

Ongoing deterioration of the nutritional status of Palestinian preschool children in Gaza under the Israeli siege

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التدهور المتواصل في الحالة التغذوية لدى الأطفال الفلسطينيين ما قبل سن المدرسة في غزة تحت الحصار الإسرائيلي

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الخلاصة: أجرى الباحثون هذا المسح السكاني المستعرض المرتكز على المجتمع في مدينة غزة في دولة فلسطين خلال النصف الأول من عام 2009 لدراسة الوضع التغذوي للأطفال الفلسطينيين ما قبل سن المدرسة بعمر 2-5 سنوات ممن هم تحت الحصار. وكان معدل الاستجابة 95.2% في عينة بلغت 770 نسمة. واتضح أن معظم السكان 94.4% يواجهون صعوبات في الوصول إلى الطعام، وأن السبب الرئيسي هو الحصار المفروض على قطاع غزة ونقص منتجات الطعام، وأن معظم السكان يعانون من عدم الأمن الغذائي (85.5%)، وأن ما يزيد قليلاً على 50% من الأطفال قبل سن المدرسة يعانون من فقر الدم، وأن 26.8% ممن أجري لهم اختبار البراز لديهم عدوى بالطفيليات، وأن 15% منهم يعانون من التقرم. ولقد كان انعدام الأمن الغذائي هو المنبئ الأول للتقرم ولنقص الوزن، وأوضحت مؤشرات سوء التغذية أنها كانت الأسوأ في قطاع غزة منذ عقود عديدة.

ABSTRACT This cross-sectional, community-based, household survey was carried out in Gaza City, Palestine during the first half of 2009 to study the nutritional status of Palestinian preschool children aged 2-5 years under blockade. The response rate was 95.2% from a total sample of 770. The majority (94.4%) of households faced difficulties accessing food, the main cause was the siege and the shortage of food products; and the majority (85.5%) were food insecure households. Just over 50% of the preschoolers were anaemic, 26.8% of those who had a stool test had parasitic infections, and 15.0 were stunted. Food insecurity was the first predictor of stunting and underweight, and malnutrition indicators indicate the worst situation in the Gaza Strip for several decades.

Détérioration continue de l'état nutritionnel des enfants d'âge préscolaire palestiniens à Gaza sous siège israélien

RÉSUMÉ La présente enquête auprès des ménages, transversale et communautaire, a été menée dans la ville de Gaza (Palestine) sous blocus pendant la première moitié de l'année 2009 afin d'évaluer l'état nutritionnel des enfants palestiniens âgés de 2 à 5 ans non scolarisés. Le taux de réponse était de 95,2 % sur un échantillon total de 770 enfants. La majorité des ménages (94,4 %) était confrontée à des difficultés pour se procurer de la nourriture. Le siège et la pénurie de produits alimentaires en étaient les causes principales. La majorité des ménages (85,5 %) souffrait d'insécurité alimentaire. Un peu plus de 50 % des enfants d'âge préscolaire étaient anémiques, 26,8 % de ceux qui ont passé une analyse de selles souffraient d'infections parasitaires et 15,0 % étaient atteints d'un retard de croissance. L'insécurité alimentaire était le premier facteur prédictif d'un retard de croissance et d'une insuffisance pondérale. Les indicateurs de malnutrition signalent la pire situation dans la Bande de Gaza depuis plusieurs décennies.

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Introduction

The Gaza Strip is a narrow piece of land lying on the coast of the Mediterranean Sea on the crossroads of Africa and Asia. The total area of the Gaza Strip is 378 km² and it has a population of about 1.6 million [1,2].

In children, the preschool period is a time of significant growth in the social, cognitive, and emotional areas [3]. Undernutrition contributes to more than one-third of all deaths in children under the age of 5 years [4], yet the international community and most developing countries have failed to tackle malnutrition and nearly one-third of children in the developing world remain underweight or stunted [5].

Anaemia is a widespread public health problem in the countries of the World Health Organization (WHO) Eastern Mediterranean Region: prevalence varies from a low of 17% to a high of over 70% among preschool children [6]. It is generally assumed that 50% of the cases of anaemia are due to iron deficiency [7]. Children's nutritional status depends on 3 necessary components, food security, access to adequate health care, and adequate feeding practices [8]. The United Nations Children's Fund (UNICEF) reported that there is a threat of increasing undernutrition and risk of dying from malnutrition in the Gaza Strip since the rapid nutritional assessment of children aged under 5 years revealed steadily increasing trends in recent years [9].

The cause of unprecedented poverty in the Occupied Palestinian territory is the socioeconomic crisis that began with the almost total siege of Gaza and the isolation of the Gaza Strip and the West Bank from each other and from the outside world by the Government of Israel [10]. The main driver of Palestinian food insecurity is political, through the military and administrative measures imposed by the Israeli occupation, such as closures, and destruction of assets [11]. The nutritional status of

vulnerable groups in the Gaza Strip may be adversely affected by these measures.

This study was conducted to assess the nutritional status of Palestinian preschool children aged 2–5 years in Gaza City under blockade. Our objectives were to identify household food security levels; to assess the prevalence of anaemia among the targeted children; to assess the anthropometric indicators of nutritional status; and to investigate the factors affecting nutritional status.

Methods

This community-based, cross-sectional study was conducted during 2009, in Gaza City. The sample included urban, rural and refugee camp children aged 2–5 years.

We used a multistage, stratified, cluster sampling technique with probability proportionate to size of population in the first stage and a constant number of children per cluster at the second stage. The sampling frame was Gaza City; it was divided into 12 primary sampling units.

Seven (7) of the primary sampling units (Al-Shati Refugee Camp, Al-Moghraga, Al-Sheikh Radwan, Al-Sha-gaia, Al-Sabra, Al-Zitoun and Al-Twfah) were randomly selected for this study; 110 households were selected in each unit giving a total of 770 children. From a random starting point in each cluster, selection of households was started and then a search was made door-to-door until the required sample size was reached. Response rate was 95.2%: 37 of selected households refused to participate. The final number of children participating in the study was therefore 733 preschoolers aged 2–5 years.

Data collection was carried out over a period of 6 months from January to June 2009. Two days of training were conducted, and a pilot study on 30 preschoolers from Gaza city was carried out for validation and verification of the questionnaires. These 30 children were not included in the study sample.

A structured questionnaire was designed by the researchers and checked for completeness and accuracy. Three research teams conducted the interviews with the mothers of the children in their homes and collected the required data and measurements over 2 days per week. Height and weight were recorded. Height was measured using a measuring rod to the nearest 0.1 cm. The Tanita Baby/Adult Digital Scale 1582 was used for weight measurements; weight was recorded to the nearest 0.1 kg [12,13]. Measurements were collected according to criteria of Jelliffe et al. [14]. The nutritional indices were compared with reference values (WHO/National Centre for Health Statistics standards) [15].

Some of the mothers refused permission for their children to participate in the laboratory investigations. Only 528 of the 733 in our sample had a haemoglobin (Hb) test, and 485 gave a stool sample. Hb concentration was measured using the most widely used method (cyanmethaemoglobin) [16] and the stool samples for were tested for parasitic infection at the main Ministry of Health laboratory (El-Remal Health Centre). We used the WHO cut-off point for anaemia for this age group, haemoglobin level 11 g/dL blood [17].

Socioeconomic status of households was determined using factor analysis. The appropriateness of the factor analysis for the 18 variables used in analysis was examined. Firstly, 10 of the 18 variables correlated at least 0.3 with at least 1 other variable, suggesting appropriateness of factor analysis. Secondly, KMO (the Kaiser-Meyer-Olkin statistic) was 0.553, above the recommended value of 0.5, and Bartlett's test of sphericity was significant ($\chi^2 = 636.57$, $P < 0.05$). None of the variables demonstrated complex structure and none of the components had only one variable in it. Factor analysis was thus completed with the remaining 12 variables. Internal consistency was examined using Cronbach alpha for each of the extracted

factors. Principal components analysis demonstrated the existence of 3 eigenvalues greater than 1.0, explaining 73.82% of the variance. The Scree test provides a graphic representation of eigenvalues and was used to further clarify the number of components to rotate. Cronbach alpha was 0.73 for factor 1, 0.63 for factor 2 and 0.87 for factor 3. Composite scores were created, with higher scores indicating higher socioeconomic status, which were then classified into groups using cluster analysis. Cluster analysis identified 2 groups, a low socioeconomic group and a high socioeconomic group. The relative poverty line was computed based on the Palestinian household expenditure and consumption survey [18]. The official poverty line was estimated at 2362 new Israeli shekels (about US\$ 569.1 at the time of the study) monthly consumption expenditure for a representative 6-person household. The per capita poverty line was, therefore, estimated at US\$ 94.8 monthly consumption, around US\$ 3.1 daily per capita consumption expenditure [19].

Food security was categorized as food secure (includes high and marginal food secure) and food insecure (includes low and very low food secure) [20].

Data entry, management and analysis were carried out using SPSS, version 16.0. *Epi-Info*, version 2002, was used to calculate the nutritional indicators. Statistical significance was established at $P < 0.05$. Frequency distributions were generated for all variables and the univariate analysis applied; those factors found to be statistically significant were included in stepwise multivariate logistic regression analysis.

Results

The total sample was 733 children, 401 (55%) boys and 332 (45%) girls. The sample was collected from 7 districts in Gaza City: these covered 3 types of locality.

Mean age was 42.4 [standard deviation (SD) 10.2] months. About 8% of the sample had been low-birth-weight babies; 33.8% were the first in birth order. The majority (95.8%) of the children had been breast-fed; 51.2% had received mixed feeding and 44.6% were exclusively breast-fed during the first 6 months. The mean duration of breast feeding was 15.0 (SD 6.7) months.

About half (51.1%) of the children belonged to families with 7 or more members and 25.1% belonged to families with 9 or more members. For 56.2% of the families, crowding index was ≥ 3 per room: mean crowding index was 3.29 (SD 1.52) per room.

All of the households we studied were connected to the sewerage system; 78% had a garbage container. Almost all households (99.9%) had access to water: 92.0% purchased their drinking water from a truck with tanks of filtered water, only 4.0% of households used tap water from the municipality for drinking use.

Most of the households (97.5%) we studied suffered from power privation and electricity shortages. Half (50.5%) the households used candles to compensate the electricity shortage and 43.0% used kerosene lamps. The majority (84.7%) of the households did not have gas available for cooking on a daily basis. Accordingly, they used alternative methods: 28.4% used electricity, 41.4% used kerosene and 14.9% used wood.

For 72.7% of the households monthly income was stated (by the mothers) to be insufficient. The distribution of the sample according to socioeconomic

status was heavily skewed, the majority (93.5%) of households being classified into the low socioeconomic group and the rest as high socioeconomic group.

The total proportion of households classed as below the poverty line was 92.1%. The majority of households (94.4%) faced difficulties with access to food products in the previous year; only 1.1% did not face any difficulties at all. The predominant causes (97.3%) of difficulty in accessing food identified by the mothers were the siege and the shortage of food products on the market, followed by increases in food prices (94.0%) and loss of income (63.0%).

The majority (85.5%) of the households we studied were food insecure and 73.3% were considered very low food secure (Table 1). In Al-Zitoun and Al-Moghraha areas 95.5% of households were food insecure, followed by Al-Twfah and Al-Shagaaia areas at 90.6%. The lowest level of food insecurity area in Gaza City was Al-Shataa refugee camp, but even here 68.6% of households were classed as food insecure. These differences were statistically significant ($\chi^2 = 58.09$; $P < 0.001$). In the rural area 95.4% of households were food insecure; in the urban area it was 86.9%. The differences between localities were statistically significant ($\chi^2 = 33.8$; $P < 0.001$).

The most common insecure food item was poultry (73.4%), followed by fruits and meats (67.9%) and fish (64.0%). Other items mentioned were eggs (53.3%), yogurt and cheese (50.5%), and flour and bread (40.8%).

Table 1 Distribution of households (n = 733) in Gaza City according to food security level, 2009

Food security level	No.	%
Secure	106	14.5
High	11	1.5
Marginal	95	13.0
Insecure	627	85.5
Low	90	12.2
Very low	537	73.3

Approximately two-thirds (70.3%) of the households had to borrow or use credit to purchase food products in order to cope with food insecurity, while 42.3% relied on aid and donations. One third (35.1%) of households reported having to sell gold and 9.4% to sell assets in order to cope with food insecurity.

Approximately half (50.6%) of the preschool children in our sample were anaemic: mean haemoglobin level was 10.98 (SD 1.00) g/dL. There was a statistically significant difference between the districts for prevalence of anaemia ($\chi^2 = 39.49, P < 0.001$). Al-Zitoun district had the highest prevalence (70.5%) followed by Al-Sabra (59.5%); Al-Shagaaia had the lowest prevalence (25.9%). The prevalence of anaemia was greater (53.6%) in rural areas than urban (50.8%) and refugee camp (45.3%) areas, but the difference was not statistically significant.

Just over a quarter of the 485 children who had a stool analysis (26.8%) had parasitic infections, mostly with *Entamoeba histolytica* (15.7%) and *Giardia lamblia* (11.1%). There was a significant difference according to age. Significantly more children in the older age group (48–60 months) were infected with *G. lamblia* (15.2%) and *E. histolytica* (20.6%) than the younger age group (9.1%) and (13.1%) respectively ($\chi^2 = 10.25; P = 0.006$).

The overall prevalence of wasting, stunting and underweight was 3.5%, 15.0%, and 6.1% respectively (Table 2),

while the prevalence of overweight was 2.9%. The prevalence of underweight among the children was statistically significantly different between the districts ($\chi^2 = 19.9, P = 0.003$), with the highest prevalence in Al-Moghraga (11.9%) followed by Al-Twfah (9.4%) and Al-Sheikh Radwan (8.8%). No significant difference was found in the prevalence of stunting between districts, the highest prevalence (17.6%) was in Al-Sheikh Radwan followed by Al-Moghraga (16.5%). The highest prevalence of wasting (7.3%) was in Al-Twfah followed by Al-Sheikh Radwan (4.9%) and Al-Moghraga (4.6%).

The children who lived in the rural areas had a higher prevalence of underweight (11.9%), stunting (16.5%) and anaemia (53.6%) than other localities (Table 2), but the difference was only statistically significant for underweight ($\chi^2 = 8.6; P = 0.014$).

Determinants of nutritional status

Univariate analysis by using simple logistic regression

Stunting was significantly associated with poverty, food security and birth weight. The prevalence of stunting was greater (15.9%) among the children from households below the poverty line with a significantly higher risk than those from households above the poverty line (5.2%) [odds ratio (OR) = 3.45, 95% confidence interval (CI): 1.06–11.24; $P = 0.04$] (Table 3). The prevalence of stunting was greater (16.4%) among the

children from food insecure households with significantly higher risk compared with those belonging to the food secure households (6.6%) (OR = 2.78, 95% CI: 1.25–6.15; $P = 0.012$). The prevalence of stunting was higher (29.3%) among studied preschool children with low birth weight, with significantly higher risk (OR = 2.59, $P = 0.002$) compared with the children with normal birth weight.

Underweight was significantly associated with food insecurity and artificial feeding. The prevalence of underweight was statistically greater (7%) among preschool children from food insecure households with the risk increased about 8-fold (OR = 7.92; 95% CI: 1.08–58.14; $P = 0.042$) compared with those from food secure households (0.9%). Children who had had artificial feeding had a significantly greater risk of being underweight than those who had been breastfed (OR = 3.73; 95% CI: 1.26–11.01; $P = 0.017$).

Wasting was apparently affected by certain factors but the differences were not significant, e.g. anaemic children had more than 2-fold risk of wasting compared with those who were not anaemic (OR = 2.16, $P = 0.099$). Children who had had artificial feeding and those from low socioeconomic level households had an almost 2-fold greater risk of wasting compared with those from high socioeconomic level households and those who had been breastfed.

Factors showing an apparent but not statistically significant association with anaemia included having *Giardia* infection and being from non-refugee localities. No association was observed as regards the remaining variables.

Multivariate analysis

Food insecurity was the most significant factor in stunting followed by low birth weight. The preschool children from the food insecure households had an almost 3 times greater risk of being stunted relative to those from food secure households (OR = 2.86; 95% CI: 1.24–6.12; $P = 0.017$) (Table 4). Children who had

Table 2 Indicators of malnutrition among 733 preschool children aged 2–5 years in 3 types of locality in Gaza City, 2009

Indicator	Locality			
	All	Urban	Rural	Refugee camp
	(n = 733)	(n = 519)	(n = 109)	(n = 105)
	%	%	%	%
Anaemia ^a	50.6	50.8	53.6	45.3
Wasting	3.5	3.3	4.6	3.8
Stunting	15.0	14.6	16.5	15.2
Underweight	6.1	4.6	11.9	6.7

^aHb < 11 g/dL blood. Only 485 children had a blood test for anaemia.

Table 3 Simple logistic regression analysis of factors associated with stunting

Variable	Total	Stunting		OR (95% CI)	P-value
		No.	%		
Socioeconomic level					
High	48	6	12.5		
Low	685	104	15.2	1.25 (0.51–3.02)	0.616
Poverty					
Above poverty line	58	3	5.2		
Below poverty line	675	107	15.9	3.45 (1.06–11.24)	0.040*
Food security					
Secure	106	7	6.6		
Insecure	627	103	16.4	2.78 (1.25–6.15)	0.012*
Sex					
Male	401	57	14.2		
Female	332	53	16.0	1.14 (0.76–1.72)	0.509
Age group (months)					
24–	487	75	15.4	1.09 (0.71–1.69)	0.675
48–60	246	35	14.2		
Weight at birth					
Normal BW	675	93	13.8		
Low BW	58	17	29.3	2.59 (1.41–4.75)	0.002*
Type of breastfeeding					
Breastfeeding (Ref.)	327	47	14.4		
Artificial feeding	31	5	16.1	1.14 (0.41–3.13)	0.791
Mixed feeding	375	58	15.5	1.09 (0.71–1.65)	0.685
Anaemia (n = 528)					
Not anaemic	261	38	14.6		
Anaemic	267	41	15.4	1.06 (0.66–1.71)	0.798
Stool analysis (n = 485)					
Negative (Ref.)	355	56	15.8		
<i>Giardia lamblia</i>	54	5	9.3	0.545 (0.20–1.42)	0.217
<i>Entamoeba histolytica</i>	76	11	14.5	0.904 (0.44–1.81)	0.776

*Significant at $P < 0.05$.

OR = odds ratio; CI = confidence interval; Ref. = reference category.

been low-birth-weight babies had a 2.66 times greater risk of being stunted relative to preschoolers with normal birth weight (OR = 2.66; 95% CI: 1.39–4.73; $P = 0.002$).

Food insecurity was the most significant factor in underweight, followed by locality (Table 4). The children from the food insecure households had 9 times the risk of being underweight compared with the children from the food secure households (OR = 8.98; 95% CI: 1.20–7.28; $P = 0.033$). Those living in rural areas had 2.5 times the risk of being underweight relative

to those who were resident in urban areas (OR = 2.40; 95% CI: 1.17–4.94; $P = 0.017$).

Discussion

The ongoing complex emergencies in the Gaza Strip over the past few years, with severe shortages of life basics, the extensive siege and the semi-permanent border closures, have had a severe impact on the poorest and most vulnerable people in the Gaza Strip.

The rate for exclusive breastfeeding in the present study was 44.6%, higher than the 2004 rate (25.4%) in the study by Palestinian Central Bureau of Statistics [21]. The higher figure in our study may indicate an improvement in breastfeeding practices over the last few years as well as a means of coping with the recurrent shortage of infant formula on the market in Gaza due to the siege.

All the households we studied had access to a water supply and to the sewerage system, although only a small minority (4%) used tap water for drinking. These findings were supported by

Table 4 Stepwise logistic regression analysis of factors associated with stunting and underweight

Variable	B	SE	P	OR (95% CI)
Stunting				
Food security				
Secure (Ref.)				
Insecure	1.054	0.442	0.017*	2.86 (1.24–6.12)
Weight at birth				
Normal (Ref.)				
Low	0.981	0.317	0.002*	2.66 (1.39–4.73)
Underweight				
Food security				
Secure (Ref.)				
Insecure	2.196	1.027	0.033*	8.98 (1.20–7.28)
Locality				
Urban (Ref.)				
Rural	0.878	0.368	0.017*	2.40 (1.17–4.94)
Refugee camp	0.003	0.483	0.996	1.00 (0.38–2.58)

*Significant at $P < 0.05$.

SE = standard error; OR = odds ratio; CI = confidence interval; Ref = reference category.

recent reports from United Nations (UN) agencies [22,23]. Most of the households experienced a shortage of gas for food preparation. This also supports the findings of recent studies conducted by the United Nations Population Fund (UNPF) [24] and the Food and Agriculture Organization (FAO) [23].

Most of the households in the present study confronted difficulties accessing food during the year preceding the survey. The most often cited prevailing causes of difficulties were the ongoing siege of Gaza and shortage of food commodities, followed by high price of food products and the loss of

income source. These findings did not differ from those of previous studies [13,21] and are in agreement with a recent report of the UN Development Programme [25].

The majority of studied households were food insecure, and although a different methodology was used by FAO/World Food Programme in their food security assessments, their recent reports revealed the deterioration in food security in the Gaza Strip [11,26].

The rural locality had the greatest proportion of food insecure households and food insecure districts. These areas experience clashes along the border with Israel and are exposed to recurrent

military invasions and attacks, in addition to being very highly populated. Our findings are in agreement with those of previous studies [13,25].

One out of two of our preschoolers was anaemic, a noticeably higher prevalence than in previous studies conducted in Palestinian [27–29]. This indicates that the prevalence of anaemia among preschoolers in the Gaza Strip has been deteriorating since 2002 and thus anaemia is considered a severe public health problem in the Palestinian's community. Not surprisingly, the Gaza Strip, being subjected to on-going, blockade has one of the highest rates of anaemia in the Middle East region, similar to the figure in Iraq, 56% [30]. The lowest prevalence was in Israel (11.8%).

Three consecutive main surveys document the nutritional status of preschool children in Palestine were Palestinian Central Bureau of Statistics [21,31], and USAID [27] in addition to other considerable related surveys [32,33].

The prevalence of underweight and stunting among the Gazan preschoolers in our study were the highest for several years, and is expected to be the highest since the occupation in 1967 [31] (Table 5). The overall prevalence of wasting among our preschoolers was markedly higher than in previous studies carried out in the Gaza Strip since 2004 [21] (Table 5).

The prevalence of stunting and underweight among preschoolers in Gaza worsened considerably between 1996 and 2010 [31] (Table 5). This is in line

Table 5 Comparison of anthropometric measurements among preschoolers in the Gaza Strip in different studies since 1996

Publisher, year [reference number]	Underweight (%)	Stunting (%)	Wasting (%)
PCBS, 1996 [33]	3.9	8	3.8
USAID, 2003[29]	NA	12.7	3.9
PCBS, 2004 [21]	4	11	1.4
UNICEF, 2005 [34]	5	10	1
WHO, 2006 [35]	3	10	3
Current study (Radi et al.), 2013	6.1	15	3.5

PCBS = Palestinian Central Bureau of Statistics.

UNICEF = United Nations Children's Fund.

WHO = World Health Organization.

with the increasing prevalence of food insecurity and poverty among households in the Gaza Strip. Food insecurity was the most significant predictor of underweight and stunting among the preschoolers in our sample.

Taking into consideration that the main reported cause of food insecurity was the prolonged siege on Gaza and the shortage of food commodities since

2006, it is reasonable to assume that the deterioration in nutritional status in the Gaza Strip was political in nature and man-made via the Israeli blockade and tightening of restrictions on the free movement of people and goods in the Gaza Strip and the unprecedented and prolonged closure of the Gaza Strip as confirmed by previous surveys by international agencies [11,34].

Deterioration of the nutritional status among Gazan preschool children and the malnutrition indicators shows the situation in the Gaza Strip is the worst for several decades. The rural area was the worst locality in the nutritional status of preschoolers; it also has more food insecure households and a higher prevalence of anaemia than other localities.

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Food security

Food and nutrition security is a major focus of the regional nutrition programme. Food security includes both physical and economic access to food. Basic components of food security include the following aspects.

- **Availability:** Sufficient quantities of appropriate food are available from domestic production, commercial imports or food assistance on a consistent base.
- **Access:** Adequate income or other resources are available to access appropriate food through home production, buying, exchange, gifts, borrowing or food aid.
- **Utilization:** Food is properly used through appropriate food processing and storage practices, adequate knowledge and application of nutrition and child care practices, and adequate health and sanitation services.
- **Stability:** Adequate food must be obtainable at all times so that access and availability of food is not curtailed by acute or recurring emergencies (sudden crises or seasonal shortages).

Further inform about the work of WHO/WMRO in this area of nutrition available at: <http://www.emro.who.int/entity/nutrition/>