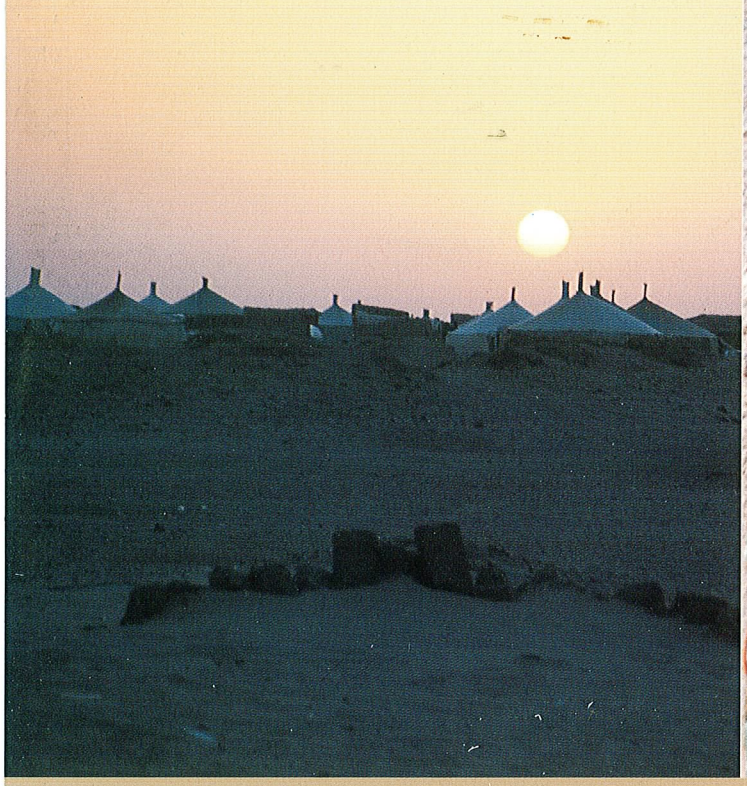




etardation in Saharawi refugee children

Strategies to fight anaemia and growth retardation in Saharawi refugee children

C. Lopriore and F. Branca

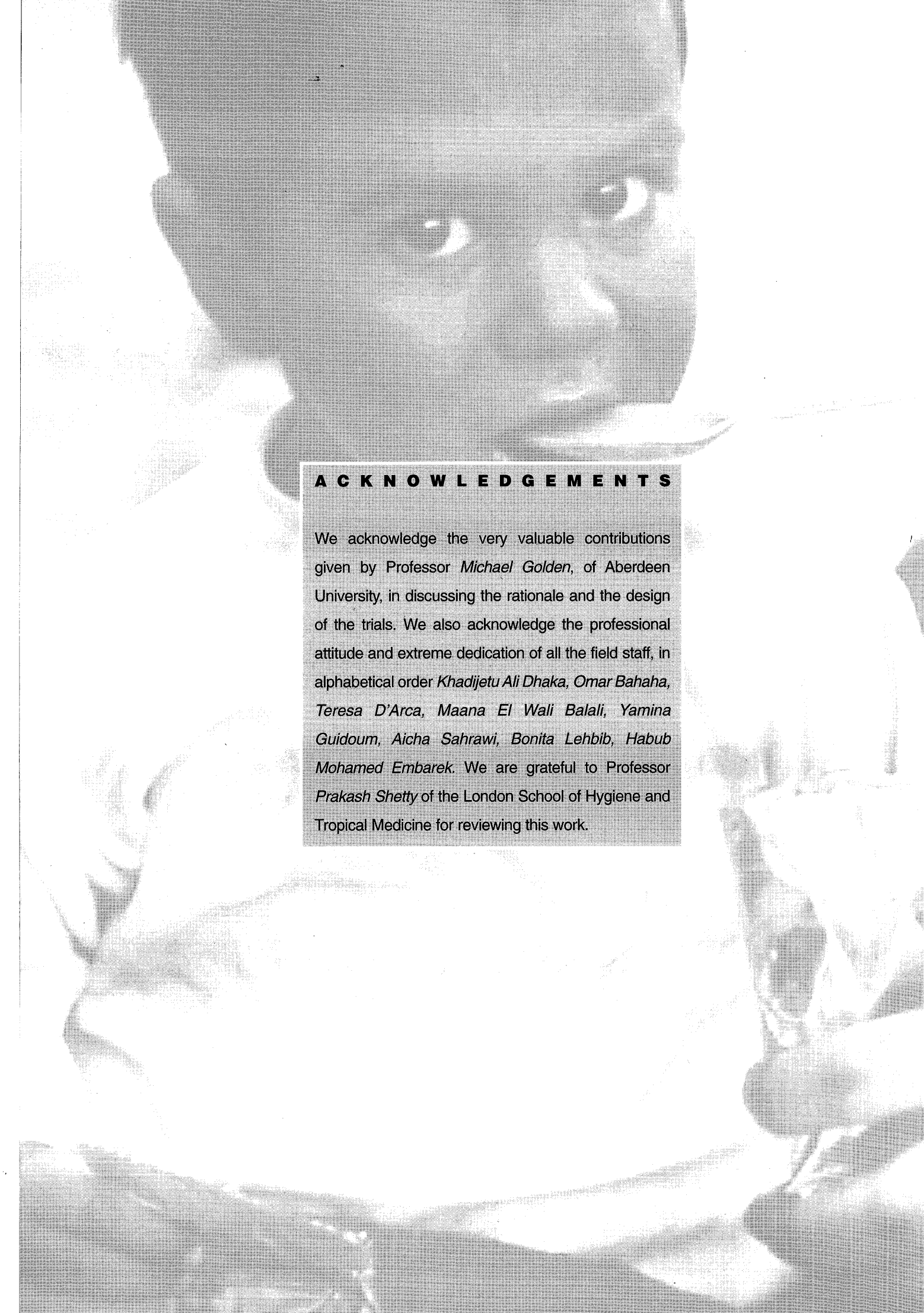
ECHO - Humanitarian Aid Office

ECHO
Humanitarian Aid Office

CISP
COMITATO INTERNAZIONALE PER LO SVILUPPO DEI POPOLI

CISP
Comitato Internazionale
per lo Sviluppo dei Popoli

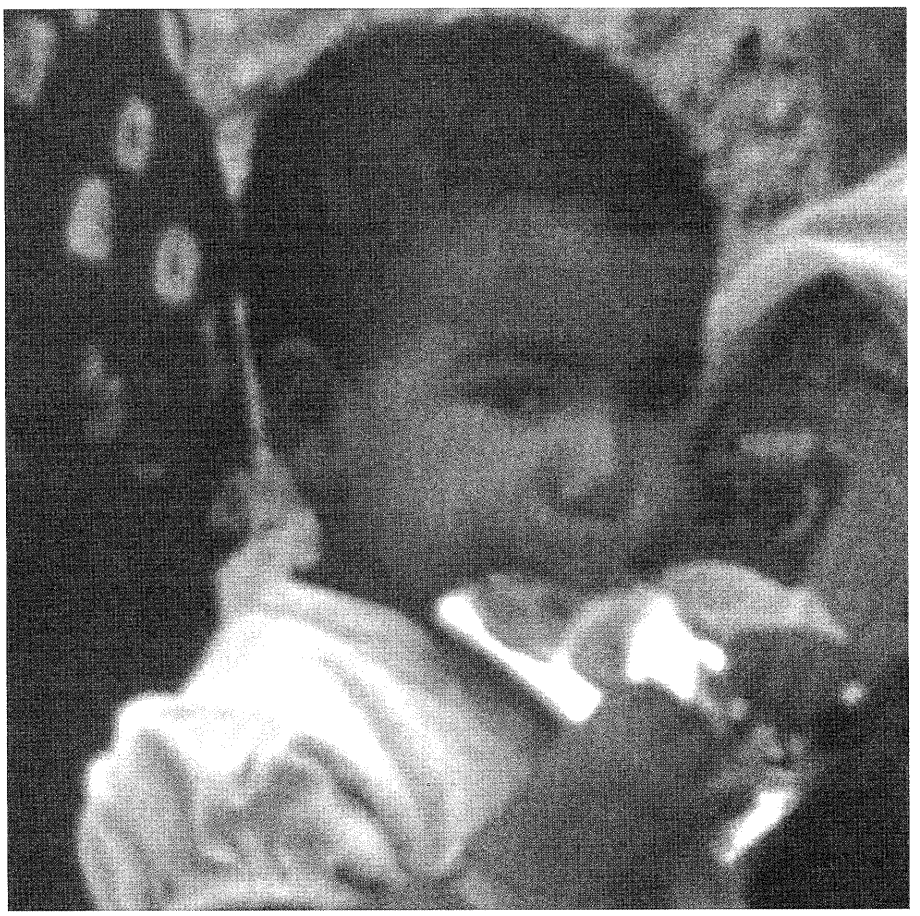
INRAN
Istituto Nazionale di Ricerca
per gli Alimenti e la Nutrizione

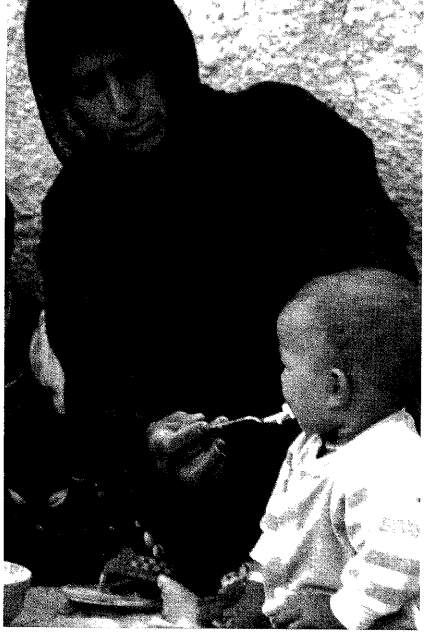


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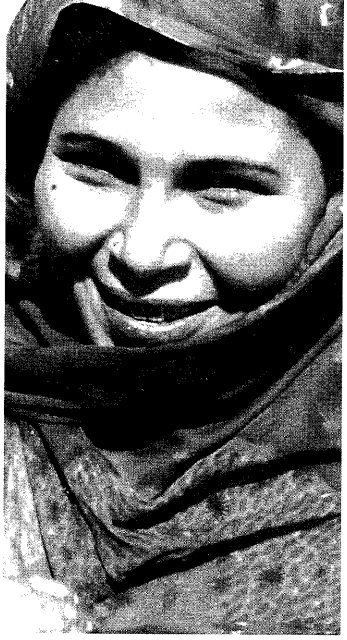
We acknowledge the very valuable contributions given by Professor *Michael Golden*, of Aberdeen University, in discussing the rationale and the design of the trials. We also acknowledge the professional attitude and extreme dedication of all the field staff, in alphabetical order *Khadijetu Ali Dhaka, Omar Bahaha, Teresa D'Arca, Maana El Wali Balali, Yamina Guidoum, Aicha Sahrawi, Bonita Lehbib, Habub Mohamed Embarek.* We are grateful to Professor *Prakash Shetty* of the London School of Hygiene and Tropical Medicine for reviewing this work.

Strategies for the prevention and control of mental retardation in Sub-Saharan Refugee children











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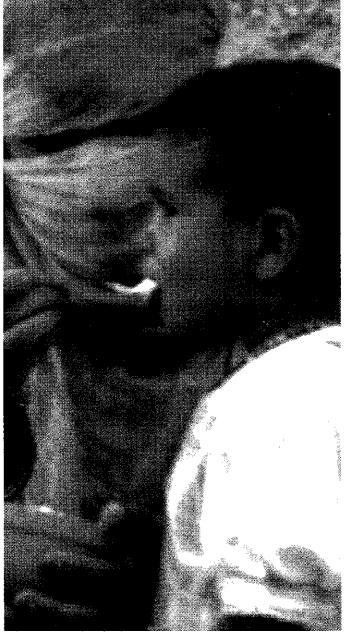
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Preface

By **Costanza Adinolfi**, Director of ECHO

The reality of the Saharawi populations, living in the south of Algeria since 1975, is one of the long-standing political and humanitarian crises of our times.

What makes particularly vulnerable this population is the high dependency from the international aid, as a result of the hardship of the climatic and environmental conditions of the area where they are settled, which is part of the Algerian desert.

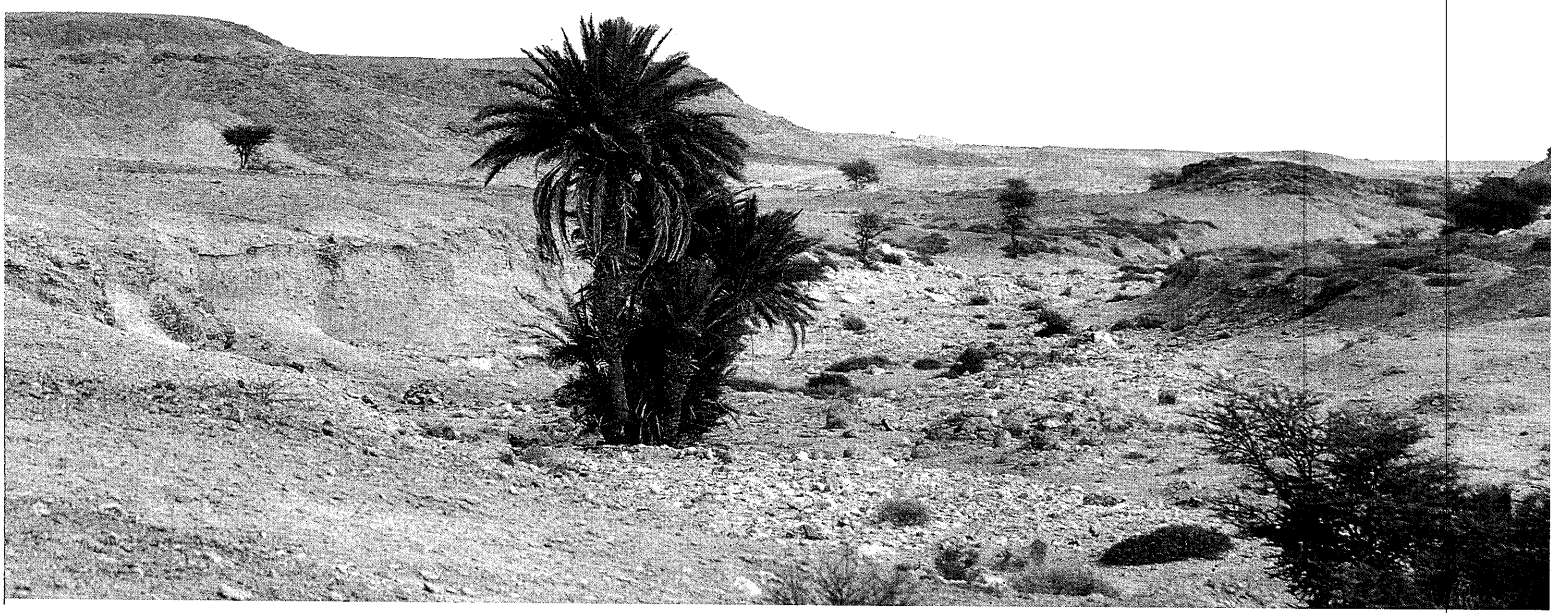
During the last twenty five years the Saharawi have organized themselves through the establishment of self-administered units within the camps, with the local Red Crescent playing a major role in the liaison with external aid givers and in the distribution of basic needs to the people living in the camps, amounting to around 150,000.

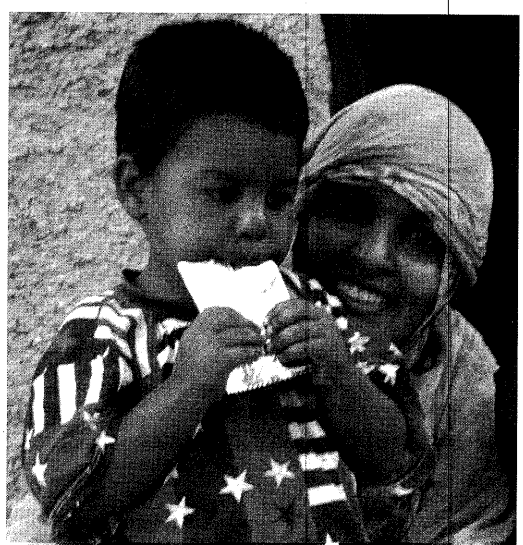
The European Community Humanitarian Office is playing since its foundation a major role in defining and funding humanitarian operations in the camps covering a number of different fields, including the emergency food aid, the support to the local health facilities, the provision of basic goods and items to the Saharawi families.

In the spirit of its partnership agreements with European NGOs, ECHO operates in this reality through the direct involvement of several NGOs. This co-operation includes the joint assessment of the priority needs, the definition of global plans and the implementation of specific projects.

Out of the European NGOs operating in partnership with ECHO in the Saharawi camps, a group of them has created a Consortium, in order to better co-ordinate the field operations and to reduce the operational expenses at the same time ensuring a proper monitoring of the projects.

The Comitato Internazionale per lo Sviluppo dei Popoli (CISP) is part of this Consortium and this publication is related to the projects implemented by this NGO, in co-operation with the Italian Institute for Food and Nutrition





Research, in support of child health, through specific target oriented nutritional interventions.

The positive impact of these interventions, in terms of care and prevention of nutrition related disease, with specific regard to anaemia and growth retardation, has been documented by scientifically sound evaluations, that this publication intends to make known to all those who operate or intend to operate in similar contests.

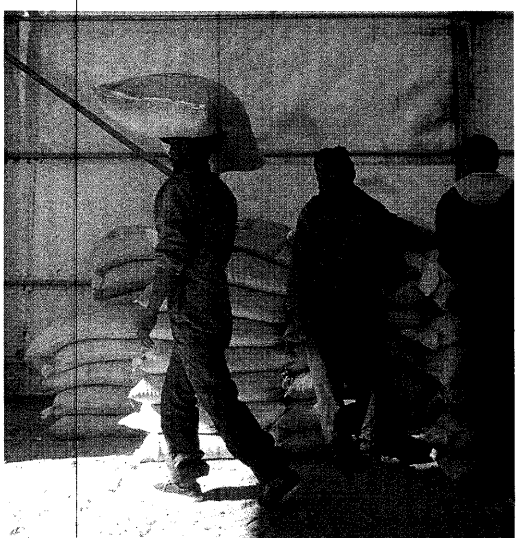
More specifically the publication refers to interventions focused on micro nutrients enriched food targeted to the Saharawi children in the period 1998–1999 and attempts to provide the reader with an exhaustive knowledge of the rationale, the achievements and the finding of the undertaken actions.

This initiative taken by CISP is welcomed by ECHO for some reasons, that I am trying to expose in short.
The first is that the publication gives account of the joint effort of ECHO and one of its partners in the contest of a prolonged emergency. It is therefore a good example of what partnership means in terms of planning, implementation and assessment in the medium and long-term.

Secondly, the publication is useful to make clear the need to define, in situations of prolonged emergencies, humanitarian strategies based on the investigation of actual needs. For instance, the work done by CISP clearly shows that the "traditional" food basket generally designed for the refugees is sometimes not enough to respond to the specific requirements of some vulnerable groups such as the children, unless qualitative integration are made available.

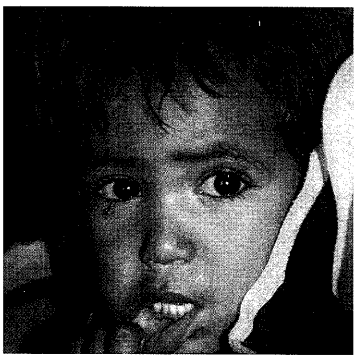
Third, this publication gives account of the role of the scientific world in the humanitarian aid. One of the characteristics of ECHO has been so far the capacity to mobilize some of the best European human resources to provide humanitarian assistance to the populations at risk, bringing the concrete European solidarity whenever necessary, up to the remote desert areas.





by **Paolo Dieci**

CISP Deputy Director, Responsible for International Programmes



This publication is elaborated on the basis of the results of the nutritional interventions carried out by CISP, in close co-operation with the Italian Institute for Food and Nutrition Research (INRAN), in the framework of the humanitarian support to the Saharawi refugees, funded by the European Community Humanitarian Office (ECHO). The collaboration between our NGO and INRAN has been – and continues to be – highly active to improve the health of children and women in the Saharawi camps, by reducing the factors of vulnerability related to the dietary imbalances.

The situation of the Saharawi population may be classified as a case of "prolonged emergency", if we consider that the refugees are living in a desert area of Algeria, near the town of Tindouf, since 1975, as a consequence of the unsolved problem of the status of Western Sahara, or Former Spanish Sahara.

The way CISP has been conducting the humanitarian activities in the Saharawi camps reflects its general approach to complex and prolonged emergencies, i.e. oriented towards the strengthening of the social and institutional contexts through training and capacity building.

In the Saharawi camps, in addition to the controlled and monitored distribution of fortified products, efforts are being made to train local health personnel and to provide the beneficiaries with information and advice on how to better use existing resources. The focus, in other words, is not only on the first relief but also on the growth of the local capacity to cope with the existing situation.

Training of local personnel has been – and still is – an integral part of the strategy aimed at a better use of local human resources. In addition to the periodical and on-the-job training, nutrition projects so far implemented have also foreseen short training periods of Saharawi doctors and health technicians in Italy, in order to update their scientific knowledge and technical skills. Most importantly, these visits allowed them to expand their views and interests to other horizons, bearing in mind that another "enemy" facing the Saharawi population is the isolation from the rest of the world.

CISP has therefore chosen to follow a humanitarian approach based on the full, direct involvement of beneficiaries and their local organisations. In this context, the collaboration with the Saharawi Red Crescent and the Saharawi Ministry of Health has been extremely important, since these institutions have provided the organisational framework under which the interventions have been and are being implemented. For instance, the distribution of products fortified with micronutrients to the families is carried out through the local health dispensaries, following an operational agreement with the Ministry of Health.

Along with the goal of reinforcing the local context, is the effort to reduce the dependency from external aid. What makes particularly vulnerable the Saharawi refugees is their high level of dependency from donors. It is in fact easily understandable that the possibility to develop food production activities are dramatically hampered by the hardship of the environment of the refugee camps, despite the many efforts delivered in this direction by the Saharawis throughout the years (irrigated school gardens, mechanised poultry farm).

The Saharawi authorities are also well aware of the risk that this status of material dependency might lead to a psychological dependency of the population, repeatedly frustrated by the many failures so far witnessed in finding, with the tools of diplomacy, a stable solution to their "historical case". The risk, in other words, is that even if one day – and we hope that twenty six years have not to be waited in vain for this day – the Saharawi population will be placed in a permanent secure settlement, their actual capacity and attitude to be self-reliant will have been seriously damaged by the prolonged exile.

It is against this risk that the humanitarian work undertaken by CISP in the camps has been oriented towards the mobilisation of the local society, including both the institutions and the families, that have not been considered merely as "recipient" of external aid but as responsible partners and owners of the projects. Local families, for instance, are constantly made aware through specific communication tools of the rationale and methodology of the foreseen activities of the projects and they have greatly contributed to their success by ensuring the participation of the children throughout the implementation phases.

by **Giulia Olmi**
CISP Desk Officer for the Programmes in Maghreb



The population living in the Saharawi refugees camps - amounting to 155,430 persons - is organised as a real "State in exile". In fact, a number of administrative and institutional bodies are in charge of the different aspects of the every day life. The refugees are distributed in four different districts (wilaya): El Ayoun, Smara, Dakhla and Ausserd. Each district is sub-divided in six or seven provinces (daira). In both cases, the denominations are taken from localities of Western Sahara, with the aim of reinforcing a social and cultural identity and a link with the roots of the refugees.

The very same organisation serves the scope of defining the activity of the "Popular Grass Root Committees" in the five sectors of Education, Health, Justice, Handicraft and Logistic, with a priority given to the Health and the Education. All the children and the adolescents are usually enrolled in the existing schools, under the supervision of the Ministry of Education. There is an existing structured net of health facilities, ranging from local dispensaries to district hospitals that are managed by the Ministry of Health.
Needs are periodically assessed by two governmental entities, the Saharawi Red Crescent and the Ministry of Co-operation which contribute to the aid planning with the different donors.

Food and other basic commodities, including drugs and medical equipment, are made available by ECHO, some bilateral development co-operations, UN agencies and several solidarity groups existing all around Europe.

Despite the difficult and basically unproductive natural environment where the refugees are living, some efforts to produce food items locally have been done during the long period of exile. For instance, approximately 100 ha have been allocated to horticulture, distributed among several gardens. The actual production compared with the running costs does not appear encouraging, but this activity has certainly had the value of allowing to a certain number of people to specialise in this field, with the idea of exploiting the acquired knowledge in future, in other areas.

A mechanised poultry farm, able to produce between 25,000 and 45,000 chickens has also been established.

With regard to livestock, it is estimated that families own, in total, approximately 150,000 between sheeps and goats, with an average of nearly one animal per person. Finally, approximately 10,000 camels are owned by the households, while 49,000 belong to the government.

These few data show that while the institutional framework of the Saharawi society appears well organised and much more structured compared with other situations of prolonged refuge, its economic fabric is inevitably extremely fragile.

It is a fact that the survival itself of this population still relies heavily on the international assistance. This is the general rationale for the humanitarian projects that ECHO has started to fund in the camps since the year 1994, immediately after its own establishment. CISP, that was already supporting the Saharawi refugees by providing basic health equipment and educational materials since ten years before, was amongst the first ECHO partners in the camps.

From the very beginning our effort has been that of channelling the assistance through the existing network of administrative structures fully exploiting their potentials in terms of outreach capacity.

The projects funded by ECHO in the Saharawi camps are included in the "Global Plans" whose definition is facilitated by the interaction among ECHO itself, the European NGOs[1] and the Saharawi partners. This joint exercise makes it easier to define the projects on the base of actual priorities, avoiding the risk of duplications and overlapping in the aid delivery.

Due to the prolonged refugee condition and the hard and infertile environment, the nutritional status of the refugee population is poor. In 1997, ECHO financed a baseline survey, conducted by CISP in collaboration with Italian Institute for Food and Nutrition Research (INRAN). This survey identified anaemia and growth retardation mostly in women and children as emergent problems as a result of the long-term negative effects of the unbalanced diet. In the unchanged living conditions of the Saharawi refugee population, it was therefore recommended to contrast these problems through targeted nutritional intervention. In 2001, the fourth nutritional supplementation programme for children will be implemented. This kind of intervention is now regularly included in ECHO's global plans.
Following the recommendations of the 1997 survey, CISP is also carrying out nutritional supplementation programmes to fight anaemia among Saharawi women in fertile age (15-45 years), financed by UNHCR.

In addition to nutrition and food aid to the general population, other ECHO funded projects are implemented by CISP in the areas of health, logistics and provision of basic items to the families.

Our wish is to contribute, in the near future, to the rehabilitation process of the Saharawi society, in a new environment. Despite the existing difficulties, the long term solution of the Saharawi situation relies in fact on the possibility that a peace plan will be implemented, giving the population the chance to build their own future.

[1] The following NGOs are part of a Consortium created by their own initiative in order to facilitate the co-ordination: Caritas Secours International (Belgium), CISP (Italy), Medico International (Germany), Movimiento por la Paz, el Desarme y la Libertad (Spain), Paz y Tercer Mundo (Spain), Solidaridad Internacional (Spain), OXFAM Solidarité (Belgium).

chapter 1

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Introduction

1. The stunting syndrome

Optimal growth and development of children is a basic human right and an obvious objective of social security and health systems. Almost one fourth of the world's children under five years of age are affected by growth retardation, or stunting (de Onis *et al.*, 1998). This condition is dramatically common in some areas of the world, such as Sub-Saharan Africa and south-east Asia, where almost half the children are affected (WHO, 1997).

Stunting is the result of repeated insults to the growth plate that slow down linear growth velocity. The diagnosis of stunting is usually done when attained height falls below the 5th centile (or below -2 SD score) of the NCHS/WHO reference height-for-age. However, when the diagnosis is made, the infant or child has already been suffering for a period between several weeks to several months, according to the severity of the insult and its timing. Growth may be impaired since foetal life, but more often failure to thrive takes place in infancy, particularly in the second semester of life, during the transition from breastfeeding to family foods. If the insult occurs very early, when growth velocity should be highest, the infant may become stunted even in the first few months of life. If the reduction of the growth rate were followed by a compensatory period of increased growth velocity, also known as "catch-up growth",, there would not be a negative impact on attained height. It is probably more common that periods of reduced growth velocity are instead followed by periods of normal growth velocity. Growth

retardation is often accompanied by a delay in skeletal maturation, so that the closure of epiphyseal cartilage occurs later in life and allows partial recovery of growth. However, stunted individuals do not achieve the height that would be allowed by their genetic potential.

The causes of growth impairment are a combination of inadequate nutrition, inadequate care practices and sustained environmental stress. Intrauterine growth retardation may take place if mothers have a low Body Mass Index, if their energy intake falls below the required amount or if some key micronutrients, such as zinc, calcium or magnesium, are short in the diet. Exclusive breastfeeding would allow complete coverage of energy and nutrient needs in the first six months of life. However, in some populations early introduction of liquids or other foods that interfere with breastfeeding is a common practice. Inadequate complementary feeding practices, such as giving diluted porridges or giving only cereal based meals, would entail that micronutrient needs, particularly zinc, are not met (Prentice and Bates, 1994). Infections act through a reduction of food intake, impaired nutrient absorption and increased nutrient needs. Gastrointestinal infections and parasitic infestations are an obvious candidate for such a multiple effect. Even in absence of clinical symptoms, bacterial overgrowth in the small bowel might interfere with growth. Gastrointestinal infections are a common occurrence in countries and in population groups with little access to safe water and living in a highly contaminated environment.

Stunting is known to be closely associated with poverty and deprivation (Martorell,1985; Tanner, 1992). Poverty involves limitations of access to food of adequate quality throughout the year; living in a harsher environment, with poor housing and water and sanitation facilities; less access to health care; less education and more time constraints that prevent mothers from providing adequate care and psycho-social stimulation.

Some scientists have suggested that stunting might be a form of adaptation that allows survival in an environment with reduced food availability. It might therefore be considered an indicator of poverty rather than a disease. This view is no longer acceptable, as there is enough evidence of the functional impairment and pathological correlates of stunting.

Some of the consequences of stunting are strictly related to the size issue. A small adult has some functional limitations compared to a taller one, such as reduced working capacity. In contexts where manpower is essential for subsistence this may have further consequences on health and wellbeing of the individual and his/her dependants (Spurr, 1988). Stunted individuals are maintained in a state of poverty, as they are not allowed to produce the extra income that might allow them to escape the cycle of mere subsistence. Reproductive performance may also be affected by stature: a small woman will usually deliver a small child, thus perpetuating an intergenerational cycle of growth retardation.

In addition, stunting is associated to conditions that are not related to skeletal growth, such as a higher risk of morbidity (Tomkins, 1988) and mortality (Pelletier *et al.*, 1993). This fact has been documented in several world populations, like Brazil (Victora *et al.*, 1994); Tibet (Harris *et al.*, 2001); Sudan (Kossmann *et al.*, 2000). Stunting is also associated with impaired motor and intellectual development; delayed commencement of a gross motor milestone was observed in Pakistan (Cheung *et al.*, 2001). Severe stunting at age two was associated with later deficits in cognitive ability in Filipino children (Mendez et al., 1999) and reduced school performance was observed in stunted children in Guatemala (Martorell *et al.*, 1992). Finally, stunting is associated with increased risk of developing chronic diseases, such as obesity (Hoffman *et al.*, 2000) and hypertension (Gaskin *et al*, 2000).

Stunting often comes in association with micronutrient deficiencies, such as anaemia and xerophthalmia, although not in all situations. A study in Brazil documented an association of stunting, diarrhoea and anaemia (Gross *et al.*, 1989). Stunting and anaemia were both highly prevalent in Tanzania schoolchildren (Lwambo *et al.*, 2000). In Honduras, the co-occurrence of vitamin A, anaemia and stunting was higher than expected, but not appreciably so, and the authors suggest that the three conditions should be considered independently (Albalak *et al.*, 2000).

These findings indicate that stunting should not only be considered a pathological condition, but a marker condition, associated with a set of pathological conditions affecting different systems in the body. It might therefore be identified as a "syndrome". The main features of the stunting syndrome would be growth retardation, increased susceptibility to infections and delayed psycho-motor development. An additional feature might be anaemia.

The common base to these pathological conditions is probably the prolonged

inadequate coverage of the requirements for micronutrients. For some of these nutrients, such as zinc and phosphorus, the sign of deficiency is specifically growth retardation and tissue concentration is not reduced (Golden, 1988). This is why a relationship between micronutrient status and stunting has been shown in some studies (Nestel *et al.*, 1999) but not in others (Hautvast *et al.*, 2000).

We propose that the "stunting syndrome" be considered the main marker condition of micronutrient malnutrition, the so-called "hidden hunger".

2.1 Micronutrients in the prevention and control of the stunting syndrome

The stunting syndrome is likely to be related to inadequacy of several micronutrients. This is also demonstrated by the fact that the use of individual nutrients in supplementation trials have not always produced positive results (Allen, 1994). The coexistence of multiple micronutrient deficiencies is a public health problem in many regions of the world. A third of the world's population is affected by vitamin A, iron and iodine deficiencies.

Elimination and control of the main micronutrient deficiencies and their health-related consequences as public health problems are currently the targets of global programmes. Action to control population growth is vital for national and global prosperity. Ensuring adequate micronutrient supplies to mothers and infants will dramatically increase the vitality, viability and intellectual capacity of future generations.

Innovative strategies are needed to fight hidden hunger. The problem is how to best deliver the nutrients, whether in the pure form, as pharmaceutical preparations (supplementation) or as food components (food-based strategies). If the latter are used, then which foods should be used? Ideally, a well balanced and varied diet should be given to everybody. There are however situations in which this is not feasible, such as in most refugee settings. In this case, design foods, based on cheap staples but then adequately fortified with the nutrients of interest may be needed. Efficacy of fortification has been demonstrated in many settings, although the feasibility of its implementation is problematic in situations where political or environmental conditions do not allow it. Finally, a combination of strategies might be used in different populations, in the context of a long term public health plan. This mix of complementary approaches would include dietary improvement, public health measures, fortification and supplementation.

Little operational research is done on the issue and many questions rise that remain to be answered. There is a surprisingly little understanding and documented knowledge of the food habits of refugees, not to mention issues like the use, acceptability and efficiency of fortified blended supplementary foods. There are no generally accepted recommendations as far as the mineral and vitamin fortification levels for supplementary foods are concerned, despite evidence highlighting their importance, nor are there established micronutrient requirements for catch-up growth. On the issue of catch-up in linear growth, more research is needed to provide answers on the length of nutritional support required, the extent to which reversibility of stunting is feasible and desirable as well as the safety of exposure to supplementation levels of micronutrients in individuals exposed to deficiencies since foetal life.

2.2 Objectives and scope of this publication

The purpose of this publication is to illustrate the rationale, efficacy and effectiveness of food-based interventions in the prevention and control of the stunting syndrome among refugees living in chronic vulnerability. These nutrition interventions have been designed to address questions with respect to whether it is possible to prevent this condition, whether it is possible to treat it, which population groups have to be targeted, how do logistics have to be planned in order to achieve the best results.

The following chapters guide the reader step by step through the approach adopted, reviewing its concepts, the practical aspects of the implementation of field activities, the results and recommendations.

Chapter 2 illustrates the rationale of the approach and reviews previous intervention trials.

Chapter 3 reviews the aspects of the food technology adopted and provides details of the foods used in the interventions described in Chapters 5 and 6.

Chapter 4 describes the setting in which the interventions were performed, i.e. the chronic emergency situation of Saharawi refugees.

Chapter 5 reports the results of the pilot efficacy trials showing the potential benefits derived from the food-based interventions in infants and in stunted children.

Chapter 6 describes the extension of these interventions to the entire refugee population showing the results achieved in a real health programme.

Chapter 7 draws out the conclusions and lessons learned from these food-based interventions giving recommendations for further action. Different strategies of intervention are also discussed in the light of issues arising from the field studies.

An extensive bibliography is given at the end of Chapter 2.

This document has been prepared as a pragmatic approach intended to be useful to field workers and all nutritionists interested in nutrition intervention programmes. A video is also available entitled "Managing Child Anaemia and Growth Retardation: A food-based intervention among Saharawi refugees".

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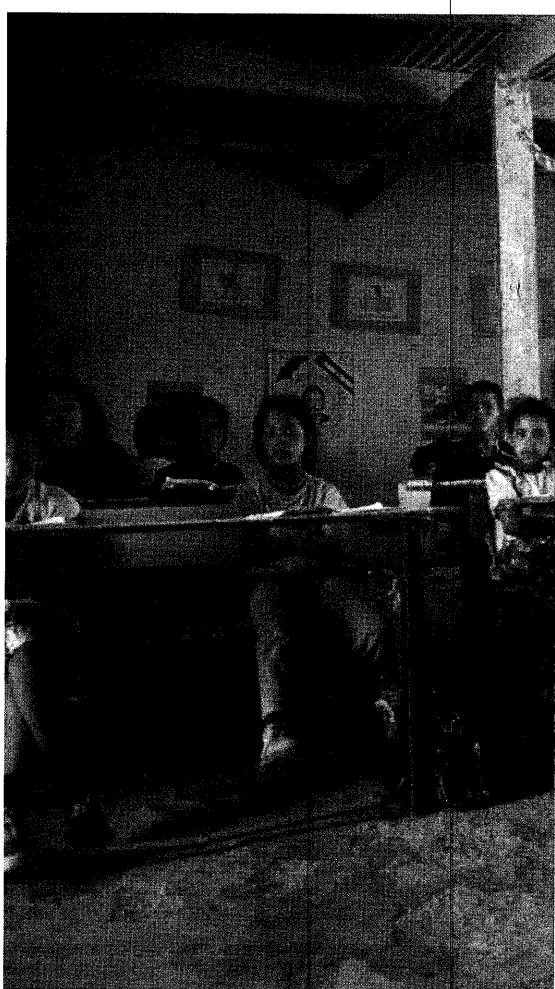
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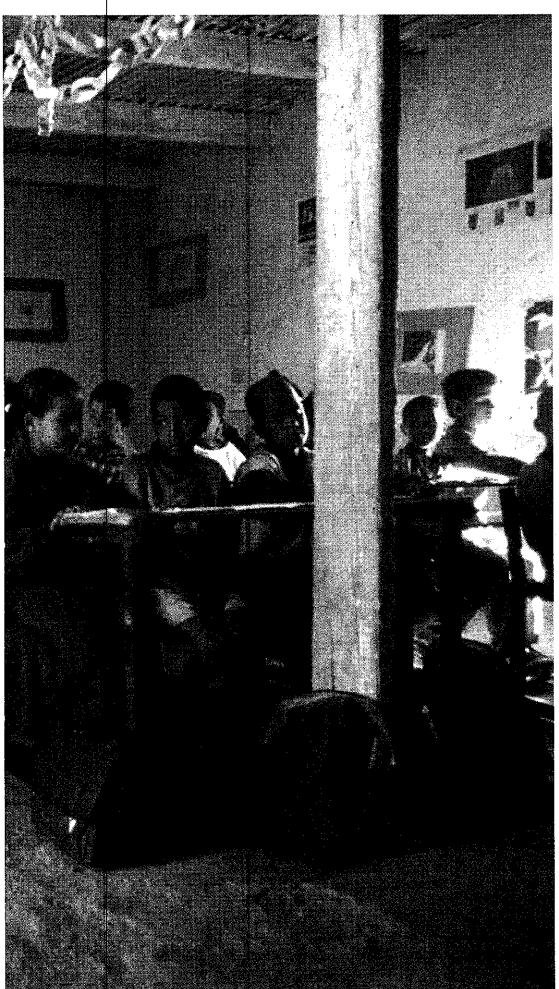
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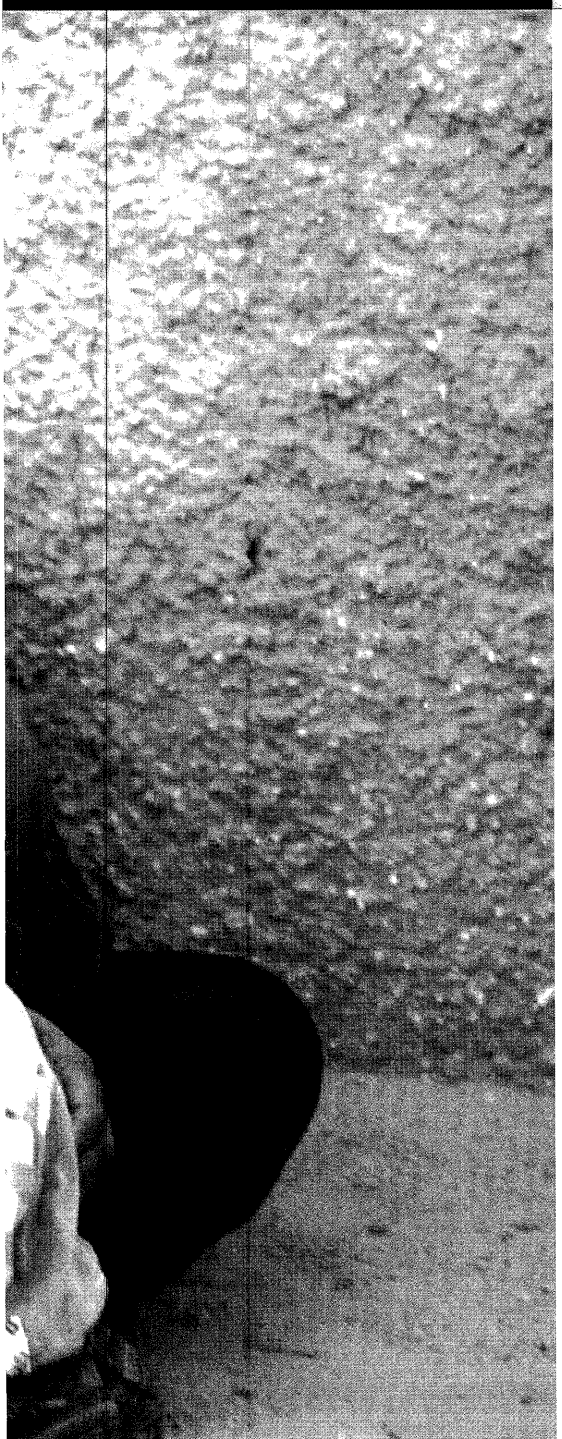
chapter 2

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1. Introduction

The syndrome of stunting, anaemia and high rates of infection commonly affects children living in situations of deprivation. The widely accepted UNICEF causal model for malnutrition identifies three underlying causes: (a) insufficient access to food, (b) poor maternal and child care and (c) inadequate health services/inferior living environments (UNICEF, 1998). Disease and inadequate

intake of food are the two primary factors leading to poor nutritional status. A synergistic relationship exists between malnutrition and disease. For example, a child who is anaemic is more likely to have frequent episodes of illness. Conversely, high levels of morbidity, particularly intestinal parasites and malaria, contribute to the development of anaemia.

Inadequate food intake is a relatively broad term combining insufficient consumption of both macro- and micronutrients. Historically, malnutrition has been attributed to a lack of protein and energy. Today, the role of micronutrients (vitamins and minerals) is increasingly recognised. There is abundant evidence in the literature to explain how micronutrient deficiencies contribute to anaemia, growth faltering and illness. Before examining the body of scientific literature available, a brief definition and explanation of the functional consequences of each condition will be given.

Stunting

Stunting results from poor linear growth and is an indicator of chronic malnutrition. It is measured in terms of height-for-age (HA) disaggregated by gender. A child is considered stunted if he/she falls 2 Standard Deviations units or Z scores (HAZ <-2), below the reference population. The population reference curve was developed by the United States National Centre for Health Statistics (NCHS) and is currently used world-wide and recognised by the World Health Organization (WHO) as the reference standard. In developing countries and in refugee populations, approximately 40% to 50% of children under five years of age are stunted. The functional consequences of becoming and remaining stunted include, increased risk of infection and mortality, delays in motor and mental development and decreased work capacity (WHO, 1998).

While stunting remains a global public health problem, there has been a secular trend toward increasing height in some countries. This trend is believed to be influenced by numerous factors including socio-economic status status, family size, education and improved diet (Cole, 2000). Two of the most striking examples of this have occurred in the Netherlands and Japan, where average adult height has steadily increased over the past fifty to one hundred years. The trend in Japan has been directly correlated to dietary changes, most notably an increase in the consumption of milk (Takahashi, 1984). The correlation between increasing height and increased consumption of foods such as milk, has often been attributed to increased protein intake, recently however, the importance of certain essential micronutrients also highly present in these foods is being recognised.

2.1 Lifecycle influences on stunting

Answering the questions of when and how stunting first appears and its progression during childhood is of utmost importance for developing appropriate public health strategies. Linear growth in human development is a complex cumulative process, beginning *in utero* prior to birth. The effect of poor maternal health on infant and child growth is often overlooked. Maternal health and nutritional status are critical determinants of infant growth, with consequences that can extend into adulthood.

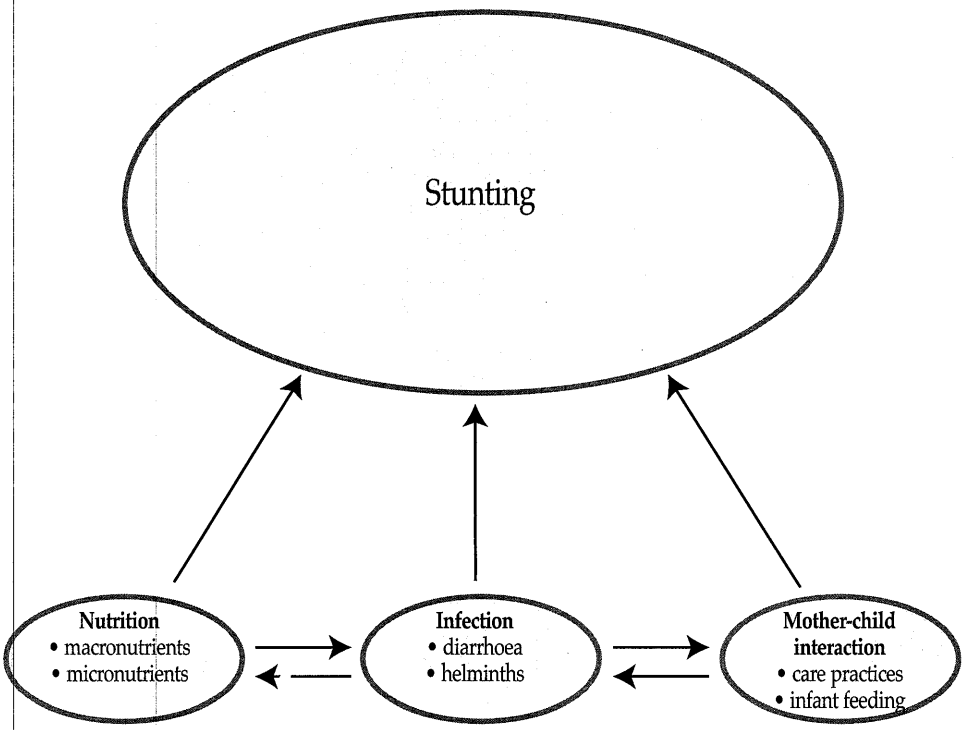
Prenatal growth retardation

Birth weight is an important indicator of foetal nutrition and a strong predictor of subsequent growth and well-being. Birth weight is governed by two major processes, duration of gestation and intrauterine growth rate. Infants born earlier than 37 weeks gestation are defined as premature. Low birth weight (LBW), defined as weight at birth of less than 2,500 grams is due to (a) a short gestation period, (b) retarded intrauterine growth or (c) a combination of both. Birth weight and gestational age each have an important impact on infant development.

The term Intrauterine Growth Retardation (IUGR) combines the two concepts of birth weight and gestational age, and is commonly defined as birth weight below the tenth centile for gestational age. Recent studies of IUGR in developing countries estimate 23.8% of infants are affected (de Onis *et al.*, 1998). While this definition provides the most accurate picture of foetal growth outcome, it is less commonly used as an indicator in developing countries due to the difficulty in accurately calculating gestational age. The most frequently used indicator for assessing foetal growth outcome is birth weight.

Approximately, 16% of all infants born in the developing world have low birth weights (ACC/SCN, 2000). It is quite plausible that this figure is underestimated due to the large number of women who give birth at home where weighing of new-borns is not routine. Maternal factors like short stature, low pre-pregnancy weight and low weight gain during pregnancy are major determinants of foetal growth retardation (WHO, 2000). Other maternal factors influencing individual weight at birth are related to a woman's burden of infection and smoking behaviour during

Diagram 1: Factors contributing to stunting



pregnancy. A higher prevalence of stunting has been seen in children whose mothers are of short stature (Hernandez-Diaz *et al.*, 1999). It has been proposed that short maternal stature can be attributed to maternal under nutrition and infection during childhood, thus creating an intergenerational cycle of stunted adults, giving birth to stunted children.

Post-natal growth retardation

There is clear evidence that growth retardation can begin prior to birth, supporting the hypothesis that growth faltering in early infancy may be attributable to factors that can only be prevented during the pre-natal period. However, it is not clear how much prenatal growth retardation contributes to postnatal stunting. A recent symposium on the aetiology of stunting concluded that stunting begins at 3-6 months of age and can continue to develop up to the age of 24-36 months (Frongillo, 1999). The most intense growth faltering is generally observed between 3 and 18 months of age (Martorell *et al.*, 1994). Two superimposed patterns account for growth during this period, an infancy growth pattern influenced by nutritional factors and childhood growth influenced by growth hormone (Karlberg *et al.*, 1994). The onset of the growth spurt in early childhood was shown to differ between healthy and deprived populations. Healthy children in Sweden began to exhibit a growth spurt at 8 months of age while this pattern was delayed by five months in children living in depressed areas of Pakistan (Karlberg *et al.*, 1994). This growth delay is a possible explanation for the increasing disparity in growth trajectory beginning around this age.

There is a clear triad of causal factors, which directly impact the development of stunting (Diagram 1). The interaction between the factors contributing to poor growth during infancy and early childhood is complex and dynamic. Important nutritional influences include, intake of macro- and micronutrients through breast milk and complementary foods, offset by the presence of dietary substances known to inhibit nutrient absorption (phytates, tannins). Infections, most notably those which affect the lining of the gastrointestinal tract, can also have a direct impact on the development of stunting. Impaired linear growth has been documented as a result of both acute and chronic infections (Stephensen, 1999). Caregiver behaviours which can influence the development of stunting include mother-child interaction, breast feeding practices and the initiation and selection of complementary foods.

2.2 Micronutrients in the prevention and treatment of stunting

Prevention, the cornerstone of public health, is basically defined as an action that pre-empts the development of a condition. In the case of stunting, associated with numerous confounding factors involving inter-generational, prenatal and postnatal determinants, it is hard to speak of prevention in the true sense of the word. Unlike the clear-cut positive or negative diagnosis of a disease, growth during childhood can fluctuate. Regardless of whether a child fits the absolute definition of stunting (HAZ <-2) at any given time he or she can demonstrate an accelerated or reduced growth trajectory. This trajectory is the best indication of individual progress or regress. However, a cut-off point is necessary for the purposes of measuring the problem on a population level.

There is a degree of overlap involved in determining whether a programme intervention is aimed at prevention or treatment. Factors which promote accelerated growth, such as certain micronutrient interventions, do not necessarily "prevent" growth faltering. For example, interventions involving children who are already stunted (selection criteria applied in many studies) clearly fall under the category of treatment approaches. The term "early intervention" is perhaps more precise when describing interventions involving a combination of stunted and non-stunted subjects. With the exception of one or two carefully designed studies, both stunted and non-stunted children are generally grouped together in intervention trials, making it difficult to isolate a true prevention strategy from one which actually describes a treatment.

Studies in the 1960's and 70's focused on the role of protein and energy in growth faltering. A comprehensive analysis of supplemental feeding programmes, which took place from 1959-1979 and involved numerous different kinds of foods high in energy and or protein, concluded that anthropometric gains from the supplements were not large for the group as a whole and that a substantial number of the programmes had little impact on the total intervention population (Beaton *et al.*, 1982).
Research in Guatemala, which provided children with a high-energy, low-protein supplement (*fresco*) or a high-energy, high-protein supplement (*atole*) reported improvements in linear growth for both groups. However, severe stunting continued to occur within the supplemented population despite protein intakes which were most likely adequate (Allen, 1994). Similarly, an assessment of toddler dietary intakes in three countries concluded that protein intake was unlikely to be a primary limiting factor in growth (Beaton *et al.*, 1992).
The potential influence of a wider range of dietary factors is now receiving attention. Present research is focusing on the role of micronutrients, particularly zinc, for early intervention and treatment of stunting. Current discussions aim at defining which micronutrient deficiencies limit growth and whether stunting is primarily due to deficiencies of single or multiple micronutrients. The following section will summarise recent supplementation studies, with a particular focus on the role of single and combined micronutrient trials.

2.2.1 The role of zinc

The link between zinc and human growth failure was first observed in the 1960's in studies of stunted pre-pubertal boys. Since that time many studies have been conducted with the aim of documenting the exact role of zinc on human growth. Much of the information is difficult to compare given the various age groups studied, duration of supplementation and type of population studied (healthy or ill/malnourished). In 1998, Brown, *et al.*, completed a meta-analysis of 25 controlled clinical trials and summarised the effect of zinc supplementation on child growth. This analysis indicated that there was a small but significant impact of zinc supplementation on both the height and weight of children, with an emphasised effect on children stunted at baseline (Brown, *et al.*, 1998). The meta-analysis indicates that zinc is a critical determinant for child growth, and that zinc supplementation should be considered for populations with a high prevalence of stunting. The results of subsequent randomised, placebo-controlled trials are summarised in Table 2.

Four out of the six studies reviewed reported some type of beneficial effect of zinc supplementation on growth. Rivera, *et al.*, found the effect of zinc supplementation to only be significant for children already stunted at baseline (Rivera, *et al.*, 1998). Umeta noted an increase in growth for both stunted and non-stunted infants, though the effect on stunted children was greater (Umeta, *et al.*, 2000). Ruz, *et al.*, noted an increase in growth only for boys, an earlier study also taking place in Chile, found a similar effect (Ruz, *et al.*, 1997, Castillo-Duran, *et al.*, 1994).

2.2.3 The role of zinc in combination with other micronutrients

The rationale for combining zinc with other micronutrients stems from the evidence that stunting is associated with marginal, simultaneous deficiencies of several micronutrients. Dietary studies from Egypt, Kenya and Mexico found the majority of

Table 1: Randomised Controlled Trials of zinc supplementation and growth

Author, Country	N	Age Months	Selection Criteria	Duration Months	Treatment	Results		
						Ht	Wt	Other
Umeta, 2000 Ethiopia	200	6-12	100 Stunted 100 Non-stunted	6	1. 10 mg Zn/d 2. Placebo	+	+	Results signif for both st. and non-st. groups
Rivera, 1998 Guatemala	89	6-9	Random	6.9	1. 10 mg Zn/d 2. Placebo	+[1]	na	
Kikafunda, 1998 Uganda	153	44-67	Random	6	1. 10 mg Zn/d 2. Placebo	NS	+[2]	
Ruz, 1997 Chile	98	27-50	Low Socio-Economic Status	14	1. 10 mg Zn/d 2. Placebo	+[3]	na	
Meeks-Gardner, 1998 Jamaica	85	6-24	Stunted	3	1. 5 mg Zn/d 2. Placebo	NS	NS	
Ninh, 1996 Vietnam	146	4-36	Stunted	5	1. 10 mg Zn/d 2. Placebo	+	+	

Abbreviations: **NS**= not significant; **na**= not applicable; **Ht**= height; **Wt**= weight
[1] For children stunted at baseline.
[2] Only in children of medium socio-economic status.
[3] Effect (p 0.04) only in boys, no effect in girls.

toddler diets were deficient in more than one micronutrient (Calloway, 1995). Little is known about the impact of multiple, simultaneous micronutrient deficiencies on health. It has been suggested that the limited success of some supplement interventions occurs as a result of focusing on replacing a single micronutrient, given the presence of multiple deficiencies (Allen, 2000). Golden has furthered this hypothesis by classifying nutrients as type I or type II nutrients, based upon unique physiologic responses evidenced when deficiency occurs in growing children (Table 2). An important distinction between a type I and a type II micronutrient is that only type I micronutrients can be stored in the body's tissues. In a type one response to deficiency, the bodily functions dependent on the particular deficient micronutrient are affected, yet the individual can continue to grow. In a type two response, growth is the

Table 2: Tentative classification of nutrients into type I and type II From Golden (1988)

Type I. Initial normal growth Reduced tissue concentration Specific signs	**Type II. Primary growth failure Normal tissue concentration No specific signs**
IA *No identified stores*	**IIA** *No identified stores*
Selenium	Nitrogen
	Essential Amino Acids
IB *Stored*	Phosphorus
Copper	Potassium
Iodine	Sodium
Iron	Zinc
Calcium	
Retinol	**IIB** *Stored*
Riboflavin	Energy
Cobalamin	
Thiamine	
Tocopherol	
Ascorbic Acid	
IC *Specific deficit in longitudinal growth*	
Manganese	
Vitamin D	

Table 3: Zinc in combination with other micronutrients

Author, Country	N	Age Months	Selection Criteria	Duration Months	Treatment	Results		
						Ht	Wt	Other
Rosado, 1997 Mexico	219	18-36	Random	12	1. Zn 20mg 2. Fe 20mg 3. Zn + Fe 4. Placebo	NS	NS	
Perrone, 1999	30	48-132	Stunted	12	1. Zn 12.5 mg + Fe 12 mg 2. Zn 12.5 mg 3. Placebo	+[1]	na	
Smith, 1999 Belize	43	22-66	Low Serum conc of Zn and vitamin A	6	1.70mg Zn/w 2. 3030 RE A 3. Both Zn + A 4. Placebo	+[2]	+	Increased Hb in Vit A group
Roy, 1999 Bangladesh	65	3-24	Diarrhoea <3days	2 Weeks	1.20mg Zn + multi vit 2. Multivit	+	+	
Thu, 1999 Vietnam	163	6-24	Random	3	1. 8mgFe, 5mg Zn, 333RE Vit A, 20mg Vit C/day 2. 20mgFe, 17mg Zn, 700 RE Vit A, 20mg C/week 3. Placebo	+[3]		Both groups had increased Hb, Retinol and Zn.
Simondon, 1996 Congo, Senegal, Bolivia and New Caledonia	447	4	Breast fed infants	3	1. Fortified Cereal based weaning porridge. 2. Traditional Weaning Foods	+[4]	NS	

Abbreviations: **NS**= not significant; **na**= not applicable; **Ht**= height; **Wt**= weight
[1] Only in Fe+Zn group and Zn only group if Ferritin levels > 20.
[2] Effect on Ht and Wt for Vitamin A supplemented group only.
[3] Children stunted at baseline
[4] Only for Senegal.

primary function affected by the deficiency.

Results of trials involving zinc plus other micronutrients are summarised in Table 3.

These studies again highlight the effect of zinc supplementation on stunted and ill children; the effect on healthy, non-stunted children remains less evident. No significant effect on growth appeared to be gained from combining iron or vitamin A with zinc. The study by Simondon *et al.* deserves more thorough discussion as it is one of the few studies fitting the definition of a prevention design (less than 4% of the sample was stunted at baseline). Despite the fortified supplement (which included most type two nutrients), length velocity of the infants displayed a negative trajectory in all countries, with infants falling below the NCHS reference standard beginning at 4 months in Senegal, 5 months in Congo and Bolivia and 6 months in New Caledonia. Some, but certainly not all, of the deviation from the reference population could be explained if the concentration and delivery of the supplement was not ideal. The study raises the question of the degree in which stunting, can be prevented by supplementation during the first 12 months of life without concomitant improvements in health, sanitation and care-giving practices. However, it is possible that the effects of early supplementation could influence later growth, with beneficial effects of the sup-plementation appearing later in childhood.

Potential for catch-up growth

The potential for full attainment of anticipated adult height, lost as a result of stunting, is an issue of uncertainty. The duration of the insult, prevailing environmental conditions, process of bone maturation and genetic

imprinting in early development all factor into final adult height (Golden, 1994). A study of infants with IUGR demonstrated growth deficits incurred in the prenatal period were partially irreversible for some infants, at least in early childhood (Rossi *et al.*, 2000). Simondon et al. studied the potential for catch-up growth by measuring mean incremental growth in stunted compared to non-stunted pre-school children. There was a significant increase in incremental growth for stunted girls age 5-16 compared with non-stunted counterparts, this finding was not demonstrated for boys (Simondon *et al.*, 1998). Similarly, in a study of 2000 stunted 2-year-olds in the Philippines, 30% were no longer stunted at age 8.5 and 32% were no longer stunted at age 12 (Adair, 1999).
These studies demonstrate that catch-up growth during childhood and pre-teen years is possible for some children stunted in the first two years of life, while it does not occur in others. Children treated for stunting and then returned to the same environment have displayed partial or incomplete catch-up growth. More substantial recovery to anticipated adult height was seen when stunted children changed environments as a result of adoption or emigration (Golden, 1994). Thus, in situations where underlying environmental factors do not change, the attainment of full growth potential for children stunted in early childhood seems unlikely. Factors found to be significant in converting from a stunted to a non-stunted state were a maternal height, birth order (first born), length and weight at birth, and severity of stunting.

2.3. Conclusions

Conclusions that can be drawn regarding the influence of micronutrients on growth faltering include:

- Micronutrients, particularly zinc, influence linear growth.
- Zinc supplements have a larger effect on children who are already stunted.
- The potential for a larger impact of micronutrient supplements on growth may be realised by focusing on multiple rather than single micronutrient deficiencies, taking into particular account the type two micronutrients with a known synergistic relationship effecting linear growth.
- The ability of micronutrient supplements to prevent growth faltering in the first twelve months of life is unclear.
- Long-term impact of any supplementation programme will be influenced by external living conditions and caretaker practices

3. Anaemia

Anaemia by definition is an abnormal decrease in the body's total red blood cell mass.
There are several clinical and haematological indicators used to detect anaemia, the most common being serum haemoglobin (Hb). Haemoglobin, a primary component of red blood cells, transports oxygen to tissues of the body and removes carbon dioxide. The production of hemoglobin is dependent on iron. If hemoglobin falls below defined levels based on age and gender, an individual is considered anaemic. Serum haematocrit (Hct), another indicator of red blood cell production, can be used in conjunction with hemoglobin to define anaemia. Table 4 demonstrates the current cut-off values for haemoglobin and haematocrit when defining anaemia.
One of the primary causes of anaemia is iron deficiency. Serum ferritin is the most sensitive indicator of iron status and can be used to detect initial iron depletion before a fall in haemoglobin or haematocrit can be

Table 4: Cut-off values for defining anaemia

Age and gender	haemoglobin below (g/dl)	haematocrit below (%)
6-60 months	11.0	33
5-11 years	11.5	34
12-15 years	12.0	36
Women (non-pregnant)	12.0	36
Women (pregnant)	11.0	33
Men	13.0	39

Source: UNICEF 1999

measured (ACC/SCN 1997). Additional micronutrients involved in the development of anaemia include, vitamin A, copper, zinc, folate and vitamin B12. In addition to inadequate intake of iron and other micronutrients, chronic or acute blood loss can cause anaemia. Common causes of blood loss include, parasitic infections (such as, malaria, hookworm and schistosomiasis), certain congenital haemolytic diseases, and blood loss during childbirth or menstruation.

Iron deficiency anaemia (IDA), is the most prevalent of all micronutrient deficiencies, affecting one third of the population world-wide (UNICEF/WHO,1999). IDA develops when there is an inadequate intake of bio-available dietary iron. Infants, children and pregnant or lactating women are the population groups most vulnerable due to their increased dietary requirements for growth and reproduction. The functional consequences of iron deficiency are reduced tolerance to exercise, decreased work capacity, growth retardation, impaired mental development and compromised cellular immunity (Fairweather-Tait,1992).

3.1 Lifecycle influences on anaemia

There is inconclusive evidence to determine to what extent maternal iron stores influence the development of anaemia during infancy. A synthesis of studies from five countries indicated that maternal serum and infant cord blood hemoglobin levels did not significantly correlate (Allen, 2000). This indicates that an anaemic mother will not necessarily give birth to an anaemic baby. A recent study in Jordan went beyond initial cord blood measurements and followed infants over a period of one year. The risk of developing anaemia in early infancy was significantly higher for infants born to anaemic mothers (Kilbridea, 1999). This finding suggests that maternal hemoglobin status may be a good predictor for infants at greater risk of developing anaemia in the first year of life. Additionally, women who are anaemic during pregnancy are more likely to deliver premature and low birth weight infants (Footea, 1997; and Scholla, 2000).

Development of anaemia

Most term infants are born with adequate iron stores. If exclusively breast-fed, infants are not at risk for developing anaemia during the first months of life. By six months of age an infant is dependent on dietary sources of iron as birth stores are depleted and the quantities of iron found in breast milk are no longer sufficient to meet requirements (Krebs, 2000). Risk factors for developing anaemia in later infancy are low stores of iron at birth, low birth weight, and the use of unfortified infant formulas and weaning foods (Fairweather-Tait, 1992).

The average global prevalence of anaemia in pre-school children is high. A synthesis of iron supplementation trials showed 35-80% of children 5-61 months were anaemic (Beaton *et al.*, 1999). In a survey of five Palestinian refugee camps 67% of the children had anaemia (Hassan *et al.*, 1997). Risk factors associated with the development of anaemia in Palestinian refugee children included geographic location, male gender, illness history and stunting (Hassan *et al.*, 1997). Dietary factors thought to be associated with the development of anaemia in the refugee camps included; low intake of meat, frequent consumption of tea, and the use of non-fortified cow's milk as a weaning food.
Caretaker knowledge and practices are crucial to child growth. Infants are entirely dependent on caretakers to supply nutritious and safe supplementary foods that complement breast-feeding. Infants are at greater risk for developing anaemia when appropriate weaning foods are unavailable or unutilised.

3.2 Micronutrients in the prevention and treatment of anaemia

Iron, a type I micronutrient, has the capacity to be stored in tissues of the body, to be used as needed. The physiologic markers (serum ferritin, elevated red cell protoporphyrin and decreased transferrin saturation) appear prior to a drop in serum haemoglobin or haematocrit, and indicate that the body's iron stores are beginning to be depleted (Herbert, 1987) These markers should be used if the aim of an intervention is to prevent anaemia from developing. A treatment strategy involves subjects whose haemo-globin level has already dropped below the cut-off point. Anaemic and non-anaemic children are often included in the same trial, blurring the distinction between prevention and treatment strategies.

Since iron deficiency is the leading cause of anaemia in women and children, intervention trials generally involve iron supplementation. Some, researchers added vitamin A, vitamin C, folate or other micronutrients to the supplement. A comprehensive review of 22 studies providing iron supplementation concluded both daily and weekly iron supplements are effective in controlling anaemia, though daily supplementation seemed to have a greater effect (Beaton, *et al.* 1999). The efficacy of single compared to multiple micronutrient supplements was not analysed in Beaton's report. Table 5 summarises recent intervention trials in

Table 5: Effect of micronutrient supplementation on preventing and treating anaemia

Author, Country	N	Age Months	Selection Criteria	Duration	Treatment	Results
Dewey, 1998 Honduras	164	4	Exclusive breast feeding (EBF)	2 months	1.Only EBF 2. BF + Fe, Vit C rich foods	Fe group had higher Hb, Hct and Ferritin levels. 20% of infants in Fe group had low Hb at final
Allen, 2000 Mexico	219	18-36	Random	12 months	1. 20mg Fe 2. 20mg Zn 3. Fe + Zn 4. Placebo	No signif. difference between anaemia status in IS and UIS after 12 months[1]. Serum ferritin was significantly higher in IS group.
Palupi, 1997 Indonesia	289	Preschool	Random	9 weeks	1.30mgFe/w 2. 30mgFe/w + antiparasite 3. Placebo	Both Fe groups: Hb increased Prevalence of anaemia decreased from 37-16%

[1] IS=Iron Supplemented; UIS= Iron Unsupplemented.
At 12 months the prevalence of anaemia was 31% and 33% for IS and UIS respectively.

young children.

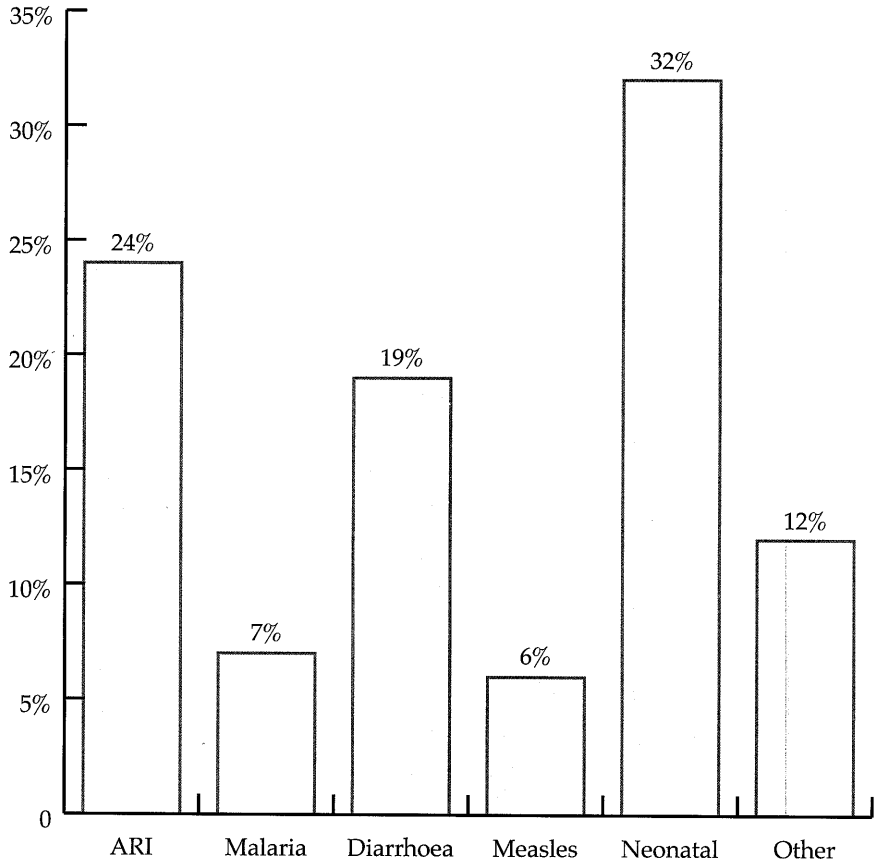
The results of these studies demonstrate that iron supplementation increases serum haemoglobin. The ability of iron supplementation to prevent or treat anaemia was partially, but not completely successful. Approximately 20-30 percent of the children in the iron supplementation groups became or remained anaemic. In infants, birth weight was the factor most significantly associated with low haemoglobin and haematocrit levels. Association between maternal iron supplementation during pregnancy and reduction in infant anaemia was not observed (Dewey, *et al.* 1998). The role of additional micronutrients in preventing and treating anaemia is likely to be of significance. Several studies documented the role of vitamin A on iron status. Two of the studies cited in Table 3 show increased serum heamoglobin as a result of vitamin A supplementation alone and in combination with iron. Studies of anaemic adults found heamoglobin responses when iron was combined with vitamin A, riboflavin or zinc (Allen, 2000, Kolsteren, *et al.* 1999). More research on the effect of combined micronutrient supplements on controlling childhood anaemia is needed.

Lack of compliance to prescribed daily or weekly dosage of iron supplements is often cited as a factor reducing the efficacy of many supplementation trials. Improved compliance to the supplementation schedule can be achieved through educational strategies which stress the importance of complying with the prescribed treatment. Public education of expected side effects such as nausea and constipation and concrete actions which can be taken to minimise unpleasant side effects should always be provided.

3.3 Conclusions

- Iron supplementation can reduce the prevalence of anaemia in infancy and early childhood.
- Low birth weight is a significant risk factor for developing anaemia in early childhood.
- The relationship between maternal iron stores and development of anaemia in early infancy is not yet well understood. There is evidence that low maternal iron stores may be a significant predictor of developing anaemia later in infancy. Research spanning at least 6-12 months of infant development is needed to address this issue.
- All supplementation programmes for infants and young children should incorporate educational messages for parents regarding the importance of exclusive breastfeeding for the first four to six months of life and the introduction of safe and nutritious weaning foods at the appropriate age.
- Several studies have shown increased effectiveness in treating anaemia when combinations of micronutrients have been used. More research is needed on the effectiveness of combined micronutrient supplements in treating and preventing childhood anaemia.

Figure 2.
Causes of childhood mortality
(WHO, 2000)



The link between health and nutrition is well established. Recurrent bouts of illness contribute to malnutrition while malnutrition increases susceptibility to infection. Malnutrition contributes to nearly 50% of all childhood mortality (WHO, 2000). Acute respiratory infections, diarrhoeal disease and malaria, are the most significant causes of morbidity and mortality in young children. Micronutrient deficiencies are both a contributing cause and consequence of these common childhood illness. Reasons for the development of micronutrient deficiency due to illness include, decreased appetite during the period of illness, impaired nutrient absorption and increased metabolic requirements (Stephensen, 1999).

4.1 Lifecycle influences on illness

Prenatal period

If a woman is ill during pregnancy there is a strong possibility of adverse foetal effect. Certain diseases, such as malaria can have a profound negative impact on foetal outcome. Malaria infection during pregnancy is known to contribute significantly to the incidence of low birth weight, IUGR and premature delivery. Acute infection during pregnancy may precipitate a miscarriage or premature birth. Several chronic diseases such as diabetes and hypertension are also risk factors for poor foetal outcome.

Postnatal period

A child is most at risk of death during the first month of life or the neonatal period. Common causes of neonatal death include, asphyxia, prematurity, birth trauma, and infections, including neonatal tetanus (UNICEF, 1997). Low birth weight has a significant impact on neonatal survival. Term infants with low birth weight are four times as likely to die during the neonatal period than are infants with birth weights between 2,500 and 3,000 grams and at ten times greater risk than infants with birth weights between 3,000 and 3,500 grams (ACC/SCN 2000).

A second period of risk associated with increased incidence of disease occurs during weaning when a child is introduced to foods and liquids other than breast milk. Increased illness during this period is due to elevated exposure to pathogens present in water and food, and on utensils and hands. Contact with these pathogens is lower during early infancy if an infant is exclusively breastfed. Furthermore, breast milk contains maternal antibodies providing added protection from infection. Crawling also begins around six to eight months of life, further exposing the infant to pathogens present in the living environment.

Table 5: The effect of zinc supplementation on morbidity

Author, Country	N	Age Months	Selection Criteria	Duration	Treatment	Results
Ruel, 1997 Guatemala	89	6-9	Random	7 months	1. 10mg Zn/day 2. Placebo	**Incidence** of diarrhoea reduced. No effect on duration of diarrhoea or incidence of respiratory infections
Sempertegui 1996 Ecuador	50	12-59	Stunted and Wasted	2 months suppl with observation occurring again after 2 months	1. 10mg Zn/day 2. Placebo	1st obs: After 60 days of supplementation cellular immunity (DTH) and Zn serum increased. **Incidence** of fever and respiratory infection lower 2nd obs: 60 days post-suppl. **Incidence** of disease the same for the two groups.
Lira, 1998 Brazil	205	Term infants	LBW	8 weeks with 18 weeks post-suppl observation	1. 5mg Zn/day 2. 1mg Zn/day 3. Placebo	5mgZn group had a 28% reduction in **prevalence** of diarrhoea and 33% reduction in **prevalence** of cough. No effect was noted for infants given 1mg Zn/day.
Bhutta, 1999 Pakistan	87	6-36	Malnourished and Ill	2 weeks	1. 3mg/Kg Zn/d 2. Placebo	No evidence of improved Wt gain or acceleration of recovery from diarrhoea.
Sazawal, 1998 India	609	6-35	Recovered from Diarrhoeal Illness	6 months	1. 10mg Zn/d 2. Placebo	Reduction by 45% in the **incidence** of acute respiratory infection in Zn group.
Zinc and other micronutrients						
Roy, 1999 Bangladesh	65	3-24	Diarrhoea <3days	2 weeks	1. 20mg Zn + Multivit. 2. Multivit.	Incidence of diarrhoea and resp. infection was decreased in Zn group for stunted and underweight children
Faraque, 1999 Bangladesh	684	6-24	Diarrhoeal illness	2 weeks	1. VitA +Vit C 2. Zn + Vit C 3. VitA+Zn +VitC 4. Vit C	Zn supplemented groups were associated with reduced **duration** and **severity** of diarrhoea.
Penny, 1999 Peru	412	6-36	Persistent Diarrhoea	2 weeks	1. 20mg Zn 2. 20mg Zn + Multivit 3. Placebo	Duration of diarrhoea reduced for Zn only group.
Roy, 1998 Bangladesh	190	3-24	Persistent Diarrhoea	2 weeks	1. 20mg Zn + Multivit 2. Multivit	**Duration** of illness was reduced only for underweight children. Mean body weight of supplemented children was maintained, compared to a decline in non Zn group.

4.2 Micronutrients in the prevention and treatment of infections

Prevention strategies are more easily defined when dealing with infections. A successful prevention strategy reduces the incidence (development of a condition) while a treatment strategy may decrease the duration or severity of an illness.

It is well established that vitamin A supplementation reduces mortality and morbidity from measles and diarrhoea. The regular distribution of vitamin A to populations with vitamin A deficiency decreased mortality by approximately 20% (Tomkins, 2000). The role of other micro-nutrients in improving the course of illness is less well understood. Some studies have shown that iron supplements may increase the risk of malaria and respiratory infections, while other studies have not observed this relationship (Tomkins, 2000). The role of zinc alone and in combination with other micronutrients is currently under study. Table 5 summarises the impact of single and multiple micronutrient combinations in preventing and shortening the course of illness.

In eight of the nine studies reviewed, zinc or combinations involving zinc had some positive effect on reducing morbidity due to diarrhoeal or respiratory illness. Decreased incidence of infection was demonstrated in four studies while shortened duration of illness was observed in three others. Of the studies comparing different micronutrient combinations, those which included zinc were more effective. These studies indicate that zinc supplementation can be an effective tool in reducing morbidity associated with common childhood illnesses.

4.3 Conclusions

- Maternal infection during pregnancy can significantly impact birth outcome, particularly birth weight.
- Repeated infections during childhood contribute to stunting and anaemia.
- In populations with vitamin A deficiency, supplementary vitamin A reduces childhood morbidity and mortality.
- Zinc supplementation alone and in combination with other micronutrients has been effective in decreasing the incidence and duration of some common childhood illnesses.

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chapter 3

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1. Rationale for food supplementation

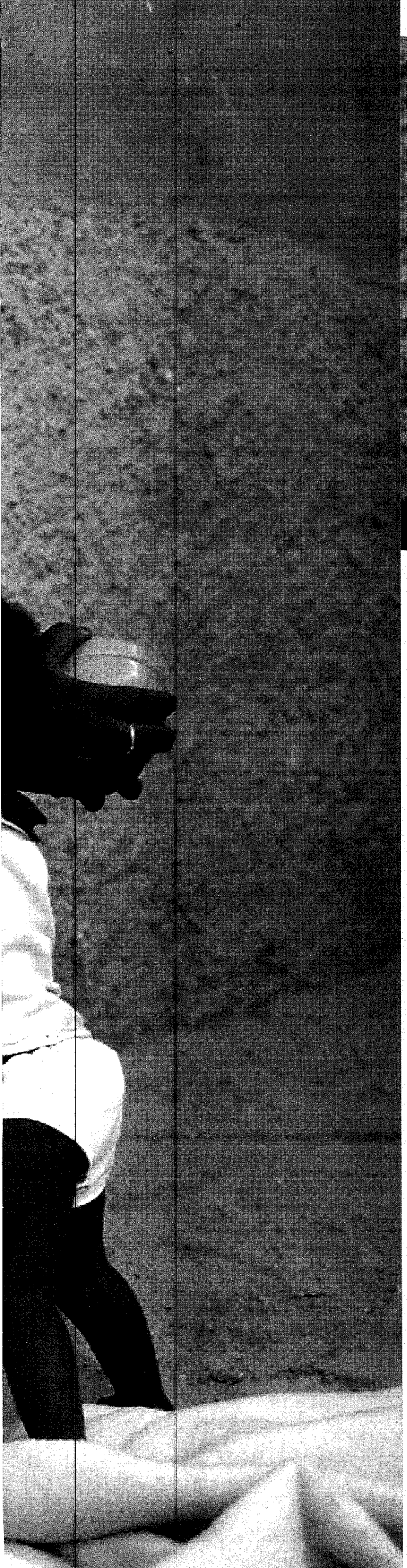
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1. Rationale for food supplementation

The overall aim of a supplementary feeding programme (SFP) is to enhance not replace general rations. Supplementary feeding is meant to increase energy and nutrients that may be lacking in the habitual diet or rations provided to persons living in refugee settings. Supplementary feeding programmes can be divided into two categories, targeted SFP's and blanket SFP's. Targeted SFP's are designed to reach a specific group of vulnerable persons who meet selected criteria, such as pregnant women with anaemia or stunted children. Blanket SFP's are designed to prevent malnutrition within a larger group, and would for example include all children under five years of age or all pregnant women. The size of the population, severity of malnutrition and available resources should be taken into account when deciding which type of SFP to implement. In situations where therapeutic feeding centres for treating the severely malnourished have been established, a targeted SFP can be used to monitor and support rehabilitation of those discharged from this type of intensive care.

Food-based supplementation strategies can be employed either during periods of chronic or acute food shortage. Refugee populations often face acute problems at the beginning of resettlement, which can turn into chronic food supply problems depending on the duration of the conflict. In a persistent

refugee situation, the monotony of the diet and lack of fresh produce can lead to micronutrient deficiencies and chronic malnutrition. In designing the beneficiary ration, expert assessment should reveal to what extent target beneficiaries can obtain adequate quantities of fresh fruits and vegetables from their own production or from the local market by purchase or barter. In the absence of these opportunities, however, rations should be adjusted by addressing fortification and supplementation strategies in order to meet specific micronutrient needs.

After deciding upon the beneficiary group for a SFP, programme planners must choose between on-site or take-home implementation strategies. An on-site supplementation approach requires beneficiaries to come to a central location once or twice a day and consume the supplement on the premises. A take-home approach allows for the supplement to be distributed to beneficiaries or their care-takers, on a weekly or two-weekly basis. There are advantages and weaknesses to both distribution strategies. On-site supplementation is advantageous for monitoring beneficiary compliance and limiting supplement sharing among other family members. The on-site approach is also required where home conditions do not allow for hygienic preparation of the supplement. Take-home supplementation is generally more acceptable to caretakers, as it involves much less transit time and a more flexible delivery at home.

"NUTRIENT DENSITY

When choosing a vehicle for food supplementation for undernourished populations, the percent of dietary energy supplied by fat should be high and the food should be tailored to the developmental age of the recipients."

2. Types of foods used for supplementation

Typically, children under the age of two receive a type of blended food, which can be made into porridge by mixing the flour with boiled water. A blended food contains a mixture of ingredients, usually consisting of a type of cereal (wheat, rice, corn) mixed with an additional source of protein such as soy, pulses or milk powder. Oil and sugar are also commonly added to enhance the energy content. Most blended foods are fortified with extra vitamins and minerals and many are used as complementary foods. Examples of blended foods suitable for young children are Corn-Soy Blend (CSB) and UNIMIX. CSB is composed of corn, full fat soy flour and a vitamin and mineral mixture. Several new blended foods have recently come on the market, including UNILITO, a wheat, corn, soy blend made in Nepal and Famix, a corn, soy, sugar blend made in Ethiopia (WFP, 1999). As will be discussed in greater detail in the following section, the use of supplementary foods manufactured locally rather than imported, should be encouraged.

Older children and adults are able to eat a larger variety of foods, making it possible to provide a wider range of supplements for these groups. Drink mixes and high-energy biscuits have traditionally been used as supplementary foods for these populations. Pregnant and lactating women are often selected to receive additional take-home rations of blended foods, beans, oil, sugar or flour to cover their higher physiological requirements.

"PALATABILITY

Enrichment of foods with minerals often reduces the palatability of the food. The food vehicle chosen should ideally have some unique flavour or other characteristic which can mask the mineral taste."

3. Technical aspects of food technology

Several components go into the formulation of a good vehicle to be used as a food supplement. Nutrient density, palatability, storage, preparation, cost, convenience and cultural acceptability should all be taken into account. Young children are the most common beneficiaries of SFP. The supplementary food provided must be nutritionally adequate as well as tailored towards the developmental stage of the child. To ensure that the supplementary food is consumed it must be palatable. With the preparation of porridges, these should be rich in energy and nutrients but low in bulk, as the stomach of the average one year-old baby can only hold 200 ml per meal.

Nutrient density

The energy, protein, fat and micronutrient composition of a supplementary food needs to be appropriately balanced and tailored to the specific nutrient deficiencies of the targeted beneficiary group. Current recommendations for refugee populations suggest 10-12% of the energy supplied by the supplementary food should be in the form of protein and 25-55% as a lipid, while specific vitamin and mineral contents are also essential (Golden, *et al.* 1995). Population dietary intolerance, such as gluten and lactose intolerance, should be identified and taken into account when selecting the ingredients for the supplementary food.

Palatability

The palatability of a supplementary food can be affected by its vitamin and mineral content. Generally, supplements fortified with higher levels of minerals are less palatable and risk not being well tolerated. The use of foods with a greater ability to mask the mineral taste of supplements is currently being tested. Developing palatable infant porridges is more difficult than food supplements for older age groups due to the limited range of foods suitable for feeding younger children. The palatability of the more

common supplementary porridges used for children of weaning age is questionable.

Storage and preparation

Supplementary food programmes generally take place in refugee settings and other areas where environmental conditions are not optimal. Extreme temperatures, lack of refrigeration, unprotected storage facilities and a shortage of cooking fuel are aspects which must be considered in the delivery of a food supplement. The supplement must be able to withstand excessive heat without spoiling and be packaged so that it is protected from insects and rodents. Additionally, the supplement should not require much cooking, due to the lack of cooking fuel in these environments. Most blended foods are pre-cooked, having the advantage of being quickly prepared. Ideally, the supplement will be packaged as a single serving to avoid measurement errors in preparation.

Cost and acceptability

The type of food used is preferably a food traditionally consumed by the population and a locally grown crop. Reasons for this are twofold, involving issues of cost and cultural acceptability. Typically, food supplements are imported during periods of crisis, the high costs involved with the import of supplementary foods are initially supported by international aid organisations. However, the costs of importing supplements on a long-term basis is generally prohibitive, leading to abandonment of the programme altogether or the imposition of strict selection criteria. If the supplement provided is based on a food familiar to the population, it will be more readily accepted and less costly than one which is made of foreign ingredients.

Sustainability

An attempt should be made to introduce technologies that can be reproduced by the population. This provides an aspect of programme sustainability and reduces the cost of local production at both the community and national level. Over time, mothers can be taught how to prepare supplementary foods for their children using available ingredients rather than relying on external assistance. Governments and private businesses should be encouraged to produce supplements using locally available ingredients. Fortification of foods with micronutrients is an inexpensive and sustainable strategy to increase the nutritional adequacy of the diet of the poorest populations. However, its implementation requires a strong commitment from local governments, food industries and donor agencies who do not always perceive the economic benefits of this approach.

Clearly, the task of developing food supplements is not easy. Achieving a balance between palatability, nutritional adequacy and costs is challenging. The additional environmental and cultural constraints make the challenge even greater. Recently, a new supplementary food has been developed which merits discussion.

4. Comparison of fat spreads with traditional supplements

Food supplementation strategies have generally not been as effective as expected. The risk of bacterial contamination is often high, as many of the products promoted are milk based, require mixing with water or are stored in conditions which promote bacterial growth. When the water or utensils used for preparation of the supplement are not clean, bacterial pathogens can be introduced. When prepared food is stored unrefrigerated for long periods of time bacteria rapidly proliferate. For this reason, the practice of preparing large amounts of food and storing part of the prepared food for later consumption should be discouraged.

Often when there is a high risk of improper food preparation and storage, infants receiving the supplementary food are only provided the supplement at special feeding centres where food preparation, attendance and intake can be monitored. Controlled feeding centres are expensive to maintain, inconvenient for families and not practical for providing supplementation to large segments of the population. Recently, a new supplement with decreased potential for bacterial contamination that can be easily consumed at home has been introduced.

A highly nutrient-dense spread (HNDS) is being promoted as an alternative to the traditional cereal/soy based supplements used in treating malnourished populations. The HNDS provides moderately malnourished children adequate amounts of micronutrients in the form of an energy dense, high fat spread. The approach of using a spread to feed children was first tested on severely malnourished children admitted to a therapeutic feeding centre. Several advantages of spreads were noted during this preliminary trial and the spread has since been adapted for use in larger population settings (Briend, 1999).

HNDS is a blended spread made from peanut butter, vegetable oil and soy flour, fortified with vitamins and minerals. A by weight comparison of HNDS with blended flours typically used for supplementation is

> "STORAGE & PREPARATION
> The use of ready-to-eat individual servings of supplementary foods is a rapid and efficient means of delivering extra micronutrients to at-risk population groups. However, the costs of this type of delivery may be prohibitive for long-term supplementation."

> "COST
> Locally available ingredients should always be chosen over imported foods when designing a food supplement."

> "ACCEPTABILITY
> In refugee settings, a wide range of factors can influence the use and acceptability of supplementary foods including the familiarity, the perceived quality and resale value of the product, the access and relationship with markets, the quality of health and nutrition services and the level of donor commitment. The balance of influencing factors shifts with local circumstances, range of opportunities and prevailing preferences."

> "SUSTAINABILITY
> Adapting the supplementary food to local conditions will ensure an element of programme sustainability."

> "HIGHLY NUTRIENT=DENSE SPREAD
> Highly nutrient-dense spread (HNDS) is being promoted as an alternative to the traditional cereal/soy based supplements used in treating malnourished populations. HNDS provides moderately malnourished children adequate amounts of micronutrients in the form of an energy dense, high fat spread."

Table 1: Comparison of the macronutrient content (in % weight) of the HNDS and blended flours usually given in supplementary feeding programmes.

	Proteins	Carbohydrates	Lipids
Blended Foods	14	70	7
HNDS	11	18	57

From Briend (2001)

"Sustainability of HNDS
HNDS offer a new potential approach to delivering multiple micronutrients to high-risk groups. There are no major technological constraints for a local production of this fortified supplementary food. Feasibility of this approach is currently being tested."

presented in Table 1.

Energy density

HNDS has an energy dense high fat composition which seems to be ideal for growing children, while several of the blended food products are high protein, high fibre, low fat foods. A composition commonly recommended for obese persons needing to lose weight. These differences in composition translate into a much higher energy density for HNDS when compared to blended foods. HNDS has an energy density over 500 Kcals/100 g while blended foods only provide 100 Kcals/100 g after the addition of water.

Bacteriological safety

HNDS has several physical properties that make it suitable for use in sub-optimal conditions. The low water content in HNDS prohibits the growth of bacteria and infestation by insects. During storage flour based products often become infested with insects, this does not occur with HNDS. Secondly, the high viscosity of HNDS prohibits sedimentation of mineral salts, a common problem in liquid–based supplements.

Palatability

Palatability of the supplement designed for the treatment of severe malnutrition was found to be as good or better than that of the World Health Organisation F100 milk-based supplement (Briend, 1999). This is believed to be due primarily to a preference for high energy density foods and, secondly, to the ability of the peanut butter spread to mask the unpleasant taste of some of the vitamins and minerals.

Convenience

Perhaps the greatest advantage of HNDS is the fact that it comes ready-to-eat with no preparation required. There is no need for cooking fuel nor water and no mixing of ingredients or utensils is required for feeding. In addition, groundnut-based supplement is a very appropriate food vehicle for many parts of Africa where groundnuts are a traditional food source. In areas where groundnuts are not a traditional food, a similar fat based supplement could be used, such as hazelnuts, almonds, soybeans or cocoa.

Cost and sustainability

Supplementary food products with high fat content, like HNDS, are a new potential approach to delivering multiple micro-nutrients to high-risk groups. However, cost and sustainability are issues yet to be evaluated. HNDS offer in theory the possibility to lower the price of a balanced dietary ration. Recently, a linear programming analysis has shown the economic impact of two possible food aid programmes in Chad comparing two food supplements, a traditional blended flour and a nutrient dense spread (Briend, *et al.* 2001). The current production system of HNDS does not yet represent a sustainable option as the product is still new and must be imported. However, there are no major technological constraints for a local production of this supplementary food. At the present stage, this approach has not yet been explored, although its feasibility is currently being tested in an African context.

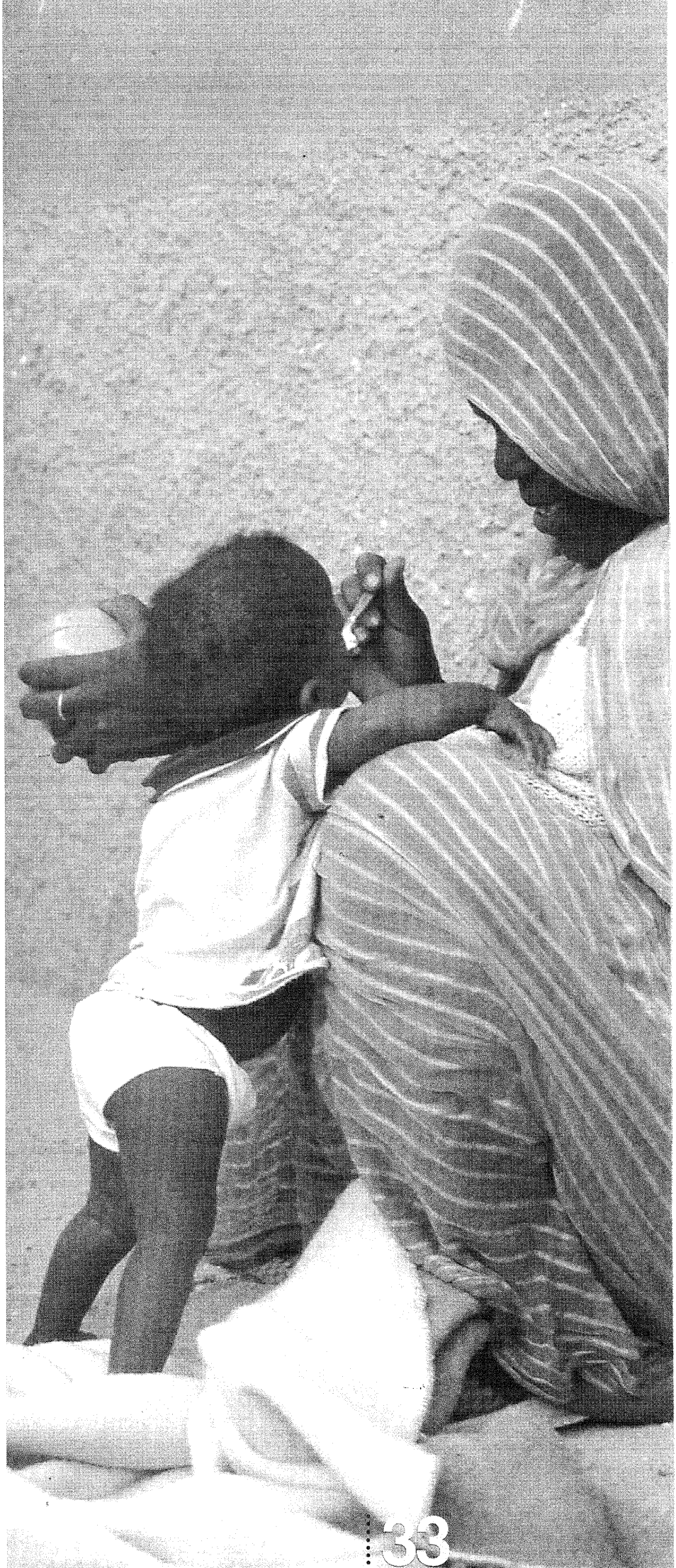
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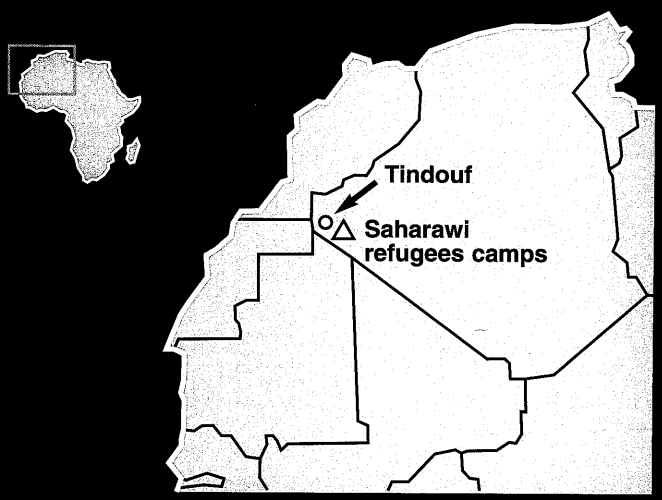
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chapter 4

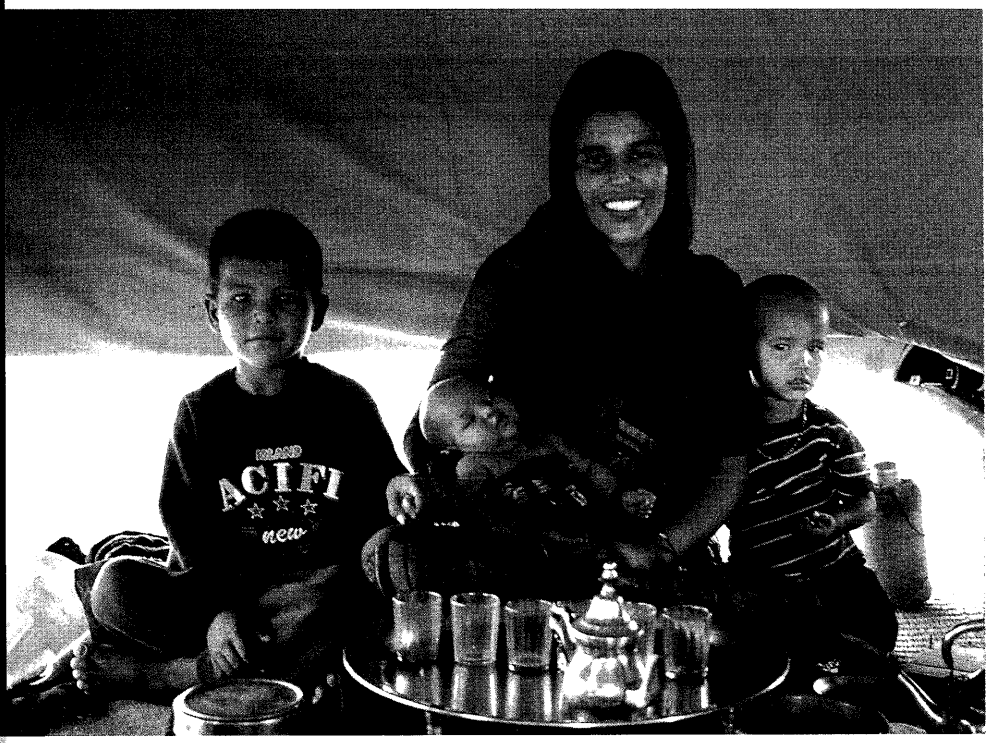
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1. The dietary profile of Saharawi refugees

2. The health and nutrition profile of Saharawi refugees







1. The dietary profile of Saharawi refugees

In 1997 CISP, with the help of the Italian Institute for Food and Nutrition Research (INRAN), carried out an evaluation of the nutritional status of the refugee population to determine the adequacy of the diet, identify particularly vulnerable population groups and define the scope of nutritional deficiencies.

Food availability and distribution of food aid

In theory, the basic general ration is sufficient to cover the energy, protein and lipid requirements but, in practice, problems often arise on the side of food supply which makes it hard to estimate what the population actually receives. Food aid is not able to fully cover all nutrient requirements to all population groups. Delivery of food products is often irregular and subject to unpredictable factors. The composition of the food basket is discussed every month and varies according to availability of products and stock situation, thus resulting in a variable and often not well-balanced food basket. Furthermore, the differing flow and reduction of external food aid is a continuous threat for the Saharawi refugees. In order to improve the nutritional adequacy of the food ration, the evaluation survey of 1997 recommended the fortification of one or two items of the general ration, namely flour and dried skimmed milk, and the targeted supplementation of the most vulnerable groups, namely women and children. However, since then the recommendations for fortification of the general food ration are not systematically applied by all food donors mainly due to a problematic co-ordination of food aid.

A BRIEF HISTORY

Western Sahara the former Spanish colony is the last African colonised country still waiting for independence. The struggle for control of the territory of Western Sahara which has a large coastline on the Atlantic and is bordered by Morocco, Mauritania and Algeria, has been ongoing. Dispute over the territory escalated in 1975 when the Spanish government relinquished control of the area and portioned it off between Morocco and Mauritania, leaving the nomadic Saharawi tribes without land. The Saharawi created the "Popular Front for the Liberation of the Saguia el Hamra and Rio de Oro" or Polisario Front, which opposed the occupation of Western Sahara by Morocco and Mauritania. Since 1973 the Polisario Front is fighting for independence. Despite resistance, Morocco occupied the northern part of Western Sahara with an offensive known as the "green march". During the Moroccan occupation of the north, more than 150,000 Saharawi fled to south-western Algeria and are now living for over 25 years as refugees in one of the most inhospitable desert regions of the world. Mauritania renounced control of the southern portion of Western Sahara in 1979. Since then most of the territory has been under Moroccan control. In an effort to gain independence from Morocco, the Saharawi established the Saharawi Arab Democratic Republic (SADR), which is recognised by 68 countries, but not by the United Nations (UN). Nine years ago, the UN proposed a peace plan envisaging a referendum on self-determination. The plan was blocked until 1996. Since then, Morocco has recognised the Polisario Front and negotiations on the referendum have resumed. Unfortunately, new obstacles continue to emerge resulting in further delays of a referendum.

Composition of diet and access to other foods

The basic basket of food aid consists of wheat flour, rice, lentils, sugar, oil, canned fish, canned meat, dried skimmed milk, tea and yeast. Many families own small livestock, which provide limited complementary quantities of milk and meat to the monotonous diet. Access to additional food items is limited and few families can afford to supplement their rations with fresh produce. The prevailing extreme temperatures, sandy soil and saline water limit the potential for household vegetable cultivation. There are some community gardens in each camp but production is insufficient to cover the needs for the population. Table 1, adapted from data collected during the 1997 survey, provides a description of the percent of households purchasing non-rationed food.

Only half of the households surveyed were able to supplement their food ration with additional purchased food. While the theoretical nutritional value of the food ration covers basic energy requirements, it does not contain adequate quantities of micronutrients, particularly iron, vitamin A, zinc and other nutrients commonly found in fresh meat, vegetables and fruit. A dietary analysis found that the standard diet provided only 49% of required iron, 36% of vitamin A and 8% of vitamin C (Branca, 1997). The primary components of the Saharawi diet are rice, couscous, bread and lentils. The average number of food items consumed per day is three, with only 1% of households varying the diet with six or more foods (Table 2).

The health and nutritional profile of the Saharawi refugees has suffered as a result of their prolonged refugee status. Their situation may be defined as highly nutritionally vulnerable, both in terms of food insecurity (i.e. availability and access to foods) and in physiological terms, i.e. according to the specific requirements of particular age and sex categories of the population.

Water and sanitation

Poor sanitation and contaminated drinking water contribute to high rates of illness, which have exacerbated malnutrition. At the beginning of the settlement in the camps, open wells were dug to supply water. The wells soon became contaminated and have since been sealed off. For a time water to supply the needs of the camps was trucked in by large tankers, more recently new wells of improved design have been constructed. The sanitation system in the camps is poor. There are a few existing pit latrines, but the majority of families do not use these facilities. There is also no system of garbage disposal.

Health profile

Acute respiratory infections in the winter, diarrhoeal diseases and dehydration in the summer are the most common illnesses affecting children under five years of age. The diarrhoeal disease problem is directly associated to the poor water and sanitation environment. Parasitic infections are highly prevalent, mostly protozoan (giardiasis and amoebiasis) and only few helminthic infections. Despite the water situation somewhat improved, outbreaks of diarrhoea and other waterborne illnesses still occur. Vaccination campaigns are periodically run in the refugee camps and most infants and children are being immunised against the major childhood diseases. Quantitative data on health statistics are difficult to obtain. The majority of births take place at home with the help of traditional birth attendants. It is estimated that approximately 15% of babies are born Low Birth Weight (birth weight below 2,500 g). Antenatal care services are lacking or poorly delivered; there is a lack of basic medication and hospital facilities are not sufficiently well equipped to provide adequate delivery services.

Nutrition profile

Results from the 1997 nutritional survey found that women and children under the age of 10 were the most nutritionally vulnerable groups. Prevalence of malnutrition among children under the age of 5 years found that 70% were anaemic, 46% were stunted (low weight-for-height, i.e. chronic malnutrition) and 10% were wasted (low weight-for-height, i.e. acute malnutrition). The situation improved slightly for older children: 60% were anaemic, 31% stunted and 7% wasted. Young children living in refugee situations are more likely to be malnourished because of inadequate dietary intakes and higher susceptibility to disease, the two immediate causes of malnutrition. The nutritional status of women in the refugee camps was also poor. Women of childbearing age had a high prevalence of anaemia (60%). Chronic malnutrition (low Body Mass Index) was found in 15% of women and 15% of the elderly. Conversely, 36% of women 18-60 and 46% of women over 60 were obese. Other micronutrient deficiencies were also observed, mainly vitamin C, vitamin A and iodine-independent goiter (Branca, 1997; Pezzino *et al.* 1998). Thus, while there is no apparent acute protein-energy malnutrition, chronic malnutrition in young children appears widespread. Also, gluten intolerance is a

Table 1: Percent of households purchasing a food item in the previous month

Food purchased	% Households
Fresh Meat	49%
Fresh Vegetables	24%
Dates	10%
Milk	0.3%

*Adapted from Branca (1997)

Table 2: Number of different food items consumed by the household the day prior to the interview.

Number of food items	% Households	N
1	2.3	7
2	23.9	74
3	43.9	136
4	25.5	79
5	3.5	11
6	1.0	3

*Adapted from Branca (1997)



serious public health problem among the Saharawi refugees and an unexpectedly high number of coeliac disease cases have recently been reported (Catassi *et al.*, 1999).

Vulnerability is not only linked to food insecurity at the household level but is also specific to some groups of the population with special physiological needs, such as children under five. The age group of 6 months to 1 year is one of particular concern as it corresponds to the transitional weaning period, when a child starts sharing the family diet. There are no appropriate weaning foods available to the Saharawi refugees. Additional factors responsible for the inadequate dietary intakes of young children include the reduced appetite due to the effect of illness and to the poor palatability of the local diet as well as its monotony.

There is also a cultural problem of intra-family food distribution and attitudes towards childcare and particularly towards feeding practices. Traditionally, young children are given only a few meals per day, made from staple food diluted with water. Very low weight-for-height is not present, so that energy is unlikely to be a problem. However, protein quantity and quality are low and micronutrients are insufficient to meet the nutritional and physiological needs of the child. Meeting these needs from supplementary foods appears to be the best solution. The variation in nutritional problems of women is in part due to the monotonous diet high in carbohydrate and a general lack of exercise and physical activity at the camps.

The poor nutrition and health profile of the Saharawi, particularly for young children, prompted the European Community to take action. The following chapters summarise the results of two nutritional intervention programmes undertaken by CISP and INRAN in the refugee camps.

Branca, 1997. Nutritional status and nutritional vulnerability among Saharawi refugees. WHO/CISP/ECHO.

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Pezzino V., Padova G., Vigneri R., Turiano M., Compagno L., Branca F., R. Sidi Mustafa. 1998. Iodine-independent endemic goiter in Saharawi Refugee camps in south-western Algeria. *IDD Newsletter*, February 1998

The difficult living conditions in the Saharawi refugee camps and persistence of the conflict characterise this situation as a permanent emergency. The environmental conditions are particularly hostile, with temperatures ranging between 40 and 60 degrees centigrade in the summer and falling below 0 in the winter. Water and food must be provided by external sources of aid. Thanks to the solid organisation structure and the large feeling of solidarity, characteristic of these people, that the Saharawi refugees were able to build an organised society in this desert. The first organisation to give aid to the camps was the Algerian government, through the Algerian Red Crescent. Individual governments, international agencies and solidarity groups also contribute. The European Union has been active in the camps co-ordinating relief efforts. Since 1993 the European Community Humanitarian Office (ECHO) has taken the lead in supplying food aid. The Comitato Internazionale per lo Sviluppo dei Popoli (CISP), an Italian NGO and ECHO partner, has been responsible for overseeing the distribution of food and monitoring the nutritional situation in the camps.

chapter 5

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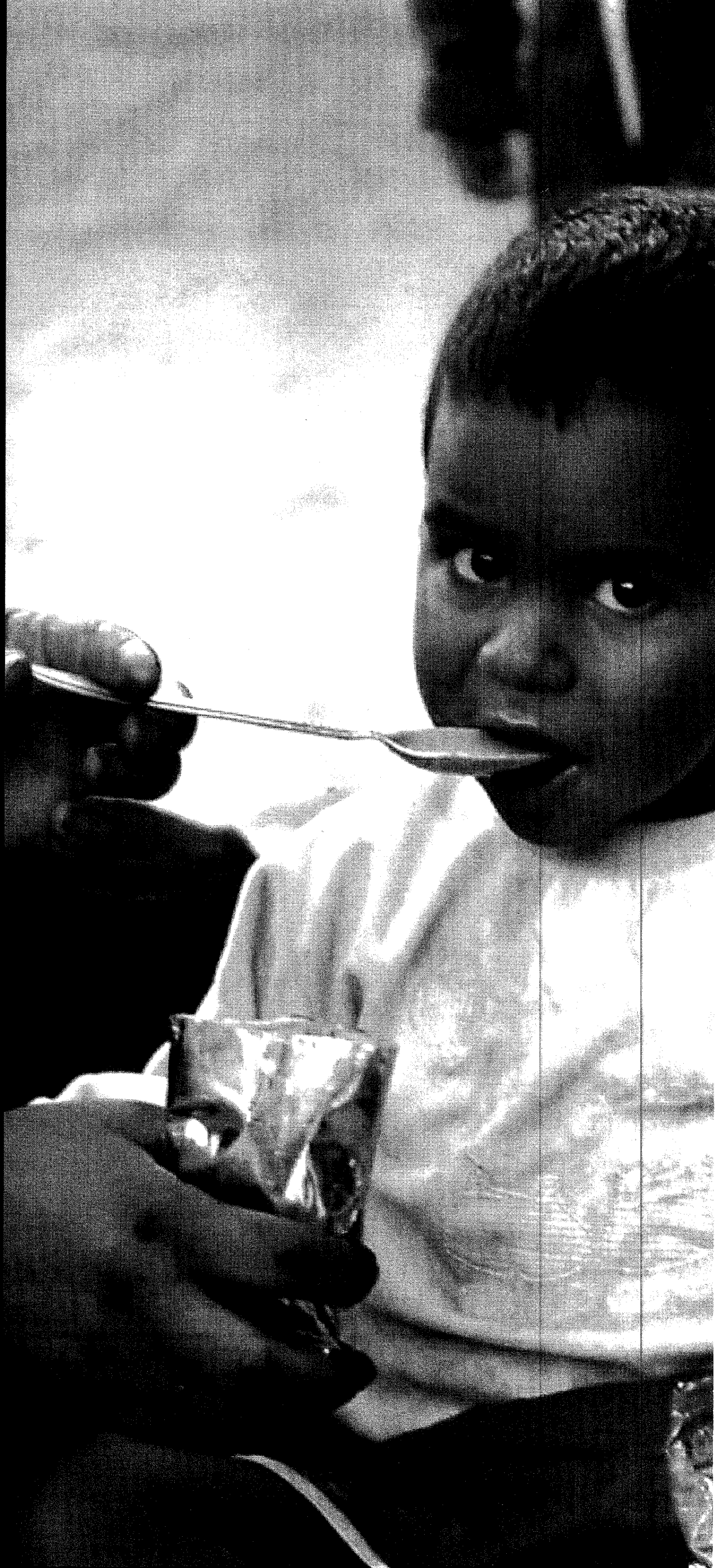
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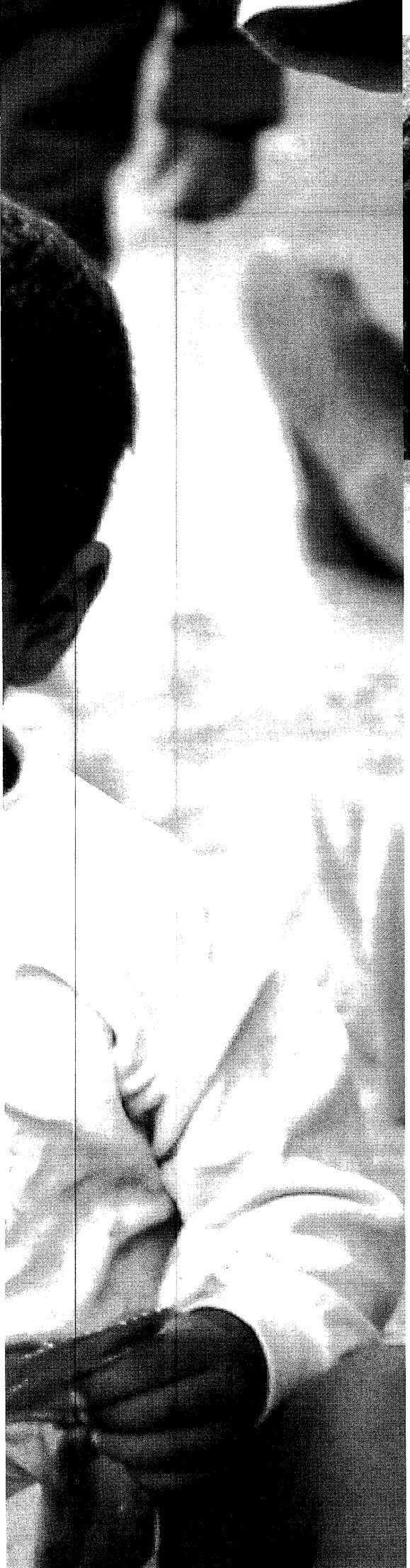
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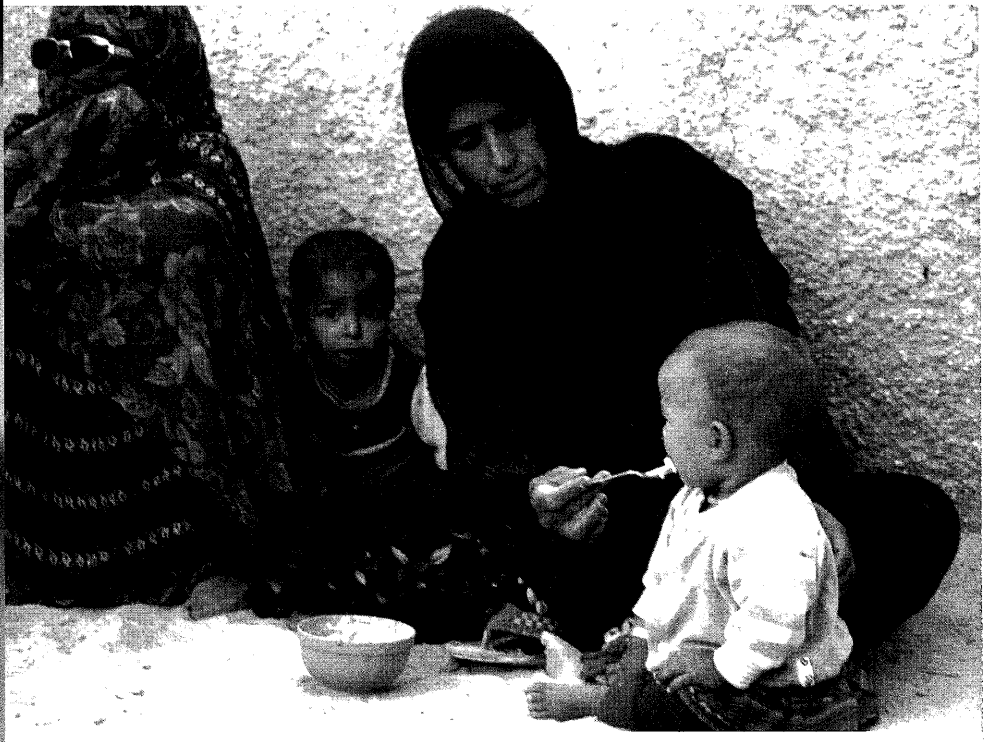
3. Description of the programme
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4. Results
- Trial A: intervention in infants
  - Impact on anaemia
  - Impact on growth
- Trial B: intervention in stunted children
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5. Discussion and concluding remarks







1. Rationale

After the age of six months, breast milk alone is no longer sufficient to meet a child's nutritional needs. Complementary foods are then needed to fill in the gap and ensure an appropriate supply of nutrients necessary for adequate growth. If the gap is not filled, the child is likely to develop nutrient deficiencies and its growth either stops or slows down. Stunting and anaemia affect 1 in 2 pre-school age children living under chronic malnutrition conditions characterised by multiple micronutrient deficiencies, so that its significance

cannot be ignored from the public health point of view. The cereal/pulse diet of Saharawi refugees is grossly deficient in minerals and vitamins. This problem can only be solved by fortifying supplementary foods with a mineral/vitamin pre-mix. However, there are no generally accepted recommendations for micronutrient intakes for use in supplementary foods nor for inducing catch-up growth.

This chapter presents two pilot efficacy trials conducted in 1998 among Saharawi refugee infants and children to examine the benefits of specially formulated mineral/vitamin fortified food supplements on the prevention and control of anaemia and growth retardation.

Objectives

In young infants

to determine the effect of 6-months daily supplementation with a blended rice flour porridge fortified with a special mix of micronutrients, compared with traditional Unimix fortification and local complementary foods, in preventing and improving anaemia and growth retardation in infants aged 6 to12 months.

In stunted children

to determine the effect of 6-months daily supplementation with a specially fortified high-nutrient density supplement, compared with an identical non-fortified supplement and local foods, in reducing anaemia rates and correcting retarded growth in stunted children aged 30 to 64 months.

Design

Two double-blind, randomised, placebo-controlled trials in which a total of 150 infants aged 6 to 12 months (Trial A) and 350 stunted children aged 30 to 64 months with a height-for-age below –2 Z-scores (Trial B) were randomly allocated to one of three groups (see Table 1). Two groups received one of two supplementation regimens, the third group did not receive any supplementation and served as a control. Informed consent of mothers was obtained before participation in the trials. Control groups received the supplement once the initial pilot period was completed. Study groups were comparable in all baseline characteristics.

Micronutrient fortifications

The absence of generally accepted recommendations for micronutrient intakes for use in supplementary foods lead us to formulate appropriate mineral/vitamin pre-mixes. The Figures 1 and 2 compare the mineral/vitamin fortification levels of the two tested formulas (RFB-G2 versus RFB-U and HNDS-F versus HNDS) expressed as percentage of the normal physiological requirements.

For 6-12 month-old infants, the traditional Unimix blend of micronutrients was revised to include usually omitted essential nutrients, such as potassium and magnesium, and increase others like iron, zinc and copper so as to meet modern standards of nutritional adequacy. The mineral/vitamin formula was derived from the G2 formula recommended by a recent expert meeting (Golden *et al.* 1995).

Micronutrient requirements for catch-up growth have not yet been established. Formulating the rationale of the fortification was a necessary first step for the choice of minerals and vitamins and of their concentrations. We first stipulated that, for catch-up growth to occur, the increments in height could be doubled compared to normal growth. Based on this assumption, we designed our micronutrient supplementation for a stunted child by doubling those minerals and vitamins requirements for a normal growing child of the same age. Micronutrient

Table 1: Intervention groups

Infants		
1.	**RFB-G2**	Rice Flour Blend with high fortification
2.	**RFB-U**	Rice Flour Blend with Unimix fortification
3.	**Control**	No supplementation
Stunted children		
1.	**HNDS-F**	High Nutrient Density Spread Fortified
2.	**HNDS**	High Nutrient Density Spread non fortified
3.	**Control**	No supplementation

Figure 1. Coverage of mineral and vitamin requirements of supplements for infants

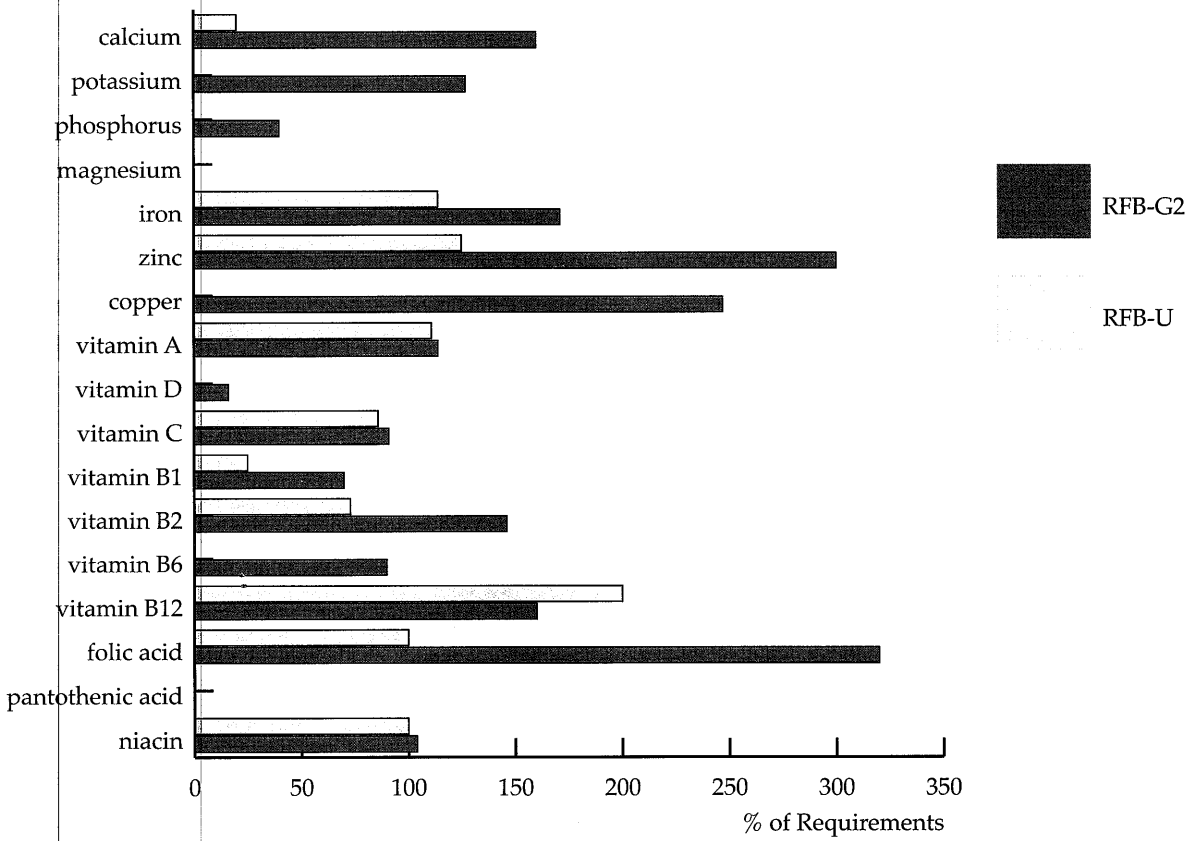


Figure 2. Coverage of mineral and vitamin requirements of supplements for stunted children

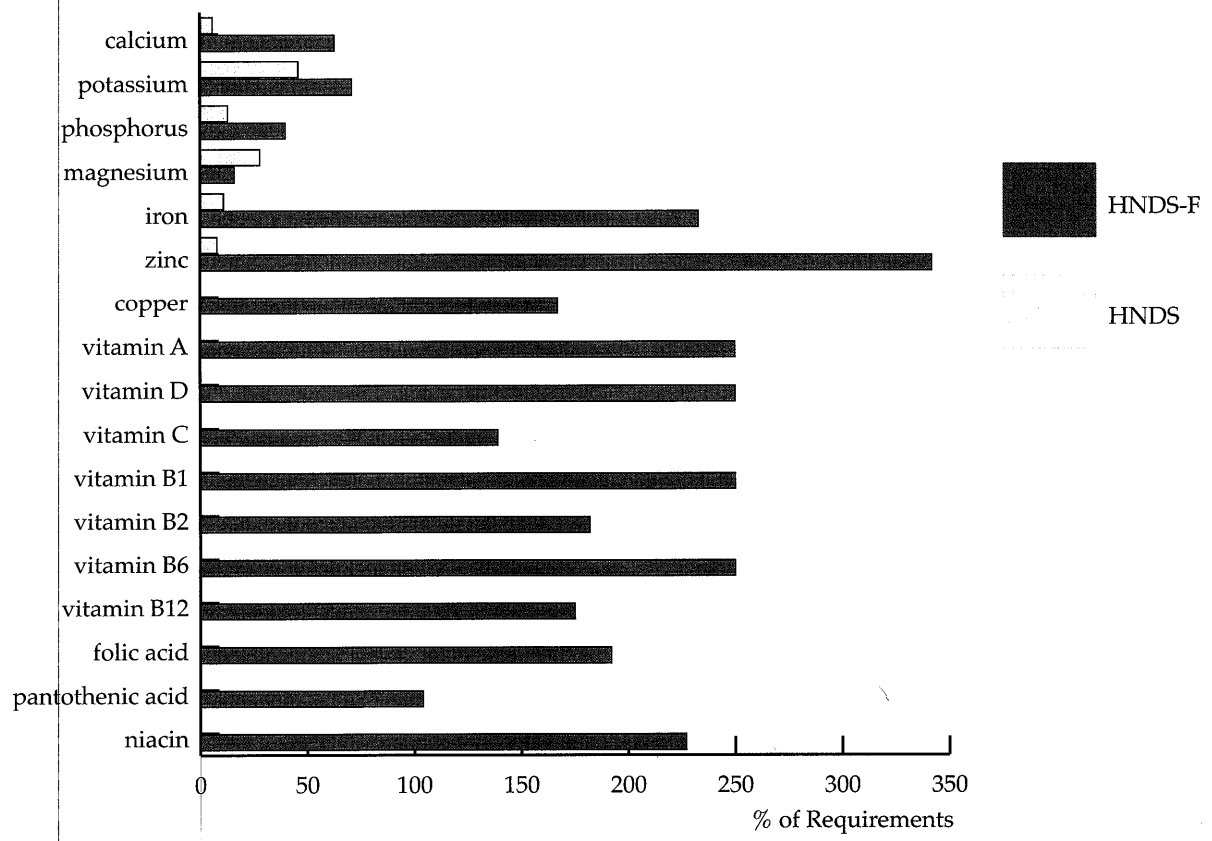


Table 2: Baseline physical characteristics of infants

	RFB-G2	RFB-U	Control
Age (months)	10 ± 2	11 ± 2	11 ± 2
Weight-for-Age Z-score	-1.7 ± 1.6	-2.1 ±1.1	-2.1 ± 1.3
Height-for-Age Z-score	-1.2 ± 1.2	-1.4 ± 1.2	-1.6 ± 1.2
Weight-for-Height Z-score	-1.0 ± 1.6	-1.4 ± 1.1	-1.2 ± 1.2

Data are means ±standard deviations.

levels hereby obtained were then compared to supplementation levels used in other supplementation studies that showed a benefit on growth. Ratios were then adjusted for known interactions between micronutrients, such as zinc and iron or zinc and vitamin A, so as not to interfere with absorption, and also for toxicity levels. For technological issues, we were not able to double all minerals. No micronutrients were added to the HNDS supplement, except those included in the main ingredients.
All supplements were identical in their energy, protein and lipid contents as well as in taste and appearance. All investigators and local health staff were blind as far as the nutrient composition of the supplements.

Supplementary foods

The food supplements were for the young infants a rice-flour blend (RFB) prepared as a porridge and for the older stunted children a high-nutrient density spread (HNDS). The RFB porridge was prepared under strict hygienic measures and only required boiled water to be added to a fixed quantity of flour (100 grams per day). The HNDS used for stunted children had groundnut as the main ingredient, given in a single-dose packaging (50 grams per day) and could be eaten either as a snack or on bread. A fuller description of HNDS is given in chapter 3.

Distribution of supplements and attendance

Food supplements were distributed every morning, six days a week giving one extra take-home ration to cover for the resting day, at specially equipped feeding centres nearby local health dispensaries. Daily attendance of beneficiaries at feeding centres was monitored and supplement intake recorded on specially designed data collection sheets. Health staff received appropriate training so as to run entirely the supplementation centre, including supervised distribution and stocks of supplements, maintenance and storage of materials.

Assessment of nutritional impact

Results show the impact on anaemia and growth comparing data at 0 months (baseline), after 3 months and after 6 months of supplementation. Results include only those subjects with complete longitudinal data. Follow-up measurements involved anthropometry (weight, height and knee-heel length) and serum haemoglobin (Hb) levels. Compliance to supplementation was represented as the percentage of days attending supplementation. Semi-structured interviews were also carried out to collect information on morbidity (presence and duration of diarrhoeal episodes, fever and respiratory infections), dietary intake and household socio-economic characteristics. Parasitological status was examined for all stunted children. Results on these latter more refined data analyses will be published elsewhere.

Trial A : intervention in infants

Of the 150 enrolled infants, 121 completed all follow-up measurements (47 infants in the RFB-G2 group, 37 in the RFB-U group and 37 in the control group). Physical characteristics before start of supplementation were comparable between all three study groups (Table 2). Compliance to supplementation was similar between RFB-G2 and RFB-U infants reaching over 60% coverage in the first trimester and dropping to 30% in the second trimester of supplementation. At baseline, about one third of the infants were already stunted (HAZ <-2) with respect to the international reference standards.

Impact on anaemia

After three months of supplementation, mean haemoglobin levels remained unchanged and did not differ between the three groups (average approximately 10 g/dL). However, after six months, Hb levels increased significantly by +0.7 g/dL in RFB-G2 children (Figure 3). Haemoglobin levels in the RFB-U and control groups behaved similarly throughout the study period and did not show any substantial difference.

Figure 3. Change in haemoglobin levels in infants at 0, 3 and 6 months of supplementation

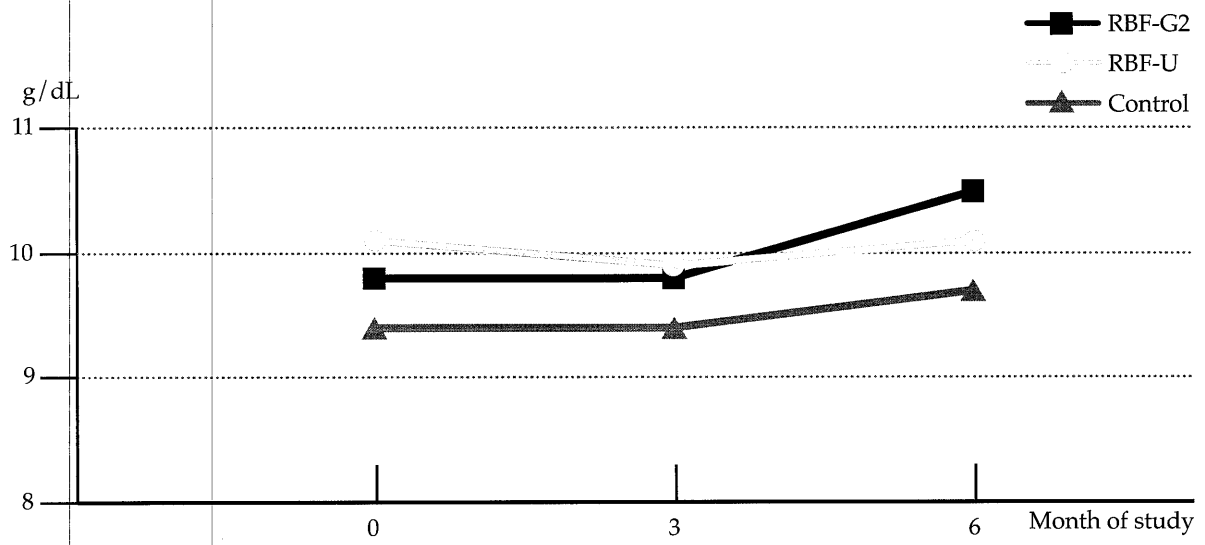
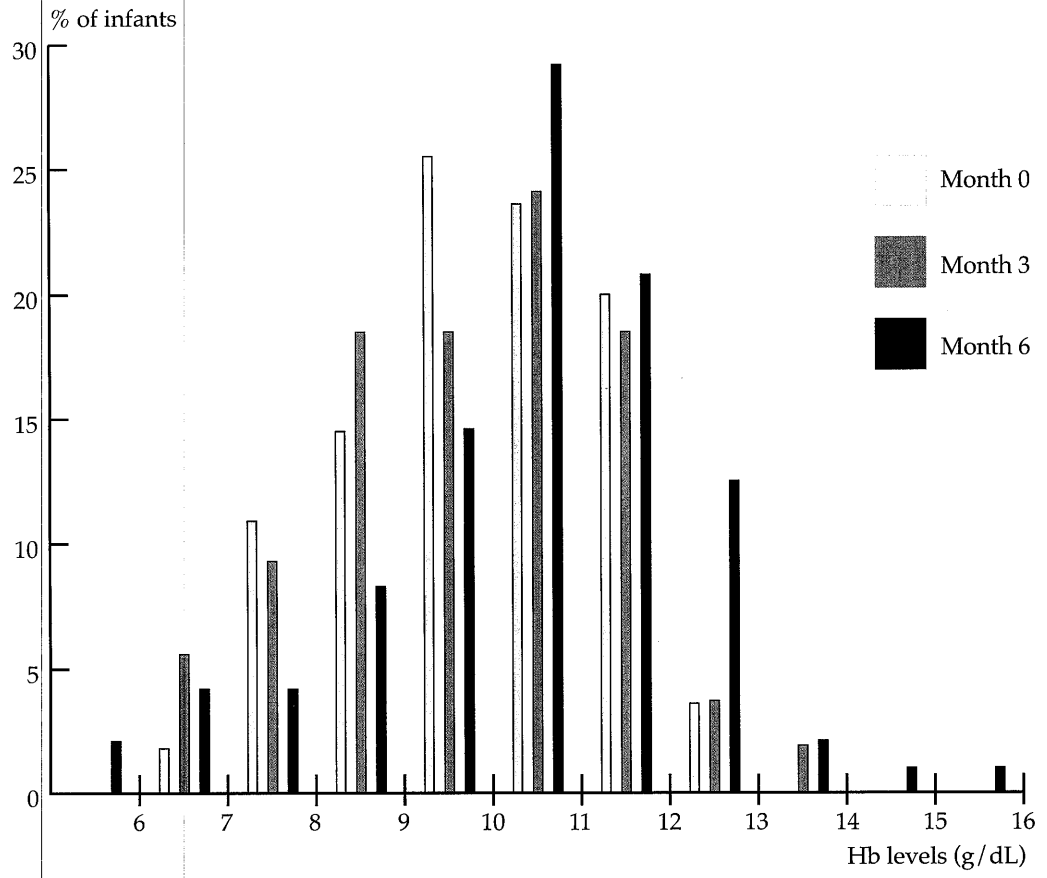


Figure 4. Anaemia distribution in RFB-G2 infants at 0, 3 and 6 months supplementation



The RFB-G2 supplementation moderately reduced the prevalence of anaemia. This is illustrated by the shift to the right of the Hb distribution curve (Figure 4). After six months, the percentage of infants affected by moderate/severe anaemia (Hb below 10 g/dL) was reduced by 20% in RFB-G2 group, while it remained unchanged or increased slightly in the RFB-U and control groups.

Impact on growth

Growth velocity in this infant population decreased substantially throughout the study period falling from 6 to approximately 4 mm/month between the first and the second trimester of supplementation (Figure 5). All infants were affected to a certain degree by retarded growth regardless of the intervention. Height-for-age (HAZ) deteriorated on average by -0.4 Z-scores in six months in all three groups (Figure 6). No marked differences were observed in the growth outcomes between RFB-G2, RFB-U and control infants.

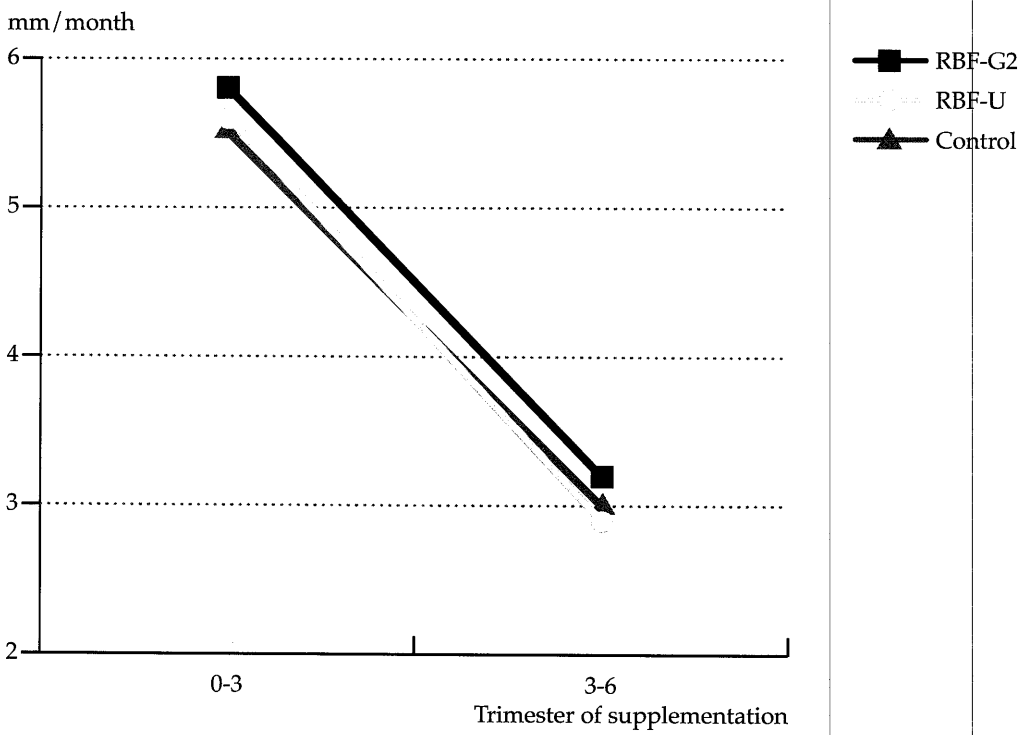


Figure 5.
Change in growth velocity in infants between first and second trimester of supplementation

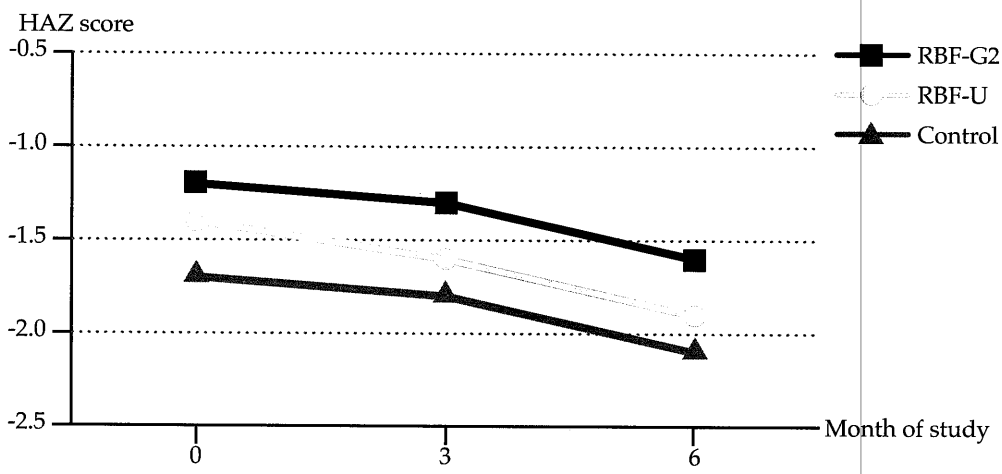


Figure 6.
Change in Height-for-Age Z-score in infants at 0, 3 and 6 months

Trial B: intervention in stunted children

Of the 350 stunted children initially enrolled, 250 completed all three longitudinal follow-ups (103 children in the HNDS-F group, 103 in the HNDS group and 44 in the control group). Compliance to supplementation was considerably higher in this trial, reaching 80% coverage in the first trimester and remaining at 70% in the second trimester. Compliance was similar in both supplemented groups.

The three study groups were homogeneous as far as physical characteristics at baseline (Table 3). The mean age was four years and children were underweight, mildly wasted and severely stunted (-2.9 mean HAZ).

Impact on anaemia

The fortified supplementation had an immediate strong positive impact on the levels of haemoglobin. After six months, the rise in mean Hb levels in HNDS-F children (+3.7 g/dL) was double that of the HNDS and control groups (+1.7 g/dL) that showed similar changes throughout the study period (Figure 7).

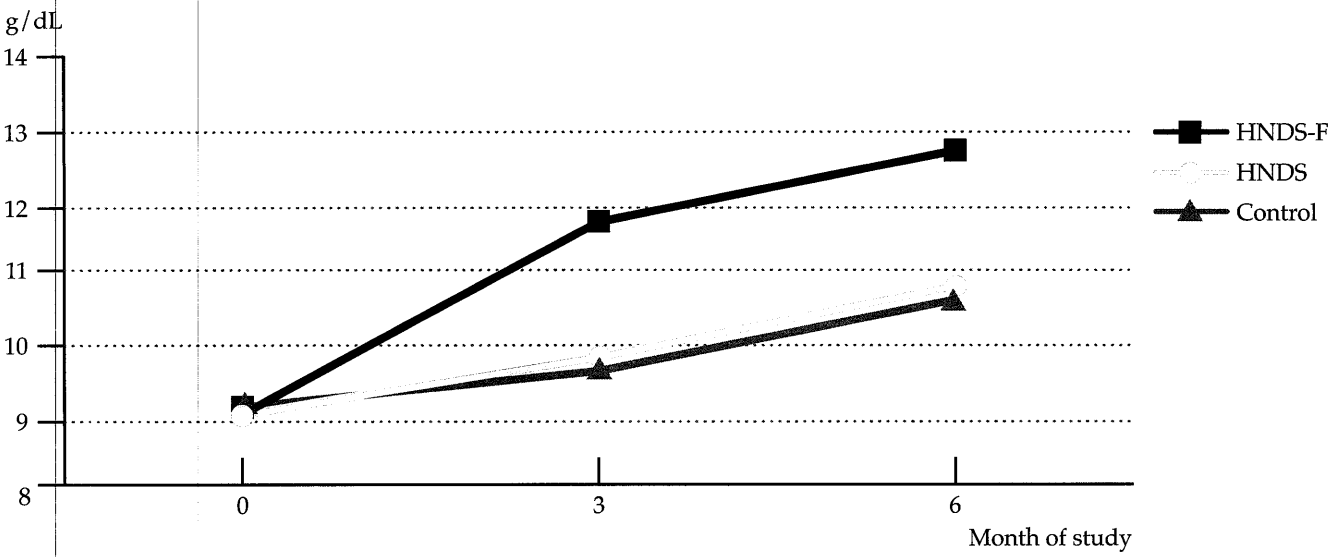
The HNDS-F supplementation drastically reduced the prevalence of anaemia as reflected by the right shift of the distribution curve (Figure 8). In this group, moderate and severe anaemia was entirely eliminated after six months (from 65% to 1%), while it decreased by about one half (from 65% to 30%) in the HNDS and control groups probably due to seasonal effects.

Table 3: Baseline physical characteristics of trial B children

	HNDS-F	HNDS	Control
Age (months)	50 ± 11	50 ± 12	47 ± 11
Weight-for-Age Z-score	-2.2 ± 0.6	-2.3 ± 0.6	-2.4 ± 0.7
Height-for-Age Z-score	-2.9 ± 0.7	-2.9 ± 0.7	-2.9 ± 0.7
Weight-for-Height Z-score	-0.7 ± 0.7	-0.8 ± 0.7	-0.9 ± 0.8

Data are means ±standard deviations.

Figure 7. Change in haemoglobin levels in children at 0, 3 and 6 months of supplementation



Impact on growth

Growth velocity was significantly accelerated in HNDS-F children during the first trimester of supplementation and slowed down in the second trimester (Figure 9). Growth in height was about 30% faster in HNDS-F children (+6.7 mm/month) compared to the other two groups that showed similar growth rates throughout the study period (+5 mm/month).

Mean height-for-age was improved considerably in HNDS-F children (+0.2 Z-scores), while it did not change in the HNDS children or was slightly worsened in the control group (Figure 10). After six months, the overall percentage of stunting was reduced by 8%, 7% and 2%, respectively in the three groups.

Trial A : infants

The prevention objective in this trial was not entirely reached as already one third of infants between 6 and 12 months of age was stunted and one half was anaemic therefore falling into the category of treatment rather than prevention. Failure to achieve improvements in stunting or anaemia may be explained by fortification levels that were designed for prevention rather than for treatment. Furthermore, the mineral and vitamin fortifications were designed to be taken in with 100 grams of flour per serving, while children were only able to take in 50 grams at each meal. Supplementation was also problematic. The porridge was not convenient enough nor was it a novelty food among these refugees, and thus compliance was not ideal. Indeed, several factors may have dissuaded some of the mothers to continue, among which the time required to feed the child, the distance to the feeding centre and the lack of environmental comfort. However, results here show that the consumption of the fortified flour slows down the progression towards stunting and anaemia. Nevertheless, growth velocity in this young age group was well below the 5th percentile

Figure 8.
Anaemia prevalence in HNDS-F children at 0, 3 and 6 months supplementation

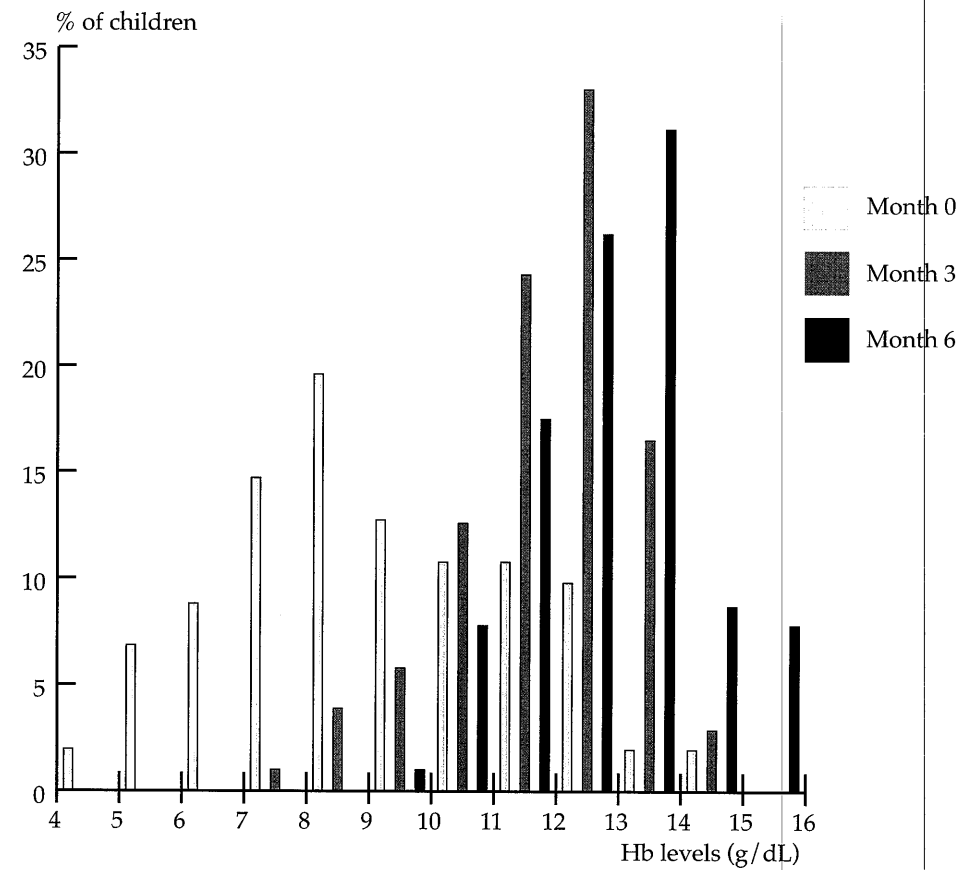
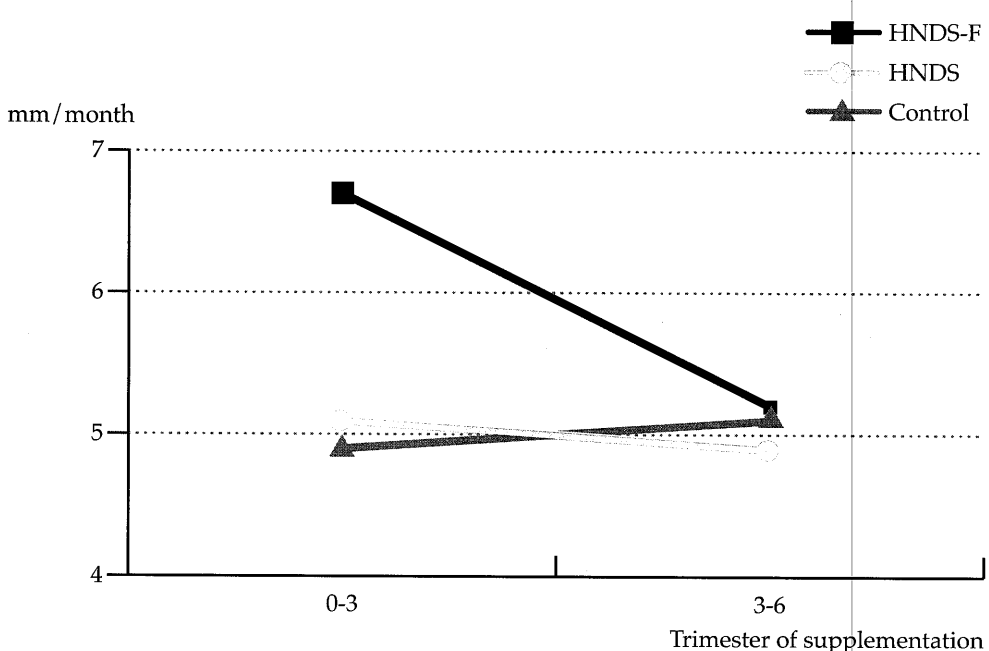


Figure 9.
Change in growth velocity in HNDS-F children between first and second trimester of supplementation

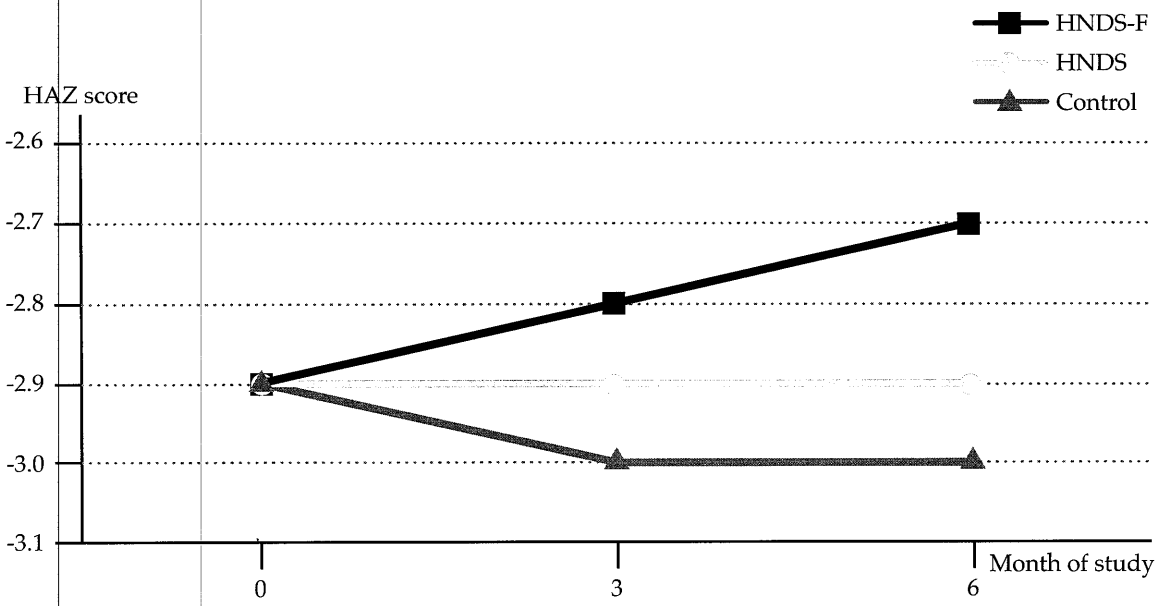


of reference growth increments for infants 6-12 months of age (Guo *et al.* 1991).

Trial B : stunted children

The fortified supplementation was fully successful in treating anaemia in the vast majority of stunted children aged 30 to 64 months, and was partially successful in inducing catch-up growth. This remarkable achievement was determined primarily by the high compliance rate reached, unlike previous supplementary feeding programmes. The factors of success were twofold: the high acceptability and convenience of the HNDS on the one hand and the rapidly visible changes in the wellbeing and vitality of children on the other. The effect of the mineral and vitamin supplementation on anaemia reduction were indeed remarkable, as they were fully achieved in just three months, without causing any of the side-effects associated with iron therapy. This is a very important result considering the impact of anaemia on physical and intellectual development and on immune function. Although it was not

Figure 10. Change in Height-for-Age Z-score in children at 0, 3 and 6 months



specifically measured here, a dramatic improvement was immediately perceived on the psychomotor development of the HNDS-F supplemented children who showed greater reactivity and better mood. This transformation before the eyes of the mothers themselves and their neighbours was a powerful tool in convincing health workers of the effectiveness of the supplementation and the importance of their role in working with the children and mothers as motivators.

Growth velocity was considerably increased, although not doubled as first stipulated, with noticeable differences in growth rates after only three months of supplementation. This accelerated growth was not sustained in the second trimester of supplementation hereby suggesting that complete catch-up of stunting cannot be entirely corrected by longer duration of supplementation. Nonetheless, in just six months of fortified supplementation, stunting was reduced by 8% improving the height-for-age indicator by +0.2 Z-scores. Inducing catch-up growth in children up to 6 six years of age is an unprecedented achievement in that catch-up from height faltering was commonly thought not to occur after the age of three years.

REFERENCES

Golden *et al.* 1995. Report of a meeting on supplementary feeding programmes with particular reference to refugee populations. *European Journal of Clinical Nutrition* 49: 137-145

Guo S. et al, 1991. Reference data on gains in weight and length during the first two years of life. *Journal of Pediatrics* 119 (3): 355-362

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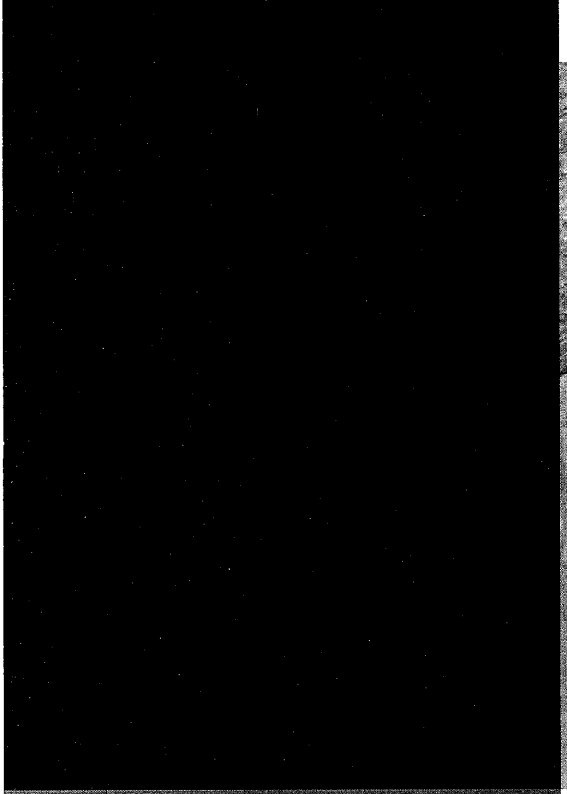
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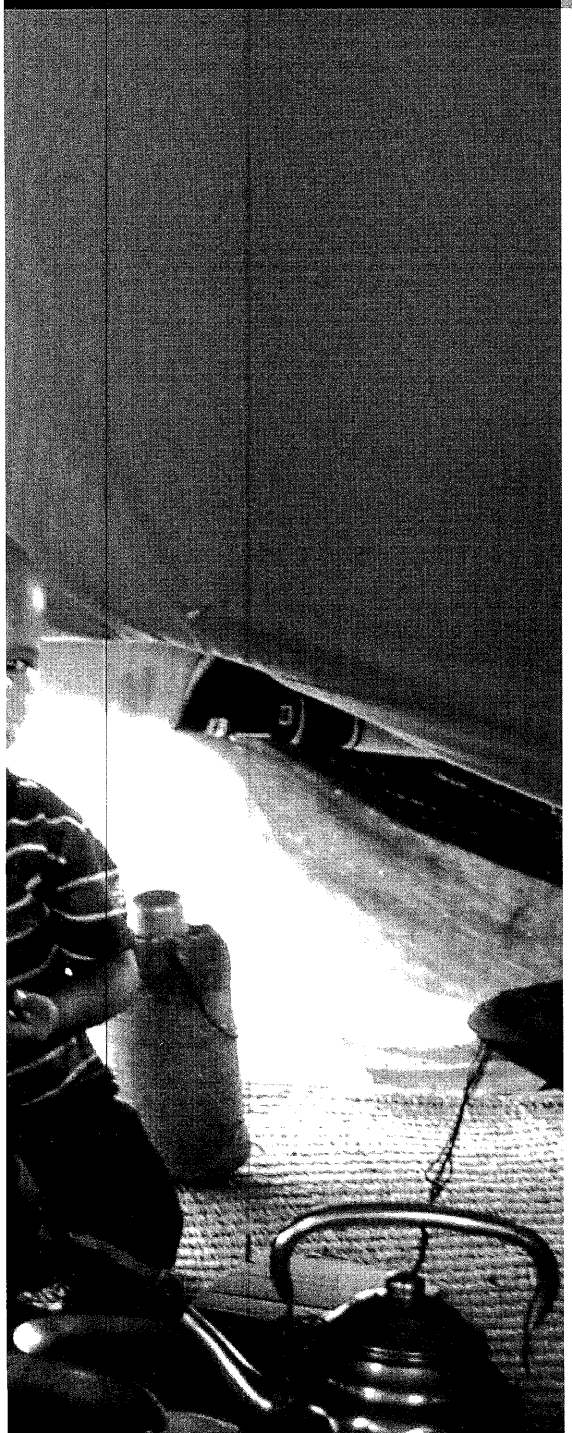
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4. Discussion and concluding remarks









chapter 6

The promising results of the pilot efficacy trials prompted us to examine the benefits of the intervention derived from a real-life programme at a large-scale population level. Indeed, one of the most problematic challenges facing supplementary feeding programmes is the continuing compliance of targeted subjects with a regimen. This effectiveness trial was carried out in 1999 in a national supplementation programme covering over 4000 children under the age of 5 years in all Saharawi refugee camps.

The general objective of the programme was to measure the effectiveness of 3-months supplementation extending the intervention to the entire refugee population.
More specifically:

- to reduce the incidence of iron-deficiency anaemia and growth retardation in children aged 6-17 months by distributing a fortified RFB-G2 porridge;
- to reduce the prevalence of iron-deficiency anaemia and growth retardation in stunted children aged 18-59 months by distributing a fortified HNDS;
- to use health dispensaries as a tool for health and nutrition promotion;
- to set up an integrated nutrition programme implemented by the local health system;
- to evaluate the implementation and impact of the intervention for applicability in other similar refugee settings.

Design of the intervention

The intervention was carried out in each of the five camp districts of Saharawi refugees. All programme activities, from the registration and nutritional surveillance of beneficiaries up to the distribution of supplements, were entirely carried out by trained local health staff and under direct supervision of the investigators.
All the children under the age of 5 years were screened at the level of every health dispensary in order to establish two supplementation groups based on the programme's targeting criteria: infants 6 to 17 months of age (intervention A) and children 18 to 59 months of age with height-for-age (HAZ) below -2 Z-scores (intervention B).

Nutritional surveillance

Before the start of the programme, dispensary health staff received a week-long training course to become familiar with the overall management of the programme, to handle measuring equipment and to master technical skills. They also learned about the basic principles of correct child feeding practices, the importance of micronutrient supplementation and that of growth monitoring.
In order to facilitate the registration of beneficiaries, a two-step process was established to screen for stunted children aged 18 and 59 months: in a first step, a life-size growth wall chart was used to quickly sort out eligible stunted children with HAZ<-2 and, in a second step eligible children were accurately measured for height and weight to complete registration. Data on each beneficiary were recorded onto the dispensary registration books and included: name of child, name of mother, age of child (confirmed by vaccination card), date of measurement, height or length, weight and hemoglobin levels (determined in two sentinel sites in each camp). Impact of supplementation was assessed by monitoring the nutritional status of children registered at the start of the programme and after 3 months of supplementation.
This nutritional surveillance is now a well established monitoring system in the ongoing supplementation programmes among Saharawi refugees and has become part of the daily routine activities of every health dispensary.

Supplementary foods

Fortified food supplements were the same used in the pilot trial: a RFB-G2 fortified porridge for infants and a fortified HNDS-F for stunted children (see chapter 5). The levels of mineral/vitamin fortification for the RFB-G2 porridge were adjusted for a daily serving of 50 grams of flour. Take-home rations of supplements were distributed weekly so as to cover one week of supplementation. The fortified flour for infants came into 350 grams sachets containing seven daily rations of 50 grams. The HNDS for stunted children came into individual daily sachets (seven sachets per week per child).
Mothers were taught to make the porridge by mixing 50 grams of fortified flour with boiling water. A common household item, the tea glass, served as the standard volume to measure the 50 grams daily ration. Advice on hygiene measures was given to protect infants from infections.

Distribution system

Food supplements were distributed once per week at local health dispensaries by

Table 1: Baseline physical characteristics of beneficiaries

	Infants	Stunted children
Age (months)	12.8 ± 3.9	40.4 ± 13.7
Weight-for-Age Z-score	-1.6 ± 1.5	-2.1 ± 0.9
Height-for-Age Z-score	-1.4 ± 1.5	-2.9 ± 0.7
Weight-for-Height Z-score	-0.8 ± 1.8	-0.5 ± 1.2
Haemoglobin (g/dL)	9.2 ± 2.9	10.1 ± 2.2

Data are means ±standard deviations.

Maternal and Child Health (MCH) staff. Mothers were given for every registered child a supplementation card that was used throughout the programme to record attendance at the weekly distributions of supplementary foods. Mothers were required to show the supplementation card in order to collect the weekly ration. A tick mark and the date of collection were recorded both on the supplementation card and on distribution registers held by each health dispensary. This quick recording system monitoring the attendance at distributions served as an indirect measure of compliance to sup-plementation. The majority of beneficiaries regularly attended the weekly distribution sessions. This was also confirmed during unannounced spot visits in households in a random sub-sample of beneficiaries to check for actual consumption of the supplement by beneficiaries.

Sensitisation campaign

An on-going broad sensitisation campaign was implemented during the entire duration of the programme. Several channels were exploited simultaneously to sensitise the population at different levels of society. Regular meetings were held with ministerial and camp authorities to discuss objectives and activities so as to ensure logistical support and maximum participation of community members. Sharing of results observed in the pilot efficacy trials proved to be a strong motivational element. Several printed materials in Arabic were prepared including short summary leaflets for all authorities and health staff and illustrated educational posters highlighting essential messages on supplementation were placed in every health dispensary.[1] A wider mobilisation of the population was generated by using local radio broadcasts periodically diffusing information on the programme and by holding regular participatory discussions at local dispensary level involving influential community leaders and key political figures.

3. Results

Results are representative of a sub-sample of 1,200 children monitored in sentinel dispensaries and with complete longitudinal measurements. Impact on nutritional status was assessed by measuring the change in anthropometric indices of height-for-age, weight-for-age and weight-for-height, and in serum haemoglobin levels at the start and end of the intervention.

Situation at baseline

Physical characteristics of infants and stunted children at start of supplementation show a similar situation as in the pilot trial (Table 1). Anthropometric indices reflecting chronic malnutrition highlight once more that stunting affects one third of infants at six months of age, while it's severity is a major concern among older children (mean –2.9 HAZ). Moderate to severe anaemia is prevalent in more than 50% of children under five years of age. Compliance to supplementation, as estimated from the attendance at distributions, shows similar coverage rates as those reached in the pilot efficacy trials. The mean attendance was near two thirds of total supplement distributions over the 3 months period (8 weeks for the infants and 9 weeks for the children).

Intervention A: infants 6-17 months of age

Impact on anaemia

After three months of intervention, mean haemoglobin levels were slightly but significantly reduced by –0.3 g/dL in these young infants. The classification of haemoglobin into degrees of severity shows that while the numbers of infants with severe anaemia did diminish, those with moderate anaemia increased compared with the start of intervention (Figure 1). The overall prevalence of anaemia worsened by 5% after supplementation.

Impact on growth

Infants aged 6-17 months showed a poor

[1] EDUCATIONAL POSTER
An example of the poster is shown at the end of this publication.

Figure 1.
Anaemia prevalence in RFB-G2 infants after 3 months supplementation

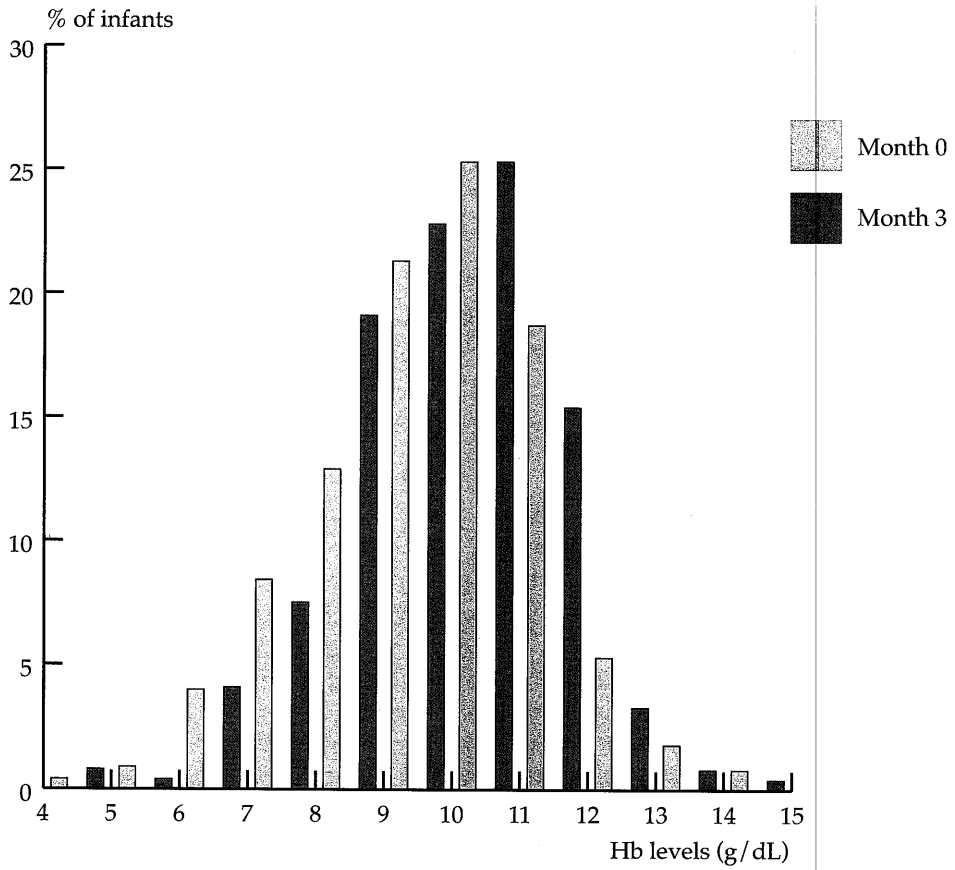
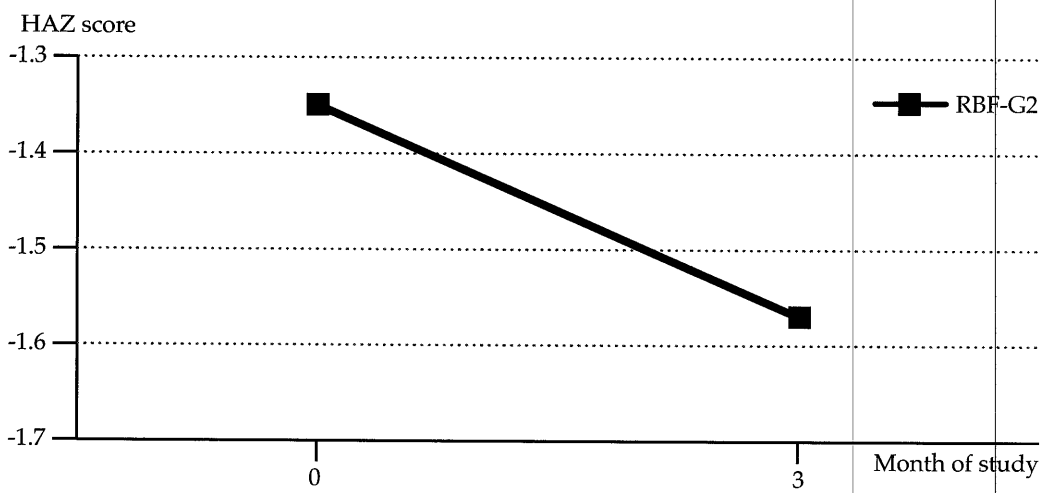


Figure 2.
Change in Height-for-Age-Z score in RFB-G2 infants after 3 months supplementation



growth performance reaching mean velocity rate of 3 mm/month. Retarded growth was reflected by the worsening of the height-for-age Z-score that dropped by 0.2 standard deviations indicating that linear growth faltering could not be prevented by the fortified supplementation (Figure 2). The percentage of infants with stunting (HAZ<-2) increased by 10% at the end of the intervention (Figure 3).

Intervention B : stunted children aged 18-59 months

Impact on anaemia

Mean haemoglobin levels in stunted children were significantly increased by +0.5 g/dL after three months of HNDS-F fortified supplementation. The percentage of children suffering moderate to severe anaemia dropped by 10%. The distribution curve of haemoglobin levels shifts to the right showing a lower percentage of children affected by severe anaemia and a higher percentage with mild anaemia and normal Hb levels (Figure 4).

Impact on growth

The HNDS-F supplementation had a positive impact on growth performance in stunted children. After three months, the mean Height-for-Age improved by +0.3 Z-scores and growth velocity reached 8.9 mm/month. The incidence of stunting (HAZ<-2) was reduced by 15% mainly among the severest cases of retarded growth (Figure 5).

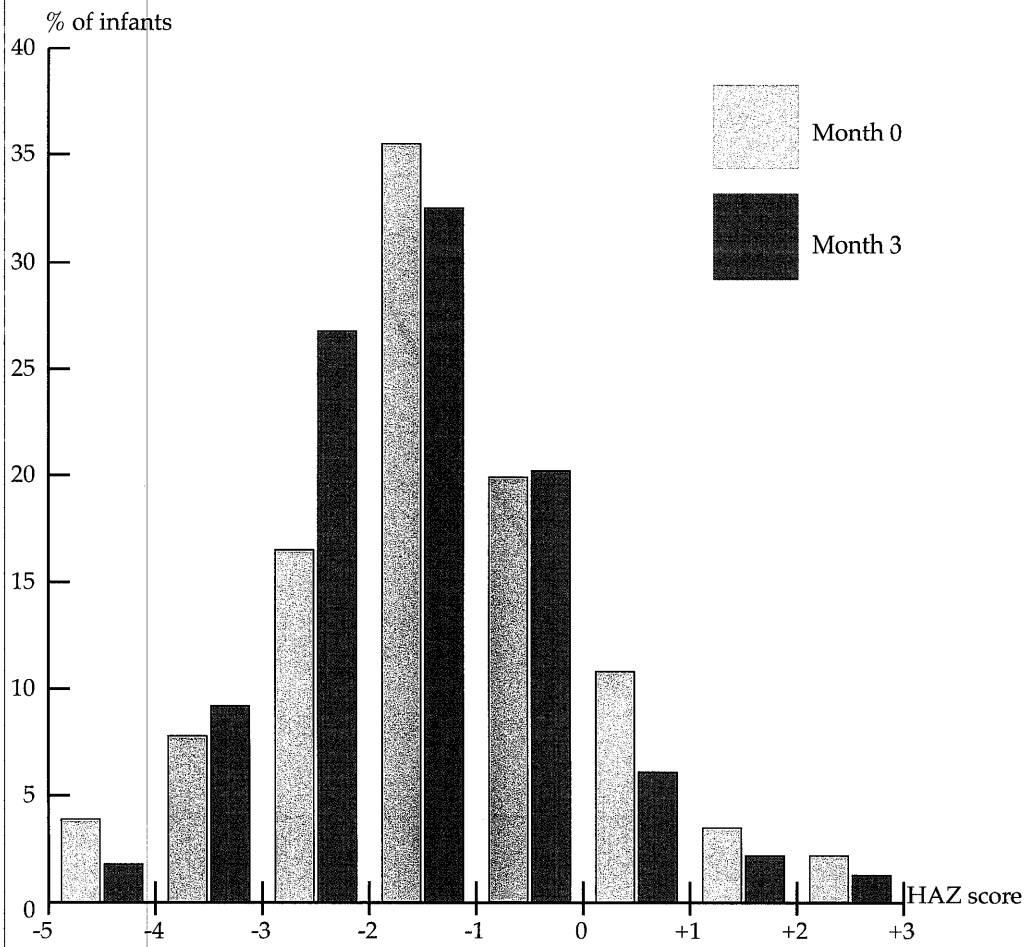


Figure 3.
Distribution of Height-for-Age-Z score in RFB-G2 infants after 3 months supplementation

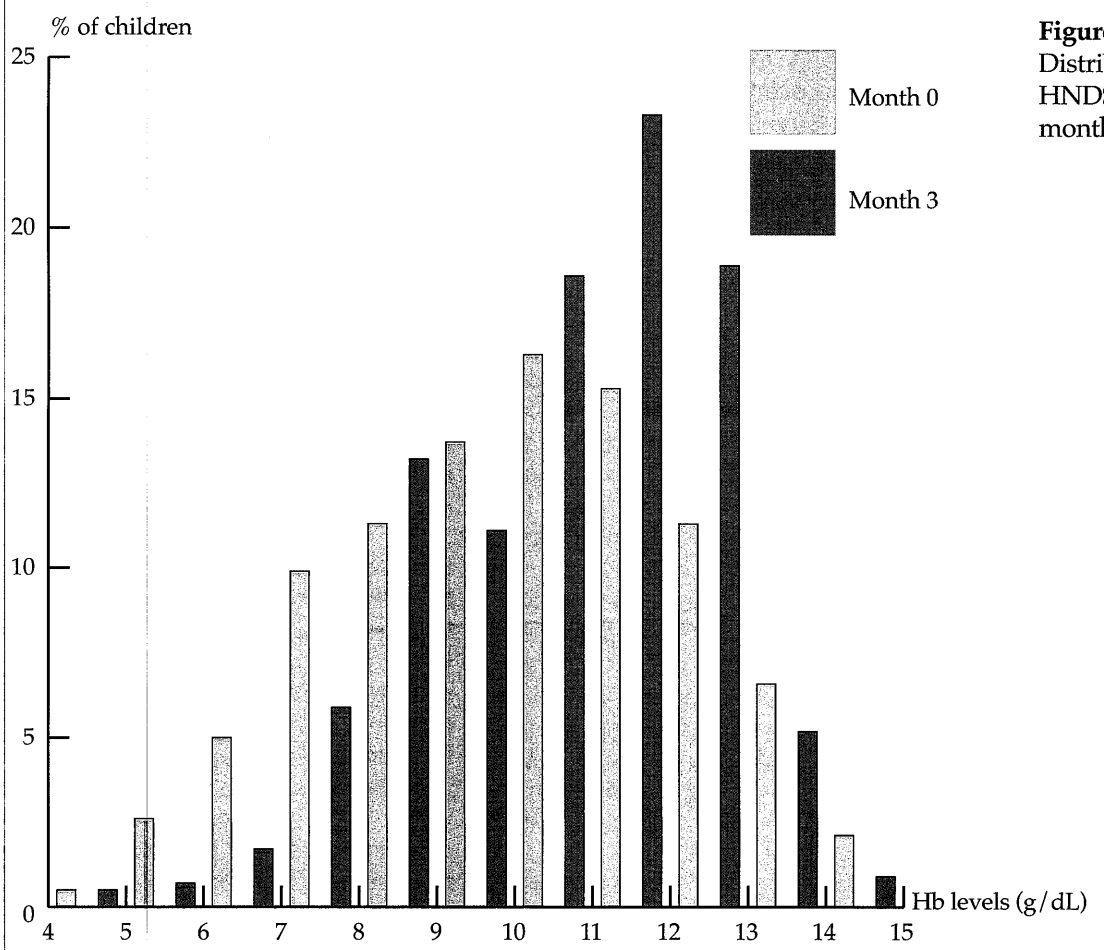


Figure 4.
Distribution of anaemia in HNDS-F children after 3 months supplementation

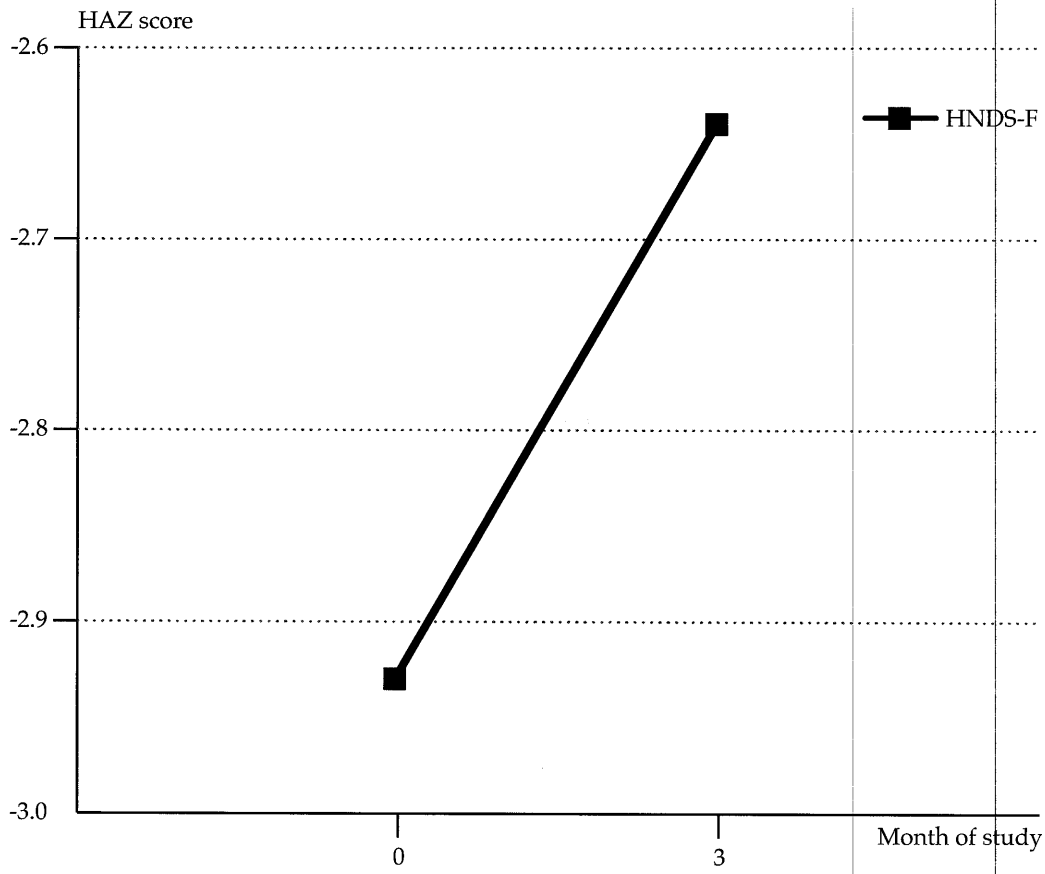


Figure 5. Change in Height-for-Age-Z score in HNDS-F children after 3 months supplementation

Effectiveness in terms of nutritional benefits

The supplementation strategy aimed at all infants aged 6-17 months only yielded limited success. Growth faltering could not be prevented in its overall progression but the extent of its severity was limited and, although overall incidence of iron-deficiency anaemia was not reduced, there was a lesser incidence of severe cases of anaemia. One main explanation for this partial success was the selection of a wider age range whereby a significant proportion of targeted infants was already showing signs of chronic malnutrition and was hence needing treatment levels of micronutrient supplementation. A further contributing factor to this worsening situation was the seasonality effect of high diarrhoea incidence rates. It is recognised that compliance and acceptability of supplements need to be improved. Nonetheless, the extremely poor growth performance in this young age group is a matter of public health concern. Linear growth faltering appears very early on in life starting in the very first few months after birth. This rapid worsening of linear growth not only urges for an earlier detection of growth retardation but advocates for other parallel prevention strategies such as correcting inadequate infant feeding practices and interventions to prevent intrauterine growth retardation.

The treatment strategy aimed at stunted children aged 18-59 months successfully reached its aims. The nutritional benefit of the fortified HNDS supplementation matched, although to a lesser degree, the benefits reached in the efficacy trial. In only 3 months, severe to moderate anaemia were significantly reduced and stunting was successfully reversed in 15% of children by markedly improving the mean height-for-age Z-score. Compliance to HNDS supplementation is very high: it is palatable and well accepted by all children and its convenient packaging form as a ready-to-eat snack allows children to consume it while walking to school. The visible changes in children's wellbeing is a powerful motivator for mothers to continue good feeding practices. Correcting stunting and anaemia by HNDS supplementation opens a new door to the management of chronic malnutrition.

Effectiveness of the distribution and monitoring systems

Over 4000 children under the age of five years were reached by this national supplementation programme that rapidly conferred a deep sense of ownership within the Saharawi refugee population. Nutritional surveillance is now a well established activity within the ongoing supplementation programmes among Saharawi refugees and has become part of the daily routine activities of every health dispensary. The integration of

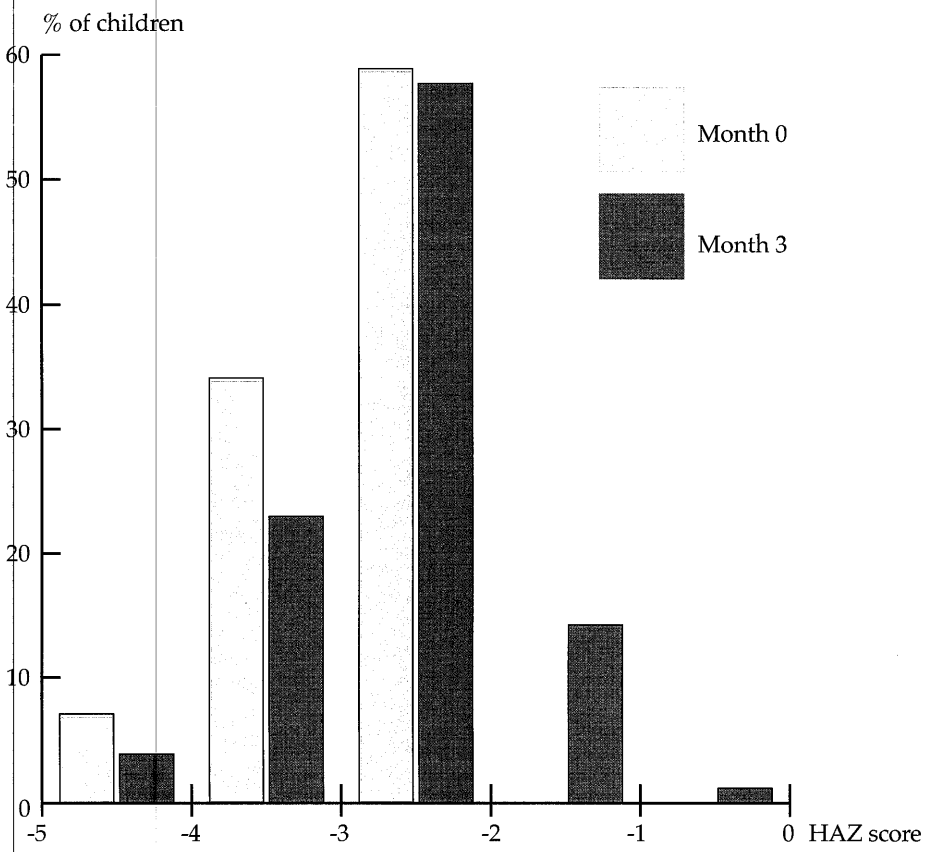


Figure 6.
Distribution of Height-for-Age-Z score in HNDS-F children after 3 months supplementation

nutrition interventions into the local health system facilitated contact between mothers and health staff and lead to more timely treatment of common childhood diseases and a better performance of health services. Management the supplementation programme, in terms of distribution and nutrition monitoring systems, was successfully carried out by the local health staff. Screening tools and methodology must be kept as simple and user-friendly as possible so as to minimise errors. Some misclassification of stunting always occurs. Gradually as the form of the malnutrition and the clinical relevance in terms of its complications become better understood, the screening methodology can be improved to increase specificity. The high turn-over of health staff makes continuous technical training a necessary component of such supplementation programmes. Programme staff should be selected on the basis of personality and interest. Investment in training activities not only pays back in terms of increased motivation and self-management of programmes but especially in terms of higher quality results.

Sensitisation campaign

The intensive sensitisation campaign integrated several successful outreach strategies involving different levels of society. Soliciting advice and support of leaders improved self-management of the programme by local health authorities. The support of the community at large was greatly enhanced through radio broadcasts, participatory discussion groups and educational printed material like illustrated pamphlets and posters. Community-based approaches that involve key community informants substantially contributed to stimulate compliance among the beneficiary population and thus fight programme fatigue. Such meetings allowed disseminating and sharing culturally appropriate messages that reinforce appropriate infant feeding practices or correct use of food supplements. For example, the best motivated mothers are good neighbourhood leaders and efficient resources to spread messages and convince other families with malnourished children. Also, at women's discussion groups, mothers are best disposed to learn by watching, participating and by talking. It must be added that some of mothers' poor compliance could be attributed to complacency and feelings of hopelessness, due to the extended refugee status of this population. Intensifying educational participatory activities directed at mothers and other infant care-takers have proven to be successful strategies to encourage parents positive behaviours and promote feelings of control.

Targeted Supplementary Feeding Programmes

In most situations with inadequate resources, it is necessary to select and prioritise the most vulnerable groups. The selection of target groups should be commonly discussed and understood with local authorities and community members. At the start of the programme, both the target selection criteria and the justification for intervention should be clearly defined.

chapter 7

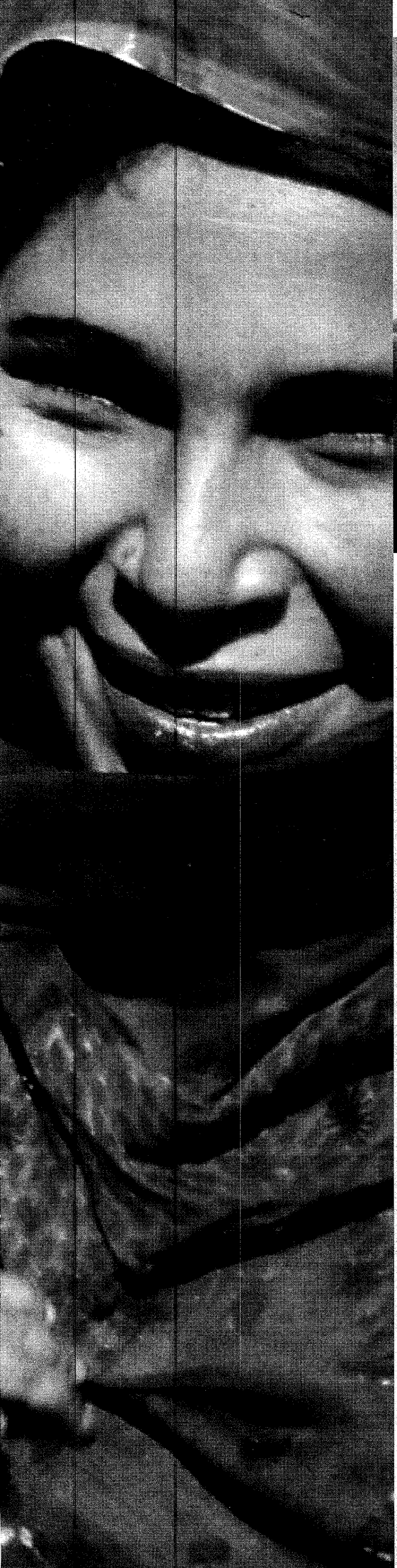
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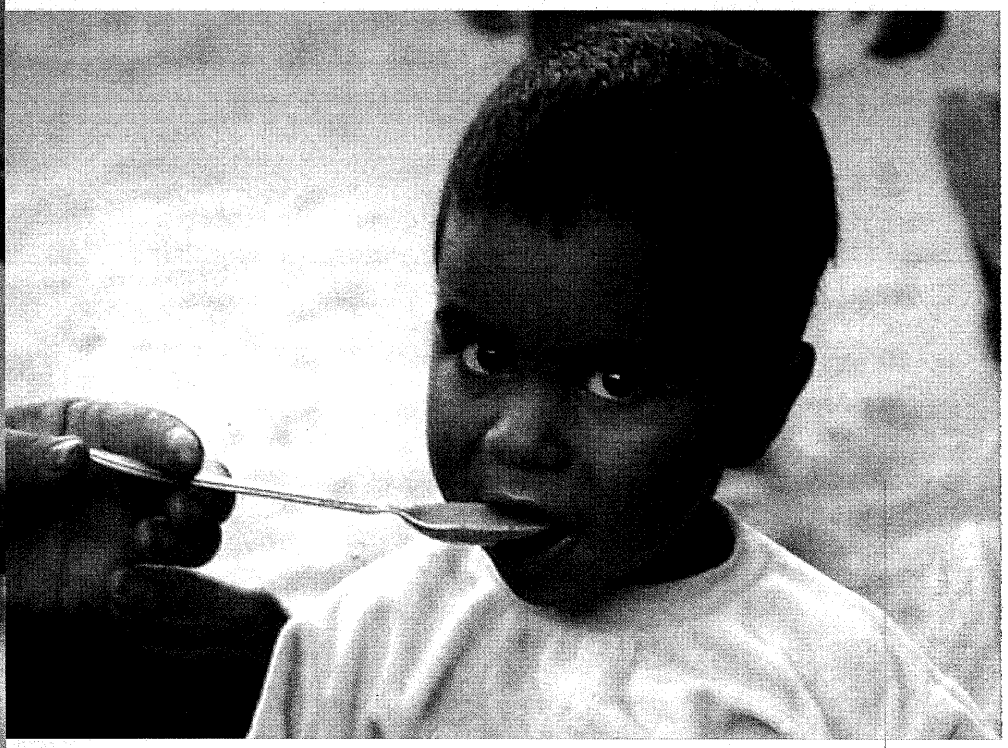


1. Micronutrient fortified foods in the prevention and control of the syndrome of anaemia and growth retardation

2. Lessons learned in the implementation of food-based interventions in the control of anaemia and growth retardation

3. Multiple integrated strategies to fight anaemia and growth retardation in refugee situations





1. Micronutrient fortified foods in the prevention and control of the syndrome of anaemia and growth retardation

The studies described in this publication bring forth a clear picture of a refugee population facing chronic nutritional vulnerability and suffering the syndrome of anaemia, stunting, increased susceptibility to infections. The co-existing nutritional problems affect various age groups of the population and underpin an intergenerational pattern of malnutrition. Poor nutrition starts in utero and extends throughout the lifecycle, particularly in young girls and women, via a chain-reaction of causal links.

The appearance of anaemia and stunting in the first four months of life indicate that growth patterns in this young age group may have been determined by prenatal and early infant factors. Poor maternal micronutrient status, particularly iron and zinc, may lead to intrauterine growth retardation. After birth, inappropriate breastfeeding practices, such as late start of breastfeeding, introduction of liquids or even solids that interfere with adequate breast-milk intake may be a leading cause of infant failure to thrive. Maternal breast-milk composition may be a problem, but only as far as vitamins are concerned. Maternal mineral status would not have an influence on breast-milk mineral content, with the only possible exception of zinc. Child care and environmental stresses are additional determining factors of poor infant growth. This would argue in favour of an earlier food-based intervention. However, introduction of

supplementary foods to infants earlier than 6 months of age is not to be recommended in similar environments as this could induce displacement of breast-milk intake and may thus have serious health consequences for infants.

Nutrition interventions addressing these conditions would not be efficient by just targeting a single high risk group, nor by just proposing approaches aimed either at prevention or at control.

Prevention and control measures using fortified food supplements should involve early and late type interventions targeted at different lifecycle stages, including infants and young children as well as young women in fertile age, pregnancy and lactation.

Prevention was not fully achieved, as the early appearance of growth retardation only allowed to perform early corrective intervention. Furthermore, it was not possible to completely arrest the development of growth retardation and to sustain normal growth rates in young children, despite the supplementary feeding given. An explanation of this finding may be that the design of the food and the distribution protocol only allowed partial coverage of the micronutrient requirements.

Fortified foods for the prevention and treatment of anaemia and growth retardation should be designed to meet the requirements for all nutrients of the different age groups.

Reversal of stunting using appropriate fortifications with minerals and vitamins was successfully achieved in growth retarded children up to five and even six years of age, with remarkable results after short supplementation periods. This argues against the age limit of three years beyond which it is commonly thought that catch-up growth is not feasible. The food vehicle used for fortifying with high levels of micro-nutrients, in this case the Highly Nutrient-Dense Spread, was undoubtedly a successful element in our supplementation programmes mainly be-cause of the high compliance rates reached among the beneficiaries.

The studies performed raise many questions. The first one is to what extent stunting is reversible. Our data do not allow us to conclude that complete reversal of stunting is achievable. Catch-up growth was markedly accelerated in the first three months of fortified supplementation but it slowed down afterwards indicating a plateauing of the growth velocity. Catch-up growth was only sustained for three months and was only 20% greater than normal. The second question concerns the long-term benefits of such accelerated growth. Is there an effect on adult height? Maturation should be followed up in children who had accelerated growth compared to those who stayed at the low centiles of growth velocity. The third question raises the issue of the safety of supplementation strategies that induce catch-up growth in individuals exposed to micronutrient deficiencies since foetal life. "By changing the nutritional environment dramatically from one generation to another and achieving phenomenal catch-up, the individuals may be metabolically disadvantaged by imprinting, so that they have difficulty dealing with the new nutritional environment in other ways (diabetes, heart disease etc). There may be an optimum rate of population improvement which is less than the maximum achievable." (communication by Golden, March 2000).

The treatment of anaemia is no doubt a human right issue: iron deficiency is a major cause of lasting brain damage and death in children. It also limits work capacity in adults. There is an urgent need to protect populations from iron-deficiency anaemia throughout the lifecycle since long-term impacts occur from infancy and childhood into adolescence. Similar considerations can be made for the increased susceptibility to infections that is caused by poor micro-nutrient status. Similar strong statements cannot be made for the treatment of stunting, until the above questions have been answered.

Treatment of anaemia and growth retardation in children can be achieved even until the age of five. Further research is needed to demonstrate to what extent stunting could and should be reversed and to rule out potential long term risks of inducing catch-up growth.

Food acceptability is a crucial factor in ensuring compliance in supplementation programmes.

Food acceptability should address cultural issues, palatability, convenience and costs. Fortified HNDS present several advantages, particularly as they allow elevated micronutrient densities, but raise issues of cost, that may not be sustainable in a long term strategy.

It is imperative that all supplementary feeding programmes should incorporate active encouragement of breastfeeding; under no circumstances should a supplementary food promote the cessation of breastfeeding.

Management of food supplements must consider factors of packaging, storage, easiness of preparation, flexibility of delivery.

Involvement of the community at every stage of the implementation and at different levels of the society is essential to access as well as share information.

Community involvement promotes the sense of ownership of the programme and improves mobilisation and participation of the beneficiary population as well as providing a clearer understanding of the problem. Key community leaders, especially respected women, have a strong influential role to play.

Sensitisation campaigns are essential in large-scale supplementation program-mes.

A variety of approaches should be developed in close collaboration with the local community using radio broadcasts, educational posters, community participatory meetings. Results must be shared and disseminated at every level of community.

Integration of the supplementation programme in the local health system allows better use of the primary health care services.

Besides allowing a better supervision of supplement use, it creates an active inter-face between mothers and health workers and facilitates early detection and treatment of common childhood diseases.

Continuous training of local staff is not only essential for adequate self-management of programme but an intelligent investment to improve the quality of results.

Periodic evaluations of nutritional status are key elements for nutrition promotion and education.

Regular monitoring helps to check if a child is progressing well. Discussing a child's progress and child feeding should be encouraged whenever possible.

Immediate and visible changes in children's wellbeing is a powerful motivator for mothers to continue good feeding practices but also for local health staff to value better their role as health carers and promoters.

The best way to check growth is to plot the child's weight and/or height on a growth chart. Regular checks of the child's progress allow mothers to see the direction of the child's line on the chart and compare it to the reference line.

From an interview with a mother: "What I see, and I don't understand yet about the analysis, yet what I observe is that they look better, and even the small children who continuously suffer from diarrhoea seem much better."

Fighting the coexistence of multiple micronutrient deficiencies with chronic malnutrition requires to mix affordable and sustainable integrated interventions appropriately adapted to resource availability and context and which are proven to be effective.

A successful coverage of population necessitates the adoption of several approaches taken in parallel. No one approach is necessarily feasible in different refugee settings.

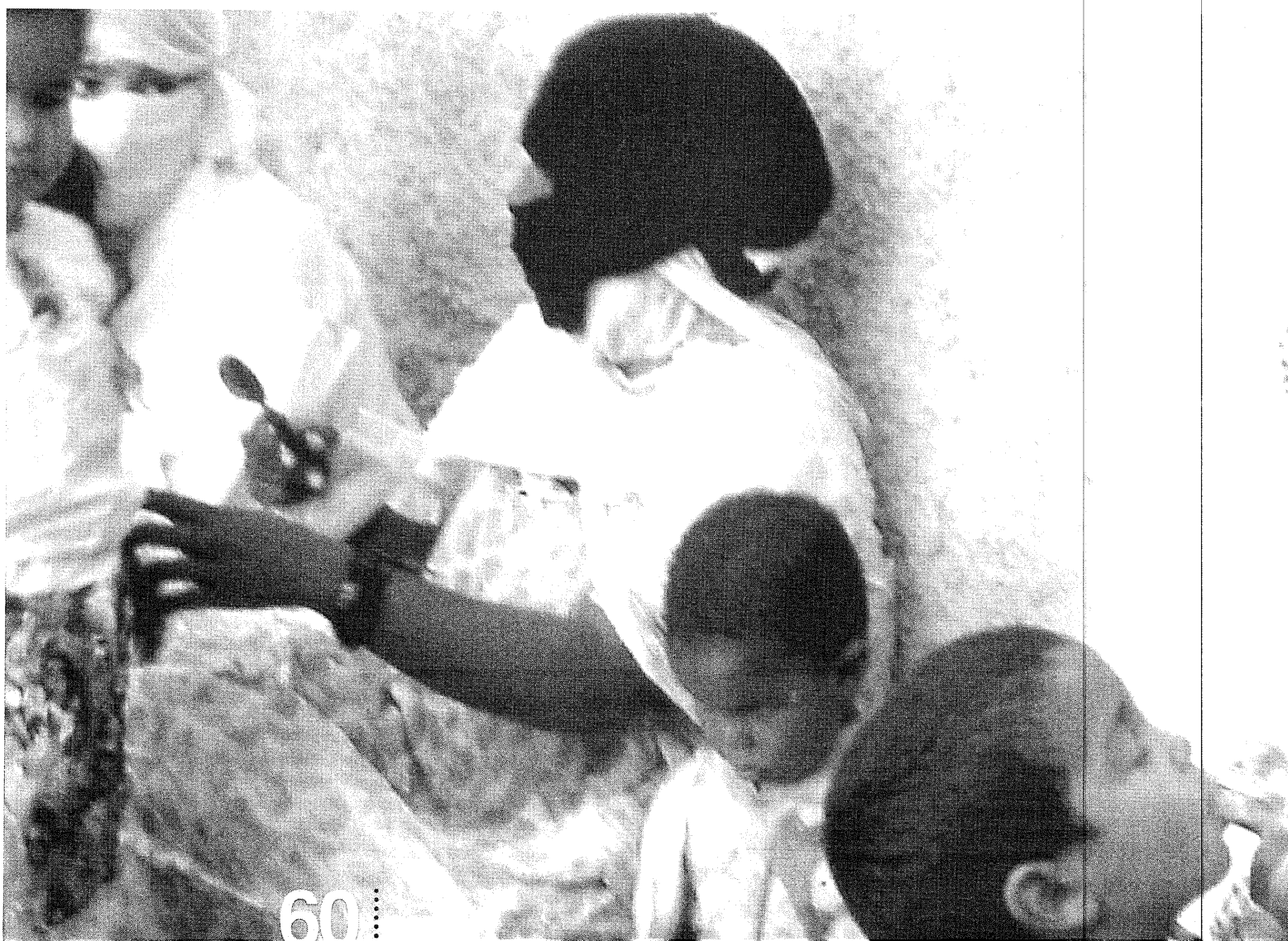
Different approaches help tackle the problem of chronic malnutrition at its different levels of causality, each of these are associated with completely differing coverage patterns, implementation, costs and convenience.

(a) The immediate causes are addressed by preventive and curative strategies and include supplementation and food-based interventions, particularly improving the nutritional quality of the general food ration provided and fortification programmes. Other health interventions also included here are infection control and oral rehydration salts;

(b) The underlying causes are essentially tackled by preventive measures such as capacity-building approaches including health education, hygiene and sanitation, infant care and protection, growth monitoring, promotion of breastfeeding and proper infant feeding practices;

(c) the root causes need actions to reduce poverty such as empowerment of women.

On the food supplementation approach, a word of warning is called for : it must be kept in mind at all times that vitamin-mineral fortification is unnecessary in case of a "well-balanced diet". The growing popularity of micronutrient supplements and micronutrient fortified foods must not at any time overwhelm other efforts in search of sustainable solutions to the problem. Distribution of supplementary foods fortified with micronutrients must be regarded only as a temporary solution. In refugee populations,



the risk of growing dependency is real in long-term supplementation programmes. Nevertheless, achieving a "well-balanced" diet may be an unrealistic, if not total fiction, when talking about populations living under extreme environmental conditions such as these of Saharawi refugees. Food fortification, on the other hand, is one of the food-based strategies with the potential for wide populations coverage and can involve a combination of micronutrients (FAO/ILSI, 1997).

FAO/ILSI. 1997 Preventing micronutrient malnutrition: a guide to food-based approaches - Why policy makers should give priority to food-based strategies. Food and Agriculture Organisation of the United Nations and the International Life Sciences Institute

Golden MH. 1994. Is complete catch-up possible for stunted malnourished children? *European Journal of Clinical Nutrition* 1994. 48 (Suppl. 1):S58-70; discussion S71



EDUCATIONAL POSTER HIGHLIGHTING KEY MESSAGES OF THE SUPPLEMENTATION:

- To prepare the porridge: Boil the water and pay careful attention to hygienic practices (wash hands, use clean utensils, keep food clean and safe, prepare porridge within 2 hours from eating, discarding unused portion, etc.).

- Only children who need the supplement are selected for the programme

- The child must eat his/her supplement every day

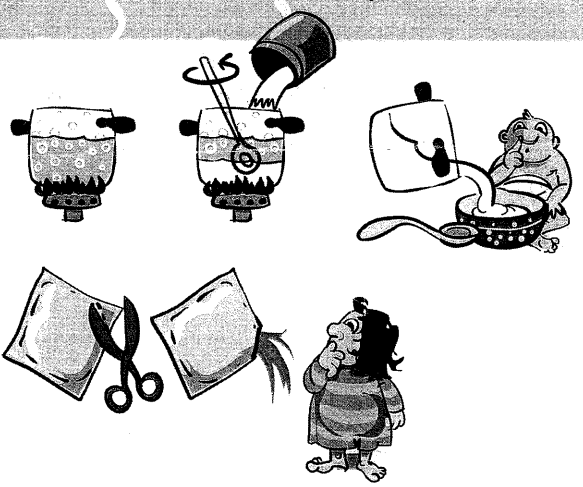
- Do not share the child's ration with his/her brothers and sisters

- Do not use the flour for household consumption

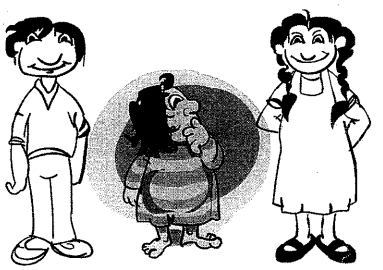
نصائح لنجاح مشروع تغذية طفلك

إغلي الماء جيّدا لتحضير البابيّة

حذاري! نظافة الملعقة و الجويرة



يشارك في البرنامج الطفل الّذي يحتاج ملى التغذية



CISP
COMITATO INTERNAZIONALE PER LO SVILUPPO DEI POPOLI

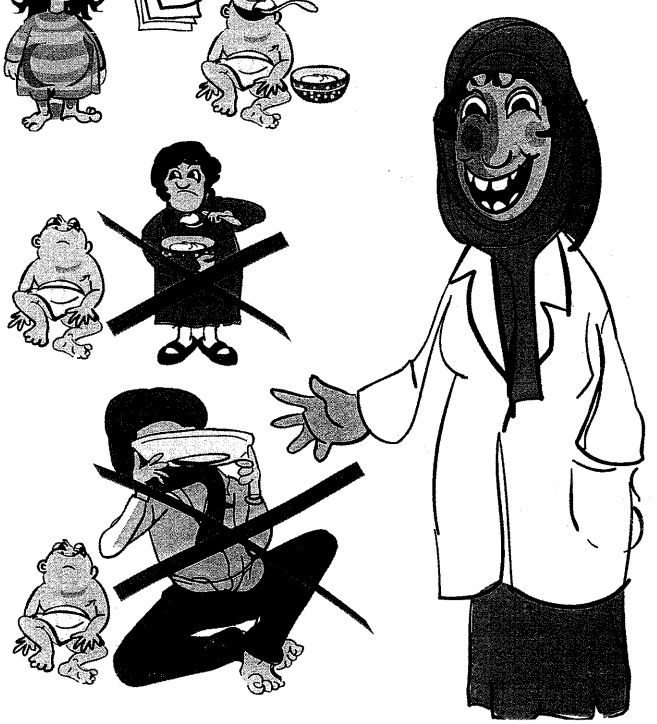
ECHO
EUROPEAN COMMISSION
European Community
Humanitarian Office

يجب على الطفل أن يأكل التغذية كلّ يوم



لا تشاركي تغذية طفلك مع أخواته

لا تستعملي تغذية طفلك لتحضير الزّريق



CISP
COMITATO INTERNAZIONALE PER LO SVILUPPO DEI POPOLI

Foundation and Goals

The Comitato Internazionale per lo Sviluppo dei Popoli (CISP) is a European non-governmental organisation (NGO) established in 1982 (formally constituted in 1983) active in international co-operation. Its goals are mentioned in a Declaration of Intent where the following main priorities are stressed:

- Basic Rights - Food Security, Combating Poverty and Exclusion, Enhancing Natural Resources
- The other fundamental rights of the individual and local communities: Education, Vocational Training, Health Care and a Healthy Environment
- Support for peacemaking Processes and Overcoming Complex Emergencies
- The role of International Co-operation

Priority Activities

In order to achieve its aims, CISP carries out, in strict collaboration with local partners, development, rehabilitation, humanitarian and applied and social research programmes in more than 20 countries in Africa, Latin America, Middle East, Asia and Eastern Europe. In Europe, CISP carries out information, training, intercultural and development education programmes, as well as fight against racism and poverty alleviation programmes. It is also engaged in actions concerning cultural policy and promotion of international solidarity.

Development Co-operation

Priority sectors are: rural development, food security (agriculture, fishery, aquaculture and small-scale breeding) and poverty alleviation, rural and urban health, education and training, natural resources and environment management, support to the peace-keeping process.

Humanitarian Aid

Within the field of emergency and humanitarian aid, until now CISP has had the following priorities: global attention to refugee communities, returnees and displaced people, health services, disaster preparedness, reactivation and reconstruction after natural catastrophes or conflicts.

Code of Conduct for Co-operation Programmes

CISP applies a Code of Conduct consistent with its strategic and methodological guidelines when formulating and implementing its humanitarian, rehabilitation or development co-operation projects. This enhances the work of the management group and all those who, in Italy and abroad, identify, implement and monitor them while in progress.

1. Projects must be designed to meet the real needs of the people and defined in accordance with the economic, social, and cultural features of each environment. This means, inter alia: constant ensuring that projects are implemented in respect for local cultures.

2. In practice, co-operation sets out to make the most of local technical, professional and material resources. This means, for example, that the functions assigned to expatriate personnel must not mortify or sideline the roles and contributions of local personnel but rather foster them and fully benefit from them. This includes promoting forms of South-South regional cooperation.

3. Activities undertaken in third countries tend to strengthen, improve and if necessary modify national development plans, but in no case must they be designed without taking account of them. For co-operation cannot be superimposed or take the place of the local planning authorities. On the contrary, it is only by acting in total respect for the role of these authorities and by engaging in dialogue with them that co-operation can enjoy the authority and prestige it needs to negotiate, whenever necessary, the introduction of corrective measures into local policies and plans.

4. In order to guarantee high standards of project effectiveness, careful attention must be devoted to identifying, planning, monitoring and evaluating them. Beneficiaries must be involved in these exercises and be given the feedback.

5. Professionalism is an essential ethical principle which typifies the relationship that exists between CISP, the countries and the communities with which it works, and is a precondition for establishing sound and effective relations based on mutual respect and co-operation.

6. Notwithstanding the principle of non-interference in the political and religious life of third countries, CISP deems it appropriate to promote the role played by institutions and organisations which actually contribute to development and democratisation processes, through specific practical forms of co-operation. In this regard, CISP attributes great importance to appraising the role of associations of women and those representing the interests of small producers and of other marginal individuals and groups (refugees, indigenous communities, ethnic minorities, etc.).

7. For reasons of transparency, governments, partners and local communities must all be kept fully briefed on the sources of the funding provided to make specific projects possible.

8. Projects must be managed so that they ensure economic, social and institutional sustainability and guarantee long-term benefits. Their management must also take account of the need to optimise financial resource-use, in order to bring the greatest possible benefit to the local people.

9. Co-ordination between international co-operation agencies and organisations and the institutions in the recipient countries is an important means of ensuring greater effectiveness to the work and the policies being implemented. In this connection, CISP is willing at all times to publicise information on its work.

10. With regard to humanitarian activities designed to overcome complex emergency situations, CISP acts in accordance with the Code of Conduct proposed by the International Red Cross which affirms among others the following principles: the universal right to humanitarian assistance without limitations due to ideology, creed, race, sex and or other consideration; the political and operational independence of all activities to prevent them from supporting one particular faction, above all in situations of conflict; respect for the rights of the individual, as defined in the Universal Declaration of Human Rights.



Foundation and Goals

The National Institute for Food and Nutrition Research (INRAN) is an Italian governmental research institute founded in 1936 and located in Rome. INRAN has multidisciplinary competence and professionalism in the study of various areas related to food science and human nutrition. The main task of the Institute is to carry out biological investigations on human nutrition, as well as analyses and assays of the composition and nutritional value of foods. Research activities are carried out by seven scientific Units, which operate as laboratories and research promotion centres. INRAN has around 200 staff members.

Priority Activities and Research Areas

Priority activities carried out by INRAN refer to four main areas of research and include: nutritional studies for human health promotion, nutritional and technological quality of foods, food consumption studies and nutritional education, studies on sustainability and development of agro-food systems and quality of food products.

Nutrition and Bone Health

The research area of Nutrition and Bone Health has acquired considerable experience, skills and knowledge in three specialisation fields that fall under the umbrella of Public Health Nutrition, mainly: (1) Nutrition and osteoporosis prevention; (2) Nutrition and growth in developing countries; and (3) Nutritional surveillance. Additional details on the work carried out by this research group are to be found on the Institute's web site under the heading "Nutrition and Bone Health" (http://inn.ingrm.it/Ricerca/scheletro/scheletro.htm).

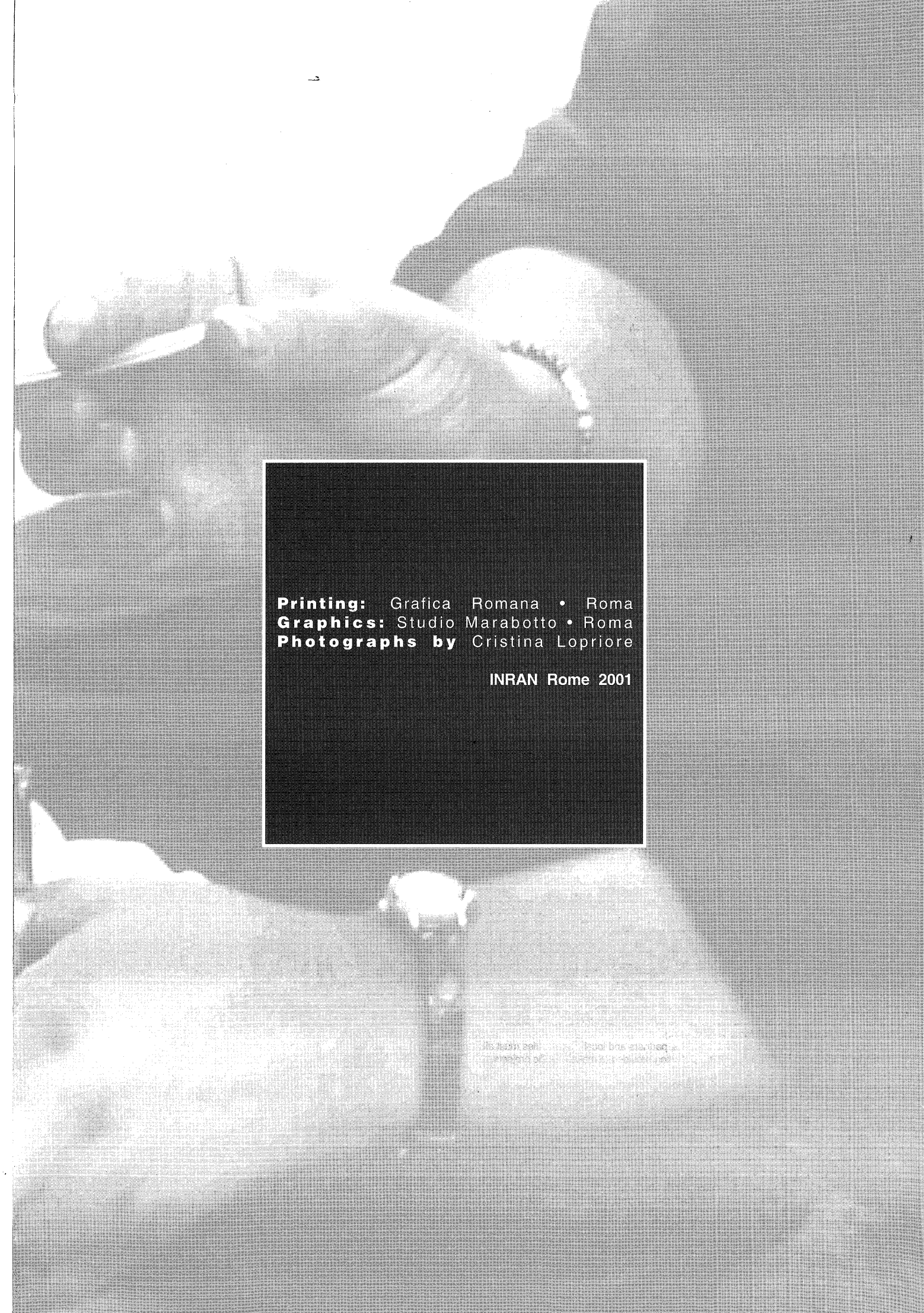
Nutrition and growth in developing countries

Specific objectives in the area of nutrition and growth are:

- prevention and control of growth retardation in intrauterine life, early infancy and childhood;
- prevention and control of multi-micronutrient deficiencies using a life cycle approach;
- promotion of integrated multiple strategies in public health policies to combat micronutrient deficiencies.

This is achieved by carrying out the following activities:

- intervention trials with multi-micronutrient fortified food supplements and anti-parasitic treatment;
- integrated, research-oriented and community-based programmes;
- nutrition education and training programmes.



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Strategies to fight anaemia and growth