugar. Increased consumption of visible fats has been associated with increased incidence of coronary heart disease as there is considerable, though not conclusive evidence that a high fat intake contributes to this disease.

Excessive intake of sucrose is not beneficial to the body either, as it provides the body with empty calories. In addition, it is believed that high intakes of sugar contribute to diabetes and coronary heart disease.

The distribution of households according to their intakes of calories and protein appear in Table 6. The results indicate that almost all households consume more energy and protein than necessary.

The distribution of households according to desirable sources of energy appears in Table 7. The data indicate that the majority of the people in the rice zone derive most of their calories from carbohydrates, with intakes above the desirable level, and only 25 percent of the households consume carbohydrates at a desirable level. Unlike carbohydrates, lipids are consumed by most of the households at a lower level than recommended. In the case of protein, the consumption of 55 percent of the households was at a desirable level and 41 percent consumed more protein than they needed.

4. Protein Quality and Consumption

Mankind faces numerous problems in providing enough food for the world's rapidly increasing population. In many developed countries the diets of most of the people are adequate in both quality and quantity. This is in contrast to conditions in developing countries where hunger and malnutrition are widespread.

Under the rubric of hunger and malnutrition, the greatest problem is that which results from inadequate protein in the diets of a large proportion of the population in the developing countries. This problem concerns the health and the efficiency of future generations because it affects infants and young children. Protein deficiency reduces growth rates and impairs health. There is evidence from studies of experimental animals and of man that shows that the basic biological processes of growth and development are adversely affected by protein and energy malnutrition.

It is important to study protein nutrition and find the factors that are involved. Information concerning dietary protein intake is needed. Although it is important to verify the quantity of protein, still greater importance must be attached to an evaluation of the quality of the protein.

Table 8 contains average daily intakes of protein in the four villages. Total protein intakes are fairly adequate as compared to amounts recommended by FAO/WHO (1973).

Animal protein consumption is not as low here as earlier studies have found. The average intake is 28 gm, which equals 26 percent of the total dietary protein. Nawar (1979) reported a value of 9.1 gm which equals 14.8 percent of the total dietary protein. In the United States, the mean daily intake of animal protein is 65.4 gm which equals 66.7 percent of the total dietary protein intake (ARS, 1969). How efficiently protein is utilized depends on both the quality and the quantity of the protein and the adequacy of the total diet as well as other physiological and environmental factors. Animal proteins are superior to plant proteins. In addition, animal proteins are the most available for absorption.

Although it is important to determine the quantity of protein, greater importance must be attached to an evaluation of the protein quality. For this reason, the protein quality has been scrutinized more closely herein. The method proposed by FAO/WHO in 1973 has been used for the evaluation.

The quality of the protein was estimated by comparing the amino acid content of the mixed dietary protein to the amino acid pattern of egg protein. The results of the comparisons expressed as scores for the four amino acids which are apt to be deficient are given in Table 9, in which the first and second limiting factors also appear.

The data reveal the most limiting amino acid is tryptophan, except in Kamha where it is lysine. The second is total sulphur amino acids, except in Kamha where tryptophan is second most limiting. These results are in agreement with results reported by Nawar (1979).

These scores, along with the consumption levels of protein, indicate that protein nutrition among the people needs more consideration. Low levels of dietary protein impair health and reduce bodily efficiency. Excess protein intake above body needs, however, is not stored, as is the case with some other nutrients. There is "a labile store" which does not exceed one percent of the body's protein. Such a small amount is not considered a store. Extra protein is used in energy production, a process which is wasteful both for physiological and economic reasons. First, this process requires more energy than it liberates. Hence, energy derived in this way from the protein is less efficiently used than energy derived directly from carbohydrates ingested as such. In addition, more work is needed to excrete extra nitrogen from high protein intakes which puts a strain on the kidneys. Secondly, most foods rich in protein are more expensive than foods rich in carbohydrates.

5. Iron Consumption and Absorption

Nutritional anemia is widely prevalent in many parts of the world, particularly in developing countries. Although many nutrients and cofactors are involved in the maintenance of a normal hemoglobin concentration, the most common cause of anemia is iron deficiency.

Studies have shown that anemia is associated with: a) an increased risk of maternal and fetal morbidity and mortality (Gatenby and Lillie, 1960),

b) anorexia resulting in a reduced food intake and the possible development of other deficiencies (Judisch, et al., 1966), c) affected bodily function (Dallman et al., 1967), d) increased susceptibility to infection (Elwood, 1970), and e) decreased working capacity (Cifuentes and Viteri, 1972).

Table 10 contains the average daily iron intake as contributed from the food groups. The total iron intake ranged from 37-40 mg in Manshaat El Gamal to 52.2 mg in El Arimon. Nawar (1979) reported an average of 16.1 mg/day in Abis, a new Egyptian village. When comparing the iron intake with recommended levels it was found that values were 290 percent, 260 percent, 207 percent, and 274 percent in El Arimon, Kamha, Manshaat El Gamal, and Shenou, respectively.

The high intake of iron might be due to the high consumption of legumes, whole grains and other foods rich in iron. In the United States, a study done by ARS (1969) showed that the iron intake was on average 167 percent of the recommended levels. There are also large differences in the sources of iron consumed for Egypt and the United States. The data in Table 10 show that in Egypt plant sources furnish from 94.67 percent to 96.94 percent with an average of 95.5 percent. Thus, animal sources contributed only 4.5 percent. In the United States it was 52 percent (ARS, 1969). Nawar (1979) reported a value of 6.6 percent in Abis, a value which is in agreement with that found in this study. This indicates that the ratio of iron furnished by plant to that from animal sources is 21.2:1 while in Abis it was 14:1; in the United States, 0.9:1.

It is not always easy to account for iron deficiency anemia in terms of inadequate iron intake. The wide difference in iron availability in foods may be a contributing factor to the high prevalence of anemia in many countries. In Venezuela, Layrisse (1968) reported that iron deficiency anemia is widespread, although iron intakes are high but almost entirely from vegetable sources. Nawar (1974 and 1979) found that iron intake in some Egyptian villages was fairly good but anemia was prevalent, especially among women and children. She suspected that this anemia might be due to parasitic infection and/or a lack of iron absorption.

As with all essential nutrients, adequate amounts of iron must be absorbed to maintain optimum body concentrations. The amount of iron which must be ingested to achieve the required daily absorption depends to a large extent on the type of diet. Heme iron in animal foods is much more readily absorbed than iron in vegetables and cereals. Absorption of nonheme iron is blocked by the presence of cereal phytates, phosphates, carbonates, and possibly by other substances common to nonanimal foods. Absorption is enhanced by the presence of ascorbic acid or of animal liver, or muscle from meat or fish (Moore, 1973; Martinez-Torres et al., 1974; Arlin, 1977; and INGAA, 1977). It has been reported that anemia is prevalent in hot climates where parasitic infestation is common and where diets are primarily of vegetable origin (Arlin, 1977). Thus, it is important to determine iron absorption.

Absorbable iron was calculated as described by Monsen et al. (1978). This method required the computation of five variables: total iron intake, heme and nonheme iron, ascorbic acid, and the levels of meat, poultry and fish consumption. On the basis of ascorbic acid concentration and the quantity of animal tissue, the meats were classified as low, medium, or high availability for nonheme iron. Low availability meals are those having less than 30 gm of animal tissue and less than 25 mg of ascorbic acid which decreases the availability of nonheme iron to 3 percent. Medium availability meals are meals having 30-90 gm animal tissues or having 25-75 mg of ascorbic acid which raises its availability to 5 percent. A meal having more than 90 gm animal tissues or 75 mg ascorbic acids, or 30-90 gm animal tissues plus 25-75 mg ascorbic acid is classified as a high availability meal with 8 percent absorption of nonheme iron. The absorption factor for heme iron is 23 percent as mentioned by Monson et al. (1978).

Table 11 shows that the percentage of absorbable iron ranges from 7.72 percent in Kamha to 8.22 percent in Shenou with an average of 8.07 percent, which is equivalent to 3.65 mg. Modern knowledge of the existence of two catagories of iron in foods, i.e., heme and nonheme compounds, and of dietary factors influencing their absorption makes it possible now to replace the previous estimate of an average of 10 percent absorption of dietary iron by a more precise concept. This concept provides a basis for increasing the availability of dietary iron through the selection of appropriate food components of individual meals. Application of this concept promises to improve the iron nutritional status of population groups in need of more iron or with excessive iron absorption (Monson et al., 1978). Therefore, it is recommended that the calculation of absorbable iron as illustrated be used in diet planning and in the evaluation of iron intake. This is a more appropriate method than the calculation of total iron availability which presumes that iron absorption is 10 percent as it depends on source and dietary composition.

In general, dietary surveys should have as adjuncts or be followed by studies of the nutritional and health status of the people. Studies concerning landless workers are also needed. Special consideration should be directed toward food subsidies.

In addition, nutrition education programs are needed to teach people why and how to choose a balanced diet that meets body needs using the available local resources. The utilization of food resources which may involve changing food habits can be achieved only by education of all the people. Furthermore, many malnutritional diseases whether over or under nutrition could be prevented if the people in general and women in particular knew how to make the best use of the available foods. Food prejudices and false beliefs are known to be impediments in the way of adequate nutrition.

Education is a powerful instrument of national development. By recognizing present and future environmental trends and population needs, education can be designed to transfer knowledge and encourage relevant behaviors required for the continuing health and progress of the society.

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Table 1: Mean Daily Consumption According to Food Groups (gm/person)

Village	Milk Group	Animal Protein Group	Legumes	Grain Product	Starchy Foods	Vegetables	Fruits	Sugar	Fat		
									Plant	Animal	Total
El Arimon	92	115	30	620	56	326	14	62	20	43	63
Kamha	109	188	26	842	69	318	74	45	27	11	38
Manshaat El Gamal	75	103	62	620	69	280	59	73	23	6	29
Shenou	80	221	43	865	73	393	452	66	29	25	54
Mean	89	156.75	40.25	736.75	66.75	324.25	149.75	61.50	25	21	46

Table 2: Individual Daily Intake and Pattern of Nutrient Consumption in the Four Villages.

Source	El Arimon	Kamha	Manshaat El-Gamal	Shenou	Mean
I. Energy					
Total intake (calories)	4,317	3,160	2,789	3,892	3,539
Percent of recommended level	144	105	93	130	118
II. Energy Producing Elements (gm)					
Total Lipids	102	77	37	90	76
Sugar	62	45	73	66	62
Total Protein	116	94	95	118	106
Starch	671	477	446	586	562
III. Pattern of Lipids (gm)					
a. Separated					
Animal	43	11	6	25	21
Plant	20	27	23	29	24
b. Unseparated	39	39	8	36	31
IV. Pattern of Protein (gm)					
Animal	24	30	25	34	28
Plant	92	64	70	84	78

Table 3. Individual Daily Intake and Pattern of Nutrient Consumption

Village	El Arimon			Kamha			Manshaat El Gamal			Shenou			Mean		
Size of Landholdings	1 feddan or less	1-4 feddan	>4 feddan	1 feddan or less	1-4 feddan	>4 feddan	1 feddan or less	1-4 feddan	>4 feddan	1 feddan or less	1-4 feddan	>4 feddan	1 feddan or less	1-4 feddan	>4 feddan
I. Energy (average)		4,317			3,160			2,789			3,892			3,539	
Total Intake (calories)	4,128	4,487	4,335	2,198	3,505	3,777	2,939	2,789	2,640	4,383	4,076	3,216	3,412	3,714	3,492
Percent of recommended level	106	115	111	56	90	97	75	72	68	112	105	82	87	95	89
II. Energy producing food corporate (gm)															
Protein (average)		114			105			110			118			112	
Protein	116	118	108	61	119	134	117	128	85	127	127	101	105	123	107
Lipids (average)		102			77			37			90			76	
Lipids	83	112	111	57	85	88	34	38	38	102	97	72	69	83	77
Carbohydrates (average)		1,087			965			701			988			936	
Carbohydrates	1,120	1,069	1,073	1,015	869	1,019	726	709	669	1,073	969	922	984	904	921
III. Protein Intake															
Plant (average)		97			66			30			85			83	
Plant	95	93	86	29	80	90	101	109	59	90	87	77	79	92	78
Animal (average)		23			38			20			34			79	
Animal	21	25	22	32	39	44	16	19	26	37	40	24	26	31	29

∧ = average

Table 4. Contribution of Main Energy Sources

Source	El Arimon		Kamha		Manshaat El Gamal		Shenou		Mean	
	Calories	Percent	Calories	Percent	Calories	Percent	Calories	Percent	Calories	Percent
Lipids	918	21.3	693	21.9	333	11.9	810	20.8	684	19.3
Protein	464	10.7	376	11.9	380	13.6	472	12.1	424	12.0
Sugar	248	5.7	180	5.7	292	10.5	264	6.8	180	5.1
Starch	2,687	62.3	1,911	60.5	1,784	64.0	2,346	60.3	2,251	63.6
Total	4,317	100	3,160	100	2,789	100	3,892	100	3,539	100

Table 5: Calories Provided by Nutrients as Percentages of Total Calories in Different Countries

Country	Total Calories	Separated Edible Lipids	Unseparated Lipids	Sugar	Plant Protein	Animal Protein
This Study	3,539	11.4	7.9	5.1	8.8	3.2
Abis. Egypt	2,112	14.4	9.1	8.1	9.9	1.7
United States	3,100	16.1	25.0	16.0	3.5	8.3
Germany	2,960	21.2	17.8	11.7	4.3	6.6
Kenya	2,118	9.0	14.4	5.6	8.9	4.7
India	1,977	6.3	6.5	2.9	9.5	1.1
Sudan	1,940	9.0	14.4	5.6	8.9	4.7

Table 6: Distribution of Families According to Adequacy of Nutrient Intake as Related to Requirements

Source	El Arimon		Kamha		Manshaat El Gamal		Shenou		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Energy	-	-	1	6.7	3	8.6	-	-	4	4
Less	-	-	-	-	-	-	-	-	-	-
Adequate	25	100	14	93.3	32	91.4	25	100	96	96
More										
Total	25	100	15	100	35	100	25	100	100	100
Protein										
Less	-	-	-	-	-	-	-	-	-	-
Adequate	-	-	-	-	-	-	-	-	-	-
More	25	100	15	100	35	100	25	100	100	100
Total	25	100	15	100	35	100	25	100	100	100

Table 7: Distribution of Families According to Percentages of Calories Derived from Major Nutrients as Related to Desirable Levels.

Source	El Arimon		Kamha		Hanshaat El' Gamal		Shenou		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Energy										
Below	2	8	4	26.7	2	5.7	-	-	8	8
Desirable	6	24	6	40.0	4	11.4	9	60	25	25
Above	17	68	5	33.3	29	82.3	16	40	67	67
Total	25	100	15	100	35	100	25	100	100	100
Protein										
Below	2	8	-	-	1	2.8	1	4	4	4
Desirable	22	88	3	20	15	42.0	15	60	55	55
Above	1	4	12	80	19	45.2	9	36	41	41
Total	25	100	15	100	35	100	25	100	100	100
Lipids										
Below	16	64	10	66.7	32	91.4	19	76	77	77
Desirable	8	32	3	20.0	2	5.7	6	24	19	19
Above	1	4	2	13.3	1	2.9	-	-	4	4
Total	25	100	15	100	35	100	25	100	100	100

Table 8: Daily Protein Intake (gm/person)

Protein Source	El Arimon		Kamha		Manshaat El Gamal		Shenou		Mean	
	gm	percent	gm	percent	gm	percent	gm	percent	gm	percent
Plant	92	79	64	68	70	74	84	71	78	74
Animal	24	21	30	32	25	26	34	29	28	26
Total	116	100	94	100	95	100	118	100	106	100

Table 9: Amino Acid Scores

Village	Amino Acid Score (percent) Lysine	Threonine	TSAA*	Tryptophan	Limiting Amino Acids First	Second
El Arimon	56	66	49	35	tryp	TSAA
Kamha	54	98	71	62	lys	tryp
Manshaat El Gamal	58	64	45	29	tryp	TSAA
Shenou	65	70	51	36	tryp	TSAA

*Total sulphur amino acids

Table 10: Dietary Iron Intake from Foods Eaten Daily Per Person

Village	Milk Group		Animal Protein Groups		Legumes		Grains		Vegetables		Fruits		Honey and Sweets		Total	
	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent
El Arimon	0.30	0.57	1.30	2.49	1.90	3.64	43.3	82.95	3.3	6.3	0.3	0.57	1.80	3.45	52.20	100
Kamha	0.50	1.07	2.00	4.26	1.10	2.34	39.7	84.64	2.5	5.3	0.3	0.63	0.90	1.91	46.90	100
Manshaat El Gamal	0.30	0.80	1.40	3.74	3.30	9.89	29.5	78.88	1.7	4.5	0.3	0.80	0.50	1.34	37.40	100
Shenou	0.30	0.60	2.20	4.45	2.70	5.47	39.0	78.95	4.1	8.3	0.4	0.81	0.70	1.42	49.40	100
Mean	0.35	0.76	1.73	3.75	2.35	3.97	37.8	81.36	2.9	6.13	0.33	0.70	0.98	2.03	46.48	100

Table 11: Absorbable Iron From Individual Daily meals in the Rice Zone

	Iron Intake						Iron Absorbed						
	Heme		Nonheme		Total		Heme		Nonheme		Total		Absorption
Village	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent	mg	percent	percent
El Arimon	0.52	1.0	51.7	99.0	52.2	100	0.12	2.8	4.13	97.2	4.25	100	8.14
Kamha	0.68	1.5	43.2	98.5	46.9	100	0.16	4.4	3.46	95.6	3.62	100	7.72
Manshaat El Gamal	0.48	1.3	36.9	98.7	37.4	100	0.11	3.6	2.95	96.4	3.06	100	8.18
Shenou	0.76	1.5	48.6	98.5	49.4	100	0.17	4.2	3.89	95.8	4.06	100	8.22
Mean	0.61	1.33	45.1	98.68	46.48	100	0.14	3.75	3.61	96.25	3.75	100	8.07

SOURCES OF FOOD SUPPLY AND CONSUMPTION PATTERNS IN RURAL AREAS

by

Amin I. Abdou

Sources of Food Supply and Consumption Patterns in Rural Areas

ABSTRACT

Economic factors influencing food demand, mainly prices and income, were less effective than patterns and magnitude of production in affecting levels of consumption in rural areas. Patterns of production, although leading to intraregional variations, acted in combination with food rations, to effect a great deal of equity among households of landholders with different farm sizes. On the other hand, most of the consumers of animal products were producers relying on their own production. Consequently, encouragement of animal production by all possible means may be an effective measure for the improvement of animal protein intake in rural areas.

Introduction

Food to meet the requirements of the rural population is obtained from different sources. In addition to purchases from the local markets, there are rationed products from government stores and products produced on households' owned or leased land. Food consumption patterns are expected to reflect the different characteristics of the variant food sources.

The market in Egypt is characterized by subsidized prices for some of the most necessary food items in short supply, and free prices determined by the forces of demand and supply for others. Food rationing involves highly subsidized prices and fixed quotas. On the other hand, consumption of self-produced farm foods involves only production and home processing costs, at most. Hence, farm produced foods are expected to be cheaper than purchased foods, unless the latter are highly subsidized. Consumption of their own produce is commonly practiced among Egyptian fellahin, especially small landholders who are producing principally for subsistence. Consequently, consumption of products produced on their own farms was expected to reflect the prevailing cropping patterns in different agronomic zones.

This study is concerned with the impact of various food sources, among other influential factors, in determining prevailing food consumption levels and patterns. The relevant data base consists of different foods consumed in August and October 1981 by selected households surveyed in ten Egyptian villages.

Consumption of the Farmers Own Produce and Production Patterns

As shown in Table 1, relatively high consumption levels were, on average, observed for major foods produced in the different agronomic zones. The following item-wise presentation details the findings.

Rice

On average, per capita consumption of rice reached 10 kg/month where consumption from farmers' own production comprised about 93 percent of total rice consumption in village 1-4 in the rice zone. The corresponding estimates were about 9 kg/month in village 1-3 which relied entirely on farm production. Despite the relatively low per capita consumption level for village 1-2, monthly comparisons showed that per capita consumption in August (1.5 kg) was a third of that in October (4.5 kg) as the consumption from their own crop percentage rose from nil to about 91 percent. Similarly, per capita consumption in village 3-1 in the vegetable zone doubled in October as consumption from villagers' own crops increased from 17 percent to 72 percent, on average. Such results also reflect the production pattern's impact. On the other hand, abundant supply in local markets, mostly due to prevalent production sharing on more than 54 percent of total cultivated land in village 1-6, may explain the high per capita consumption despite the relatively low percentage consumed from villagers' own crops. Additionally, comparison with villages in Upper-Egypt (4-9 and 5-10) where rice production is nonexistent, as shown in Table 1, reveals the wide differences in per capita consumption and emphasizes the effect of production patterns.

Wheat

Wheat has been released from compulsory delivery in the last few years and the entire yield is freely marketed. In addition, wheat straw and even wheat grain is being widely introduced into animal feed. Therefore, farmers exhibit a growing tendency toward selling their entire production and purchasing their bread and flour requirements at subsidized prices. To cite empirical evidence, the percentage of consumption from the villagers' own crops in village 2-5 was about 8 percent in August 1981, whereas it was found to have been 75 percent in a survey undertaken in 1977. In view of these factors, wheat production appeared to have no apparent influence on consumption levels.

Maize

As is apparent from Table 1, the highest per capita consumption levels were found in villages 2-5, 3-7, 3-8, and 4-9, where averages were not less than 6 kg per month. The very same villages were distinguished by the highest proportion of land devoted to maize production. On the contrary, the lowest average per capita consumption was found in village 1-1 which also was characterized by the lowest proportion of land devoted to maize; and the highest consumption levels in the rice zone were in villages 1-3 and 1-4 where consumption from the villagers' own crops virtually accounted for total consumption. Per capita consumption in village 4-9, on average, was found to have increased from about 9.1 kg/month in August to about 16.2 kg/month in October as reliance on the villagers' own production rose from 27 percent to 83 percent.

Vegetables

Comparison among agronomic zones revealed the superiority of the vegetable and fruit zone, zone 3, on average, in regard to per capita consumption of summer and nili vegetables. Per capita consumption was 6.1 kg/month for zone 3 as opposed to 4.0 kg/month for the others. On the other hand, village 1-2 was characterized by relatively high consumption of vegetables compared to other villages in zone 1, as opposed to village 2-6, where vegetable consumption was almost nil during the two months of the study. These findings may be due to the relatively high percentage of the total cropped area devoted to vegetables in the first village, and the almost nonexistent percentage in the other. The relatively sizable production of such perishable foods would doubtlessly enrich the local village market lowering prices and encouraging high consumption despite total reliance on the market, the case in village 1-2.

Additionally, per capita consumption of broad beans exceeded 1.1 kg/month in village 1-2 where consumption from the villagers' own crop percentage reached 71 percent, while the general average for all villages was about 0.57 kg/month with only 11 percent consumed from villagers' own crops.

Dairy Products

The highest percentage of consumption of the farmers' own products has always been that of dairy products. In this data set it accounted for 86 percent for whole milk and 66 percent for Kareesh cheese. Production has been a major factor influencing level of consumption. Comparing the consumption level in village 1-1 where total reliance on the market was the the case, with that of other surveyed villages emphasizes this argument. Per capita consumption of milk, as shown in Table 1 in village 1-1 was about one-fourth the overall average for the villages surveyed, and per capita consumption of Kareesh was about 59 percent.

Except for village 5-10, only slight differences in the stock of livestock assets were apparent among the surveyed villages, on average, and hence the impact of the size of the stock of livestock assets seemed to be almost nonexistent. Additionally, most of the surveyed farms were small and hence sold most of their produce. Consequently, consumption from their own farm products was only a very small portion of total production, and hence differences were almost negligible. Parenthetically producing milk and not having to rely on the market has apparently worked against the poor food habit, generally prevalent in Egypt, of reluctantly consuming dairy products in the form of milk.

Poultry and Eggs

As shown in Table 1, about 57 percent of total poultry consumption was supplied from farm production, and average per capita consumption was about 0.58 kg/month which was almost double the corresponding national figure (1977). Similarly, egg consumption from villagers' own production was almost 64 percent of total consumption, and per capita consumption was around

0.23 kg/month versus 0.13 kg/month at the national level (1977). Accordingly, one might conclude that reliance on products from villagers' own farms up to some level positively affects consumption levels. However, exceptional cases may exist such as that of village 2-5 where per capita consumption of poultry was the highest and the consumption from their own flocks' share the lowest.

Comparison between average per capita consumption of poultry and eggs for village 1-2 and corresponding estimates for other surveyed villages reveals the impact of the size of the poultry operation, providing there is a high degree of reliance on farm production. For example, per capita consumption of both poultry meat and eggs in village 1-2 was about four times the corresponding estimate for village 1-4 where the per capita share of poultry raising was one-seventh the level for the first village.

Arguments might be raised regarding the village averages of livestock assets being indirect indicators of the magnitude of supply in local markets, influencing purchases through the market mechanism. However, combining both concepts--livestock assets and the consumption from the farmers' own production percentages--may emphasize the influence of farm produced animal products upon consumption levels.

Food Sources and Farm Size Impact

The data indicated a higher degree of dependence on farm production on the part of larger landholding classes in general. The highest proportion of interviewed households relying on markets, partially or entirely, were those of small landholders. An explanation may invoke the tendency of small farmers to sell most of their production, if not all, and to purchase their limited requirements. On the other hand, holders of larger farms are in better economic circumstances enabling them to keep a considerable amount of their production for consumption, especially their animal products. On the whole, observations of per capita consumption were fairly consistent. This may be the result of the impact of off-farm income earned by some of the interviewed small producers.

In general, as shown in Table 2, reliance on farm produced foods, especially vegetables, was found to curb consumption level variability among farm size classes. This is because small, as well as large, producers do not bear direct costs when consuming their own-produced foods. However, some cases revealed substantial variability in per capita consumption of animal products correlated with equal variability in holdings of livestock assets.

Food rationing, especially for sugar and vegetable oil, tends to enforce a great deal of equity among different farm size classes. Accordingly, quantities consumed of rationed items characterized by the highest degree of consistency among all food items.

Detailed discussion of different basic foods may shed more light on the argument presented previously.

Rice

It may be assumed that small producers sell their entire rice production and purchase their consumption needs at subsidized prices, while large producers make use of the village facility to grind their rice before selling some and keeping a considerable portion for home consumption. That might explain the low consumption from their own production percentage for holders of less than one feddan (46 percent) in village 1-2, while the corresponding estimate for holders of 4-5 feddans was as much as 100 percent and per capita consumption was almost double that of villages in 1-2. For other villages where a high percentage of consumption from the farmer's own produce or animal products occurred on the part of small landholders as well, differences were insignificant, even at times contradicting economic logic.

Maize

Data showed that consumption of maize is also characterized by a pattern of higher reliance on farm production for relatively large landholders. Since it is a cereal product, a low income elasticity of demand was expected for maize, and since farm size may be regarded as an indicator of income, variation in consumption levels between different farm size classes was expected to be slight. Moreover, dependence on farm production, as indicated in Table 2, seemed to strengthen the tendency toward consistency among the different farm size classes.

Vegetables and Fruits

As in the case of maize, only slight or moderate variations in consumption levels of fruit and vegetables were apparent in the vegetable zone, (zone 3). An analogous conclusion holds for village 4-9 in Upper-Egypt despite the generally low consumption level in that village.

Dairy Products

The impact of farm production was clearly revealed in the case of dairy products. There were drastic variations in milk consumption between the very few households depending on markets, as shown in Table 2, and insignificant differences among the largest proportion relying on farm production. Exceptions were detected for cases where wide variations in livestock asset holdings led to equal variations in quantities consumed. Examples of these cases are provided by observations in villages 2-5 and 2-6 where the per capita share of livestock assets for holders of more than five feddans was almost three times the corresponding estimate for holders of less than one feddan and the farmer's per capita consumption of milk was almost double. On the other hand, the consumption level of Kareesh, a principal food in rural areas, was highly consistent among different farm size classes, Kareesh was farm produced in most cases.

Poultry

Considerable differences in consumption levels among landholding classes were detected for the very few poultry consumers depending on markets, a result possibly explained by differences in purchasing power. A completely different situation prevailed for poultry producers as a whole. Consumption level variations were negligible since scales of poultry raising were, on average, almost the same. However, a relatively wide dispersion occurred within classes of small landholders, strongly related to an equal dispersion in scales of poultry raising, especially in village 1-3.

Egg consumption was also characterized by substantial differences for those relying on markets. However, despite the differences in scales of poultry raising only insignificant variations in consumption levels were observed, which might have been the result of the generally low level of consumption.

Rationing Impact

As mentioned previously, food rationing represents the major factor offsetting the impact of other factors leading to variability in consumption levels among different income classes, or landholding classes, since landholdings are a proxy for income. Accordingly, consumption levels of vegetable oils, tea, and sugar, all subject to food rationing, were characterized by the highest degree of similarity among all the sample observations. Other foods of minor importance in food rationing like broad beans and lentils, logically showed a higher degree of variability. Such results may be deduced from Table 3 through estimation of variance coefficients (sd/x x 100), which were apparently inversely correlated with the percentage share of rations in total consumption of certain foods. As an example, the highest variance coefficient for cottonseed oil consumption reached 50 percent for village 2-5 in August, where the share of rations was at a minimum (31.0 percent), while the variance coefficient reached 280 percent for lentil consumption in village 3-7 in August, when the share of rations dropped to nil.

Summary and Conclusions

Consumption patterns in different regions of Egypt, which are predominantly rural, are heterogeneous. Food patterns and habits differ from one region to another and are mainly associated with availability which is mainly determined by production patterns. Accordingly, delineating food problems and pinpointing shortages should be based on intra- and interregional investigations considering the existent heterogeneity.

It was also found that economic factors underlying demand, mainly prices and income, are not the most dominating determinants of consumption levels in rural areas. Patterns and magnitude of production are often more influential. The proportion of villagers' own products consumed have, in fact, noticeably diminished in the last few years for some products subject to price subsidies. Farmers purchase their requirements and devote larger portions of their produce to the feeding of animals. Nevertheless, farm produced food, although leading to intraregional variations in consumption levels in combination with food rationing, makes for a great deal of equity among landholders with different farm sizes. This situation is different from that prevailing in urban areas when the differences in quantities of various foods consumed between the lower and upper income classes is wide.

It appears that even though farmers producing animal products have a high propensity to sell most of their production and keep little for their own consumption, they constitute the majority of animal products' consumers. Nonproducers hardly consume any quantities of such products. In view of these findings, it may be concluded that an increase in consumption levels of foods of animal origin in rural regions, and hence, the alleviation of the shortfall in the per capita intake of high quality protein, can be achieved through encouragement of livestock production using methods such as extending credit to small producers, and, most of all, devoting more effort to effectively allaying the animal feed shortage crisis.

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SOURCES OF FOOD SUPPLY AND CONSUMPTION PATTERNS IN RURAL AREAS

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Table 1. Per Capita Consumption of Some Major Foods Related to Cropping Patterns and Livestock Holdings 1980-81 (kg/month)

illage p.	Rice			Maize (Flour)			Summer and Nili Vegetables			Milk		Kareesh		Per Capita Share of Cattle and Buffaloes (head)	Poultry		Eggs		Per Capita Share of Poultry Raising
	Per Capita	Auto-Consumed	Total Cultivated Area	Per Capita	Auto-Consumed	Total Cultivated Area	Per Capita	Auto-Consumed	Total Cultivated Area	Per Capita	Auto-Consumed	Per Capital	Auto-Consumed		Per Capita	Auto-Consumed	Per Capita	Auto-Consumed	
		---------percent---------			---------percent---------			---------percent---------			--percent--		--percent--			--percent--		--percent--	
1-1	9.6	15.8	54.4	0.9	6.7	2.0	5.4	5.3	2.0	0.2	0	0.4	0	0.19	0.7	24.2	0.1	31.4	0.8
1-2	3.0	68.0	47.5	2.4	87.8	27.9	8.2	0	17.2	0.6	100.0	1.4	100.0	0.22	0.8	85.6	0.4	80.8	7.7
1-3	9.1	100.0	38.5	5.2	100.0	29.7	4.4	15.6	1.1	0.4	91.2	0.5	91.2	0.21	0.4	78.0	0.2	96.2	1.6
1-4	10.1	93.3	54.5	6.1	91.5	18.0	4.7	10.8	0.5	0.2	100.0	0.3	92.9	0.27	0.2	95.4	0.1	91.1	1.1
2-5	2.4	0	0	8.5	92.5	60.9	2.7	31.5	10.2	1.6	92.7	1.9	63.0	0.27	1.2	9.7	0.3	43.6	—*
2-6	1.6	56.9	37.0	3.6	33.0	32.7	0	0	0.7	0.1	78.6	0.7	65.5	0.30	0.4	98.3	0.4	88.4	2.5
3-7	2.1	53.1	12.4	8.3	28.8	68.8	7.3	12.1	7.5	0.4	100.0	0.4	100.0	0.18	0.8	95.0	0.2	87.0	2.6
3-8	2.6	0	0	6.1	82.5	100.0	5.4	37.8	42.7	2.1	82.5	0.7	49.0	0.13	0.7	43.0	0.4	26.0	—
4-9	1.0	0	0	12.9	62.3	68.5	0.7	49.6	10.4	1.0	98.5	1.0	63.7	0.20	0.6	49.4	0.2	70.6	1.6
5-10	0.4	0	0	0	0	26.0	0.5	4.0	5.6	1.3	95.1	0.6	77.5	1.70	0.4	74.2	0.2	90.4	0.8
verage	4.5	33.0	31.1	5.7	62.5	37.5	4.5	12.0	8.6	0.8	86.4	0.7	66.3	0.21	0.6	56.8	0.23	63.9	1.8

— missing information.

Table 2. Per Capita Consumption of Some Major Foods Related to Supply Sources (kg/month)*

Village No.	Farm Size (fed.)	Rice			Maize		Milk (whole)			Poultry		
		Produced	Mixed	Market	Produced	Market	Produced	Mixed	Market	Produced	Mixed	Market
1-1	<2	—**	—	7.9	--	0.5	--	--	--	0.7	—	0.4
	4<	11.7	--	10.6	--	1.1	—	--	--	0.7	1.0	0.7
1-2	<2	3.1	5.0	1.4	5.1	0.8	0.5	--	--	0.4	—	0.4
	4<	3.5	—	—	6.6	0	0.6	--	--	1.0	—	0.8
1-3	<2	15.9	—	--	5.0	—	0.4	—	0.2	0.4	—	0.2
	4<	9.2	—	--	5.3	--	0.4	0.1	—	0.4	0.7	0._
1-4	<2	9.4	8.5	8.3	5.3	4.6	0.6	—	0	0.3	—	0.1
	4<	10.8	—	—	6.5	--	0.4	--	0	0.3	—	0
2-5	<2	—	—	2.4	9.4	6.2	2.0	—	0.3	—	1.8	1.1
	4<	—	—	2.8	7.3	0	3.3	—	4.0	2.0	—	0.9
2-6	<2	1.8	2.5	1.5	2.7	3.3	0.3	—	0.04	0.6	—	0.1
	4<	1.8	—	8.0	3.6	2.7	0.6	--	0.04	0.8	—	--
3-7	<2	3.0	—	1.78	6.3	7.9	3.0	—	0	0.8	—	1.1
	4-5	2.7	—	1.4	6.0	10.0	0.6	--	—	0.9	—	--
3-8	<2	—	—	2.4	6.1	0.6	3.8	—	0.5	1.1	0.9	0.6
	4<	—	—	3.2	8.5	8.0	4.1	2.3	1.6	0.4	1.7	1.3
4-9	<2	—	--	0.9	19.3	9.9	2.0	—	0	0.4	0.8	0.5
	4<	—	--	1.0	14.4	11.0	2.0	—	—	0.4	0.6	0.6
5-10	<2	—	—	0.4	—	—	1.7	—	0.1	0.5	—	0.1
	4<	—	—	0.5	—	—	1.2	—	1.0	0.5	—	0.4

*Average for two months (August to October).

**No observations fall in category.

Table 3. Per Capital Consumption of Major Rationed Items Related to Rationed Proportions (kg/month)

Village No.	Month	Sugar			Tea			Cottonseed Oil			Broad Bean			Lentils		
		$\overline{X}$	Sd	Rations Percent	$\overline{X}$	Sd	Rations Percent	$\overline{X}$	Sd	Rations Percent	$\overline{X}$	Sd	Rations Percent	$\overline{X}$	Sd	Rations Percent
1-1	Aug.	1.9	.30	39.6	.10	.02	39.6	.57	.17	36.5	1.3	.67	0	.39	.36	0
	Oct.	2.0	.36	38.5	.10	.02	47.0	.55	.20	34.4	1.1	.49	0	.38	.23	0
1-2	Aug.	1.2	.04	62.8	.13	.04	63.0	.30	0	100.0	0	0	0	.16	.10	51.[illegible]
	Oct.	1.8	.30	42.1	.21	.05	38.4	.30	0	100.0	0	0	0	0	0	0
1-3	Aug.	1.5	.08	100.0	.08	0	100.0	.33	.13	74.9	.13	.23	27.7	.35	.16	33.[illegible]
	Oct.	1.6	.12	96.1	.08	.02	66.8	.49	.09	59.9	.09	.12	33.7	.32	.11	36.[illegible]
1-4	Aug.	1.5	.10	97.9	.08	0	100.0	.30	0	100.0	0	.16	36.9	.34	.18	41.7
	Oct.	1.5	0	100.0	.08	0	100.0	.30	0	100.0	0	.17	36.3	.32	.11	53.3
2-5	Aug.	1.8	.85	40.5	.16	.15	23.8	.46	.23	31.0	.23	.31	0	.24	.26	0
	Oct.	2.1	1.81	69.8	.11	.09	66.7	.52	.38	54.0	.38	.53	30.5	.24	.26	27.3
2-6	Aug.	1.9	.35	40.5	.10	.02	40.2	.32	.23	46.3	.12	.15	27.7	.16	.10	0
	Oct.	1.6	.15	49.2	.06	.01	68.1	.24	.08	63.5	.08	.12	0	.14	.07	0
3-7	Aug.	1.7	.30	43.3	.18	.04	42.6	.35	.08	86.5	.08	.41	0	.05	.14	0
	Oct.	1.7	.35	44.5	.28	.08	28.9	.30	.05	100.0	.05	.25	0	.60	.13	16.5
3-8	Aug.	1.8	.99	49.7	.08	.01	98.0	.63	.36	61.4	.36	.30	2.8	.38	.65	3.1
	Oct.	1.6	.59	51.9	.07	.02	100.0	.43	.16	68.4	.16	.17	0	.31	.22	0
4-9	Aug.	2.3	.62	68.3	.10	.02	89.7	.34	.12	89.5	.12	.35	25.5	.28	.23	44.[illegible]
	Oct.	2.2	.50	65.5	.10	.03	82.3	.35	.17	87.0	.17	.32	31.5	.35	.18	40.8
5-10	Aug.	1.5	.43	46.2	.08	.03	76.2	.31	.12	43.6	.12	.78	0	.21	.35	18.2
	Oct.	1.8	.68	73.4	.10	.05	71.8	.34	.16	76.9	.16	.44	0	.27	.24	46.4

IMPACT OF SMALL SCALE POULTRY FARMS ON THE NUTRITIONAL STATUS OF INHABITANTS: A CASE STUDY

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INTRODUCTION

In Egypt, animal protein provides an average of 13.0 grams per capita per day and this represents 17 percent of the total protein consumed, an amount far lower than that recommended by the International agencies. The intake of an "average" Egyptian person can be subdivided as follows:

Livestock and Poultry	5 gram/day
Milk and Dairy Products	4 gram/day
Eggs	1 gram/day
Fish	3 gram/day.

These average values were calculated using simple arithmetic and do not represent reality for low income families in urban areas. The situation is even more serious in rural areas where low incomes and the high cost of animal protein sources make for a large body of inhabitants who hardly have any animal protein in their diets.

MAJOR CONSTRAINTS

It has been anticipated that by the year 2000 the population of Egypt may reach 70 million if birth control measures are maintained within present limits. This of course is a serious situation which needs special consideration on all our parts. It appears that doubling production is a requirement if we want to keep the intake of an "average" Egyptian person on the aforementioned level in the year 2000.

Returning to the simple statistics we may notice that the total Egyptian population is estimated to be about 40 million (with an annual growth rate of 2.2 percent) of which over 20 million dwell in rural areas. The total area of cultivated land is estimated to be close to 6 million feddans (acres) or 10 million cropped feddans, due to double cropping. The ratio of people to agricultural land is 6 persons per feddan or 3.6 per crop feddan. The percentage of the rural population to the total population has been decreasing steadily during the preceding decades falling from 76 percent in 1937 to 55 percent in 1974 due to the emigration of rural people to urban centers. They are emitted by the low level of income and poor living conditions in the village and attracted by better opportunities for employment, higher incomes and the usual inducements of city life.

OPPORTUNITY

In the final analysis, food supply lags behind demand because of the collective effect of countless isolated decisions by families and government. The elements required to close the gap between supply and demand are relatively simple to describe. Yet their implications for the policies of the nation can be most troublesome. Until population growth is slowed, the supply demand gap in Egypt's food can only be closed by focusing on what is, and what can be, made available for people to eat.

The first need is to place increased on food output into the context of overall development.

The prosperity of the population who engage in agriculture is a major requirement if there is to be total national economic well-being.

Growth in agricultural output is essentially derived from four sources:

- extension of the land frontier by opening raw land to farming or grazing;
- improved efficiency in farm operations;
- intensification of the use of traditional farm inputs by adding one or more units of each, and
- the use of inputs singly or in combination with traditional production factors in a new technical relationship.

To put food production into perspective, it is necessary to first look at the whole problem of development.

The development problem for most of the world's nations is how best to accomplish a transformation from a stage where a national economic product is derived primarily from the practice of traditional agrarianism to the stage where output is generated from the use of modern science-based technologies. Technological change needs to be limited in scope and nature and better tailored to the self-determined requirements of the society.

In Egypt most of the efforts to increase animal protein consumption in the past depended alomst exclusively on the government and huge enterprises which held a great deal of control over the factors of production (capital, labor, land). There were efforts to disseminate new agricultural technology through Community development and agricultural extension programs, but the small scale farm sector was not a beneficiary of the new technologies that were introduced, and the beneficiaries continued to be those producers holding the greatest control over the factors of production.

The major factors which restrict the use of existing resources and new technologies by small farmers who could contribute to the nation's animal protein output appear to be:

- limited funds available to farmers;
- low productivity of native breeds;
- problems with management and husbandry;
- lack of a solid data base for actual production, and
- the economics and composition of production.

THE PROJECT

A striking example of how to increase the capacity of the small farm sector is the program now being undertaken by the National Research Center, titled "More and Better Food." The program is a large ambitious diffused activity. Consequently it offers opportunity for many varied activities. The program personnel realized that the achievement of early success necessitated the program place its efforts on problems which could be solved quickly and whose solution would have a high probability of adoption by farmers and consumers.

We realized that it was very important, if the program was to operate effectively, to:

1. coordinate with government agencies and responsible organizations and individuals, <u>including those on the village and farm level</u>;
2. maximum local-level participation and education;
3. build on existing data to the maximum extent, and accord with local Egyptian crops, food habits and customs, i.e., attempt to achieve significant improvements in food quantity and quality <u>while building</u> on the concept of <u>minimal change</u>.

ROLE OF POULTRY INDUSTRY

The poultry industry expanded very rapidly during the last ten years largely because of a complete and fundamental change in viewpoint. Yet, its contribution to the food chain of the nation could be more effective if we could involve the small farm sector (where 98 percent of land owners owned from less than .5 to 5 feddans) in the production operation. The rationale were simply that small farms through small scale operations can reduce cost, make a significant contribution to animal protein production and provide a decent living for the producers.

We believe that the efficiencies of large-scale, fossil fuel, capital-intensive poultry farms have been garnered without regard for the loss of jobs, damage to the environment and added cost of the commodity produced. In reality big agribusiness has been subsidized.

Small farmers now tend to keep chickens as a sideline for some incidental profit and/or for family use on certain occasions. According to recent statistics, the total number of local chickens kept by small farmers is 26.986 million chickens (statistical yearbook, 1979), the size of flocks averaging from 5 to 20 chickens. Such small flocks are raised under the worst conditions that poultry can stand. There are no modern feeding practices, vaccination programs or brooding systems.

The project started its activities in two villages selected to represent the old rural communities and the new settlements in the Menoufia and Beheira governorates. These were microcosms for the implementation of the project. Base line data relevant to production, socio-economic, health and nutritional factors limiting the adoption of new technology in rural societies has been collected since 1978. A considerable part deals with poultry production by small farmers.

METHODOLOGY

The data collected on poultry production in the two villages were presented to villagers and representatives of governmental agencies for possible interpretations. As a consequence of the strategy set in motion by the project it was possible to gather the following information:

- total number of chickens, on the village level;
- size of flocks;
- feeding status of the poultry;
- diseases and parasites, and the
- marketing mechanism.

A questionnaire was designed to determine the ability of families to join the project's activity for developing small scale broiler units.

Following the administration of the questionnaire, a model unit was designed to confine 100-200 chickens. The confinement area was equipped with hung feeders, a specially designed gas stove which could be used for heating and lighting and semi-automatic drinking vessels.

Intensive training programs on feed formulation using concentrated premixes plus corn and other available home produced plant proteins were carried out. Training programs on vaccination, management and husbandry were also held.

The developed model was tested by ten farmers before further modification.

The cost for one day-old chicks and feed was borne by the farmers while the cost of setting up the confinement area and the equipment was covered by a loan provided by the cooperative. The loan was to be repaid within one year, with a grace period of 3 months.

EVALUATION

Due to the fact that the final goal of the "More and Better Food" program is to improve the nutritional status of rural societies, the evaluation had two main concerns:

a) the degree of success of the program, and

b) the impact of the project on the nutritional status of the farmers.

The first part of the evaluation was undertaken using the following parameters:

1. from the managerial viewpoint:

   general health of the poultry;

   mortality rate;

   weekly growth rate;

   marketing weight;

   marketing date;

   feed consumption;

2. from the standpoint of project implementation:

   the number of poultry raised on village level before starting the program;

   number of poultry after test;

   number of units on village level, and

   technoeconomic evaluation.

The second evaluation was done by counting the total kilograms of meat produced and dividing it by number of inhabitants to find the "global" impact. Records of actual sales and actual chickens kept for family use were termed "family impact."

PROJECT IMPACT

The project had different impacts. For the purpose of this article they are divided into those that affected the teams working on the project, and those that affected the beneficiaries.

On project teams: The interaction of the research team and the farmers showed that precise understanding of the biophysical environment as well as the production systems and the farmers' constraints could lead to viable combinations of new or modified processes to increase poultry production.

During one year the program comprised 70 units producing 7,000 chicks per rotation in Omar Makram and 40 units producing 4,000 chicks per rotation in Kafr El-Khadra. Every unit has 5 rotations per year.

The overall program was highly appreciated by all participants, and the official agencies. However, the future goal is to provide a chick per person per month.

During the implementation period, complete records were kept concerning the traits of the flocks (Table 1).

We have now reached a stage where necessary steps are under way to establish a cooperative for the development of animal and poultry production on the village level. The cooperative's function will be to provide finance, marketing facilities and technical advice with the help of the project team.

Table 1

Number of Units	Total Number of Chicks	Average Mortality Rate (Percent)		Average Marketing Weight Kg.		Average Market Price L.E./Kg.	Total Poultry Meat Production (12 month) (Kg.)
		Summer	Winter	Summer	Winter		
<u>Omar</u> <u>Makram</u>							
Before Project: 0	17,500	16	10	1.1	1.1	1.15	14,700
After Project: 70	37,000	2	1	1.350	1.670	1.1	54,667
<u>Kafr</u> <u>El-Khadra</u>							
Before Project: 0	5,000	7	7	1.250	1.250	0.85	5,812
After Project: 40	20,000	1.5	0.1	1.450	1.700	1.1	32,000

THE IMPACT OF THE PROJECT ON NUTRITIONAL STATUS

The total number of chickens raised on the village level was 37,000 chickens for Omar Makram and 20,000 for Kafr El-Khadra. The total quantity of poultry meat produced annually was 54,667 and 32,000 kilograms live body weight for Omar Makram and Kafr El-Khadra, respectively. Taking the number of inhabitants of the villages as 4,860 for Omar Makram and 5,630 for Kafr El-Khadra, it may be assumed that per capita quantities would be 11.25 kg and 3.6 kg annually for Omar Makram and Kafr El-Khadra, respectively.

These figures can be applied to estimate the global impact disregarding the socio-economic features of the villages. The adoption of the model had a strong impact on development and had an obvious role in increasing output and improving nutritional status.

To determine the impact of the project on the nutritional status of the producers themselves, the number of chickens sold in the local market were recorded, and the rest kept by the family for their own use were all weighed for a period of one year.

The most amazing thing was that a producer, on average, is not keeping or using more than two chickens for his family from every rotation. This means that one family (5 person on average) is consuming 10 chickens annually. Assuming the average body weight of a chicken was 1.6 kg and the carcass percentage 70 percent, the total kilograms used per family was 11.2 kg. The quantity consumed per capita per year was 2.24 kg. This caused some frustration among members of the project team, who were expecting to obtain a higher impact rate. In an effort to find the reasons behind this finding several workshops were held. It seems producers prefer to translate their production efforts into money rather than food for their families. They need the money to improve their living status.

TECHNOECONOMIC EVALUTION OF THE PROJECT

The technoeconomic evaluation of this project is based on real figures extracted from the results obtained. The degree to which this program could be economically evaluated is primarily a function of:

- equipment and investment cost;
- expected life of the equipment;
- pay-back period;
- interest rate, and
- operating costs.

The figures for the units established in the two villages were as follows:

A. Initial Investment (L.E.)

Land (10.0m^2)	50
Equipment for production	73
Auxiliary equipment	7
Fixed capital	100
TOTAL	230.0

B. Annual Operating Costs/Returns Analysis (L.E.)

a. Costs

Price of chickens (five rotations)	160
Price of feed (five rotations)	270
Price of fuel	5
Maintenance	5
Transportation	5
Veterinary (0.02 L.E. x 500 chickens)	10
Salaries	—
TOTAL	450

b. Returns

500 chickens x 2 percent mortality x 1.5 kg. weight x

1.1 L.E.	= 808.5
$1.2m^3$ poultry manure x 5 rotations x 6 L.E.	= 36.0
TOTAL	844.5

C. Profit

(b - a)	394.5
D. Benefit/Cost Ratio	1.9

E. Pay-back Period

For Total Initial Investment = 0.58/year.

CONCLUSION

In conclusion the development problem for most of the world's nations is how best to accomplish a transformation from a stage where a national economic product is derived primarily from the practice of traditional Agrarianism to the stage where output is generated from the use of modern science-based technologies.

The course of technical change should be limited in scope and nature and be better tailored to the requirements of the self-determined needs of the society.

In this case study it seems that the developed prototype for developing a poultry industry successfully met these requirements.

Food Security in Egypt: The Socio-Economic Implications of Dietary Protein--Energy Interrelationships

by

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Problem Analysis and Objectives

The topic of "Food Self-Sufficiency" is very discrepant. It is narrow enough to permit economists, statisticians and political scientests to think that they are makng precise statements, yet broad enough to encompass almost anything an author has to say. In long term planning, food production targets are generally based on projections of demand. However, attention has to be given to the nutritional needs of the popultion, especially, the vulnerable groups. Attention should be given to kind, quality and quantity of food consumed by these groups.

It is unlikely that an increase in food production will automatically result in a higher average consumption, and a reduction in the protein and/or energy deficiency. This is because of the inequitable nature of food distribution and consumption. Variations in both intake and requiremets must be considered in estimating adequacy of protein supplies, and planning should be based on studies of individual and household food consumption rather than on overall production targets. National per-capita projections of food consumption provide little or no information about the situation that exists among those at risk and no information about the situation among those at high risk or the malnourished segments of the population. These projections totally ignore the problem of regional distribution of food intake and nutrient intake among the members of the population. Using such estimates in evaluating the food gap and food sufficiency could be misleading and may have inappropriate implications for planning.

A number of international conferences and several recent publications have contributed to the belief that malnutrition and ill health are widespread manifestations of poverty and at the same time obstacles to national development. Also, the difficulty of raising the often miserably low returns to labor and of reducing inequalities in the distriubtion of income accentuate the problem of poverty, (Berg, 1973 and Berg et al., 1973; FAO/WHO, 1976 and World Bank, 1975).

The term malnutrition is used to refer to the physical effects on the human body of dietary intakes that are inadequate in quantity and/or quality. In addition, the high prevalence of infection in developing nations exacerbates malnutrition by decreasing nutrient utililzation and enhancing disease susceptibility (Johnston & Martorell, 1977). However, malnutrition also embraces "overnutrition" contributing to obesity, diabetes and heart disease, but that is a problem associated with affluence rather than poverty.

The narrow concentration of agricultural research, extention, and government subsidies for cereals is an unintended byproduct of the present wave of statements that protein is not a problem if people receive enough calories. Indeed, the major food security programs in developing countries including Egypt stem from this belief (FAW/WHO, 1973). However, throughout the 1960's it was emphasized by international and bilateral agencies that, while increased cereal production, utilizing modern techniques, might ensure adequate dietary calories, there was a parallel need to ensure production of foods providing more protein relative to calories.

Many attempts have been made to estimate the prevalence of malnutrition. According to FAO estimate, in 1977, the number of persons in developing countries thought to have less than a "critical minimum energy intake" increased from 400 million in 1969-71 to just over 450 million in 1972-1974. Reutlinger and Selowsky (1976), on the other hand, have estimated that 56 percent of the population in developing countries, or some 840 million persons had calorie deficient diets. Inspite of the differences between these estimates, they underline the basic fact that protein-calorie malnutrition and deficiencies are widespread problems which adversely affect the quality of life for many individuals throughout the world and often impair their ability to learn and work productively. Does the famished world include the Egyptian economy or at least the low income segments of it, and if not, does the nature of the nutritional deficiency problem in Egypt support the feasibility of the current price subsidy policies, particularly for grains.

Data Base and Methodology

Data Base. The sample for the Family Budget Survey in 1974/1975 conducted by the Central Agency for Public Mobilization and Statistics was used for purposes of this study. The survey involved four visits over one year. It included 12,000 households from the urban and rural areas of Egypt with a ratio of two of the former to one of the latter.

Food consumption by annual household expenditure class, and sex and age structure of households were used in this study to estimate energy and protein consumption and requirements per capita per day.

Estimation of Energy Requirements. The energy requirements of individuals depend on several interrelated variables, including physical activity, body size, sex and environment. Individuals of the same size, living in the same environment and with the same mode of life have similar energy requirements, whatever their ethnic origin.

Table 1 presents daily energy requirements per person by sex and age group for moderate activity and average weights presented in the table. These requirements were adapted from FAO/WHO estimates in 1973. They were applied for the urban and rural sub-samples according to the age and sex group classification published in the 1974/75 Family Budget Survey. Requirements per capita per day for each household expenditure class was weighted by numbers of each age and sex group included in the sample for a given expenditure class.

Protein Requirements. More is known about energy needs than protein needs under varied conditions. Accordingly, protein requiremets are discussed in more detail. For many policy purposes it is desirable to know the percent of total calories that should come from protein. This is frequently referred to as the protein/energy ratio (P:E) ratio. It is a more practical way of determining the adequacy of diets than by separately examining requirements for nutrients that are so interrelated.

Initially, the concept is to compare "Net Dietary Protein Calories Percent" (NDPCa percent) with the percent of calories represented by "The Safe Protein Allowance", corrected for protein quality, relative to the age and sex-specific average daily calorie requirements (Platt et al., 1961). The problem lay in the fact that, even if the estimates for mean protein requirements on which the calculation was based were correct, the resulting figure, by definition, was sufficient for only half of the population. Using a protein to calorie ratio based conceptually on the protein needs sufficient for 97.5 percent of the population (NDPCal requirements plus 2SD over energy requirements - 2SD) ensures that statistically the protein needs of 97.5 percent of the normal population will be met when energy needs are met. Based on the 1973 FAO/WHO "safe allowance" for protein, nearly 7 percent of

Table 1: Energy Requirements Per-Capita Per-Day in Calories for Moderately Active Persons by Age and Sex Group.

Age Group	Males		Females	
	Average body weight (kgs)	Calories	Average body weight (kgs)	Calories
Less than one year	7.3	820	7.3	820
1-4 years	14.5	1,455	14.4	1,430
5-9 years	25.9	2,132	25.1	2,004
10-19 years	51.6	2,877	48.1	2,473
20-39 years	65.0	3,000	65.0	2,200
40-59 years	65.0	2,775	65.0	2,135
60 years and above	65.0	2,250	65.0	1,650

Source: Adopted from Food and Agricultural Organization and World Health Organization. Energy and Protein Requirements, WHO Chronicle, Vol. 27:481-486, 1973.

protein calories would be needed as egg or milk protein.

However, there is strong evidence indicating that the 1973 FAO/WHO recommendations for a protein "safe allowance" are too low for long term maintenance of normal adults, and presumably even less satisfactory if the need for recovery from episodes of stress is taken into account. Acute infections are quite frequent in under-privileged populations, particularly, in young children. The net result of the multiple effects of infections is the need for a margin above normal protein requirements to allow for rapid repletion before the next acute episode worsens the degree of depletion. Accordingly, 30 percent higher requirements for protein above the "safe allowance" by FAO/WHO was suggested. Therefore, the P:E value that would be required to cover 97.5 percent of the population, depending on various additional assumptions would be 8 percent, as egg or milk ND Cal, (Scrimshaw, 1977). Further adjustment is required for the utilization of protein in the diet. For a good quality diet it would be approximately 9-10 percent. For the predominantly vegetable protein diets, as the case of developing countries, it might be 11-12 percent. Therefore protein quality (as the average weighted Biological Value (BV) percent, i.e., the quality score) was taken into consideration in estimating the P:E ratio.

Energy and Protein Dietary Intake. The quantity consumed from each food item recorded in the published family budget survey was calculated in average per-capita daily grams. Daily per-capita energy consumption was clculated on the basis of the calorie content of each food item, as shown in Table 2. Protein intake was calculated as Gross Protein (GP) quantity in grams, using the protein percentage on Table 2. Net protein utilized intake (NPU) was also calculated using corresponding BV percentages in Table 2. NPU-Intake was

Table 2. Nutrient Content of Major Food Items in Egypt

Food Item	KCal/gram	Percent protein	Biological Value (BV) percent	Food Item	KCal/gram	Percent protein	Biological Value (BV) percent
Wheat	3.5	11.7	60	Artificial Ghee	8.84	0.00	0.00
Maize	3.6	9.3	60	Liquid Milk	0.87	3.9	85
Milit	3.43	10.1	60	Full Cream White Cheese	2.02	20.0	73
Wheat Flour	3.7	--	0.52	Fatless Cheese	1.01	19.2	73
Bread	3.66	11.13	60	Butter	7.33	0.6	73
Milled Rice	3.6	6.7	60	Ghee	9.4	0.00	0.00
Macaroni	3.62	0.5	52	Potato	0.81	2.0	67
Broad Beans	3.45	22.2	60	Onion	0.4	1.4	55
Lentils	3.45	22.2	60	Tomato	0.17	1.8	55
Red Meat	2.07	18.8	67	Oranges	0.47	0.9	55
Poultry	1.29	12.6	70	Date	1.13	2.4	55
Fish	0.62	8.8	70	Sugar	2.87	0.00	0.00
Eggs	1.63	12.4	94	Honey	2.9	0.00	0.00
Vegetal Gils	8.84	0.00	0.00	Halawa Tahini	4.81	9.05	78

Source: Collected from:

(1) Ministry of Agriculture - Under Secretary for Agricultural Economics. Food Balance Sheet of Egypt, 1979, Cairo (in Arabic).

(2) Nutrition Institute of Egypt. Food Nutritive Values Tables, Cairo, 1977 (in Arabic).

compared with NPU-requirements i.e., 8 percent of NDPCal out of total energy requirements. GP-requirements is calculated as: ("NPU" requirements + "NPU" intake) x "GP" = intake.

Other food items, particularly some fruits, vegetables, and some milk products. . . etc., that were not explicitly recorded as quantities consumed were imputed by dividing their monetary values by the corresponding average price from the survey data. Each imputed quantity was transformed into calories and protein by the usual procedure and added up to the dietary intake.

Dietary Calorie Availability and Adequacy in Egypt

Table (3) and Table (4) show that grains, particularly wheat, are the main sources of energy for per-capita dietary intake. Tables (5) and (6), and Figures (1) and (2) emphasize that the average calorie intake either in urban or in rural areas of Egypt are higher than the requirements. Though that those in progressively lower income categories have dietary energy intakes increasingly below aggregate average intakes, for both the urban and rural areas, all income groups have dietary intakes above normal requirements. However, average energy intakes of lower income categories (less than LE 500 per household per year) are only slightly above average requirements. The ratios of average calorie intake to average requirements are about 118 percent in urban and 115 percent in rural areas. Whatever the average calorie intakes for population are, relative to estimated requirements, the affluent sector of the population, consume considerably more food than they need. This is more significant in rural than in urban areas. Some of this excess energy contributing to their obesity is a sort of malnutrition, and most of the

Table 3. Aggregate Daily Nutritional Pattern Per Capita in Egypt

Food Item	URBAN		RURAL		NATIONAL AVERAGE	
	Daily Per Capita Intake	Percent of Per Capita Intake	Daily Per Capita Intake	Percent of Per Capita Intake	Daily Per Capita Intake	Percent of Per Capita Intake
Energy Intake (KCal)	2,800	100	2,670	100	2,728	100
Wheat	1,771	69.2	1,198	44.9	1,448	58.1
Rice	246	8.8	267	10.0	258	9.5
Maize	74	2.6	559	20.7	346	12.7
Other Grains	1.0	--	1.0	--	0.8	--
Legumes	80	2.8	72	2.7	76	2.8
Fats and Oils	246	8.8	626	9.8	255	9.3
Suggres	156	5.6	147	5.5	151	5.5
Animal Products	150	5.4	106	4.0	125	4.6
Vegetables and Fruit	76	2.7	64	2.4	69.0	2.5
Protein Intake (gms)	79.1	100	73.1	100	75.7	100
Vegetable Protein	66.2	83.7	63.5	86.9	64.7	85.5
Animal Protein	12.9	16.3	9.6	13.1	11.0	14.5
Protein Quality (BV) percent	--	61.7	--	62.4	--	62.1
NPU (gms)	48.8	--	45.6	--	47.0	--

Source: Calculated from:

(1) Egypt (Arab Republic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in A.R.E.: Aggregate Data of the Four Visits (1974-1975), Ref. 80-12524/78, Sept., 1978 (in Arabic).

(2) Table (1) and (2).

Table 4. Wheat Calories Per-Capita Per-Day by Annual Expenditure Class Per Household

Comparative Item	200 L.E.	200- L.E.	350- L.E.	500- L.E.	600- L.E.	800- L.E.	1,000 L.E.	1,400+ L.E.	Mean
					URBAN				
Cal/Capita/Day	1,544	1,729	1,756	1,808	1,760	1,866	1,832	1,769	1,771
Percent Total Calories	63.7	67.1	65.6	65.1	61.4	59.5	57.2	51.9	63.2
Cal/Capita/Day	1,105	1,089	1,178	1,283	1,292	1,500	1,784	1,877	1,189
Percent Total Calories	47.2	44.6	44.9	45.0	42.6	44.3	47.5	47.6	44.9

Source: Calculated from:

Egypt (Arab Rebublic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in Arab Republic of Egypt: Aggregate Data of the Four Visits 1974-1975,

Table 5. Effect of Income Distribution on Per Capita Energy and Protein Availability in Urban Egypt

Annual Household Expenditure in L.E.	Percent of Urban: Population	Percent of Urban: Annual Expenditure	Daily Per-Capita in Kilo Calories: Consumption	Daily Per-Capita in Kilo Calories: Requirements	Daily Per-Capita in Kilo Calories: Net Balance	Daily Per-Capita Protein in Grams: Consumption: Gross Protein	Daily Per-Capita Protein in Grams: Consumption: Net Protein Utilization	Daily Per-Capita Protein in Grams: Require-ments in Net Protein Utilization	Daily Per-Capita Protein in Grams: Net Balance in Net Protein Utilization
< 200	5.7	2.62	2,437	2,240	+197	68.2	41.5	44.8	-3.3
200 -	21.4	12.30	2,585	2,324	+261	72.0	43.0	46.5	-3.1
350 -	24.4	17.55	2,681	2,373	+309	75.3	46.2	47.5	-1.3
500 -	12.6	10.97	2,777	2,400	+377	80.0	49.2	48.0	+1.2
600 -	15.7	16.60	2,865	2,406	+459	81.0	50.1	48.0	+2.1
800 -	7.5	10.60	3,136	2,416	+720	88.0	33.1	48.3	+6.8
1,000 -	7.8	13.50	3,201	2,438	+763	91.0	57.3	48.8	+8.5
1,400 +	4.9	15.86	3,427	2,454	+968	100.7	64.4	49.2	+15.2
Urban Mean	100	100	2,800	2,378	+422	79.1	48.7	47.6	+1.1
S.D.:			248.9	50.95	205.5	7.83			
C.V.:			8.9%	2.1%	48.7%	9.9%			

Note: Average protein quantity score = $\frac{\text{Net Protein Utilized}}{\text{Gross Protein}}$ = 61.5% ∓ .09% SD.

Source: Calculated from:

Egypt (Arab Republic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in A.R.E. Aggregate Data of the Four Visits 1974-1975, Ref. 80-12524/78 Sept., 1978 (in Arabic).

Table 6. Effect of Income Distribution on Per Capita Energy and Protein Availability in Rural Egypt

	Percent of Rural		Daily Per-Capita in Kilo Calories			Daily Per-Capita Protein in Grams			
						Consumption			
Annual Household Expenditure in L.E.	Population	Annual Expenditure	Consumption	Requirements	Net Balance	Gross Protein	Net Protein Utilization	Require-ments in Net Protein Utilization	Net Balance in Net Protein Utilization
< 200	14.39	9.26	2,333	2,257	+176	65.4	39.9	45.1	-5.2
200 -	35.49	27.62	2,449	2,314	+135	67.8	41.3	46.3	-5.0
350 -	23.82	23.62	2,625	2,327	+298	72.4	44.3	46.5	-2.2
500 -	8.45	9.63	2,853	2,358	+495	80.0	49.4	47.2	+2.2
600 -	8.68	11.75	3,042	2,331	+711	83.6	51.4	46.6	+4.8
800 -	4.39	6.77	3,386	2,327	+1058	44.6	58.0	46.5	+11.5
1,000 -	2.80	5.59	3,752	2,376	+1316	109.0	68.2	47.5	+20.7
1,400 +	1.98	5.76	3,947	2,706	+1241	116.3	74.8	54.1	+20.2
Urban Mean	100	100	2,670	2,324	+346	73.4	45.3	46.6	-1.2
S.D.:		367	67.3	372	12				
C.V.:		13.81%	2.6%	107.8%	16.5%				

Note: Average protein quantity score = $\frac{\text{Net Protein Utilized}}{\text{Gross Protein}}$ = 61.3% ∓ .06% SD.

Source: Calculated from:

Egypt (Arab Republic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in A.R.E. Aggregate Data of the Four Visits 1974-1975, Ref. 80-12524/78 Sept., 1978 (in Arabic).

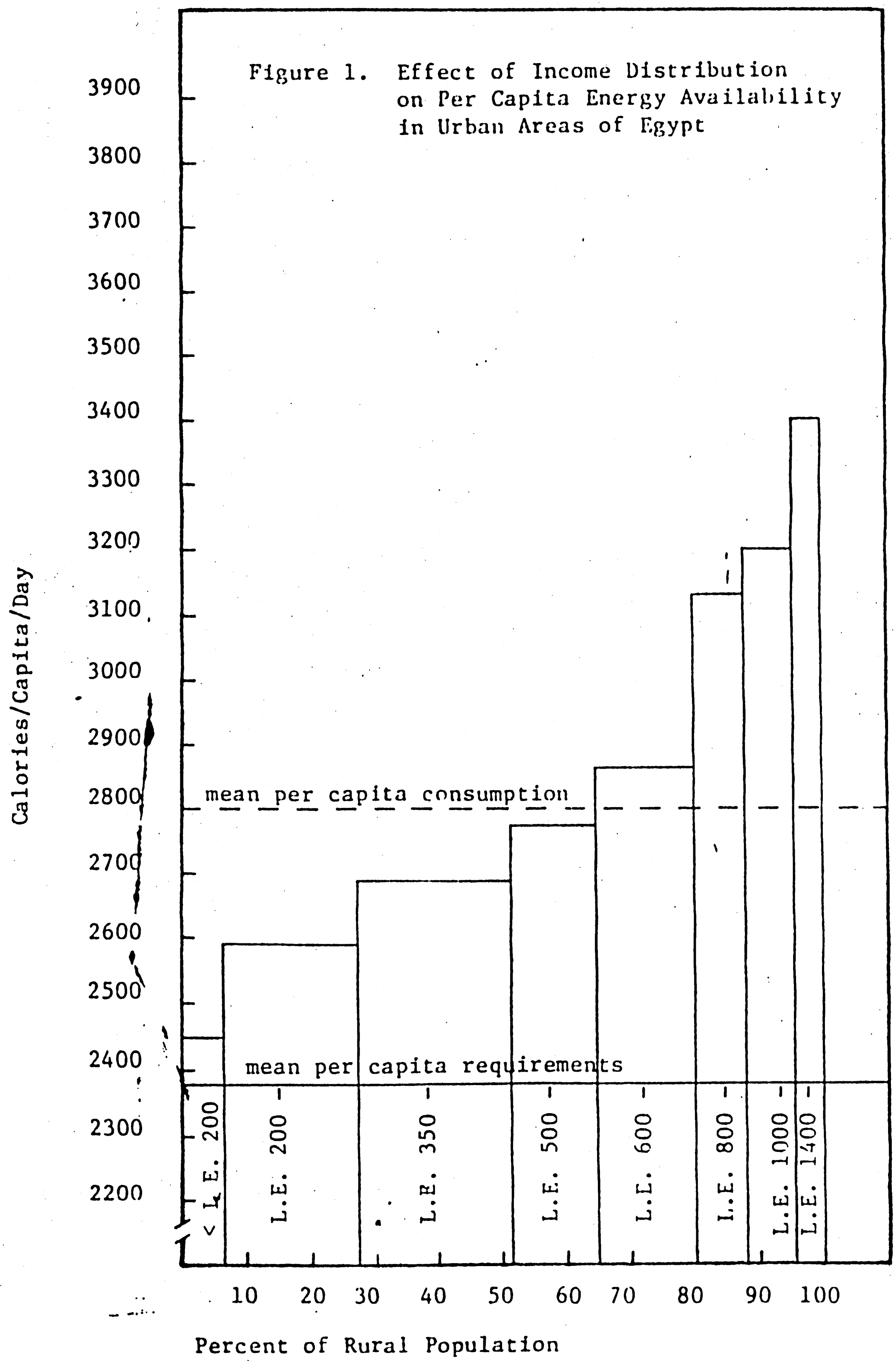


Figure 1. Effect of Income Distribution on Per Capita Energy Availability in Urban Areas of Egypt

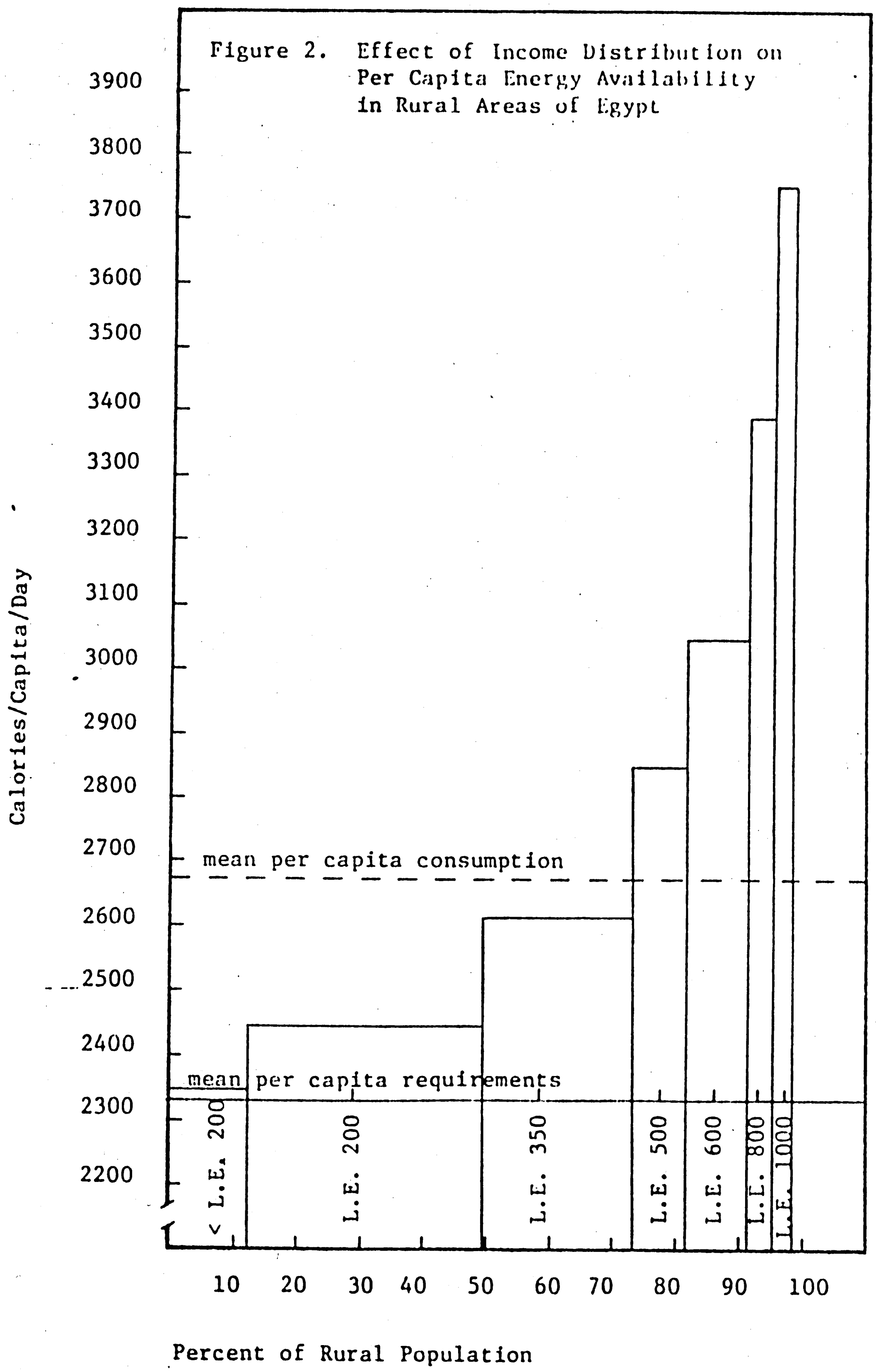


Figure 2. Effect of Income Distribution on Per Capita Energy Availability in Rural Areas of Egypt

excess food is simply wasted or utilized as animal feed. Some reviews have missed these points and assumed that all calories, consumed by a household are actually ingested.

Considering an adult man of moderate activity as a consumption unit, "the sex-age structure" of the household is the scale for nutritional requirements. This scale per-capita is almost constant between income classes. Its average is 0.7931 consumption units (I 0.0445 SE) in urban and 0.7725 consumption units (I 0.0036 SE) in rural areas. Due to this similarity in the per-capita "sex-age scale," the variability in requirements (coefficient of variability) is very small between income classes within each sub-population.

The interaction between the income distribution and propensity to consume shows a variability in per-capita calorie intake by income class, around the population average of about 9 percent in urban and 14 percent in rural areas. However, current subsidy policy (mainly devoted to grains) keeps per-capita dietary intake of each income class above normal requirements. It seems that such a policy kept the Egyptian population away from "the World Famine Circle" whereas under-nutrition is severe in Asian and Latin American developing countries. As Reutlinger and Selowesky (1976) indicated, about 47 percent of Latin American population have energy intakes below requirements and those in progressively lower income categories have dietary energy intakes increasingly below normal requirements.

Dietary Protein Availability and Adequacy in Egypt

As shown in Tables 3 and 4 most of the energy intake from Egyptian food comes from grains (vegetable sources). Therefore it was expected that most of the Egyptian protein intake would also come from vegetable sources (Table 7). Although there is no energy gap, it was not expected that, in consequence,

Table 7. Daily Per-Capita Animal Protein Consumption by Annual Expenditure Per Household

Comparative Item	200 L.E.	200- L.E.	350- L.E.	500- L.E.	600- L.E.	800- L.E.	1,000 L.E.	1,400+ L.E.	Mean
					URBAN				
gms/capita/day	7.1	7.3	10.3	11.9	14.3	18.2	21.5	32.2	12.9
Percent Gross Protein	10.4	10.1	13.7	14.9	17.7	20.7	23.6	32.0	16.3
gms/capita/day	8.2	8.9	10.5	12.0	14.7	16.0	22.9	22.1	9.6
Percent Gross Protein	12.5	13.1	14.5	15.0	20.1	17.0	21.9	19.0	13.1

Source: Calculated from:

Egypt (Arab Republic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in A.R.E., Aggregate Data of the Four Visits 1974-1975, Ref. 80-12524/78, 1978 (in Arabic).

Figure 3. Effect of Income Distribution on per Capita Protein Availability in Urban of Egypt

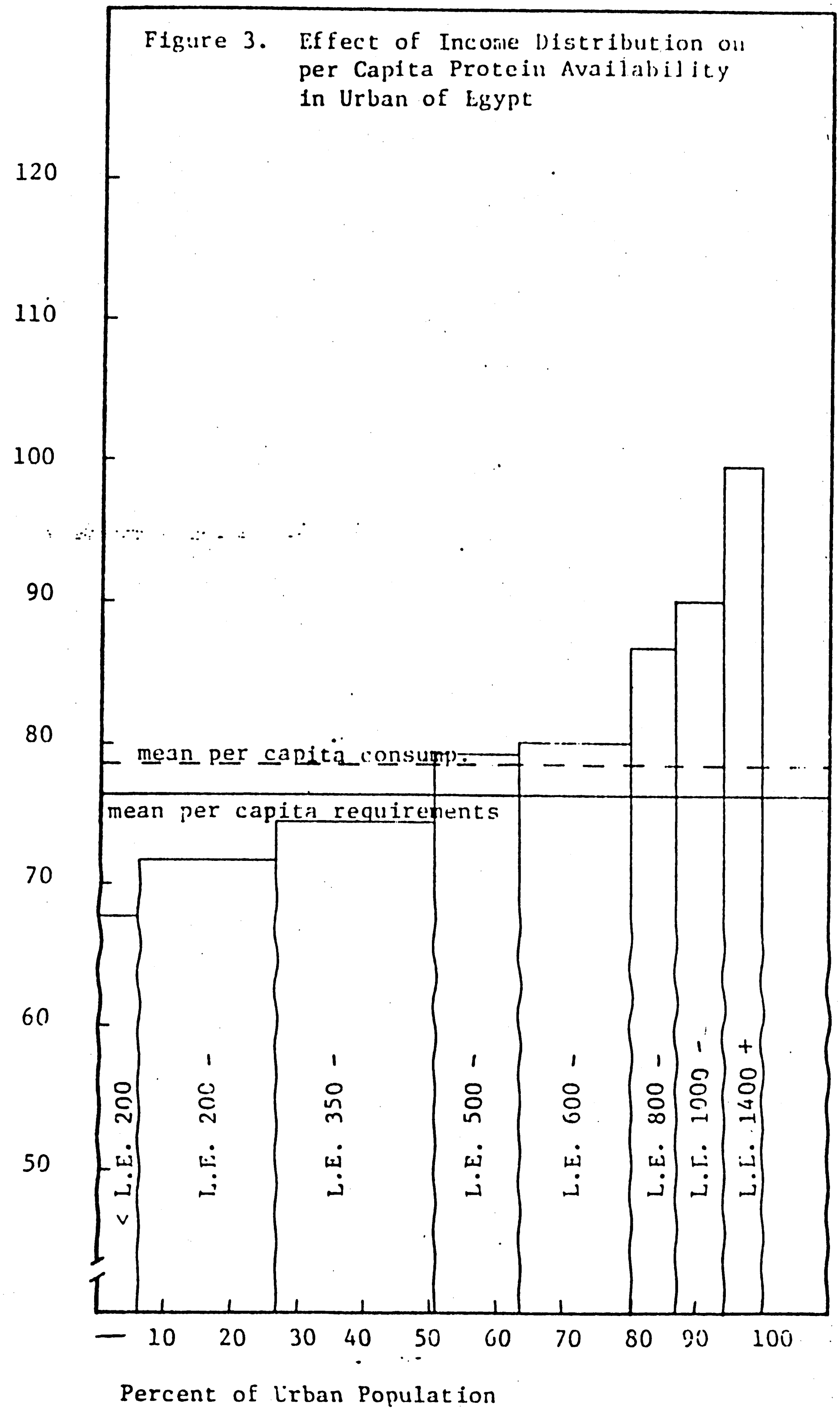
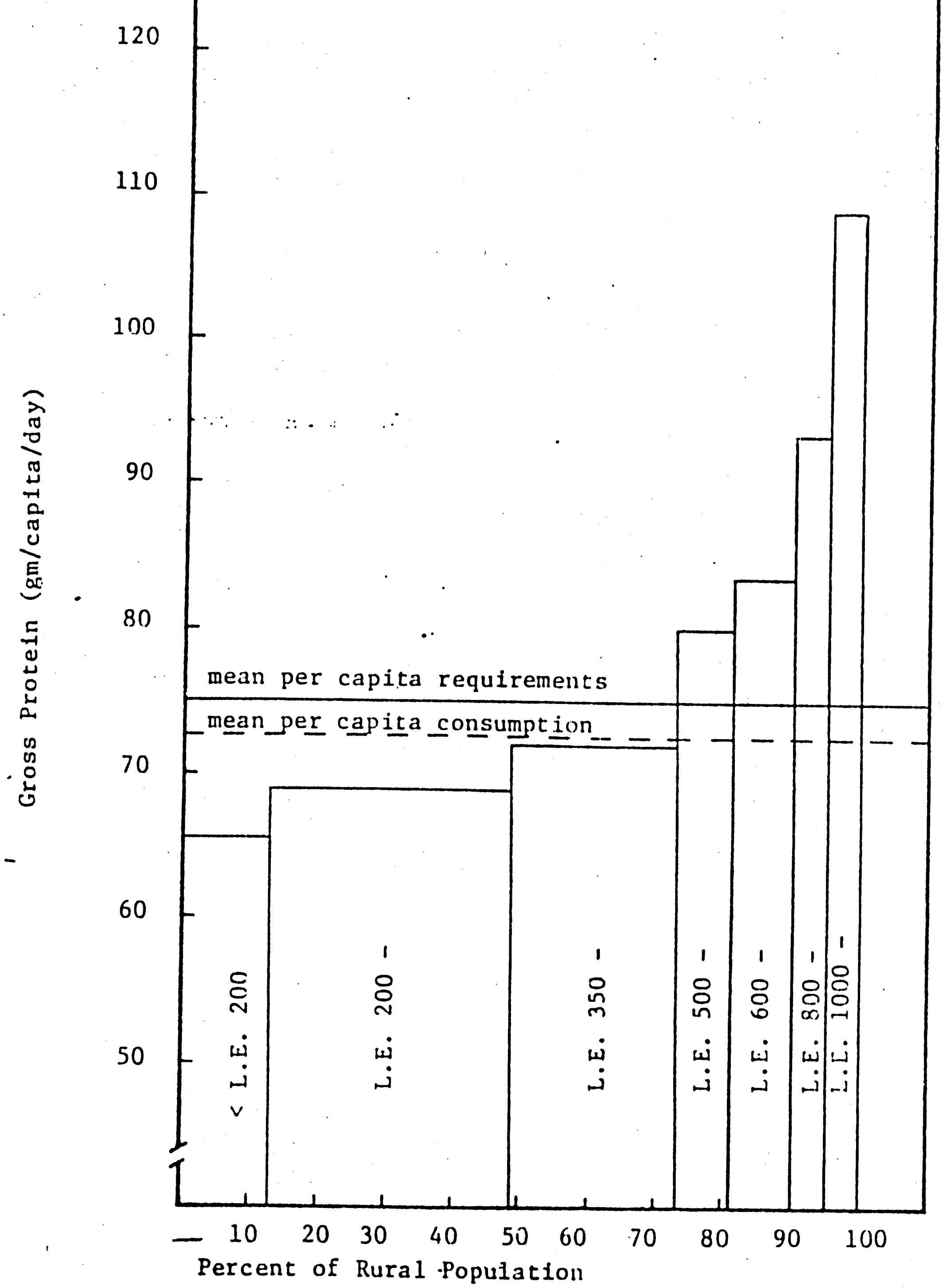


Figure 4. Effect of Income Distribution per Capita Protein Availability in Rural of Egypt



there would also be no protein gap, because in addition to quantity, protein quality determines its adequacy. If one looks at Figure 3 for urban and Figure 4 for rural intakes, and Tables 5 and 6, it is easily concluded that there is no protein gap for the total urban population, where the average per-capita consumption is about 79 grams per day of gross protein (48.7 grams net protein utilized), while the requirements are about 77 grams gross of protein (47.6 grams net protein utilized). For the rural population, there is a gap because consumption is slightly lower than the requirements. However, the same tables and figures show the distribution of protein with income. It is clear that large segments of the population have dietary protein intakes below requirements. About 52 percent of the urban population and about 74 percent of the rural population have a protein gap. These segments are the households with less than 500 LE annual expenditure per year. Although the general pattern of the protein distribution according to income brackets shown in Figures 3 and 4 is similar to that for calories in Figures 1 and 2, the issue is still more complicated, because the poorer segments of the population not only consume less protein, but also protein of poorer quality. The inadequacy in intake is most pronounced in the case of animal protein (Table 7). This phenomenum actually stems from consumer behavior and is reflected in the income (expenditure) elasticities of nutrients (Table 8). Thus while total available protein and calories both tend to decrease more or less proportionately with income, this is deceptive because utilizable protein drops faster than calories. Moreover, the poorer the socio-economic group, the more vulnerable they will be to acute and chronic infections and likely to need extra protein for periods of recovery.

However, these are not the types of models with which economists and national planners usually deal. Therefore, it has been very difficult, in

Table 8. Estimated Engel's Curve for Per-Capita Daily Consumption of Calories and Protein (Quantity and Quality) in Egypt.

Food Ingredient	Intercept	Average Estimated Elasticity	Coefficient of Determination	Intercept	Average Estimated Elasticity	Coefficient of Determination
Calorie Intake	1139.1864	0.1976	0.7365	617.2873	0.3609	0.9575
Gross Protein	29.2676	0.2188	0.7709	14.7973	0.3981	0.9588
Vegetable Protein	44.9576	0.0817	0.2495	16.2684	0.3376	0.9388
Animal Protein	0.2982	0.8147	0.9717	0.5073	0.7428	0.9602
Net Utilizable Protein	15.8919	0.2463	.8122	8.1297	0.4248	0.9652

Estimated Model is $\hat{C}_{ijr} = \hat{\alpha} Y^{\hat{b}}_{ir}$

Where : $\hat{C}_{ijr}$ denotes daily per-capita intake of ingredient j in region r for an individual i.

$\hat{Y}_{ir}$ denotes annual per-capita expenditure of an individual i in region r.

Source: Estimated from the data of:

Egypt (Arab Republic of) - Central Agency for Public Mobilization and Statistics: Household Budget Sampling Survey in A.R.E., Aggregate Data of the Four Visits 1974-1975, Ref. 80-12524/78, 1978 (in Arabic).

connection with the announced food security strategy, to explain the nature of the protein problem, and the reason for concern about it. It is easy to demonstrate that, on an aggregate per-capita basis, there is almost no protein gap for the total population. This would be generally true if protein were, or could be, distributed according to requirements, but this demands a degree of control over the lives of individuals that is unacceptable in most economic systems.

Succinctly about one-half of the urban population and three-fourths of the rural population in Egypt consume diets that are progressively lower in the percentage of utilizable protein as income drops. And, we must accept the fact that regardless of the economic system, food security programs are not willing to settle for anything but protein intakes well above the currently estimated allowances.

The Protein Quality Problem in Egypt

It is clear from analysis presented above, that the protein quality of Egyptian household diet is in general low as net utilizable protein and biological value [as the percent of net utilizable protein to gross protein], as though its quality improves as income increases (Table 8). Therefore, even for population segments that have a dietary gross protein intake which meets requirements, it is mainly from a high proportion of grains consumed in adequate quantities to meet caloric needs. The complementary effect of gross protein may be suitable for adults. However, if there is severe infection or stress of any kind, a diet higher in protein value than that supplied by cereal-based diets is required if the diet is nearly devoid of animal protein and very limited in legumes as it is for the low income segments of the population.

The continuing high prevalence of protein malnutrition among children is quite clear once the utilizable protein content decreases with lower income. The data available indicate tat the amounts of protein reaching the preschool child are seriously inadequate (FAO/WHO, 1973b), in most of the developing countries. In Egypt, the results of a study, conducted by Nutrition Institute in 1978, showed that about 2-3 percent of pre-school children suffer from acute malnutrition and 21.2 percent of them suffer from chronic malnutrition. This provides basic evidence that suitable foods are not provided to these children. For young children under 3 years of age, the traditional diet is frequently so bulky that they have difficulty in eating enough of it to fully meet either caloric or protein needs; and they not only need the recommended allowances for healthy children, but also enough to meet additional needs since they often suffer from infectious diseases particularly if they are children from low income groups. In many cases, cultural practices may deny young children sufficient access to protein foods.

Economic Policies and Socioeconomic Concept of Food Security

The two direct policies that serve the socioeconomic concept of food security are: (a) to raise income levels through economic development plans and (b) a price subsidy policy for food items, particularly grains.

Economic growth and protein problem. The net measure of economic growth is the increase in real per-capita income. Now, the question is, will the protein problem be solved by increasing income? As shown from the protein consumption income distributions (Figures 3 and 4, and Table 7), and estimated "Engel's curves" (Table 8) individuals can and do, if they can afford it, cosume 150 percent of their estimated requirements. Therefore, it may be expected that the effects of increasing income on the maldistribution of protein would be very pronounced.

General economic development deals with the root of the protein problem and offers an effective long run approach to its solution. However, there are substantial numbers in the vulnerable groups who will not receive sufficient income in the near future. Waiting a generation or two for economic development to do away with protein malnutrition means acceptance of continued high morbidity and mortality and of the impairment of physical and mental performance of future adults upon whom economic and social development depends.

Food price subsidies and the socioeconomic concept of food security. The consumer food price subsidy policy in Egypt is devoted mainly to grains, particularly wheat, as subsistance foods. Wheat consumption represents about 63 percent, 45 percent and 53 percent of calorie consumption for urban, rural, and the total population, respectively (Table 3). The average international wheat price is about 2.5 times its local market price, as estimated from the FAO trade yearbook of 1981. The average international price of wheat was about 150 LE per ton in 1981, while in the local market it is sold at 60 LE per/ton to all income classes. Its main processed product is Egyptian bread.

Under current subsidy policy there is an energy surplus above requirements for all income classes (Table 5 and 6). Such a surplus increases with increasing income levels. It may reach 1.5 times requirements for the highest income class. The equivalent wheat tonage of the energy surplus weighted by 1981/1982 population size is about 1,679.22 thousand tons valued at 251.883 million LE at international prices. Some of this excess contributes to obesity in high income groups, a sort of malnutrition, but most of it is simply wasted or may be devoted to animal feeding. However, a significant part of grain energy sources provide significant portions of protein requirements. Without affecting protein adequacy, this surplus could diminish to about 488 thousand tons valued at 73 million Egyptian pounds, all of these coming only from high income groups (above 500 LE/household/year).

Now, what would the impact on energy and protein requirements be in the absence of the present wheat price subsidy? Assuming that other prices were constant and income was also constant, the consumer would diminsh his wheat consumption at free market prices. The magnitude depends upon the wheat price elasticity of each income class demand curve. El-gendi, in 1973, estimated a national price elasticity for wheat of about -0.08, i.e., wheat is on the average a very inelastic commodity. To obtain an imputed estimate for wheat price elasticity for urban and rural residents and for each income class, a hypothesis is formulated. It is, the higher the income elasticity the higher is the price elasticity. An Engel's curve for wheat calorie consumption was estimated for both the urban and rural regions. The best fitting models for each region were those shown in equation (1) for urban and equation (2) for rural residents. The cross-section data of the household budget survey of Egypt in 1974/75 were used in the estimations.

$$\hat{C}i = 1940.3457 - \frac{15716.9525}{\hat{Y}_i}, \quad R^2 = .8222 \quad \ldots\ldots\ldots\ldots\ldots (1)$$

$$\hat{C}_i = 721.5865 + 489.351 \ln \hat{Y}_i, \quad R^2 = .8235 \quad \ldots\ldots\ldots\ldots (2)$$

where: $\hat{C}_i$ denotes per-capita daily consumption of wheat calories for an individual and

$\hat{Y}$ denotes annual per-capita total expenditure for an individual.

The two models show that wheat consumption decreases with increasing income levels in urban areas, while it increases up to a given income level in rural areas and then decreases according to progressively increasing income levels.

Table (9) shows the estimated income (expenditure) elasticity for each region by income class. These estimates were derived from models 1 and 2. It is clear that wheat income elasticity in rural areas is much higher than for urban areas because rural consumers substitute maize for wheat at higher income levels. The weighted aggregate national income elasticity for wheat is about 0.21.

The imputed price elasticity for wheat for each region and for each income class was estimated using model 3.

$$Ep_{ij} = (Ep_o)\, \frac{Ey_{ij}}{Ey_o} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where: Ep_{ij} denotes the price elasticity coefficient of wheat for an income class of the region j.

Ep_o denotes estimated national average price elasticity of wheat from the time series data (-0.8).

Ey_{ij} denotes the income elasticity coefficient of wheat for income class i and the region j.

Ey_o is the aggregate average income elasticity of wheat = 0.21.

Accordingly, imputed price elasticity coefficients are shown in Table 9.

Impacts of wheat free price on wheat consumption. As mentioned earlier the free price of wheat means a 1.5 times relative increase in its price. Demand response to such an increase weighted by the price elasticity coefficient, shown in Table 9, indicates that per-capita consumption decreases by about 12.3 percent and 24.9 percent for lowest income class in urban and rural regions, respectively, while it decreases by .33 percent and

14.7 percent for the highest income class in urban and rural regions respectively. The lower income classes would cut their wheat consumption at a much higher rate than the higher income classes (Tables 10 and 11). In addition, actual wheat consumption at free market prices would save about 472.9 million LE as a difference between the subsidized price and the free market price. Therefore, the Egyptian economy would save about 602.8 million LE from the implementation of free market price policy for wheat.

Impacts of free market price for wheat on energy and protein availability and adequacy. Since wheat is the main food item involved in energy intake and protein intake from the daily diet, it is expected that decreased quantities of wheat would have a great impact on energy and protein adequacy of the traditional diet. As Tables 12 and 13 indicate, in comparison with Tables 5 and 6, the present protein deficit would be much worse.

The protein deficit would be two fold the present one for population segments with less than 500 LE annual expenditure per household. These segments represent about one-half of the urban population and three quarters of the rural population (Tables 12 and 13). In addition, the protein deficit would expand to include those segments with less than 600 LE in urban areas and less than 800 in rural areas. This raises the proportion of the population suffering from protein malnutrition to about 64 percent of the urban population and about 91 percent of the rural population. To treat this severe deficit with a protein-rich food, (even if it is the cheapest one, i.e., milk with 4 percent fat), about 2.5 million tons are required valued at not less than 370 million LE at the international price of milk (212 LE per ton of dissolved dry milk equivalent). In addition about 3.2 million poor rural persons would suffer from an energy gap and about 1.1 million members of the urban population would be in a critical situation with respect to energy.

Table 9. Income and Price Elasticities for Wheat Calorie Consumption by Income Class in Egypt.

Elasticity Coefficient	200 L.E.	200- L.E.	350- L.E.	500- L.E.	600- L.E.	800- L.E.	1,000 L.E.	1,400+ L.E.	Mean
					URBAN				
Y	46.4	57.9	74.0	89.4	108.2	145.6	177.3	322.2	102.4
E_y	.216	.1570	.1210	.0922	.0825	.0578	.0484	.0274	.0867
E_p	-.0818	-.0591	-.0455	-.0366	-.0311	-.0218	-.0182	-.0022	-.0395
					RURAL				
Y	38.0	47.8	62.5	71.8	85.3	79.1	125.5	182.7	63.0
E_y	.4409	.4485	.4185	.3814	.3779	.3262	.2743	.2607	.4116
E_p	-.1660	-.1668	-.1564	-.1436	-.1423	-.1228	-.1033	-.0981	-.1556

Where Y denotes annual per-capita expenditure in L.E.

E_y denotes income (expenditure) elasticity of wheat.

E_p denotes price elasticity of wheat.

Source calculated from models (1), (2) and (3), and Table (4).

Table 10. Decreased Wheat Quantities Due to Implimentation of Free Market Price of Wheat in Urban Egypt.

Annual Household Expenditure Class L.E.	Urban Population (000) persons in 1981/82a	Diminish in Wheat Consumption Due to Free Price Per Year			
		Per-Capita		Total Urban	
		Kilogramsb	Value (L.E.)c	Tons	Value (L.E.)
< 200	1,110.116	19.9	2.8	22,091	3,313,656
200 -	4,361.172	16.6	2.4	69,779	10,4668,850
350 -	4,757.642	12.5	1.9	59,477	8,920.650
500 -	2,497.762	10.4	.6	25,977	3,896,550
600 -	3,112.291	8.6	1.3	26,766	4,014,900
800 -	1,486.763	6.4	1.0	9,515	1,427,250
1,000 -	1,546.234	5.2	.8	8,040	1,206,000
1,400 -	951.528	0.6	.2	571	85,650
Total	19,823.508	11.2	1.7	222,210	33,331,500

a Calculated from population structure on Table (5) and total urban population in 1981/82.

b Calculated from tables (4) and (9).

c Valued at international price of wheat (150 LE per ton), in 1981.

Table 11. Decreased Wheat Quantities Due to Implementation of Free Market Price of Wheat in Rural Egypt.

Annual Household Expenditure Class L.E.	Rural Population (000) persons in 1981/82[a]	Diminish in Wheat Consumption Due to Free Price Per Year			
		Per-Capita		Total Rural	
		Kilograms[b]	Value (L.E.)[c]	Tons	Value (L.E.)
< 200	3,216.765	28.8	4.3	92,643	13,896,450
200 -	7,933.499	28.8	4.3	250,084	37,512,600
350 -	5,324.763	28.8	4.3	153,353	23,002,950
500 -	1,888.927	28.8	4.3	54,402	8,160,300
600 -	1,940.342	28.8	4.3	55,882	8,382,300
800 -	981.348	28.8	4.3	28,263	4,239,450
1,000 -	625.917	28.8	4.3	18,026	2,703,900
1,400 -	442.613	28.8	4.3	12,747	1,912,050
Total	22,354.169	28.8	4.3	643,800	96,570,000

a Calculated from population structure on Table (5) and total urban population in 1981/82.

b Calculated from tables (4) and (9).

c Valued at international price of wheat (150 LE per ton), in 1981.

Burden of free market price for wheat on consumer budget. Since wheat is a subsistance food with an inelastic demand curve, a great burden would be added to the low income consumer's budget under a free market price policy.

Table 14, shows that expenditure for wheat under free market prices may raise the average propensity to consume food (percent food expenditure/total expenditure), to reach about 100 percent or more, for low income groups, assuming income and other prices are kept constant.

The Agricultural Policy and Socioeconomic Concept of Food Security: An Over-View

It is well recognized that concentration on improving yields of cereals (wheat, corn and rice) has been associated with a decrease in the per-capita production and a rise in the relative price of legumes. Legumes are an important source of concentrated protein to complement cereal diets. The population, however, has been able to afford less of them, relative to cereals. Therefore, the nutritional status of the population has deteriorated in some instances.

If agriculturalists are encouraged by nutritionists and planners to believe that populations can subsist on cereal diets, there will continue to be a lag in the production or development of better sources of protein, and the diets of the poor will deteriorate further.

Another consequence of the lack of concern for maintaining a proportionate availability of legumes, oilseeds, or animal protein has been a loss of foods of greater caloric density than that of cereals. Oilseeds, in particular, are not only good sources of protein but, as their name indicates, are also sources of fats and oils which are the most concentrated sources of food energy. Just as cereal diets are marginal in their protein value

Table 12. Effect of Free Market Price of Wheat on Per-Capita Energy and Protein Availability by Income Class in Egypt.

Annual Household Expenditure Class in L.E.	Percent of Urban		Daily Per-Capita in Kilo Calories			Daily Per-Capita Protein in Grams			
						Consumption			
	Population	Annual Expenditure	Consumption	Requirements	Net Balance	Gross Protein	Net Protein Utilization	Require-ments in Net Protein Utilization	Net Balance in Net Protein Utilization
< 200	5.6	2.62	2,246	2,240	+6	61.8	38.1	44.8	6.7
200-349	22.0	12.30	2,432	2,324	+108	66.8	40.3	46.5	-6.2
350-499	14.0	17.55	2,561	2,373	+188	71.3	43.8	47.5	-3.7
500 -	12.6	10.97	2,678	2,400	+278	76.7	47.2	48.0	-0.8
600 -	15.7	16.6	2,783	2,406	+377	78.3	48.5	48.0	+0.5
800 -	7.5	10.6	3,075	2,416	/659	86.0	53.9	48.3	+5.6
1,000 -	7.8	13.5	3,151	2,438	+713	89.3	56.3	48.8	+7.5
1,400 +	4.8	15.86	3,418	2,459	+959	100.4	64.2	48.2	+15.0
Urban Mean	100	100	2,742	2,378	+364	69.0	42.6	47.6	-5.0

Calculated from Tables 4, 5, 6, 9 and 10.

Table 13. Effect of Free Market Price of Wheat on Per-Capita and Protein Availability by Income Class In Rural Egypt.

Annual Household Expenditure in L.E.	Percent of Rural: Population	Percent of Rural: Annual Expenditure	Daily Per-Capita in Kilo Calories: Consumption	Daily Per-Capita in Kilo Calories: Requirements	Daily Per-Capita in Kilo Calories: Net Balance	Daily Per-Capita Protein in Grams: Consumption: Gross Protein	Daily Per-Capita Protein in Grams: Consumption: Net Protein Utilization	Daily Per-Capita Protein in Grams: Require-ments in Net Protein Utilization	Daily Per-Capita Protein in Grams: Net Balance in Net Protein Utilization
< 200	14.39	9.26	2,077	2,257	-180	55.1	33.8	45.2	-11.3
200 -	35.49	27.62	2,171	2,314	+143	58.1	35.6	46.3	-10.7
350 -	23.82	23.62	2,348	2,327	+ 21	63.1	38.8	46.5	- 7.7
500 -	8.45	9.63	2,577	2,358	+219	70.8	43.9	47.2	- 3.3
600 -	8.68	22.75	2,766	2,331	+435	73.8	45.9	46.6	- 0.7
800 -	4.39	6.77	3,109	2,327	+782	84.8	52.5	46.5	+ 6.0
1,000 -	2.80	5.59	3,416	2,376	+110	99.8	62.7	47.5	+15.2
1,400	1.98	5.76	2,394	2,206	+965	106.8	68.8	54.1	+14.7
Rural Mean	100	100	2,394	2,324	+ 70	64.2	39.8	46.5	- 6.7

Source: Calculated from Tables 4, 5, 6, 9 and 11.

Table 14. Percent Food Expenditure/Total Expenditure Under Present Wheat Price Subsidy Policy and Under Proposed Free Market Price Policy for Wheat.*

Annual Household Expenditure Class in L.E.	Percent (Food Expenditure/Total Expenditure)			
	Urban		Rural	
	Under Subsidy Policy	Under Free Price Policy	Under Subsidy Policy	Under Free Price Policy
< 200	61.7	112.8	67.0	135.9
200 -	54.7	97.6	63.0	115.0
350 -	51.7	80.5	62.5	95.8
500 -	49.0	68.3	60.6	80.9
600 -	47.5	61.9	54.9	67.0
800 -	44.2	55.8	54.4	65.9
1,000 -	40.6	50.6	51.4	62.5
1,400 +	33.6	38.8	43.0	51.1
Total	46.0	62.2	57.9	54.8

* Assuming constant income and other prices.

Source: Calculated from Tables 4, 9, 10 and 11.

relative to both their bulk and caloric density, so also are they marginal in their energy ratio relative to their bulk. In addition, it is useless to suggest that a child can obtain sufficient protein and calories from a cereal diet if he merely eats more of it. Young children on some cereal diets often do not have the capacity to ingest the large quantities of food that would be necessary to satisfy all of their nutrient requirements.

It is also apparent that with the continuing rapid increase in world population it will be far easier and cheaper to provide the basic staple, whether it is a cereal or a starchy root, than it will be to provide the legumes, oilseed or animal protein needed in addition by major vulnerable segments of the population, i.e., infants and young children, pregnant and lactating women, and persons effected by the stress of infections or other diseases. For this reason, the Protein Advisory Group (PAG) of the United Nations continue to emphasize the desirability of genetic improvement in the protein characteristics of cereals and other staple food crops.

Apart from increasing consumption of milk or other protein foods of animal origin, which may not be feasible, the alternatives are: (a) to encourage consumption of more legumes with a smaller proportion of cereals in diets and (b) to supplement cereal consumption with a food with a higher protein concentration such as a peanut or soy-preparation.

The latter alternative raises the question of the importance of evaluating the feasibility of soybeans in two alternative uses: either for poultry feeding as in the present situation or as a direct processed food for the human diet.

A Proposed Crash Program

The study indicates that to raise income through economic development to do away with protein malnutrition means waiting a generation or two, and relying on a free market price for wheat makes protein malnutrition worse, particularly for low income groups who are the majority of the population. There is therefore a need for specific action programs, "A Crash Program" for the nutritional protection of vulnerable groups. Attention to the nutritional needs of these groups, including the need for suitable protein-rich foods, will continue to be required for many years.

Traditional Egyptian diets may be improved with respect to protein through home preparation of legumes. Food legumes are good sources of protein and the cheapest ones also, when they are used in conjunction with cereal diets (Cameron and Hofvender, 1971). However, there is a concern for adding still other high quality types of protein, because the amounts of legumes consumed relative to cereals is very small (Table 3), and the considerable bulk of a starchy diet with a poor ratio of protein to calories makes it extremely difficult for the young child to eat enough to meet his requirements. Under these circumstances, increasing consumption of milk as the least cost item among animal products in terms of net utilizable protein (Table 15), is recommended. The deficit in utilizable protein among lower income groups in urban or rural areas (less than 500 LE/household/year) should be covered by providing additional milk (enriched with iron) in a proposed crash program. Estimated values for such a program are calculated on the basis of the international price of disolved imported powdered milk equivalent (4 percent fat) in 1980/1981. The supplemented total milk required for about 10 million persons in urban areas is about 252 thousand tons and for about

16.5 million persons in rural areas is about 792 thousand tons (Table 16). Total national cost for such a program will be about 221 million Egyptian pouonds, about 76 percent of it for rural areas. In general this program will provide about 90 grams per day per person of additional milk for about 77 percent of the total Egyptian population, i.e., a total quantity of about one million tons.

Table 15. Average Value Per 1-gram Net Protein Utilization From Different Animal Product Substitutes and Wheat and Legumes.

Item	Red Meat	White Meat	Eggs	Liquid Milk Equivalent 4% Fat	Wheat	Legumes
Average Boarder Price Per Ton (L.E.)	1,600	1,280	1,200	212	150	150
Percent Protein Content	18.6	12	12.4	3.5	11.6	22.2
Percent Protein Quality	67	70	94	85	60	60
Net Protein Utilization Per Ton (NPU) Kgs.	124.62	84.0	116.56	19.75	69.6	133.2
Average Border Price Per gm NPU PTT	1.28	1.52	1.03	6.71	0.22	0.11

Source: Calculated from:

Food and Agriculture Organization: <u>Trade Year Book</u>, Rome, 1981.

Table 16. Additional Milk Required to Overcome Protein Malnutrition in Low Income Classes in Egypt.

Annual Household Expenditure Class (L.E.)	Population in (000) persons	Additional Required Milk Per-Capita Per Year		Total Additional Milk Required		Energy
		Kilograms	Costs L.E.	Tons	Costs L.E.	Net Balance (Calories)
URBAN						
< 200	1,110.116	31.9	6.8	35,413	7,567,556	+273
200-	4,361.172	34.1	7.2	148,716	31,527,792	+342
350-499	4,757.642	14.3	3.0	68,034	14,423,208	+342
S-Total	10,228.93	24.6	5.2	252,163	53,458,556	+329
RURAL						
< 200	3,216.765	65.0	13.8	209,090	44,327,080	+351
200-	7,933.494	57.2	14.2	453,796	96,204,752	+269
350-499	5,324.763	24.2	5.1	128,859	27,318,108	+355
S-Total	16,475.022	48.1	10.2	791,745	167,849,940	+318
Total	32,950.044	31.7	6.7	1,043,908	221,308,496	+261

Source: Calculated from Tables 5. 6 and 15.

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