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## ABSTRACT


Surveys were conducted in winter and summer in eight rural villages in high and low rainfall zones of Aleppo Province Syria. Information was obtained upon living conditions, farm resources, dietary pattern and infant feeding practices together with height, weight and age data on children. Living conditions and farm resources were generally superior in the high rainfall zone but anthropometric findings did not differ greatly in both zones. Anthropometric data from 235 children from the surveyed families demonstrated that 50% of the children were below 90% of international reference standards in weight for age and that there was also a high prevalence of stunting in both zones with 17% of preschool and school children being below 90% height for age. Weight for height values were generally close to reference standards in both zones. The percentage deficits in weight/age and height/age increased with age and a larger sample of 331 school age children from the same villages confirmed these findings. For school age children differences between zones were however significant with the high rainfall zone being superior. The validity of the international reference standards used was supported by the finding that 95, 7-8 year old Syrian children from more a privileged backgrounds attending a private school in Aleppo closely paralled reference data from well nourished healthy children from western populations.

The majority of families in both zones preserved and stored cereals, food legumes (mainly lentils), dairy products and a variety of vegetables and fruits. Purchases of raw or preserved products from the market were significantly more frequent in the low rainfall zone, except for dairy products which were provided mostly from owned livestock in both zones. Cereals were present in the largest number of meals per day in both zones, and were commonly consumed combined with dairy products and/or oils.

The interrelationships between farm resources and dietary consumption were suggested by: significantly higher consumption of dairy products as more livestock was owned; the seasonal variations in the variety and frequency of consumption (more fruits & vegetables and less cereals and fresh dairy products in the summer); and finally the greater impact of drought on food reserves in the low rainfall zone. Although weight and height deficits in children increased with age in both zones, no direct relationships between anthropometric deficits, farm resources and dietary patterns could be demonstrated since the differences between zones while frequently significant were small and all the farmers were relatively poor.

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# NUTRITION AND AGRICULTURAL DEVELOPMENT

The world prevalence of Protein Energy Malnutrition in its severe and moderate forms is presently estimated to be about 104 million cases in developing regions, of whom 11 million are reported in the Near East (Pellett, 1983b). It has now become more accepted that malnutrition is caused by interrelated social, political and economic factors which affect food supply and distribution between and within families (Pellett, 1983a). Efforts therefore to solve major nutritional problems must be made within the framework of economic and social development, rather than solely through nutrition intervention aimed at specific nutritional deficiencies (Pinstrup-Andersen, 1986). Both agricultural (more production) and nutritional (better utilization) solutions are thus needed to solve societal problems of malnutrition.

Traditionally nutrition and agricultural development have been considered as separate activities, however their linkage is now recognized and has been acknowledged (FAO, 1982; Frankenberger, 1985; Lunven and Sabry, 1981; Miladi et al., 1983; Nygaard and Pellett, 1986; Pinstrup-Andersen and Berg, 1984). A full bibliography of "Food consumption and nutrition effects of international development projects and programs" has also been produced (Editorial Experts for USAID, 1983). The immediate causes of malnutrition: food shortage, lack of access to food, uneven distribution within the family and inefficiency of physiologic utilization due to impaired health may all be involved either individually or in combination. Some of them can be affected by agricultural policies, while others require other approaches. Agricultural development can improve nutrition by increasing food availability, as well as accessibility to food by influencing prices and household incomes (Lunven and Sabry, 1981; Pinstrup-Andersen, 1981). However, in some cases food shortage may be a major problem, yet increased food production will not necessarily result in increased food consumption and better nutrition, if some factors such as farm families' diet and food preparation techniques are ignored (Tripp, 1984). A new crop variety which complies with agricultural considerations including soil, climate and cropping system and is of high nutritional value may not be an important component in the diet of the vulnerable groups. In addition, it might displace the production of a traditional food, and if it is accepted because of its income generating potential, the latter may not be spent on food purchases. Equally important considerations pertain to preparation, cooking and storage problems that the new variety may entail. These are some of the factors that might limit or hinder the potential benefits of improved agricultural techniques to farmers and other consumers, such as the rural landless and urban poor populations.

Agricultural projects are often directed to the small farm sector. Although there is often considerable overlap between the malnourished section of the population and the small farm sector, this may not be the case in a particular area. Therefore identification and ranking of vulnerable groups in terms of geographic location and socioeconomic characteristics will allow setting research goals and priorities. As mentioned by Lunven, who reports six cases of failures of agricultural development projects, "Often the problems were targeting ones: the projects were not reaching the people most in need" (Lunven, 1986). To prevent such failures, many scientists involved in agriculture, food science and nutrition recommend the integration of nutrition considerations into all rural and agricultural development projects at the level of planning and later evaluation of the projects' success (Fleuret and Fleuret, 1980; Lunven, 1986; FAO, 1982; Whelan, 1983). Nutritional assessment will not only prevent negative effects, but most importantly will increase their effectiveness. If nutrition information can be collected and analyzed within the framework of farming system research, decisions can be made as to whether nutritional objectives can be effectively incorporated into development aims.

## OBJECTIVES

An extensive survey, was conducted within the Farming Systems Program at ICARDA in 1977-1980, involving sociological and economic considerations pertaining to agricultural practice (FSP/ICARDA, 1980). One of the important results of this research was the documentation of significant differences in agricultural production across different rainfall zones and the profound effect that this had on overall food availability and the socioeconomic status of farmers in each zone. Since the survey was not designed to answer nutritional questions, it was not known whether these differences led in practice to effects on the nutritional status of the population.

Because nutritional considerations should be integrated into agricultural development, the present research was initiated. Nutritional and qualitative dietary assessment surveys were thus conducted in eight rural villages in the high and low rainfall areas of Aleppo Province, in order to answer the following questions:

1. Do nutritional problems exist in children, if so how serious are they?
2. What are the major factors which affect nutritional status and can differences in nutritional status be explained by investigation of patterns of food consumption, food processing and preservation, and economic constraints on food purchases ?
3. To what extent and in what ways could these factors be incorporated into ICARDA's research priorities and alternatively can knowledge of food patterns, preferences, and general family behavior in relation to food affect the priorities for the region.

# METHODOLOGY

Nutrition assessment is concerned with the measurement and description of the nutritional status of populations in relation to economic, sociodemographic and physiologic variables that affect nutrition. Four basic methods are available: anthropometry, dietary, clinical, and laboratory studies, that can be used separately or collectively. The choice is determined by the objectives of the survey along with other considerations such as the availability of trained personnel, laboratory facilities, financial resources and the urgency of the situation. In view of these considerations in the study area and the objectives of the research, anthropometric and dietary surveys were selected. The anthropometric indicators and their interpretation using reference standards are described in Annex I. The methods used to assess dietary intake are presented in Annex II. Finally, some background information on surveyed villages, as reported by the village headmen, is presented in ANNEX III. The reader is referred to the material in the thesis: "Evaluation of nutritionally relevant indicators in villages in Aleppo Province, Syria, and their relation to agricultural development." (Mokbel, 1985) for more detailed information concerning this research.

## Sampling procedure and sample size.

Two areas in Aleppo Province were chosen for investigation which differed substantially in their rainfall and hence their farming systems. This was hoped to allow a better comparison and evaluation of nutritional indicators in relation to agricultural development. Four villages were selected by systematic random sampling from a list of all villages in each of the two rainfall zones: a high rainfall (up to 600 mm and not less than 250 mm annually) and a low rainfall zone (200 to 250 mm). Very large and very small villages were excluded by selection of only those villages whose mean population size fell within ±0.5 SD of the means. Since the survey aimed at identifying nutritional problems affecting children, potential household participants consisted of families having children under 6 years of age, again selected at random from a list provided by the village headman. Household interviews began in February 1984 and were completed by April 1984. Second interviews to allow for seasonal variations were performed in August 1984. Thirty-eight families were interviewed in each rainfall zone during the first survey. Fewer families were interviewed in the second survey, especially in low rainfall villages. This was because of the extreme drought in the region during 1984, and 14 families in the low rainfall zone left their homes for the summer. These families were either looking for seasonal agricultural work and/or grazing areas for their flocks in higher rainfall areas, or were in search for nonagricultural work in a city.

Questionnaires were originally written in English but were later translated into Syrian Arabic dialect as spoken in the villages. Bilingual versions were used in the survey. Questionnaires were constructed to obtain information on: (1) family composition and living conditions; (2) agricultural resources; (3) traditional food processing and storage practices; (4) family food consumption pattern: qualitative 24-hour recall and food consumption frequencies; (5) general health indicators and infant feeding practices. Finally anthropometric determinations were made on children in the villages of both zones.

Anthropometric measurements.

Weights and heights were collected on children of all interviewed families. Additional measurements were made on the children of nonparticipant families to allow better comparison between rainfall zones. Children of interviewed families consisted of both preschool children (under six years of age) and school children (six to twelve years). The total number of children from interviewed families was 235, of whom 151 were preschool children and 84 were school children (Table 1). Eighty-eight of the preschool children were measured in both winter and summer. The ages of preschool children were those given by the parents, while school records were used for older children of both participant and nonparticipant families. The latter group included 331 children examined at the village school, in addition to the children of interviewed families. Thus the overall sample of rural children was 566 children.

The growth standard that was used was the WHO/NCHS data recommended as an international reference (Waterlow et al., 1977; WHO, 1979). This standard is in practice almost identical to the U.S. median values for the various age groups. The possibility of genetic differences in growth potential, and hence the distinction to be made between "reference values" and "standard or target" for populations of different

Table 1

Sample size

| | Households Winter | Households Summer | Number of children: Interviewed households | | Noninterviewed households | |
|---|---|---|---|---|---|---|
| | N | N | N | % | N | % |
| Bahwarta | 8 | 7 | 28 | 12 | 52 | 16 |
| Sandara | 10 | 10 | 41 | 17 | 58 | 17 |
| Tiltane | 10 | 8 | 30 | 13 | 32 | 10 |
| Massudie | 10 | 10 | 28 | 12 | 70 | 21 |
| Total high rainfall | 38 | 35 | 127 | 54 | 212 | 64 |
| Rshadiye | 10 | 5 | 27 | 11 | 20 | 6 |
| Raheb | 10 | 4 | 20 | 9 | 42 | 13 |
| Harbakiye | 10 | 9 | 36 | 15 | 28 | 8 |
| Hibss | 8 | 6 | 25 | 11 | 29 | 9 |
| Total low rainfall | 38 | 24 | 108 | 46 | 139 | 36 |
| Both zones | 76 | 57 | 235 | 100 | 331 | 100 |

ethnic origins has been raised (Keller et al., 1976; Waterlow et al., 1977 and Gueri et al., 1980). A group of socioeconomically advantaged children from a private school in Aleppo City was thus used for comparison both with the international reference standard and with rural children. Measurements were taken in September 1984 on 95 children between 7 and 8 years of age.

A pediatric scale and a measuring box were used for infants, and a beam balance with a height meter for older children. Scales were standardized in each village, and measurements were taken following the precautions recommended by Jelliffe (1966). Following the procedure used in the National Nutrition Survey of Egypt (ARE, 1979; ARE, 1981), the criteria for height/age were chosen to be below 85 and between 85 and 89% for severe and moderate stunting respectively, while below 80 and between 80 and 85% of weight/height were used for indication of severe and moderate acute malnutrition. The Gomez classification (Gomez et al., 1956) was used to evaluate the weight/age criteria with above 90% being normal and the 1st, 2nd and 3rd degree malnutrition categories beginning at 90%, 75% and 60% of the reference values respectively.

<u>Traditional food processing and storage practices</u>.

Information was gathered on foods processed in 1983 for consumption in 1983-84. A list of some 20 foods traditionally processed in villages was elaborated and during the visit to the families housewives were questioned concerning their storage of the tabulated foods. When the response was affirmative, questions were asked concerning the origin of the food and whether processed at home; the time of year of processing;

the quantity stored and the period over which it was consumed. Since each food was generally stored once a year, the quantities stored were considered available to the family for twelve months, although the consumption generally take place over much shorter periods. Yearly per caput availability of each stored food was obtained by dividing the total quantity stored by the total number of household members. Only families who stored the food were included and, since the purpose was to estimate availability rather than actual consumption, children and adults were given the same weighting.

Family food consumption pattern.

The 24-hour recall was conducted first. The approximately 40 food items listed in the questionnaire were used as a check list. Open-ended questions were asked as follows: "Did your family eat breakfast this morning ?" If yes, "What did you eat ?" The same sequence was followed for lunch and dinner and snacks of the previous day. Foods were recorded under each meal in which they were recalled. Thus the maximum number of occurrences of each food could be four. Inquiries were also made as to the origin of these foods, e.g., purchased or grown, and whether they were also eaten on other days. When the 24-hour recall was completed, weekly frequency and origin of foods included in the list but not reported in the qualitative 24-hour recall, were determined as follows: "Did you eat this food on any other day of this week ?" and if yes, "On how many days?". Finally, the total number of household members eating regularly together at the time of the survey, was inquired as it might not necessarily coincide with reported family size.

In order to obtain food consumption patterns, individual foods were grouped into categories for most of the statistical analyses. These were: dairy products; cereals; food legumes; vegetables; fruits; meats (including eggs) and oils. For example the dairy products category would include: milk, yoghurt, cheese, ghee, butter, shneena (buttermilk) and duberkeh (processed buttermilk). A miscellaneous category was added for composite food items which were often purchased such as "lahm bi ajeen" (meat pie).

First however the average number of meals containing the individual food ($F_i$) was calculated:

$$F_i = (n_1 + 2n_2 + 3n_3 + 4n_4)/38$$

where $n_1$ to $n_4$ are the numbers of families reporting the consumption of that individual food, once, twice, three and four times a day and 38 is the total number of interviewed families in each rainfall zone. The frequency of consumption of foods grouped into the various food categories ($F_c$) was then calculated by averaging the consumption of foods in that category by use of the formula:

$$F_c = \sum_{i=1}^{N} (F_i)/N$$

where $F_i$ is calculated as described above and N is the number of foods in that category.

As an example from data collected in the high rainfall zone, Khobz saj (saj bread) was consumed once daily by one family, twice daily by two families, three times daily by eight families and four times daily by four families. The average number of meals containing saj bread (Fi) was thus 45/38 = 1.18 meals/day. The other foods in the cereal category (bakery bread, burghul, freekeh and rice) averaged 1.89, 0.77, 0.02 and 0.39 meals/day respectively. Thus the average number of meals containing cereal foods ($F_c$) was 4.25/5 = 0.85 meals/day.

Seasonal variation.

The second (summer) survey was mainly concerned with the origins and quantities of cereals, food legumes and dairy products stored for 1984-85 consumption. These were assessed so as to investigate variations in the availability of staple foods, especially in view of the unusual drought of the 1984 winter season. In addition however determinations of family dietary patterns were repeated exactly as described for the winter survey sa as to determine seasonal variations in food intake patterns.

## RESULTS

Socioeconomic and agricultural background.

Since direct questions on income were not encouraged, socioeconomic status was assessed from living conditions. It was found that families in the high rainfall zone had significantly better living conditions as was indicated by the total number of rooms in the house, number of persons per room, availability of electricity and running water, and fresh food storage facilities (Table 2). When data from both rainfall zones were combined, there was an average of 5.3 children per family and 7.7 persons per household. Between zone comparisons showed no

Table 2

Average family size, living conditions and farm resources of surveyed families in the two rainfall zones.

| | High Rainfall Zone | | Low Rainfall Zone | |
|---|---|---|---|---|
| <u>Family size</u> | N | Mean | N | Mean |
| Children/family | 38 | 5.4 | 38 | 5.3 |
| Persons/household | 38 | 8.1 | 38 | 7.7 |
| <u>Living conditions</u> | | | | |
| Rooms/house | 38 | 2.6[b] | 38 | 1.5 |
| Persons/room | 38 | 3.4[b] | 38 | 5.4 |
| <u>Farm Resources</u> | | | | |
| Cultivated land Area/family ha | 29 | 12.1[b] | 31 | 4.6 |
| Area/person ha | 29 | 1.7[a] | 31 | 0.6 |
| Farm Animals Sheep and goats/family | 31 | 14.6 | 35 | 18.3 |
| Chickens/family | 35 | 14.8[b] | 31 | 7.4 |

a,b. Significant differences between zones based on one way analysis of variance: $P<0.01$ and $P<0.001$ respectively.

significant differences for these values. The ability to read was high among husbands, but most wives were illiterate. The majority of husbands in both zones were farmers and most women worked on the family's land (Tables 3, 4 and 5). Most interviewed families (72%) owned land but while no significant difference was found between zones in total land holding, the mean cultivated area per household was significantly larger in the high rainfall zone, 12.1 ha compared to 4.6 ha (Table 2). Per caput land availability was also significantly larger in the high rainfall zone at 1.7 ha and 0.7 ha per caput respectively. The average number of sheep and goats owned did not differ significantly between zones and averaged 16 per family. Twice as many chickens were however owned per family in the high rainfall zone compared to the low rainfall zone, and this difference was highly significant ($P<0.001$). Not unexpectedly, a greater variety of crops was grown in the high rainfall zone and consisited of cereals, food legumes, and various vegetables and fruits, compared to predominantly barley and wheat in the low rainfall zone. Some details on the areas used for the major crops and the yields obtained are presented in Table 6.

Fluctuations in production can affect food consumption of rural families by reducing availability of foods, as well as in an indirect manner by affecting income. The survey coincided with extreme drought conditions, and to cope with the resulting reduction in grazing areas, many families sold all or part of their flock (Table 7). The effect of the drought on livestock was significantly greater in the low rainfall zone where 11 families (58%) sold all or part of their sheep, compared

Table 3

Occupations of husbands and locations of nonagricultural occupation

| | Number and Percentages of Husbands | | | | |
|---|---|---|---|---|---|
| Zone | High Rainfall | | Low Rainfall | | Significance |
| Total Households | (38) | | (38) | | |
| | N | % | N | % | P< |
| Type of Occupation | | | | | |
| Farmer only | 7 | 18 | 10 | 26 | |
| Farmer & additional work | 17 | 45 | 17 | 45 | NS |
| Wage-earner only | 11 | 29 | 10 | 26 | |
| Unemployed or deceased | 3 | 3 | 1 | 3 | |
| Location Nonagricultural Occupation | | | | | |
| Same village | 14 | 52 | 0 | 0 | |
| Aleppo or other city | 13 | 48 | 21 | 81 | 0.001 |
| Other country | 0 | 0 | 5 | 19 | |

Significance between zones based on Chi-square procedures.

Table 4

Women's work in agriculture

| | Number and Percentages of Women | | | |
|---|---|---|---|---|
| Zone | High Rainfall | | Low Rainfall | |
| Total Women | (37) | | (38) | |
| | N | % | N | % |
| Family land | 25 | 68 | 29 | 76 |
| Wage-earning labor | 2 | 5 | 2 | 5 |
| Did not work | 10 | 27 | 7 | 18 |

No significant difference between zones based on Chi-square procedure.

Table 5

Division of agricultural labor among household members

| Zone<br>Total Households | High Rainfall<br>(29) | Low Rainfall<br>(31) | Significance<br>P< |
|---|---|---|---|
| Total Family Contribution(1)(%) | 55 | 32 | 0.05 |
| Female Contribution(2)(%) | 44 | 49 | NS |
| Average Numbers/Family | | | |
| Males | 2.2 | 1.2 | 0.001 |
| Females | 2.1 | 1.3 | 0.01 |

Significance between zones based on t-tests.

(1) Total Family Contribution =

Total family agricultural labor/Total family size.

(2) Female contribution =

Total female agricultural labor/Total family agricultural labor.

(Part-time = 0.5 and full-time = 1)

Both calculations included children who were given the same weight as adults.

Table 6

Mean areas and yields of various crops

| Rainfall Zone: | Area (ha) | | | | | | | Yield (tons/ha) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High | | | Low | | | | High | | | Low | | | |
| | N | Mean | ±SD | N | M^an | ±SD | P< | N | Mean | ±SD | N | Mean | ±SD | P< |
| Wheat | 23 | 4.6 | 5.1 | 17 | 1.9 | 1.1 | 0.05 | 23 | 1.7 | 1.0 | 17 | 0.4 | 0.1 | 0.001 |
| Barley | 26 | 3.1 | 2.5 | 31 | 3.5 | 2.0 | NS | 26 | 1.3 | 0.3 | 31 | 0.4 | 0.1 | 0.001 |
| Lentils | 25 | 1.9 | 1.6 | 0 | 0 | 0 | - | 22 | 0.7 | 0.4 | 0 | 0 | 0 | - |
| Chickpeas | 3 | 1.7 | 1.4 | 0 | 0 | 0 | - | 2 | 0.6 | 0.5 | 0 | 0 | 0 | - |
| Faba beans | 4 | 0.6 | 0.2 | 0 | 0 | 0 | - | 4 | 0.9 | 0.9 | 0 | 0 | 0 | - |
| Summer crops | 27 | 1.8 | 1.7 | | | | | | | | | | | |
| Vegetables | 26 | 0.5 | 0.4 | 1 | 0.1 | - | - | | | | | | | |
| Trees | 12 | 2.0 | 2.0 | | | | | | | | | | | |
| Cotton & sugarbeet | 9 | 1.9 | 1.3 | | | | | | | | | | | |

Significant differences between zones based on one-way analyses of variance.

Syria's average yields for 1982 were: wheat 1.3; barley 0.4; lentils 0.9; and chickpeas 0.7 tons/ha (SAR, 1983).

Table 7

Changes in agricultural production and livestock:
1984 compared to 1983,
and their effects on family food storage

| Zone | High Rainfall N | High Rainfall % | Low Rainfall N | Low Rainfall % | Significance P< |
|---|---|---|---|---|---|
| | Number and Percentages of Households | | | | |
| **Crop Production** | | | | | |
| Decrease | 21 | 84 | 18 | 100 | |
| Increase | 1 | 4 | 0 | 0 | NS |
| Same | 3 | 12 | 0 | 0 | |
| Total | 25 | 100 | 18 | 100 | |
| **Sheep** | | | | | |
| Sold all | 2 | 7 | 5 | 26 | |
| Sold part | 1 | 4 | 6 | 32 | 0.05 |
| Same | 25 | 89 | 8 | 42 | |
| Total | 28 | 100 | 19 | 100 | |
| **Goats** | | | | | |
| Sold all | 3 | 11 | 1 | 5 | |
| Sold part | 2 | 7 | 4 | 21 | |
| Same | 22 | 79 | 13 | 68 | NS |
| Increase | 1 | 3 | 1 | 5 | |
| Total | 28 | 100 | 19 | 100 | |
| **Effect on Food Storage** | | | | | |
| Decrease | 7 | 100 | 5 | 28 | |
| Delay | 0 | 0 | 9 | 50 | 0.01 |
| More purchase | 0 | 0 | 4 | 22 | |
| Total | 7 | 100 | 18 | 100 | |

Significance between zones based on Chi-square procedures.

to only 3 families (11%) in the high rainfall zone. In a study conducted in Al Bab region of Aleppo Province in July 1984, Tully (1984) reported that 38% of village livestock had been sold by July in low rainfall villages. Somel (1983) suggested the "banking" function in livestock production, whereby herds are thinned in times of financial need.

Rural families in the high rainfall zone thus had ,in general, greater and more stable farm resources and reserves than families in the low rainfall zone.

Health and infant feeding practices.

Most mothers in both zones (82%) delivered at home where they were assisted by traditional midwives. Forty-two percent of mothers reported incidents of miscarriage and 37% reported infant deaths in the first year of life, with the cause of death being unknown to parents in the majority of cases. Diarrhea was often involved, but a causal relationship between diarrhea and infant deaths could not be confirmed.

Four episodes of diarrhea per year per child occurred on average in the preschool children and was slightly more frequent in winter. As a consequence, one-third of the mothers fed the child more fluids, 11% discontinued milk (breastfeeding or bottle) but the majority made no dietary changes.

Mothers breastfed their children for 18 months, and introduced solid foods at about 10 months. Most mothers (80%) gave their children home-prepared weaning foods based on mixtures of rice, yoghurt, eggs, tea, and bread, with only 7% using purchased packaged foods. On the whole, no significant differences were found between zones in maternal health and infant feeding patterns.

## Anthropometric findings

Preschool and school age children from interviewed families. Data are expressed as percentages of reference standard values for weight/age, height/age and weight/height and the mean values for sexes and zones combined but tabulated according to age are presented in Table 8. Statistical analyses were also performed to test the significance of differences between zones, sexes, and age groups by use of a three-way analysis of variance procedure. No significant differences were observed between sexes or zones when mean weight/age, height/age and weight/height were compared. When the weight/height criterion was used no significant difference by age was found, but in contrast, a very highly significant difference between age groups was found when weight/age ($P<0.01$) and height/age ($P<0.001$) were used, with deficits progressively increasing as age increasing (Table 8). Using the combined group of children from interviewed families some 50% of all children were defined as below normal (<90%) using weight/age criteria, 17% were chronically undernourished using height/age (<90%) but only 5% showed acute undernutrition (<85%) when weight/height was used (Table 9). Although not shown in tabular form, a Chi-square test for these data showed no significance between zones. One criterion of severe malnutrition refers to children who are both stunted (<90% height/age) and wasted (<85% weight/height). Only three children fell into this

Table 8

Mean percentages of the WHO/NCHS median weight/age, height/age and weight/height for children of interviewed families: sexes and zones combined

| | | Weight/Age[a] | | Height/Age[b] | | Weight/Height | |
|---|---|---|---|---|---|---|---|
| Age (years) | N | Mean | ±SD | Mean | ±SD | Mean | ±SD |
| < 1 | 34 | 99 | 17 | 99 | 5 | 100 | 18 |
| 1 - 1.9 | 17 | 87 | 14 | 95 | 6 | 95 | 13 |
| 2 - 3.9 | 51 | 91 | 14 | 94 | 7 | 101 | 10 |
| 4 - 5.9 | 49 | 94 | 11 | 95 | 4 | 103 | 8 |
| 6 - 7.9 | 29 | 91 | 11 | 94 | 4 | 101 | 6 |
| 8 - 9.9 | 30 | 85 | 11 | 93 | 4 | 102 | 7 |
| 10 - 12.9 | 25 | 81 | 18 | 92 | 5 | 103 | 11 |
| Total | 235 | 91 | 14 | 95 | 6 | 101 | 11 |

[a,b] Significant differences between age groups at $P<0.01$ and $P<0.001$ respectively, based on three-way analyses of variance.

Table 9

Anthropometric data in relation to WHO/NCHS standards: Children of interviewed families, N = 235.

| Malnutrition Degree | Weight for Age Definition[a] | % | Height for Age Definition | % | Weight for Height Definition | % |
|---|---|---|---|---|---|---|
| Severe | <75 | 11 | <85 | 4 | <80 | 3 |
| Moderate | 75–89 | 39 | 85–89 | 13 | 80–84 | 2 |
| Normal | > 90 | 50 | > 90 | 83 | > 85 | 95 |

Gomez classification (Gomez 1956) severe category here includes secondary and tertiary degree malnutrition.

combined grouping; two of them were from the higher rainfall area.

Growth. Since winter measurements were taken in February-April, and summer measurements in August, there was a gap of 4 to 6 months between measurements. In order to evaluate growth, the differences between summer and winter weights were computed for individual measurements and compared with the difference in weights of reference children over the same period. A similar computation was done for height. The results obtained are summarized in Table 10 which also shows significance levels obtained from paired t-tests. Children less than 2 years of age increased in weight at the same rate as reference children, while weight increments of children between 2 and 5 years of age were significantly less than those of reference children. On the other hand, growth in height of the sample preschool children compared well with that of reference children except for those children between 7 and 11 months who grew at a significantly smaller rate than reference children of the same age.

School age children from villages. Data for these children, combined with the school age children from interviewed families are shown in Table 11. When rainfall zones were compared using three-way analyses of variance, significantly higher values in the mean weight/age percentages ($P<0.05$) and weight/height ($P<0.01$) were observed in the high rainfall zone. No differences were observed between zones when mean heights/age percentages were compared. When zones were combined, significant differences ($P<0.05$) between sexes were found only for

Table 10

COMPARISON OF GAINS IN WEIGHT AND HEIGHT OF PRESCHOOL CHILDREN WITH GAINS OF REFERENCE CHILDREN OVER THE SAME PERIOD

| | Age groups (Months) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-6 | | 7-11 | | 12-23 | | 24-35 | | 36-47 | | 48-59 | | 60-71 | |
| Number of Children | 13 | | 7 | | 9 | | 16 | | 13 | | 16 | | 14 | |
| | Means and Standard Deviations | | | | | | | | | | | | | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| Weight Gain (kg) | | | | | | | | | | | | | | |
| Sample | 2.2 | 1.2 | 1.1 | 1.4 | 0.7 | 0.9 | 0.4[b] | 0.5 | 0.4[b] | 0.4 | 0.2[c] | 0.4 | 0.2[b] | 0.4 |
| Reference | 2.7 | 0.7 | 1.3 | 0.2 | 0.8 | 0.1 | 0.9 | 0.1 | 0.8 | 0.1 | 0.7 | 0.1 | 0.6 | 0.1 |
| Height Gain (cm) | | | | | | | | | | | | | | |
| Sample | 9.7 | 4.6 | 2.1[a] | 1.9 | 3.0 | 2.6 | 3.1 | 1.5 | 3.3 | 1.5 | 3.0 | 1.1 | 2.6 | 0.9 |
| Reference | 9.9 | 2.8 | 5.8 | 0.6 | 4.1 | 0.8 | 3.6 | 0.5 | 3.1 | 0.5 | 2.7 | 0.4 | 2.4 | 0.4 |

[a,b,c] Significance between sample and reference children at P <0.05, P <0.01 and P <0.001 respectively, based on paired t-tests.

Age groups based on ages of children in the winter survey.

Table 11

Mean percentages of the WHO/NCHS Median Weight/Age, Height/Age and Weight/Height for Village School Children

| | High Rainfall Zone | | | | Low Rainfall Zone | | | |
|---|---|---|---|---|---|---|---|---|
| | Weight/Age | | Height/Age | Weight/Height | Weight/Age | | Height/Age | Weight/Height |
| | N | Mean% | Mean% | Mean% | N | Mean% | Mean% | Mean% |
| Age (Years) | | | | | | | | |
| 6 - 7 | 73 | 97[b] | 96[a] | 104 | 51 | 92[b] | 95[b] | 101 |
| 8 - 9 | 89 | 91 | 94 | 105 | 61 | 91 | 95 | 102 |
| 10 - 12 | 94 | 87 | 94 | 104 | 47 | 80 | 92 | 100 |
| Total | 256 | 91[c] | 94 | 104[d] | 159 | 88 | 94 | 101 |

a,b Significant differences between age groups at (P<0.01 and P<0.001 respectively.

c,d Significant differences between zones at P<0.05 and P<0.01 respectively.

Based on three-way analyses of variance.

Note: These data are inclusive of the 84 school age children from interviewed families.

weight/age with males slightly heavier than females at the same age. Significant differences were observed between age groups when weight/age and height/age were compared (P<0.001) for combined sex and zone data. The sample was thus analysed separately for each zone using one-way analysis of variance, so that the percentages weight/age, height/age and weight/height at different ages could be compared. As was demonstrated for the children of the interviewed families, these children were also increasingly in deficit in height/age and weight/age as age increased. It can be concluded from Table 11 that while the 6-7 year old children from the combined zones averaged 95% of the reference standard for weight/age, the 10 to 12 year old group averaged only 85% of the reference standard. For height/age the corresponding values were 96% and 93% respectively. Both groups however remained at about median values using weight/height criteria.

Although not shown in tabular form, when sexes and zones were combined, and when based on weight/age, Gomez (1956) classification, 43% were mildly malnourished (1st degree), 10% moderately malnourished (2nd degree), but only 1% were in the severe (3rd degree) malnutrition category. Thus some 54% could be described as below normal. In contrast using height/age (<90%) only 14% of the sample were below normal and further by use of weight/height (<85%) only 1% were categorized as below normal. As had also been observed in the Egyptian surveys (ARE, 1979; ARE, 1981), weight/age considerably overestimates the prevalence of malnutrition when compared to weight/height measurements, with height/age being in an intermediate position. In this survey as with the Egyptian survey the children weighed less than well-nourished (reference) children of the same age but have become adapted to the situation and may be apparently healthy. The number malnourished is thus dependent on the definition used but could also depend on more detailed tests which might qualify the term "apparently healthy".

Comparison with urban sample. That comparison with the WHO (1979) standard was justified, was demonstrated by a survey of socially advantaged children from an Aleppo private school. The 95 children aged 7-8 years were compared with a village sample of 172 children of the same age (Table 12). The mean percentages of reference (median) weight/age, height/age and weight/height for the socially advantaged sample were 112, 101 and 108% compared with 94, 95 and 103% respectively for the village children. Ten percent of the latter children were in fact below 90% height/age with several below 85% weight/height. In contrast, no socially advantaged children were below these normal values for both indicators. When weight/age criteria were used, 27% of village children were below normal (<90%) weight/age compared to only 4% for the socially advantaged sample. Chi-square determinations showed these values to be highly significant different between the two samples (P<0.001). It could be concluded that the use of the WHO/NCHS standard for Syrian children was indeed justified and that poor performance in relation to the standards was not genetic but lay in the areas of health, nutrition and socioeconomic status.

Home Food Preservation and Storage

Table 12

Comparison of 7-8 year old Aleppo Private School children with village children of the same age.

| | N | Mean percentages of reference standard values | | |
|---|---|---|---|---|
| | | Weight/Age [a] | Height/Age [a] | Weight/Height [a] |
| Aleppo Private School Children | 95 | 112 | 101 | 108 |
| Village Children [b] | 172 | 94 | 95 | 103 |

a Significantly different from village children (P<0.001) by t tests.

b 7-8 year old children, rainfall zones combined: part of sample described in Table V.

Wheat. Wheat is the major staple food in Syria and other Middle Eastern countries. It is widely consumed as bread, parboiled wheat (burghul) and roasted wheat (freekeh). The preparation techniques of freekeh and burghul as applied in Syrian villages have been described by Williams (1984) and Williams and El Haramein (1984). The majority of farmers reported storing whole wheat (Table 13). Periodic milling, using a stone mill, provided wholemeal flour for home baking of single-layer bread (khobz saj). Burghul was stored by all interviewed households, and was processed at home by almost all families. Wheat used to prepare freekeh was produced on the farm in all cases. This was not so for flour and burghul where significantly more farmers in the low rainfall zone purchased their wheat stores for flour and burghul preparations than did those in the high rainfall zone ($P<0.05$ and $P<0.01$ respectively). The quantity of stored burghul available per year to individual household members was significantly more in the low rainfall zone, as is shown in Table 14. However, there was no significant difference between zones in yearly per caput supply of whole wheat, 136 kg in the high rainfall zone as compared to 146 kg in the low rainfall zone.

Year to year variation in wheat storage would be expected to be minimal in view of the widespread storage among households, and the sizable per caput supplies which it represents. These expectations were however not fulfilled by results from the summer survey. Only 13% of farmers in the low rainfall zone stored wheat in both years, compared to 66% in the higher rainfall zone (Table 15). This situation was probably

Table 13
Families reporting storage of various foods in different rainfall zones.

| | Number and Percentage of Households reporting storage of the various foods | | | | Percentage dependence[d] | |
|---|---|---|---|---|---|---|
| Zone: | High rainfall | | Low rainfall | | High rainfall | Low rainfall |
| | N | % | N | % | % | % |
| **Cereals** | | | | | | |
| Wheat/flour | 29 | 76 | 33 | 87 | 62[a] | 18 |
| Burghul | 38 | 100 | 38 | 100 | 54[b] | 21 |
| Freekeh | 10 | 26 | 5 | 13 | 100 | 100 |
| **Food Legumes** | | | | | | |
| Lentils | 37[a] | 97 | 29 | 76 | 68[c] | 3 |
| Chickpeas | 10 | 27 | 5 | 13 | 33 | 0 |
| Faba beans | 2 | 5 | 0 | 0 | 50 | 0 |
| **Vegetables** | | | | | | |
| Squash | 24[b] | 63 | 10 | 26 | 71 | 0 |
| Eggplant | 32 | 84 | 29 | 76 | 34[a] | 3 |
| Okra | 28 | 74 | 22 | 58 | 75[c] | 0 |
| Tomato | 37 | 97 | 38 | 100 | 46[c] | 3 |
| Green beans | 28[b] | 74 | 12 | 32 | 39 | 0 |
| Pepper | 37 | 97 | 31 | 82 | 23[a] | 3 |
| **Fruits** | | | | | | |
| Apricots & Figs | 32[b] | 84 | 21 | 55 | 6 | 0 |
| Grapes | 11[b] | 29 | 0 | 0 | 73 | 0 |
| **Dairy products** | | | | | | |
| Cheese | 37 | 97 | 36 | 95 | 64 | 53 |
| Ghee | 29 | 76 | 34 | 90 | 93 | 73 |
| Duberkeh | 24 | 63 | 18 | 47 | 88 | 72 |
| **Meat** | 13 | 34 | 9 | 24 | 15 | 22 |
| **Miscellaneous** | | | | | | |
| Olives | 36[a] | 95 | 29 | 76 | 0 | 0 |
| Other vegetables | 16 | 42 | 11 | 29 | 38 | 9 |

a,b,c. Significant differences between zones at P<0.05, P<0.01 and P<0.001 respectively based on Chi-square.

d Percentage of households depending entirely on farm production for storage; significance only tested when number of families reporting storage (N) exceeded 20 in each zone.

Table 14

Yearly per caput supplies from stored foods, winter survey.

| | High Rainfall Zone Yearly (Kg) | | | Low Rainfall Zone Yearly (Kg) | | |
|---|---|---|---|---|---|---|
| | N | Mean | ±SD | N | Mean | ±SD |
| Cereals | | | | | | |
| Wheat/Flour | 29 | 136.1 | 54.8 | 32 | 146.0 | 96.3 |
| Burghul | 38 | 22.8 [b] | 8.9 | 38 | 30.7 | 16.1 |
| Freekeh | 10 | 3.2 [a] | 1.0 | 5 | 4.7 | 1.4 |
| Vegetables | | | | | | |
| Squash | 24 | 0.9 | 0.7 | 10 | 0.7 | 0.4 |
| Okra | 28 | 0.5 | 0.3 | 20 | 0.6 | 0.4 |
| Tomato | 37 | 1.8 [b] | 0.8 | 37 | 2.9 | 2.3 |
| Green beans | 13 | 2.2 | 2.5 | 9 | 1.8 | 1.5 |
| Dairy products | | | | | | |
| Cheese | 37 | 3.9 [a] | 2.2 | 36 | 5.7 | 5.0 |
| Ghee | 29 | 2.0 | 1.0 | 32 | 2.3 | 1.8 |
| Duberkeh | 24 | 1.5 | 0.9 | 18 | 1.4 | 0.8 |
| Miscellaneous | | | | | | |
| Meat | 13 | 2.2 | 2.5 | 9 | 1.8 | 1.5 |
| Lentils | 37 | 5.2 | 4.6 | 29 | 4.5 | 2.9 |
| Olives | 36 | 3.1 | 1.5 | 29 | 2.9 | 3.4 |

a,b. Significant differences between zones based on t tests at $P<0.05$ and $P<0.01$ respectively.

Table 15
Changes in food storage over two consecutive years

| | Number and Percentages of Households who stored various foods both years | | | |
|---|---|---|---|---|
| | High Rainfall (35) | | Low Rainfall (24) | |
| | N | % | N | % |
| Cereals | | | | |
| Wheat/flour | 23[b] | 66 | 3 | 13 |
| Burghul | 34[a] | 97 | 15 | 63 |
| Freekeh | 3 | 9 | 0 | 0 |
| Lentils | 24[a] | 67 | 5 | 22 |
| Dairy products | | | | |
| Cheese | 31[b] | 91 | 8 | 35 |
| Ghee | 25[b] | 76 | 6 | 25 |
| Duberkeh | 17 | 52 | 5 | 21 |

a,b. Significant differences between zones at $P<0.01$ and $P<0.001$ respectively, based on Chi-square procedures.

exceptional because of the drought with farmers delaying their storage of wheat and burghul.

Food legumes. Lentils, chickpeas and faba beans are important sources of protein in the Middle East as well as in many developing countries (ICARDA, 1983). In the surveyed villages, lentils were the most frequently stored of these products; 87% of farmers from both zones stored lentils compared to 20% for chickpeas and 3% for faba beans. As would be expected, lentil storage was significantly higher among farmers of the higher rainfall villages where the crop is grown. Most of these farmers (68%) stored lentils from their own farm production, while the majority (90%) of farmers in the low rainfall zone relied on purchases. Nevertheless, an analysis of variance showed no significant difference between zones in the yearly per caput supply of stored lentils, 5.2 and 4.5 Kg in the high and low rainfall zones respectively. However, only 5 families (22% of the low rainfall sample) reported storing lentils in both years, compared to 24 families (67%) in the high rainfall zone. This decrease in frequency of lentil storage could be attributed to lower production as a result of drought and the related higher prices. Farmers did report higher retail prices in the summer.

Vegetables and fruits. Most housewives in both zones reported preserving and storing a variety of vegetables and fruits. However, fruits and some vegetables such as squash and green beans, were more frequently processed in the high rainfall zone. Sun drying was the most usual preservation technique. Most vegetables were either coarsely sliced or cored (eggplants and peppers), and laid on large aluminum dishes in the yard or on the roof of houses for one or two days. Further grinding of dried pepper was also reported. Preservation of tomatoes was more elaborate, involving sun drying for one or more days. Ripe tomatoes were mashed, sieved to remove seeds and further sun dried before storing in glass jars. Jars were kept airtight by pouring a layer of olive oil on top. Pickling of eggplant and pepper in oil or vinegar was also a popular preservation procedure. Most of these activities are done in the summer when fruits and vegetables are most available. Preserved products were stored for periods varying from 2 to 7 months depending on the vegetable, the type of preservation and the quantities stored.

Purchases of preserved products from the market were more frequent in the low rainfall zone, while home preservation of farm produced vegetables was more prevalent in the higher rainfall zone (Table 13). Yearly supplies for most vegetables and fruits were similar in both zones, with the exception of tomatoes which were significantly greater in the low rainfall zone although not grown in that area (Table 14). This finding is not as surprising as it may seem when viewed in context of food preferences. The most popular recipe for burghul in surveyed villages involved frying with onions and tomatoes. As reported earlier, burghul supplies were significantly higher in the low rainfall zone.

Meat and dairy products. Processing of dairy products, mostly sheep and goat milk, was widespread among households in both zones, in contrast with meat (mostly lamb) preservation. Dairy products included cheese (jibneh), ghee (samneh), and processed buttermilk (duberkeh).

The majority of the sample (97%) stored cheese, 85% stored ghee and 55% duberkeh, which were mostly processed at home. Detailed descriptions of home processing of a variety of dairy products as practiced in the Middle East and North Africa are described by Basson (1981) and Zumrawi et al. (1983). In the winter survey, yearly per caput supplies of cheese and ghee were slightly higher in the low rainfall zone, but differences were not statistically significant (Table 14). In a similar manner to that observed for wheat and lentils, significantly fewer families stored cheese and ghee at the time of the summer survey (Table 15). Also, as a consequence of drought, supplies of cheese and ghee in 1984 were significantly lower than in the previous year. Although not included as a question in the interview, some farmers commented on the decrease in milking capacity of their flocks as a result of reduced feeding. Their winter stocks of animal feed were exhausted, and grazing areas were affected by drought. On the whole, the yearly supplies of cheese and butter in surveyed villages compare well with the FAO Food Balance Sheets (FAO, 1980) estimates for Syria of 3.4 and 2.9 Kg respectively. They are also in good agreement with results obtained in a survey of semi-nomadic families in the north-western Syrian steppe: yearly per caput availabilities of cheese and ghee were estimated at 2.9 and 2.8 kg respectively (Thomson et al., 1986).

## Dietary Consumption Pattern

*Qualitative 24-hour recall.* Tabulation of the average number of meals consumed daily containing the food categories is presented in Table 16. Dairy products were more frequently consumed in the high

Table 16

Winter survey: Mean number of meals/day per family containing each food category

| Zone<br>Total Households | High Rainfall (38) | | Low Rainfall (38) | | Significance |
|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | P< |
| Dairy products | 0.53 | 0.18 | 0.31 | 0.23 | 0.001 |
| Cereals | 0.85 | 0.21 | 0.87 | 0.22 | NS |
| Food legumes | 0.09 | 0.17 | 0.09 | 0.18 | NS |
| Vegetables | 0.12 | 0.10 | 0.14 | 0.12 | NS |
| Fruits | 0.05 | 0.16 | 0 | 0 | NS |
| Meat products | 0.30 | 0.34 | 0.21 | 0.31 | NS |
| Oils | 0.51 | 0.26 | 0.64 | 0.48 | NS |
| Miscellaneous | 0.42 | 0.28 | 0.15 | 0.21 | 0.001 |
| Total meals/day | 2.91 | 0.55 | 2.44 | 0.51 | 0.001 |

Mean Meals/Day and Standard Deviations (heading spanning the High Rainfall and Low Rainfall columns)

Significance between zones based on one-way analyses of variance.

Mean meals/day for a food category $= \sum_{i=1}^{N} Fi/N$

Fi = Mean number meals/day for individual foods in category.

N = Total number of food items grouped into a category.

rainfall zone. The variety of foods (more miscellaneous foods) and the total number of meals per day were also significantly higher. Cereals contributed the largest number of meals per day in both zones, and were commomnly consumed combined with dairy products and/or oils.

Changes in consumption patterns between seasons are summarized in Table 17. Seasonal variations in consumption patterns were more pronounced in the high rainfall zone, and significant differences were observed for most food categories. The number of meals containing dairy products decreased significantly in summer. This coincided with the end of the lactation period of ewes. Significant decreases were also observed for cereals, meat, poultry and other miscellaneous foods in the high rainfall zone, while consumption of vegetables and fruits increased significantly in both zones. Vegetables and fruits are grown in summer, and are thus available to producers, and are at accessible prices for nonproducers.

Food frequencies per week. Significant differences between zones were found in the number of days per week on which various foods appeared (Table 18). Dairy and meat (including eggs) products appeared significantly more often in the high rainfall zone, while burghul, potatoes and tomatoes were more frequently consumed in the drier zone. Paired t-tests were performed to determine whether there were significant differences in consumption patterns between seasons as estimated on a weekly basis (Table 19). Most vegetables (eggplants, squash, green beans, tomatoes, peppers and onions), and vegetable oil which is used for frying were more frequently consumed in summer in both

Table 17

Seasonal variation in the mean daily meals per family, containing each food category

| Total Households | Mean Number Meals/Day/Family and Standard Deviations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | High Rainfall (35) | | | | | Low Rainfall (24) | | | | |
| | Winter | | Summer | | | Winter | | Summer | | |
| | Mean | ±SD | Mean | ±SD | P< | Mean | ±SD | Mean | ±SD | P< |
| Dairy products | 0.53 | 0.18 | 0.33 | 0.23 | 0.001 | 0.31 | 0.20 | 0.23 | 0.25 | NS |
| Cereals | 0.86 | 0.21 | 0.72 | 0.22 | 0.05 | 0.87 | 0.25 | 0.79 | 0.19 | NS |
| Food legumes | 0.08 | 0.16 | 0.06 | 0.21 | NS | 0.09 | 0.20 | 0.01 | 0.06 | NS |
| Vegetables | 0.12 | 0.11 | 0.51 | 0.24 | 0.001 | 0.13 | 0.12 | 0.51 | 0.27 | 0.001 |
| Fruits | 0.05 | 0.17 | 0.24 | 0.23 | 0.001 | 0 | 0 | 0.02 | 0.09 | NS |
| Meat | 0.31 | 0.35 | 0.13 | 0.21 | 0.01 | 0.25 | 0.33 | 0.06 | 0.19 | 0.05 |
| Oils | 0.51 | 0.27 | 0.49 | 0.30 | NS | 0.69 | 0.54 | 0.69 | 0.31 | NS |
| Miscellaneous | 0.41 | 0.29 | 0.12 | 0.21 | 0.001 | 0.22 | 0.23 | 0.09 | 0.18 | 0.005 |

Significance between seasons based on paired t-tests.

Table 18

Mean number of days/week on which individual food items occurred in the winter survey

| Zone<br>Total Households | High Rainfall (38) Mean | High Rainfall (38) ±SD | Low Rainfall (38) Mean | Low Rainfall (38) ±SD | Significance P< |
|---|---|---|---|---|---|
| **Dairy Products** | | | | | |
| Milk | 2.4 | 2.7 | 1.7 | 2.5 | NS |
| Yoghurt | 6.7 | 0.9 | 5.0 | 2.7 | 0.001 |
| Cheese | 2.0 | 3.0 | 0.8 | 1.6 | 0.05 |
| Ghee | 2.4 | 1.8 | 0.6 | 1.3 | 0.001 |
| Duberkeh | 0.4 | 1.6 | <0.1 | 0.2 | NS |
| Butter | 0.9 | 2.2 | <0.1 | 0.2 | 0.05 |
| Shneena | 1.3 | 2.7 | <0.1 | 0.3 | 0.01 |
| **Cereals** | | | | | |
| Saj bread | 2.5 | 3.0 | 3.3 | 2.8 | NS |
| Bakery bread | 4.8 | 2.7 | 4.0 | 2.5 | NS |
| Burghul | 1.8 | 1.0 | 3.3 | 1.8 | 0.001 |
| Freekeh | 0.1 | 0.5 | 0 | 0 | NS |
| Rice | 1.4 | 0.9 | 1.6 | 1.0 | NS |
| **Food Legumes** | | | | | |
| Lentils | 0.9 | 1.0 | 1.1 | 1.1 | NS |
| Chickpeas | <0.1 | 0.2 | <0.1 | 0.2 | NS |
| Faba beans | 0.1 | 0.4 | 0.5 | 0.8 | 0.05 |
| **Vegetables** | | | | | |
| Potato | 1.3 | 1.3 | 2.5 | 1.3 | 0.001 |
| Eggplant | 0.4 | 1.2 | 0.2 | 0.4 | NS |
| Squash | <0.1 | 0.3 | 0 | 0 | NS |
| Okra | 0.2 | 0.4 | 0.3 | 0.5 | NS |
| Green beans | 0.3 | 0.5 | <0.1 | 0.3 | 0.05 |
| Tomato | 1.9 | 1.3 | 2.7 | 1.9 | 0.05 |
| Pepper | 0.4 | 1.3 | 0.1 | 0.4 | NS |

Table 18--Continued

| | | | | | |
|---|---|---|---|---|---|
| Fruits | | | | | |
| Fresh fruits | 0.5 | 0.7 | 0.6 | 0.8 | NS |
| Jam | 0.4 | 0.8 | 0.1 | 0.4 | NS |
| Grape | 1.3 | 2.4 | 0 | 0 | 0.01 |
| Meat | | | | | |
| Lamb | 1.1 | 1.4 | 0.1 | 0.3 | 0.001 |
| Poultry | 0.6 | 0.7 | 0.2 | 0.5 | 0.01 |
| Eggs | 4.9 | 2.1 | 3.8 | 2.3 | 0.05 |
| Oils | | | | | |
| Olives | 2.4 | 2.9 | 1.3 | 2.4 | NS |
| Olive oil | 4.6 | 2.4 | 5.4 | 2.3 | NS |
| Vegetable oil | 1.6 | 2.2 | 2.0 | 1.9 | NS |
| Refined Sugar | 7.0 | 0 | 7.0 | 0 | NS |
| Miscellaneous | | | | | |
| Wild plants | 1.0 | 1.8 | 0.3 | 0.7 | 0.05 |

Significance between zones based on one-way analyses of variance.

Table 19

Seasonal variation in the number of days/week on which individual food items occurred

| | Mean Days/Week and Standard Deviations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | High Rainfall | | | | | Low Rainfall | | | | |
| Total Households | (35) | | | | | (24) | | | | |
| | Winter | | Summer | | | Winter | | Summer | | |
| | Mean | ±SD | Mean | ±SD | P< | Mean | ±SD | Mean | ±SD | P< |
| **Dairy Products** | | | | | | | | | | |
| Milk | 2.5 | 2.7 | 0.6 | 1.7 | 0.001 | 1.6 | 2.4 | 0.6 | 1.7 | 0.01 |
| Yoghurt | 6.6 | 0.9 | 4.8 | 2.7 | 0.01 | 4.9 | 2.8 | 3.6 | 2.9 | NS |
| Cheese | 2.2 | 3.0 | 4.0 | 2.7 | 0.001 | 0.8 | 1.2 | 0.9 | 1.7 | NS |
| Ghee | 2.5 | 1.7 | 1.9 | 1.6 | NS | 0.7 | 1.4 | 0.4 | 0.8 | NS |
| Duberkeh | 0.5 | 1.7 | 0.2 | 0.9 | NS | <0.1 | 0.2 | <0.1 | 0.4 | NS |
| Butter | 0.9 | 2.2 | 0 | 0 | 0.05 | 0 | 0 | 0.1 | 0.6 | NS |
| Shneena | 1.4 | 2.8 | 0.4 | 1.1 | 0.05 | <0.1 | 0.4 | 1.3 | 2.4 | 0.05 |
| **Cereals** | | | | | | | | | | |
| Saj bread | 2.6 | 3.0 | 2.1 | 2.5 | NS | 3.0 | 0.6 | 3.2 | 0.6 | NS |
| Bakery bread | 4.6 | 2.7 | 5.2 | 2.3 | NS | 4.4 | 2.7 | 3.2 | 3.1 | NS |
| Burghul | 1.8 | 1.0 | 1.2 | 1.0 | 0.05 | 2.9 | 1.5 | 2.2 | 1.3 | 0.05 |
| Freekeh | 0.1 | 0.5 | 0.0 | 0.2 | NS | 0 | 0 | <0.1 | 0.2 | NS |
| Rice | 1.2 | 0.8 | 0.9 | 0.7 | 0.05 | 1.7 | 1.0 | 2.0 | 1.5 | NS |
| **Food legumes** | | | | | | | | | | |
| Lentils | 0.9 | 0.9 | 0.5 | 0.6 | 0.05 | 0.9 | 0.9 | 0.2 | 0.5 | 0.01 |
| Chickpeas | <0.1 | 0.2 | 0 | 0 | NS | <0.1 | 0.2 | 0 | 0 | NS |
| Faba beans | 0.1 | 0.2 | 0 | 0 | NS | 0.6 | 0.8 | 0 | 0 | 0.001 |
| **Vegetables** | | | | | | | | | | |
| Potato | 1.1 | 0.9 | 1.6 | 1.2 | 0.05 | 2.5 | 1.2 | 1.2 | 1.1 | 0.001 |
| Eggplant | 0.4 | 1.2 | 2.2 | 1.7 | 0.001 | 0.2 | 0.4 | 3.7 | 2.1 | 0.001 |
| Squash | 0.1 | 0.3 | 1.4 | 1.4 | 0.001 | 0 | 0 | 1.0 | 1.5 | 0.01 |
| Okra | 0.2 | 0.4 | 0.3 | 0.4 | NS | 0.3 | 0.5 | 0.4 | 0.7 | NS |
| Green beans | 0.2 | 0.5 | 0.6 | 0.8 | 0.05 | <0.1 | 0.2 | 0.4 | 0.7 | 0.05 |

Table 19-Continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Tomato | 1.8 | 1.2 | 6.1 | 1.8 | 0.001 | 2.5 | 1.6 | 6.0 | 1.7 | 0.001 |
| Pepper | 0.4 | 1.3 | 5.0 | 2.7 | 0.001 | 0.1 | 0.3 | 4.7 | 2.8 | 0.001 |
| Onion | 2.3 | 2.7 | 4.8 | 2.6 | 0.001 | 2.9 | 2.7 | 4.3 | 2.5 | NS |
| <u>Fruits</u> | | | | | | | | | | |
| Jam | 0.4 | 0.9 | 0.1 | 0.6 | NS | 0.1 | 0.4 | 0.1 | 0.6 | NS |
| Grape | 1.4 | 2.5 | 0 | 0 | 0.001 | | | | | |
| <u>Meat</u> | | | | | | | | | | |
| Lamb | 1.1 | 1.4 | 0.7 | 1.0 | NS | 0.2 | 0.4 | 0.4 | 0.8 | NS |
| Poultry | 0.6 | 0.7 | 0.5 | 0.6 | NS | 0.3 | 0.6 | 0.2 | 0.4 | NS |
| Eggs | 4.9 | 2.1 | 3.0 | 2.1 | 0.001 | 4.6 | 1.7 | 2.4 | 2.1 | 0.001 |
| <u>Oils</u> | | | | | | | | | | |
| Olives | 2.4 | 2.9 | 0 | 0 | 0.001 | 1.3 | 2.2 | 0 | 0 | 0.01 |
| Olive oil | 4.5 | 2.4 | 3.6 | 2.8 | NS | 5.5 | 2.0 | 4.6 | 2.7 | NS |
| Vegetable oil | 1.6 | 2.2 | 3.0 | 2.3 | 0.01 | 2.0 | 1.7 | 3.5 | 2.5 | 0.05 |
| <u>Miscellaneous</u> | | | | | | | | | | |
| Wild plants | 1.0 | 1.9 | 0 | 0 | 0.01 | 0.3 | 0.7 | 0 | 0 | 0.05 |
| Thym | 3.0 | 2.9 | 1.3 | 2.4 | 0.01 | 2.3 | 2.8 | 0.9 | 2.1 | 0.01 |
| Other foods | 2.3 | 2.7 | 0.8 | 2.0 | 0.05 | 0.9 | 1.4 | 0.1 | 0.3 | 0.05 |

Based on paired t-tests.

zones. The significant decrease in consumption of fresh dairy products (milk, yoghurt, butter and shneena) in the high rainfall zone was paralleled by a significant increase in consumption of cheese. Burghul, food legumes (lentils and faba beans), olives and olive oil were also consumed less frequently in both zones in summer.

Sources of the foods consumed. In both zones and both seasons, the farm produced the majority of dairy products. Most vegetables consumed in winter were either purchased fresh from the market (43%) or came from stores in a preserved form (48%), while in the summer 75% of vegetables consumed were purchased and only 18% were farm produce. When combining all foods together, more foods were purchased over the summer, 59%, compared to 49% in winter. Obviously, preserved foods contributed a larger proportion of the diet in winter, 26% compared to 14% in summer. Vegetables were purchased by at least 92% of households in the low rainfall zone, while significantly more farmers relied on farm production in the high rainfall zone.

## DISCUSSION

### Interrelationships between farm resources and the nutritional status of children.

Since agriculture in the region is mostly rainfed, and rainfall influences crop variety and yield, farmers in the high rainfall zone not unexpectedly had significantly greater socioeconomic reserves as was shown by their better living conditions and greater farm resources.

Income level has been suggested as a suitable indicator which may substitute for assessment of nutritional status (Pinstrup-Andersen, 1981), rainfall zones could be considered an overall indicator of socioeconomic status of rural families.

Evaluation of weight/age and weight/height data for school age children revealed significant differences between zones in the nutritional status of these children. The mean percentage of both indicators was significantly lower in the low rainfall zone in relation to international standards. The relationships between the anthropometric indicators (weight/age, height/age and weight/height) with both the socioeconomic (type of occupation) and agricultural (land area and livestock population) indicators were also investigated. Results are presented in Table 20. Significant differences were found in farm resources as measured by cultivated areas and livestock populations among the three categories of occupations, but no significant differences were found in the anthropometric indicators. Nevertheless, the mean percentages of weight/age and weight/height of the children of full-time farmers were the lowest and gained significance if the barely significant category of $P<0.10$ was used. Similar findings were reported in a study conducted in Guatemala, where the children of skilled workers and merchants had a "tendency" to have a higher mean weight/age than children of farmers, although the difference was not statistically significant (Valverde et al., 1977). Further analysis showed that 19% of preschool children (zones combined) were identified as acutely malnourished (<80% weight/height) in the families

Table 20

MEAN PERCENTAGES OF THE WHO/NCHS MEDIAN WEIGHT/AGE, HEIGHT/AGE AND WEIGHT/HEIGHT OF PRESCHOOL CHILDREN DISTRIBUTED ACCORDING TO: FATHER'S OCCUPATION, LAND AND LIVESTOCK OWNERSHIP

| | Agronomic Indicators | | | | | | | Nutritional Indicators | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Land (ha) | | | | Livestock | | | | | | | | |
| | Total | | Cultivated | | | | | Weight/Age | | Height/Age | | Weight/Height | |
| | Mean | ±SD | Mean | ±SD | Mean | ±SD | N | Mean | ±SD | Mean | ±SD | Mean | SD |
| Full-time farmer | 11.0 | 7.0 | 8.9[a] | 7.2 | 27[b] | 23 | 21 | 90 | 12 | 95 | 7 | 98 | 18 |
| Farmer & other job | 10.9 | 13.8 | 7.7 | 8.7 | 14 | 13 | 51 | 96 | 14 | 95 | 5 | 103 | 11 |
| Wage-earner | 4.2 | 9.9 | 2.2 | 5.4 | 7 | 8 | 27 | 97 | 14 | 96 | 5 | 103 | 13 |
| Total[c] | 8.9 | 11.7 | 6.4 | 7.9 | 15 | 15 | 99 | 95 | 14 | 95 | 6 | 102 | 13 |

[a,b] Significant differences in agronomic resources between the type of occupation at $P < 0.05$ and $P < 0.001$ based on one-way analyses of variance.

[c] Four fathers were deceased or unemployed.

of full-time farmers compared to 7% and 4% respectively in the families of part-time farmers and full-time wage-earners ($P<0.05$). Since there were constraints on the collection of direct information on income, one can only speculate that part-time and full-time wage-earners, having a more regular income, were less likely to be affected by fluctuations in agricultural production which could negatively affect food availability as well as income.

Factors other than socioeconomic status were also investigated. Step wise regression analyses with farm indicators (land area and livestock) and infant feeding practices (breastfeeding duration and age at weaning) as the independent variables failed to predict nutritional status as described by either weight/age, height/age or weight/height when expressed as percentages of reference median values. Negative correlations were however obtained between breastfeeding duration ($P<0.05$) and weight/height, and also between age at weaning and weight/age ($P<0.05$). Children were generally breastfed for about 18 months and were given supplementary feeding at about 10 months of age. Long breastfeeding together with late supplementary feeding may not provide infants with adequate energy intake during the periods when growth potential is high. Comparison of the growth in height and weight of preschool children with the growth of reference children showed that children between 7 and 11 months grew in height at a significantly smaller rate than reference children of the same age.

The great majority of mothers were illiterate and therefore a comparison of the nutritional status of children in relation to the mothers'education level was not possible. The distribution of malnourished children related to the mothers' work in agriculture was also unable to yield significant results since the majority of women in both zones were engaged in agriculture to some degree (Table 4).

The failure of many of the interrelationships between child growth and farm indicators could be partially due to the fact that the differences between zones, while often statistically significant, were never large. Families in the high rainfall zone had "better" living conditions and "more" farm resources than families in the low rainfall zone, but apparently not enough to qualify them as privileged or "rich". In both rainfall zones, the nutritional status of the children as measured by anthropometric indicators, was also significantly lower than that of children at the same age from privileged Aleppo socially advantaged communities. Therefore, the differences between the two rainfall zones would separate them into "poor" and "less poor" rather than into "poor" and "rich".

The major factors which affect nutritional status including patterns of food consumption, food processing and preservation and, economic constraints on food purchases are presented next.

## Interrelationships between farm resources and dietary pattern

Linear regression analyses were conducted to investigate whether farm resources were correlated with dietary consumption patterns. Dietary patterns involved the number of meals/day containing a particular food category; the frequency of consumption of individual food items per week; and the quantities stored or consumed at the time of the survey. Farm resources were described by: total land owned; total cultivated land; irrigated land; total number of livestock owned; total yields of barley and wheat; and areas allocated to summer crops and vegetables.

These results are summarized in Table 21. The total livestock population per household was positively correlated with consumption of dairy products as indicated by the mean number of meals/day containing dairy products; the per caput daily consumption of yoghurt and ghee. Dairy products were eaten more frequently by families owning livestock, and frequency of consumption increased as more livestock were owned. For the overall sample, the average number of daily meals containing cereals increased significantly with total land owned, total cultivated land, total irrigated land, and with the area allocated to vegetables. A decreasing contribution of cereals to the diet with a simultaneous increase in meat products would normally be expected as wealth increased. This did not seem to be the case in surveyed families since, on the contrary, meat consumption was negatively correlated with total land area and total livestock owned ($P<0.05$). A possible explanation could be that the resources of these farmers are so limited that increased income may be needed to purchase more of the staple foods rather than to acquire a greater variety of higher quality foods. In a separate analysis the fact that the consumption of meat among the families of full-time wage-earners was significantly higher than for full-time and part-time farmers ($P<0.01$) may indicate a positive association between consumption of meat and income.

Table 21

Summary of correlation coefficients and their significance between farm resources (X) and dietary pattern (Y) of surveyed families, zones combined winter survey (N=76).

| X | Y | Correlation Coefficient[a] (R) | Significance P< |
|---|---|---|---|
| Livestock/household | Meals/day containing dairy products | 0.21 | 0.05 |
| | Per caput supply of ghee | 0.22 | 0.05 |
| | Per caput supply of yoghurt | 0.37 | 0.001 |
| | Per caput supply of cheese | 0.11 | NS |
| | Meals/day containing meat | -0.20 | 0.05 |
| Total land owned | Meals/day containing cereals | 0.23 | 0.05 |
| | Meals/day containing meat | -0.26 | 0.05 |
| Cultivated land | Meals/day containing dairy products | 0.24 | 0.05 |
| | Meals/day containing cereals | 0.20 | 0.05 |
| | Meals/day containing meat | -0.17 | NS |
| Irrigated area | Meals/day containing cereals | 0.21 | 0.05 |
| | Meals/day containing veg. | -0.08 | NS |
| | Meals/day containing food legumes | 0.18 | NS |
| Area allocated to vegetables | Meals/day containing cereals | 0.19 | 0.05 |
| | Meals/day containing veg. | -0.14 | NS |

[a] Linear Regression analysis.

About half the farmers in the low rainfall zone grew wheat despite the difficult conditions (Table 6), only few were able to meet their entire family needs from their farm production (Table 13). Specific questions on the per caput consumption of wheat (flour and burghul) from home storage revealed average values of 159 and 177 kg/year in the high and low rainfall zones respectively. From data on average yields per hectare, areas allocated to wheat and the family size (Tables 2 and 6), per caput supplies of wheat from farm production were calculated. These showed values of 965 and 99kg/acaput in the high and low rainfall zones respectively indicating that wheat production was six times greater than need in the high rainfall zone but was only 50% of need in the low rainfall zone. In the latter zone income obtained from barley fed sheep would allow wheat purchases.

# CONCLUSIONS

To assign priorities of action, that is, to reach the people most in need, the identification and ranking of vulnerable groups in terms of geographic location and socioeconomic background is required. This is in agreement with ICARDA objectives which are "to contribute towards increased agricultural productivity, thereby increasing the availability of food in both rural and urban areas, and thus improve the economic and social well-being of people" (ICARDA, 1983).

The nutritional status of preschool and school children is a reflection of overall development within the community. Although the present nutritional status of rural children based on weight/height is apparently normal for most children, the high percentage of stunting (height/age <90%) in all age groups indicates an unsatisfactory situation in that there has been adaptation of these children to a lower plane of nutrition. That the standard used was valid is shown by the finding that other Syrian children from relatively privileged backgrounds closely parallel reference data from western populations.

The potential seriousness of nutritional problems cannot however be fully assessed on the basis of anthropometric data and the limited nature of this investigation is fully recognized. For example, how do the rural children compare with the socially advantaged children in terms of work performance? Functional indicators (Solomons and Allen, 1983) are needed to assess whether work performance or resistance to disease are affected by mild-moderate malnutrition and more sophisticated nutritional assessment procedures are necessary to evaluate specific nutrient deficiencies including avitaminosis A, iron deficiency anemia, and goiter, which are known to be prevalent in many developing countries of the Near East region (Pellett, 1983b; Nygaard and Pellett, 1986). Few studies of this type in relation to agricultural development have yet been undertaken in the region but their importance is recognized. A recent workshop on the interfaces between nutrition and agriculture in the Sudan (Miladi et al., 1983) makes very pertinent recommendations for such studies.

Qualitative data cannot give quantitative information, and detailed quantitative studies would be needed to fully evaluate the dietary intake in terms of requirement. However, in general, the quality of the Middle Eastern dietary is good (Pellett, 1982), and in view of the relatively limited socioeconmic resources of rural families, expectations would be that the diet is more likely to be limited in quantity of food rather than quality. As a result of these conclusions, it is recommended that nutritional and food consumption considerations be included in all planning activities such that improved agriculture can result in greater food availability as well as overall improvement in the socioeconomic well-being of rural families.

To improve the situation, long-term actions aiming at improving the food availability (including increased purchasing power) would be beneficial to the rural families of the region. Special attention should be given to the drier rainfall zone where fluctuations in production were shown to have a greater impact on food acquisition and consumption in rural families. Amongst the agricultural measures that are required are the continuation of efforts to improve overall production by increases in yields (introduction of new varieties, better usage of fertilizer, and cropping rotations which enhance soil productivity), as well as increases in livestock production which can also result in increased availability of dairy products. The importance of livestock production in rural welfare is discussed elsewhere (Somel and Mokbel, 1985).

Increased food production may not necessarily result in increased food consumption if the farm families'diet and preferences are not taken into consideration. Increasing the productivity of faba beans, lentils and chickpeas continue to be the major objective of the Food Legume Improvement Program (FLIP) at ICARDA (ICARDA, 1983). The results of this study have shown that while the majority of farm families stored lentils, 87% of farmers from both zones, only 20% stored chickpeas and 3% faba beans. In the high rainfall zone where food legumes are grown, "dislike or unfamiliarity with cooking procedures" were the major reasons provided by housewives to explain the low consumption of both chickpeas and faba beans. Therefore, increased production which would result in greater availability for producers, does not necessarily entail increased consumption. For these foods to be "important as a cheap source of high-quality protein" (ICARDA, 1983), their increased production should be associated with measures aiming at promoting their consumption in rural areas. The current procedures which include taste and acceptable cooking behavior are highly important considerations in breeding programs and their continuation should be encouraged. Investigation of the patterns of food legume utilization in the various sectors of the community (urban and rural) in Syria and other countries of the Near East region would also be of value in this respect.

The present study on food preference patterns and nutritional status of small farmers in Aleppo Province-Syria has revealed information of considerable potential importance for ICARDA in assigning priorities for agricultural development in the region. More detailed nutrition research such as investigation of functional indicators of nutritional status (Solomons and Allen, 1983) in Aleppo Province, would be desirable to answer more specific questions. Nevertheless, similar studies to those reported here conducted on small farmer's families in other countries in the region where ICARDA is involved, would allow development of a data base for dietary consumption patterns, home food preservation, food storage and nutritional status of the vulnerable groups of the population. This would allow nutritional considerations to be more closely integrated with agricultural activities in the many dry areas of the Near East region.

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# ANNEX I

## Anthropometric Measurements

### Anthropometic indicators.

Nutritional requirements vary with age and physiologic status of individuals and therefore accurate determination of age is needed in evaluating anthropometric measurements.

Weight for age. Measurement of body weight has long been and still is used in pediatrics to monitor the growth and development of infants and children. It is an early indicator of growth problems and nutritional inadequacy, and reflects more recent nutrition of the child or adult than height. The growth chart is recommended as a tool for both preventive and curative care (Morley and Woodland, 1979). It is used in under-five clinics or at home, and is based on serial measurements at regular intervals.

When a single measurement is taken, the child's weight is compared with a reference: the weight of a normal child of the same age. Weight for age was first introduced as a basis for classification of malnutrition by Gomez in 1956 (Gomez et al., 1956; Keller et al., 1976; Seoane and Latham, 1971).

Weight for age is particularly useful in children under one year of age when length measurements are often inaccurate. In addition, weight measurements can be used as a preventive tool by drawing attention to a developing nutritional deficit before the advent of more permanent sequelae of prolonged malnutrition such as a deficit in height for age.

Height for age. Height measures past and chronic malnutrition. In contrast with weight, which may be rapidly lost and fairly quickly regained, height gain is progressive and any marked retardation is likely to be more permanent than retardation in weight (Seoane and Latham, 1971). A deficit in height for age which is referred to as "stunting" takes some time to develop; up to six months may elapse before a significant change in height can be noted (Morley and Woodland, 1979). Height for age is therefore an indicator of past and chronic malnutrition.

Weight for height. Weight for height is an indicator of leanness and fullness of the body, and is used to identify present under and overnutrition (Keller et al., 1976; Waterlow et al., 1977).

Weight for height is obtained as follows:

- The subject's height is recorded and the corresponding expected weight for that height is obtained from reference tables.
- The percentage values using actual weight against the theoretical weight for height is then calculated.

A deficit in weight for height is referred to as "wasting". When weight for height is combined with height for age, a broader range of conditions can be described. For example, "nutritional dwarfism", which is a late effect of Protein Energy Malnutrition, is diagnosed when height for age is less than 90% of the reference, while weight for height is greater than 80% (McLaren and Read, 1972; Waterlow et al., 1977). Therefore, it is desirable to obtain both height and weight.

Unfortunately in developing countries, age is often difficult to obtain with the accuracy needed for age comparisons of weight and height. Weight for height offers the advantage of being nearly independent of age between one and ten years of age, as the child's weight is compared with the weight of a reference group of the same height rather than same age (Waterlow et al., 1977). In addition, weight for height is considered relatively independent of ethnicity particularly between one and five years (Keller et al., 1976).

In summary, there is general agreement on weight/age, weight/height and height/age as indicators of present and past nutritional status. However, their use depends upon the acceptibility of reference standards.

## Reference Standards

Standards of reference are needed in community nutritional studies for comparison purposes. Some researchers recommend the development of internal or local standards; to resolve the problem of genetic or ethnic differences in growth potential (Keller et al., 1976). Other workers believe that these differences play a minor role, and find that the use of reference data from western populations is justifiable in most developing countries as long as data are interpreted with caution (Waterlow et al., 1977). A distinction should be made between "reference values and standard values" (Gueri et al., 1980). Reference data must be used for comparison purposes and are not to be confused with "standard or target" which may not be the same for populations with different gene distributions (Waterlow et al., 1977).

A comparison among three western reference data (Harvard, Denver and NCHS) for weight and height for age showed a high degree of similarity among them (Stephenson, Latham and Jansen, 1983). At present, the data determined by the U.S. N.C.H.S. (National Center for Health Statistics) seem most suitable for use as international reference (Waterlow et al., 1977). They are presented in the form of centiles. As an example, the 10th centile for weight for age is the weight below which 10% of the reference population at that age are found (Hamill et al., 1979). The data are available for children and adolescents up to 18 years of age; however, because differences exist in the onset of puberty in different populations, these charts are not recommended for children beyond the age of ten (WHO, 1979).

To account for possible ethnic differences, adjustments can be made so that the target for any one of the measurements could be set at an "arbitrary" value such as 95% of the reference height rather than 100% (Waterlow et al., 1977). In addition, "cut-off points" which are used to separate the population examined into low, medium or high with respect to the indicators, must be set. Cut-off points are based on percentage deviations from the median and are chosen so as to correspond to one, two and three standard deviations. In undernourished populations, -2.0 SD weight for height corresponds approximately to 80% of the median weight for height, and 90% of the median height for age (Waterlow et al., 1977). These are considered useful classification limits in identifying malnourished children (Waterlow et al., 1977; Keller et al., 1976; Gueri et al., 1980).

Interpretation of Anthropometric Indicators

Prior to analysis of the anthropometric data collected from a sample of children, it is advisable to subdivide the sample into age and sex groups in order to investigate the pattern of findings; different groups may be affected at various levels of severity due to culturally determined food practices and priorities within the family. Various age groupings are possible depending on the size of the sample (Waterlow et al., 1977).

Individual values can be compared with the reference population. For example, the height of each child can be expressed as a percentage of the median reference height for children of the same age (height/age), and weight can be expressed as a percentage of the median weight of children of the same height (weight/height). This permits the screening of cases for individual attention. One may also be interested in studying the pattern of nutritional problems relative to other variables such as socioeconomic indicators or regional variations; here means or median values of the various anthropometric indicators can be computed relative to the variables of interest.

Finally, if the purpose is to screen the population for prevention or curative community measures, then the distribution of the sample population on the reference standard can be computed. The proportion of the population below a certain level of acceptability for one or more indicators is used to identify the type of nutritional problem that is most prominent and hence the type and priority of intervention. The interpretation of a combination of indicators is presented in Table A1.1

(WHO, 1979). The cut-off points used for classification of indicators into "high" and "low" may vary. "Low" can be defined as more than 1 SD below the median, and "high" as more than 1 SD above the median.

In addition to indicating past or present, chronic or acute malnutrition the combination of indicators is valuable in identifying the priorities for action:

| | |
|---|---|
| "Wasted and stunted | Priority |
| Wasted but not stunted | Action |
| Not wasted but stunted | Action? |
| Not wasted and not stunted | No action" |
| | (Keller et al., 1976). |

As seen in Table A1.1, the wasted children (low weight for height) are clearly underfed whatever the other two indicators show; however the degree of the problem and its duration are determined by the combination of all indicators (WHO, 1979). A more complete picture of the situation and hence a more appropriate scheme of action also requires the investigation of various causative factors such as lack of food and/or ignorance, and the sanitary conditions and resulting infectious diseases. Various combinations of factors are possible and must be taken into consideration when interpreting anthropometric data and deciding priorities for action.

Table A1.1

Interpretation of anthropometric indicators (WHO, 1979)

| Combination of indicators | Interpretation of nutritional status |
|---|---|
| 1. Normal wt/ht + low wt/age + low ht/age | Normally fed with past history of malnutrition |
| 2. Normal wt/ht + normal wt/age + normal ht/age | Normal |
| 3. Normal wt/ht + high wt/age + high ht/age | Tall, normally nourished. |
| 4. Low wt/ht + low wt/age + high ht/age | Presently underfed ++ (1) |
| 5. Low wt/ht + low wt/age + normal ht/age | Presently underfed + |
| 6. Low wt/ht + normal wt/age + high ht/age | Presently underfed |
| 7. High wt/ht + high wt/age + low ht/age | Obese ++ |
| 8. High wt/ht + normal wt/age + low ht/age | Presently overfed with past history of malnutrition. |
| 9. High wt/ht + high wt/age + normal ht/age | Overfed but not necessarily obese. |

(1) No explanation is given for "++" and "+".

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# ANNEX II

## Dietary Methodologies

Dietary information can be obtained at different levels: the country as a whole, specific population groups, households and finally individuals. In each case, the purpose of the dietary study may necessitate a different degree of accuracy, a different sample size, and hence a different method. The choice of method is also affected by practical considerations, such as cost, availability of trained personnel, time limitations, and the level of education and degree of cooperation of the people surveyed (Beal, 1967; Pekkarinen, 1970).

Dietary methods have been grouped into three main categories: the food account, weighing and interview methods (Pekkarinen, 1970). Others separate them into families or group methods, and individual dietary intakes (Christakis, 1979). This discussion will begin with consideration of country-wide procedures such as FAO Food Balance Sheets, and will be followed by the dietary methods which can be used to assess family food intake.

### FAO Food Balance Sheets.

Food balance sheets are produced periodically by the Food and Agricultural Organization of the United Nations. They present a comprehensive picture of food supply during a specified period, by country. The sources of supply (local production, imports and stocks) and the utilization of each food item are included. Per caput food supplies are obtained by dividing the total amount of the different foods by the total population of the country (FAO, 1980).

Food balance sheets are useful in providing information concerning the level of self-sufficiency of a country, and hence agricultural priorities (FAO, 1980). They can also be used to infer general food patterns of the population at large (Pekkarinen, 1970). It should be noted that food balance sheets take into account waste on the farm and during distribution and processing; however, losses at the household level are not accounted for. These include losses of edible food and nutrients during storage, preparation and cooking and therefore actual consumption may be lower than that recorded (FAO, 1980). In addition to this limitation, food balance sheets do not account for the differences in consumption within each country between the different socioeconomic groups, or different geographical regions; neither do they show seasonal variations in food availability (FAO, 1980).

In spite of their limitations, food balance sheets may constitute a useful baseline dietary information for comparison with the results of dietary surveys of sample populations and evaluation of survey results with respect to the general pattern of the country.

Food accounts, records and lists.

These methods are used for the study of food consumption of groups of people in institutions (boarding schools, orphanages, hospitals) or in families. They are defined as follows:

- Family food accounts: families are asked to keep a record of all foods purchased, produced at home or received, on a daily basis for a period varying between two and four weeks (Pekkarinen, 1970). This method can be accompanied by an inventory of the household supplies at the beginning and at the end of the survey period as a check of the method.
- Food records: a daily meal-by-meal record of foods consumed is reported in household measures (portions, cups, slices) for one to seven days (Pekkarinen, 1970).
- Food lists: an estimate of the quantities of food used during a period of time is obtained by an interview of the person in charge of the food (Christakis, 1979).

Both food accounts and records require the cooperation of the person responsible for the food in the household or institution. They are restricted to literate people, and thus may not be representative of the whole population, especially in household surveys (Pekkarinen, 1970). Another disadvantage shared by both methods is the failure to assess food wastage: food fed to animals, discarded or spoiled (Christakis, 1979). The amounts estimated by any of the three methods must be corrected for food losses; an average of 10% reduction was found applicable in rural households (Pekkarinen, 1970).

Food lists are not limited to literate participants as they are performed by an interviewer. In spite of the problems arising from converting household measures into weights and the failure to account for food wastage, food lists may constitute a useful method in studying the dietary patterns of families, especially in communities where the level of illiteracy is high. In addition, they may be repeated at different periods to account for seasonal variations.

Qualitative 24-hour recalls.

This method was applied in the context of Farming Systems Research (FSR) in Ecuador, in an attempt to integrate nutrition considerations into agriculture development programs. Its purpose was to provide information on farm families' diets and food preparation techniques as both factors play a major role in the decision of farmers to accept new agricultural technologies (Tripp, 1982).

The survey was conducted twice in two countries, and included foods consumed, methods of preparation and the source of each food item (Tripp, 1982). This approach proved useful for guiding agricultural research in the area, by providing information on (1) the frequency of consumed items in the diet, and seasonal pattern; (2) the proportion of meals in which various food items appeared, and (3) modes of preparation (parboiling, drying) and storage. Evaluation of these dietary data along with information gathered by agricultural researchers permitted the orientation of research to the most important problems facing farmers. For instance, the dietary survey showed maize to be the most frequently consumed item, while researchers within the farming system found that storage problems seriously affected maize availability in households. Maize storage experiments were thus initiated. Quinoa, a crop grown in the Andes, is another example of how dietary information can influence agricultural research. Although its content in protein, calcium and riboflavin is high and increasing its production would be beneficial especially since previous surveys showed calcium and riboflavin to be in short supply, its frequency in the diet of farmers was found to be very low, and an increase in production would not necessarily result in increased consumption as its preparation is tedious (Tripp, 1982).

The qualitative recall method has the disadvantages of the standard quantitative 24-hour recall procedure (Neisheim, 1982) and therefore does not necessarily provide a measure of usual intake (Pekkarinen, 1970). In addition, changes in food intake due to a variety of reasons such as availability of foods, illness or seasonal variations are not shown by a single recall (Beal, 1968). Nevertheless single qualitative 24-hour recalls when combined with questions on weekly food consumption patterns can supply important information for agricultural purposes.

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# ANNEX III

## Background Information on Surveyed Villages

Information on population size and agricultural resources in surveyed villages are summarized in Table A3.1. Most village headmen did not have recorded information and thus some questions remained unanswered, except in one village (Bahwarta) where the Mukhtar, who was also the farmers' union representative, kept an official record. The population size in villages ranged from 250 inhabitants (Tiltane) to 700 inhabitants (Sandara), and total cultivable land ranged from 220 ha (Massudie) to 2500 ha (Rshadiye). Irrigated areas (mainly tube well irrigation) in the high rainfall zone varied between 2 and 14% of total cultivable land. No irrigation was reported in low rainfall villages. Irrigation allows a greater variety of crops as well as a larger and more stable productivity. Hence, the total area of irrigated land can be considered as an indicator of wealth. Other indicators of agricultural resources available to villages included ownership of agricultural machinery and livestock. The number of tractors, threshers and combine harvesters was greater in the high rainfall zone, while the livestock population was larger in the low rainfall zone where it was usually the main source of farm income. Because of the wide range in land productivity in different rainfall zones, total cultivated land

Table A3.1

SUMMARY OF INFORMATION ON SURVEYED VILLAGES IN ALEPPO PROVINCE, AS REPORTED BY VILLAGE HEADMEN (1)

| | Total population | Number families | Total area | Irrigated area | | Average holding size | Land/ person | Landless families | | Tractor | Total flock |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (ha) | (ha) | % | (ha) | (ha) | N | % | N | N |
| **High Rainfall** | | | | | | | | | | | |
| Bahwarta | 500 | 46 | 902 | 42 | 5 | 18 | 1.8 | 6 | 13 | 6 | 450 |
| Sandara | 700 | 55 | 450 | - | - | 7 | 0.6 | 10 | 18 | 3 | 300 |
| Tiltane | 250 | 45 | 350 | 50 | 14 | 15 | 1.4 | 10 | 22 | 4 | 300 |
| Massudie | 400 | 39 | 220 | 5 | 2 | - | 0.6 | - | - | 1 | - |
| **Low Rainfall** | | | | | | | | | | | |
| Rshadiye | 400 | 40 | 2500 | 0 | 0 | 20 | 6.2 | 10 | 25 | 2 | 2000 |
| Raheb | 650 | 50 | 550 | 0 | 0 | 16 | 0.8 | 10 | 20 | 0 | 700 |
| Harbakiye | 450 | 65 | 500 | 0 | 0 | 10 | 1.1 | 15 | 23 | 2 | 450 |
| Hibss | - | 54 | 500 | 0 | 0 | 10 | - | 2 | 4 | 0 | - |

(1) - No information given.

as well as per caput land availability should be interpreted in the context of cropping systems and yields.

The cropping systems applied in surveyed villages consisted of the cereal/food legume/summer crop rotation in the high rainfall zone, while barley (65-100% of total area) and wheat were essentially the only crops in the low rainfall zone (Table A3.2). When asked to evaluate present yields relative to two decades ago, most village headmen in the low rainfall zone reported a decrease in yields of barley and wheat which they attributed to a fall in the water table. However, an increase in yields of most crops was observed by village headmen in high rainfall villages. These increases in cultivated areas and yields were attributed to mechanization and greater availability of fertilizers.

## Table A3.2

### PRESENT CROPPING SYSTEMS IN SURVEYED VILLAGES AND CHANGES, AS REPORTED BY VILLAGE HEADMEN

| | Percentage of Cultivated Land/Crop | | | | | Change in Area | | | Change in Yield | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barley | Wheat | Lentils | Chickpea | Others | Increase | Decrease | Same | Increase | Decrease | Same |
| **High Rainfall** | | | | | | | | | | | |
| Bahwarta | 7 | 24 | 17 | 3 | 49 | Barley<br>Chickpea<br>Trees | Wheat<br>Lentils<br>Watermelon<br>Vegetables | | | Lentils<br>Chickpea | |
| Sandara | 5 | 50 | 5 | 2 | 38 | Lentils<br>Chickpea | Barley<br>Wheat<br>Trees | | All | | |
| Tiltane | 14 | 14 | 20 | 0 | 52 | Trees<br>Cotton | | Barley<br>Wheat<br>Lentils | All | | |
| **Low Rainfall** | | | | | | | | | | | |
| Rshadiye | 100 | | | | | | | Barley | | Barley | |
| Raheb | 75 | 25 | | | | Barley | Wheat | | | Barley<br>Wheat | |
| Harbakiye | 65 | 35 | | | | | | Barley<br>Wheat | | | Barley<br>Wheat |
| Hibss | 67 | 33 | | | | | | Barley<br>Wheat | | Barley<br>Wheat | |

Others: summer crops, sugarbeet, cotton and trees.