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NUTRITION INTERVENTION:
AN ANTHROPOMETRIC EVALUATION OF CHANGES IN NUTRITIONAL STATUS, WITH REFERENCE TO THE NATIONAL NUTRITION PROGRAMME IN BAHIA - BRAZIL

Report of a research project, submitted in part fulfilment of the regulations for the degree of Doctor of Philosophy in the Faculty of Medicine, University of London

Ilka Magaly Esquivel Rios

London School of Hygiene and Tropical Medicine
University of London - June 1981

"A major objective of national development is to create conditions which enable every individual to have a diet which provides his nutrition requirements, to permit him to achieve his inherited physical and mental potential and to sustain him at a full level of activity."

FAO (31)

To Rodrigo, Roberto, Deraldo and Maria.

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ABSTRACT

Brazil, has for four years carried out a well-designed large-scale nutrition programme which combines primary health care with food supplementation. However, the nutritional aspects of this programme have not been evaluated. Failure to evaluate nutrition intervention is common in most countries, partly because of the lack of interest of governments, and mainly because of the lack of a methodology for assessing their effectiveness. The Brazilian programme has provided a stimulus and an opportunity to evaluate the results of such interventions. The objective of the present study is to contribute to the methodology for evaluating nutrition interventions.

This study reports a follow-up of 4041 children aged 6 to 36 months at admission to the programme, from slum areas in the city of Salvador, North East Brazil. Weight and height were measured periodically for four years; the exact ages of the children were available from birth certificates.

The effectiveness of the programme is evaluated in terms of changes in the nutritional status before and after supplementation. Cohorts were established for the analyses, according to the nutritional status, age of admission and period of supplementation.

Commonly used anthropometric methods are tested and modifications presented.

The U.S.A. National Center for Health and Statistics (NCHS) growth curves are adopted as standards.

The significance of changes in weight for age, weight for height and height for age are tested by McNemar's test. A highly significant deterioration of nutritional status is observed in the youngest group (6 to 11.9 months) both in weight and height for age indicators. For children admitted from 12 to 36 months of age, weight for age and weight for height at any age show a significant improvement, regardless of the period of supplementation. However, height for age does not show any significant change and even deteriorates in children who started below 24 months of age. The significance of these findings is discussed.

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CHAPTER ONE

INTRODUCTION

1. OBJECTIVES OF THE PRESENT STUDY.

The challenge of childhood nutrition in the Third World has led to many different kinds of intervention programmes, ranging from relatively small-scale experimental studies to large government-sponsored programmes. In the first type of study different interventions - e.g. nutritional supplements, improved medical care, sanitation - have been provided to different villages in the same region, and comparisons made of morbidity and mortality. Examples are the studies made in Guatemala by INCAP (59) and in India by the Johns Hopkins group (55), which were carefully planned, and the results analysed and considered in detail.

By contrast, the large government programmes have in general, suffered from a lack of evaluation. There is not even any well-worked out methodology for assessing the effectiveness of such programmes.The objective of the present work is to make a contribution to filling this gap.

I live and work in Salvador the capital of Bahia State an impoverished region of N.E. Brazil where the government has established a nutrition intervention programme. This has provided a stimulus and an opportunity to try to assess the results of such an intervention.

The detailed objectives were:

a) To assess the prevalence and characteristics of malnutrition in pre-school children attending supplementary feeding programmes in the city of Salvador.

b) To analyse anthropometric indicators and techniques in the evaluation of changes in the nutritional status of pre-school children.

c) To evaluate what effect a food supplement given to a family has on the future outcome for a child presenting a specific type and severity of malnutrition at a given age of admission.

d) To determine to what extent a food supplement given to a normal child will prevent it from becoming malnourished even in an environment which is known to be adverse, as judged by the conditions of its malnourished sibling.

2. BACKGROUND

2.1. PROTEIN-ENERGY MALNUTRITION (PEM) - PUBLIC HEALTH CONSIDERATIONS

Problems related to food and nutrition affect the conditions of physical, mental and social wellbeing of populations, particularly in developing countries where a great proportion of the population is exposed to the "ecology of underdevelopment".

Protein-Energy Malnutrition constitutes the main public health problem in these countries. It affects mainly young children, producing many deleterious effects on their physical and mental development, health and survival, which have been extensively documented in the available literature (32, 42, 45, 47, 48, 54, 80, 83).

The relationship between PEM and growth is firmly established and accepted, especially where malnutrition is common. Thus, the physical growth and development of children is considered a sensitive index of the health and the nutrition of the population (68).

The physical growth of individuals is a result of genetic characteristics and environmental influences, among which infectious disease and dietary intake are of particular importance in developing areas of the world (19, 28, 110). Observations have shown a decrease in the rate of growth of people living in a deprived and adverse environment (29, 63).

The extent to which the genetic potential for growth and development is achieved, is determined by the nutritional status of a child, which is a direct function of its interaction with the environment. The nature of these interactions is defined basically by social and economic factors related to food supply (production and marketing), food demand (income, food prices and education), biological utilisation of nutrients (basic sanitation, environmental hygiene and primary health care) and finally by socio-cultural factors (parental care, food habits, weaning, etc.).

It has been fully demonstrated that the lower the income of a family, a social group, or a nation, the lower will be its level of food consumption and sanitation, consequently the more precarious the nutritional status of its members (19, 31, 67).

The frequency, severity and type of malnutrition vary considerably in different areas of the world, between different regions of a country, different ages and different social groups within a country (28, 32).

The developmental policies of the developing countries promoting a rapid industrialization process have resulted in large-scale migration of people from rural areas to the cities, which do not have the infra-structure to cope with them. These new town dwellers gather on the periphery of the cities, forming the urban slums or shanty towns. There, deprived cultural and socio-economic conditions in an adverse environment make the young children victims of a chronic process of undernutrition and infection, marasmus being the commonest clinical pattern observed. Those siblings who managed to stay nutritionally "normal" in the rural areas are exposed in the cities to a high risk of becoming undernourished since they are under the same epidemiological conditions (13).

The high proportion of malnutrition found in urban areas of developing countries constitutes the main public health problem for these nations (46).

It has been widely proposed and repeatedly stressed that improvement of the nutritional status of populations, and the prevention of malnutrition of vulnerable groups are long-term objectives, which must be part of the socio-economic development of the country (18, 23, 26, 31, 74, 87). However, improvements in socio-economic conditions depend on economic growth, which is a slow evolving process determined by the direction of national policies, political will and resources. Furthermore, this process, in many developing countries, is frequently delayed by mismanagement, and political instability affecting negatively the food and nutrition sector (26,88).

The actual developmental policies adopted by most developing countries have by-passed large segments of the population by widening the already existing broad discrepancies and disparities in income distribution (31). Therefore basic structural changes in economic policies are required in order to correct the direction of the actual policies and this is likely to delay considerably the already slow process of development.

Meanwhile, direct short term actions can be undertaken to alleviate the magnitude and severity of the problem of malnutrition, as an essential component of a long-term solution (26). It is within this context that Nutrition Intervention Programmes emerge as the mainstay for the prevention of malnutrition.

2.2. NUTRITION INTERVENTION PROGRAMMES

2.2.1. General Aspects

The improvement of nutritional status of children in the developing countries has been considered the highest priority in any food policy, due to the biological, social, political and economic importance of this group (88, 95).

During the past two decades nearly all developing countries have undertaken some kind of nutrition intervention programmes to assist vulnerable groups of the population (31).

Nutrition Intervention Programmes can be classified into four categories (93).

<u>Nutrition Education Programmes</u>: which involve the use of formal and informal media to promote improvement of food habits and nutritional status.

<u>Supplementary Feeding Programmes</u>: non-commercial distribution of food to provide additional nutrients to the diet of target population groups. The food supplement can be distributed as take-home and on-site feeding, as well as at nutrition rehabilitation centres.

<u>Fortification Programmes</u>: Improvement of the nutritive quality of food through the addition of nutrients (usually vitamin A, iron or iodine) at the manufactured level.

<u>Multisectoral Programmes</u>: (or integrated programmes), comprise several programmes at least one of which is directed towards a sector other than nutrition.

Supplementary feeding programmes have been frequently adopted as a national policy by several governments, and international organisations are strongly supporting their implementation.

The general preference by governments for supplementary feeding programmes, is mainly due to the fact that the programme philosophy does not affect government policies and can usually be easily justified and granted. In their planning and execution these programmes are usually directed at particular age-groups of recipients such as: infants (0 to 1 year), pre-school children (1 to 6 years), school children (7 to 12 years), and pre-adolescents and adolescents (13 to 18 years). Due to their direct relationship with the nutritional status of young children, pregnant women and nursing mothers are also included in such activities (88).

Nutrition programmes are defined as those which can be hypothesized or demonstrated to modify the nutritional well being of a designated target population. Therefore, the impact of these programmes must by definition be measured in terms of improvement of nutritional status (11, 58).

Unfortunately, many nutrition intervention programmes have failed to improve the nutritional status of the target groups (93).

There is growing concern among government organisations and researchers about the lack of success of these programmes. Several studies have analysed possible factors at the level of implementation; while others emphasize the need for an effective and practical procedure of evaluation, which would provide a relative index of change (13, 31, 57).

The reasons presented for the lack of success of nutrition programmes vary considerably; in a broad sense they have been classified as "failure at different levels of process". (51). Other authors are more specific. Chaves pointed to a socio-political atmosphere which surrounds the programmes implementation, as a cause for its weaknesses (18). Lack of managerial and administrative skills to implement a programme properly is also quoted as the major constraint to its success. (88). The sense of social dependence developed by the programme is considered the main cause of undesirable features, together with defects related to: selection of recipients, the type of supplementation, the methods of distribution, the lack of educational value, the frequent absence of medical assistance and lack of evaluation (13).

The factors responsible for the lack of success of nutrition programmes were classified by Beghin in three categories at the level of content: poorly defined objectives, lack of quantitative goals, unclear or unproven basic assumptions, and loose assessment of resources and cost. The second category is at the level of methodology: inadequate sampling and collection of data, and unscientific processing and interpretation of information. The third category is poor communication (reports, journals and meetings) (10).

Finally, in a recent publication by WHO it is suggested that the non-response of children to feeding programmes, may be due to the screening criteria of weight-for-age to select the beneficiaries, because these criteria will include a proportion of stunted children without actual malnutrition, who are likely <u>not to</u> respond to the feeding programmes. Other children who are malnourished but relatively tall will be classified as "normal" and will not participate in the programme (112).

General agreement has been reached on the need for more research on direct and indirect indicators of the value of feeding programmes, in terms of nutrition and health status (6).

An alternative indirect measure, an improvement in toddler mortality rate, has been used as an indicator of improvements in health and nutritional status (58). However, it has been demonstrated that mortality is not sensitive enough to be used as an indicator of nutritional status or to measure the effects of nutrition intervention programmes in population (37).

It has also been observed that the decline in infant mortality in developing countries during the last three decades, is mainly a result of implementation of public health measures and maternal child care services, rather than of improvements in the nutritional situation in these countries (31, 68).

2.2.2 Evaluation

The evaluation of nutritional status has become a subject of increasing interest, as countries throughout the world are seeking to provide services to meet the needs of their populations. It provides information for adequate planning for the rationalization of administrative actions in health and nutrition policies (25, 26, 93).

Most of the few studies which assess recovery from malnutrition have been conducted in wards or metabolic units (78, 3) or recuperation centres (8, 9, 15, 34, 56, 92).

Good results have been obtained in well controlled conditions but in many recuperation centres results have been disappointing (7, 15, 69).

Furthermore, even if there was a clear response, the results observed in this kind of study cannot be expected to apply to children living in a normal social setting, since ecological factors have not been considered These factors have proved to play a decisive role in the determination of nutritional status (9, 25). McDowell has reached the conclusion that from a knowledge of the home environment it may be possible to estimate the risk that mother and child will fail to respond to out-patient treatment (61).

Programmes for the improvement of nutritional status of children should be analyzed within a specific environment, in order to obtain a practical and realistic analysis of their outcome. The first question to be answered, should be: Does a food supplement given to a child living in a deprived environment, produce any significant change in its nutritional status?

Proper evaluation of nutrition intervention programmes could clarify this question.

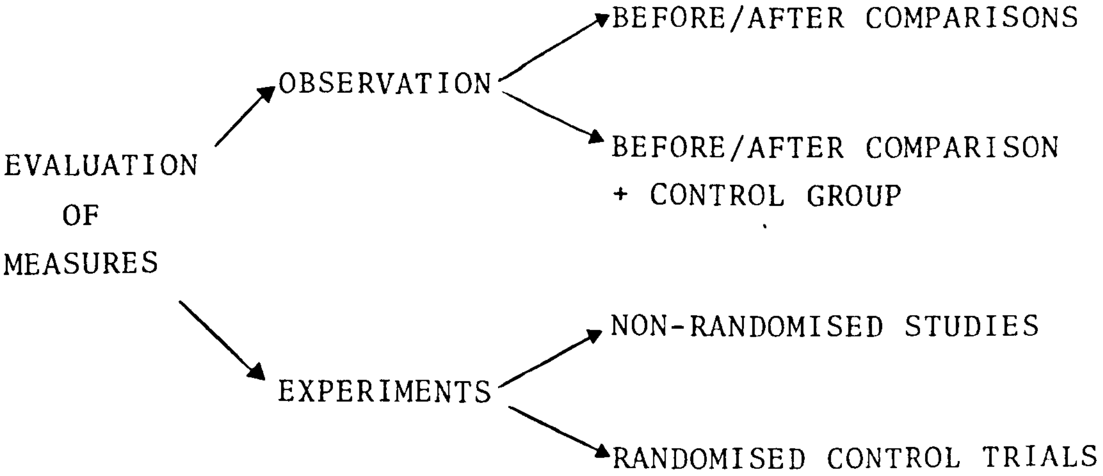
Regrettably, however, most of the programmes implemented are not evaluated. The few programmes which have been evaluated, are basically considered in terms of an overall impact of intervention from cross-sectional studies.

Studies providing evidence of change in the nutritional status of pre-school children receiving a food supplement are almost non-existent. This scarceness of evaluation is partly due to the lack of interest of the governments in the nutritional aspects of the programme, and partly because evaluation of nutrition interventions has proved to be a difficult task. It presents problems related to methodology as well as content (31). The establishment of causation is uncertain because of the frequency with which outside variables intervene; control of these variables through control groups has not been feasible.

Longitudinal studies are expensive and time consuming, thus of limited use (26). This lack of evaluation of nutrition intervention programmes has been confirmed by Shan and Pestronk in a recent literature review prepared for the Agency for International Development (A.I.D.). From a review of sixty-seven documents abstracted they found that many documents labelled "evaluation" were in fact reports of research activities or assessments of population nutritional status, while others emphasized the success or failure of projects using specific designs, but little information was provided on the success or failure of the evaluations themselves (93).

The prevention of chronic diseases distinguishes conceptually between measures to prevent the first onset of illness (primary prevention) and measures aimed against progression or recurrences (secondary prevention). Generally in practice, as is the case in malnutrition, those measures may be considered as "primary prevention" which are applied to individuals in whom disease is not yet clinically recognisable, and as "secondary prevention" those which are taken to reduce the risk or severity of a second attack (4).

Evidence for the effectiveness of a preventive measure needs to be direct, not indirect or merely theoretical. The evidence may take various forms (4):



The evaluation of nutrition intervention programmes is accomplished through the use of indicators which provide a quantitative assessment of the nutritional status of target groups. These indicators should have a practical value providing measurable numerical information, by relatively simple collection procedures. They must be as specific as possible for nutritional or nutrition-related changes (23). Selected anthropometric indicators have proved to be the simplest, most feasible and most objective means for the assessment of Protein-Energy Malnutrition in a community (58, 85).

The indicators and measurements employed in anthropometry vary greatly in number and complexity. Their choice will depend on the purpose and objective of the particular survey or study, as well as the type and prevalence of the major nutritional conditions, the age group affected, the availability of trained personnel, supporting facilities and financial resources (51).

In this study, particular attention will be paid to anthropometric indicators and measures employed in the evaluation of nutrition intervention programmes in developing countries.

2.2.2.1 Nutritional Anthropometry

Nutritional anthropometry has been the most valuable and widely used tool for assessing the nutritional status of young children in developing countries, dealing largely with the detection of Protein-Energy Malnutrition (2, 21, 47, 51, 58, 110). It provides a profile of growth or body size attained and of changes over time. It reflects nutritional status in terms of the effect of Protein-Energy Malnutrition, its location, extent, severity and duration (62, 113).

Various anthropometric measurements have been recommended and employed for the evaluation of nutritional status of children: weight, height (or length), skinfold thickness and mid-upper arm circumference, being the most commonly used. Of these measurements, weight and height (or length) are considered the most reliable, because they provide a direct quantitative assessment of the nutritional status, as determined by growth (51, 93).

Furthermore, these two measurements have proved to be reliable as sensitive indices to the improvement of nutritional status in children. On consideration of the factors associated with intervention programmes height has been shown as being a more sensitive index than weight (11, 37).

Anthropometric measurements may be related to each other by means of an index to chronological age, or by using appropriate regression techniques, constituting indicators. These indicators provide an indirect measure from which the nutritional status is inferred. In addition, the impact of intervention on nutritional status can be evaluated, permitting a diagnosis of malnutrition in an epidemiological sense. The indicators also allow screening procedures to select those children in need of food supplementation (112).

Anthropometric indicators are not specific for nutritional status, since they also reflect the influence of non-nutritional factors. The degree of sensitivity of an indicator is a function of the extent to which it reflects or predicts change in nutritional status (39).

A wide range of anthropometric indicators has been designed for the evaluation of nutritional status; they are used as single parameters, or in conjunction with other relevant indicators such as clinical, biochemical, etc. For field studies, weight and height (or length) related to chronological age and to each other form the three basic indicators of nutritional status (2, 58).

These indicators are not mutually exclusive but rather intercorrelated (2, 36, 109).

The estimation of deficit in any numerical indicator can be obtained through different methods:

a) Percentage of Standard

b) Percentiles

c) Standard deviation units.

In order to determine the proportion of children at different levels, cut-off points are chosen for the indicators, above or below which a child can be classified as being normal, over or under-nourished.

Cut-off points for grading severity vary according to the indicator. There seems to be general agreement on using the approximate standard deviation of each indicator to define cut-off points. Thus, weight-for-age and weight-for-height, are graded at 10% intervals and height-for-age at 5% intervals; the cut-off points for the normal lower limit being 90% and 95% respectively.

A. Single Anthropometric Indicators

a. Weight-for-Age

Weight is the most traditional and popular measurement for assessing health and nutritional status (34, 76, 110). Weight-for-age has for many years been a mainstay in the classification of Protein-Energy Malnutrition (34, 47, 56, 109). It is a sensitive index of acute malnutrition, as it detects weight loss, the principle sign of PEM (46, 109). It has also been considered the most sensitive index in detecting the effect of infection on nutrition (76, 87) and as an index of mortality risk in malnourished children (34, 54).

Weight for age as an index of nutritional status has been popularized through the classification suggested in 1955 by Gómez (34). This classification graded the nutritional status in three categories, according to the percent of median weight for age values derived from American children, as follows: first degree malnutrition 90% - 76%, second degree malnutrition, 76% - 60% and third degree of malnutrition below 60% . Gomez's classifications has been widely adopted in most developing countries. The most commonly used standard with this classifications has been the Stuart- Meredith or Harvard Standard (96).

This classification offers a quick and useful tool for the assessment of the extent of malnutrition in a community, and has special value in measuring the public health significance of PEM in pre-school children (75, 86, 87). It has also been commonly employed as a screening tool for the selection of malnourished children to be referred to and assisted by supplementary feeding programmes (70).

Acciari et al. analysing Gómez's classification concluded that this classification tends to detect cases of acute and chronic malnutrition, but loses sensitivity in the cases of acute malnutrition associated with children who are tall for their age. Nevertheless, as a method of detecting children at risk, this low sensitivity may be considered as an advantage rather than a defect (1, 81).

Somewhat later, Jelliffe proposed a classification similar to Gómez where the intervals for weight-for-age are subdivided as 90%- 80%, 80% - 70%, 70% - 60% and less than 60% of the Harvard standards (47). The advantage of this subdivision is that every interval (10%) represents 1 standard deviation of weight-for-age, producing a more rational index than the Gómez classification.

The disadvantage of these classifications is that it is not possible to differentiate whether the process of malnutrition is actually developing, or whether it is a chronic, past or recovered process (36, 58, 81, 91). However, when a series of measurements in the same child are possible, weight for age becomes a very useful guide to monitor the progress and recuperation of malnourished children (58, 75, 109).

Weight curves as represented by charts at the individual level are an effective instrument for growth surveillance and health care supervision of the community (23, 76, 110). Most of these charts apply the percentage classifications of weight deficit proposed by Gómez (34) and Jelliffe (47).

b. Weight-for-Height

The third indicator is determined by the relation to the ideal weight-for-height (or length), providing an index of current nutritional status of a child, virtually independent of its chronological age (2, 58, 103).

When a child presents a low percentage of weight for height it suggests that the child currently is, or in the period immediately prior to the assessment has been on a deficient diet. However, the indicator fails to detect a malnourished child whose growth is retarded both in length and weight due to past chronic malnutrition (58). Standard weight-for-height as an indicator to evaluate changes in the nutritional status of children tends to overestimate the degree of recovery (62).

A number of indicators have been proposed which express a weight-for-height relation mathematically. However, they offer little if any advantage over the simpler methods, and they present a wide variability in estimates of prevalence (89).

c. Height-for-Age

It has been demonstrated that a child affected by chronic malnutrition during the early years of life is retarded in its growth and development. The extent of height deficit in relation to age is regarded as an index of the duration of malnutrition, representing past environmental effects conditioned by long term factors (30, 106). From the epidemiological point of view, this index gives a clear picture of the severity and duration of malnutrition in the population studied. Height is a more stable index of growth than weight, because height increments, once attained cannot be lost, and growth retardation only occurs as a result of a long term chronic process of malnutrition (91), and is therefore relatively insensitive to rapid changes in nutritional status (76).

Height-for-age has been proposed as the best single indicator of nutritional changes among population groups undergoing transition (67).

Height-for-age as an indicator also has limitations in its lack of sensitivity for detecting the present nutritional status of the child, and it does not allow the distinction between a child who has suffered from chronic malnutrition at an earlier age, but is now adequately fed and the one who is actually malnourished (58, 91). A reduction in the rate of linear growth is referred to as retardation and reduction in final stature is defined as "stunting" (102, 106).

The three indicators which have been described express only the severity of PEM.

The differentiation of types of malnutrition and in relation to its acuteness or chronicity has been considered an important guide for planning health and nutrition action (58, 67).

B. Waterlow Classification

Waterlow (102) proposed a classification which distinguishes cases according to category and differentiates them by three grades of severity in addition to normal for each indicator; represented in a 4 x 4 table. The intervals used for grading the severity of these two parameters are based on the SD of height for age (≃ 5%) and weight-for-height (about 10%); thus cut-off points for mild retardation are defined as 95% of expected height for age and 90% of expected weight-for-height (103, 105). The question of standards for 'expected' height and weight arediscussed in the next section.

Grade of Stunting	Percent expected ht/age	0 >90%	Grade of wasting 1 Expected 90-80%	2 wt/ht 80-70%	3 <70%	Total
0	> 95%	A	A	B	B	A + B
1	95-90%	A	A	B	B	A + B
2	90-85%	D	D	C	C	D + C
3	< 85%	D	D	C	C	D + C
Total =		A+D	A+D	B+C	B+C	A+B+C+D

In this way, four broad categories are quantitatively differentiated as:

(A) NORMAL (adequate nutritional status)

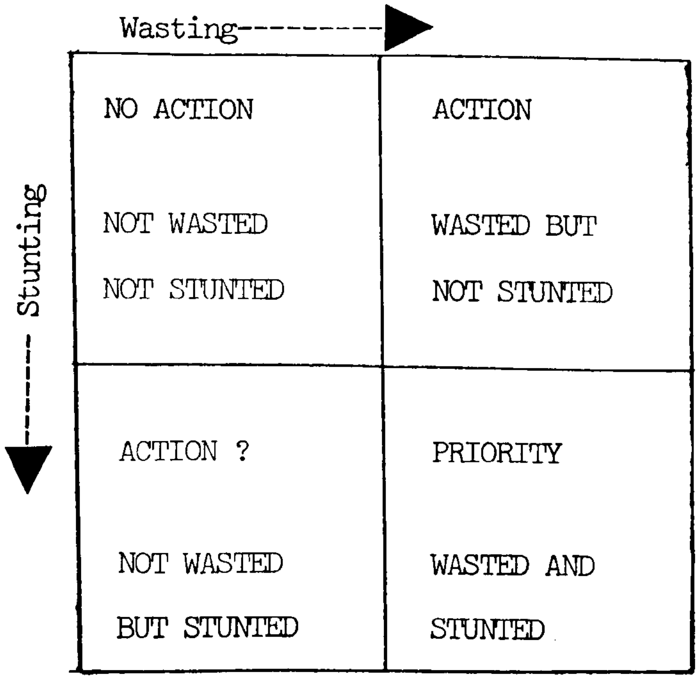
(B) WASTED BUT NOT STUNTED (i.e. acute malnutrition)

(C) WASTED AND STUNTED (i.e. acute plus chronic malnutrition)

(D) STUNTED BUT NOT WASTED (i.e. nutritional dwarfs or recovered malnutrition)

These four categories are presented in a simplified classification called "action diagram". It consists of a 2 x 2 table where different priorities for action can be assigned (104). Horizontal axis: severity of wasting. Vertical axis: severity of stunting. In each case, the dividing lines separate grades 0 + 1 (normal and mild) from grades 2 + 3 (moderate and severe).

ACTION DIAGRAM



NO ACTION NOT WASTED NOT STUNTED	ACTION WASTED BUT NOT STUNTED
ACTION ? NOT WASTED BUT STUNTED	PRIORITY WASTED AND STUNTED

The "action diagram" has special importance as a guide for decision concerning public health actions, for a most suitable and promising type of intervention (51).

While differentiation of PEM into various categories seems possible with the indicators previously presented, there is a need for confirmation of their usefulness in diverse ecologies.

Standardization of methods and techniques is necessary to ensure comparability of results among countries and at different times within the same community.

C. References and Standards

Irrespective of the indices used or the methods of their analysis, an appropriate standard is necessary, against which the anthropometric measurements can be assessed, and compared.

The conceptual difference between a reference and a standard, is examined at this point. A reference is defined as a set of measurements which provide a frame for the assessment of a normal physical growth, e.g. NCHS reference. A standard is a level of the reference frame considered as normal or ideal for the purpose of comparison e.g. 50th centile of NCHS reference.

The use of reference for growth of children is based on the assumption that every child has an inherent growth potential that can be reached under favourable environmental conditions. Thus, reference populations to be adopted as standards have been selected from well nourished children from a higher social class in developing countries or well nourished from industrialized countries.

One important aspect of the standard of reference chosen is that it should allow the possibility of establishing a common basis for comparison of the nutritional status of different countries.

a. International Standards

The international standards available refer to children from industrialized countries, who present different genetic and environmental backgrounds from those in developing countries. However, the relative importance of genetic factors is not clear (99). Evidence suggests that differences in height and weight due to ethnic background or geographical area are much smaller in young children than variations due to social class (38). Many differences observed in nutritional studies in various groups that appear to be a reflection of ethnic differences, were in fact, socioeconomically determined (79).

There is evidence also, that poor malnourished children when kept in an adequate environment exhibit a remarkable increase in their growth rate which brings them very close to their presumed genetic potential (5, 35, 84).

One point of view is that the most appropriate reference population should be derived from a representative sample, on a national basis, of the same population. However, building up a well executed national reference involves theoretical and practical difficulties which are generally beyond the resources available in developing countries. Therefore, the international standards available are considered adequate for comparative studies.

An anthropometric reference has its main application in the evaluation of nutritional status, and is employed as a standard against which changes in nutrition and health can be measured in a given population, to evaluate the results of intervention programmes and to estimate the deviation from the genetic potential for physical growth (44).

When a national standard is established it could be used as an index of the health and nutrition of that population; for the evaluation of sanitary conditions; and through change in time it could evaluate the efficiency of social and sanitary programmes of a local region (50, 100).

From the international references for anthropometric indicators available the Harvard (or Stuart-Meredith) standard (96) has been the most widely used in the past. However, many criticisms have been made of its design. It does not provide percentile curves for weight for height and it is considered out of date (98).

Recently, the National Center for Health Statistics (NCHS), the FELS Research Institute and the Center for Disease Control (CDC) collaborated in developing a modern reference standard according to the recommendations of the U.S. National Academy of Sciences for assessing growth of contemporary children and adolescents in the United States (40). These growth data are based on a large nationally representative sample, following guidelines of a group of experts on physical growth, paediatrics and clinical nutrition.

Centile values between the 25th and 75th are taken to represent normal growth. Values at or below the 5th centile and at or above the 95th centile for weight, length or height are taken to represent undernutrition and overnutrition respectively, and indicate risk for ill health compared to the rest of the population.

Although the NCHS reference may not be the ideal standard population for all countries, which have not yet established a national reference, it seems to be the most appropriate available data base (58). It allows international comparison and has been recommended by WHO (112).

b. Brazilian Standards

There is no national reference population for anthropometric measurements in Brazil.

An anthropometric study carried out by Marcondes and Cols, in 1968 and 1969, has been adopted as a national reference population (64). It consists of a cross-sectional assessment of 9,258 children of both sexes, from birth up to 12 years of age. 97.5% of these children were residents in Santo André and 2.5% in São Bernardo do Campo, councils of the metropolitan zone of São Paulo, the most developed state of Brazil.

Socio-economic variables were used to characterize the group; however no separate specific analyses were undertaken.

These data published in 1971, have been widely used throughout the country, and officially adopted as a national reference population. It has been extensively used for screening children for nutrition and health programmes.

A further analysis of these data has been done by Marques R.M. et al., published by Panamerican Health Organization WHO in 1975 (65). It includes growth curves for weight and height by sex according to four social classes.

Figures 1 and 2 display a comparison of weight and height Marcondes and NCHS, and reference values for boys aged 3 to 36 months. A complete set of data is available in appendix I.

2.2.2.2 Epidemiological Design and Methods

A. Controlled studies for evaluating nutrition interventions

Ideally any evaluation should follow the classic laboratory research design, in which the effects or changes produced by an experimental treatment or component are evaluated, other relevant variables being controlled (49). In terms of evaluation of nutrition intervention following this design, a group of recipients receiving food supplement is compared with a group which is similar in all relevant characteristics and living under identical conditions but not receiving food supplement. Thus, a comparison of changes would indicate whether an observed improvement in nutritional status is in fact a result of the programme or whether it is due to changes unrelated to it (112).

Unfortunately, such a design has proved to be rarely if ever feasible in the evaluation of supplementary feeding programmes.

To obtain a control group meeting the specifications required would mean to exclude deliberately from

Fig. 1

Comparison of weights 50th centiles reference value for Brazilian class IV and classes with North American boys from 3 - 36 months of age.

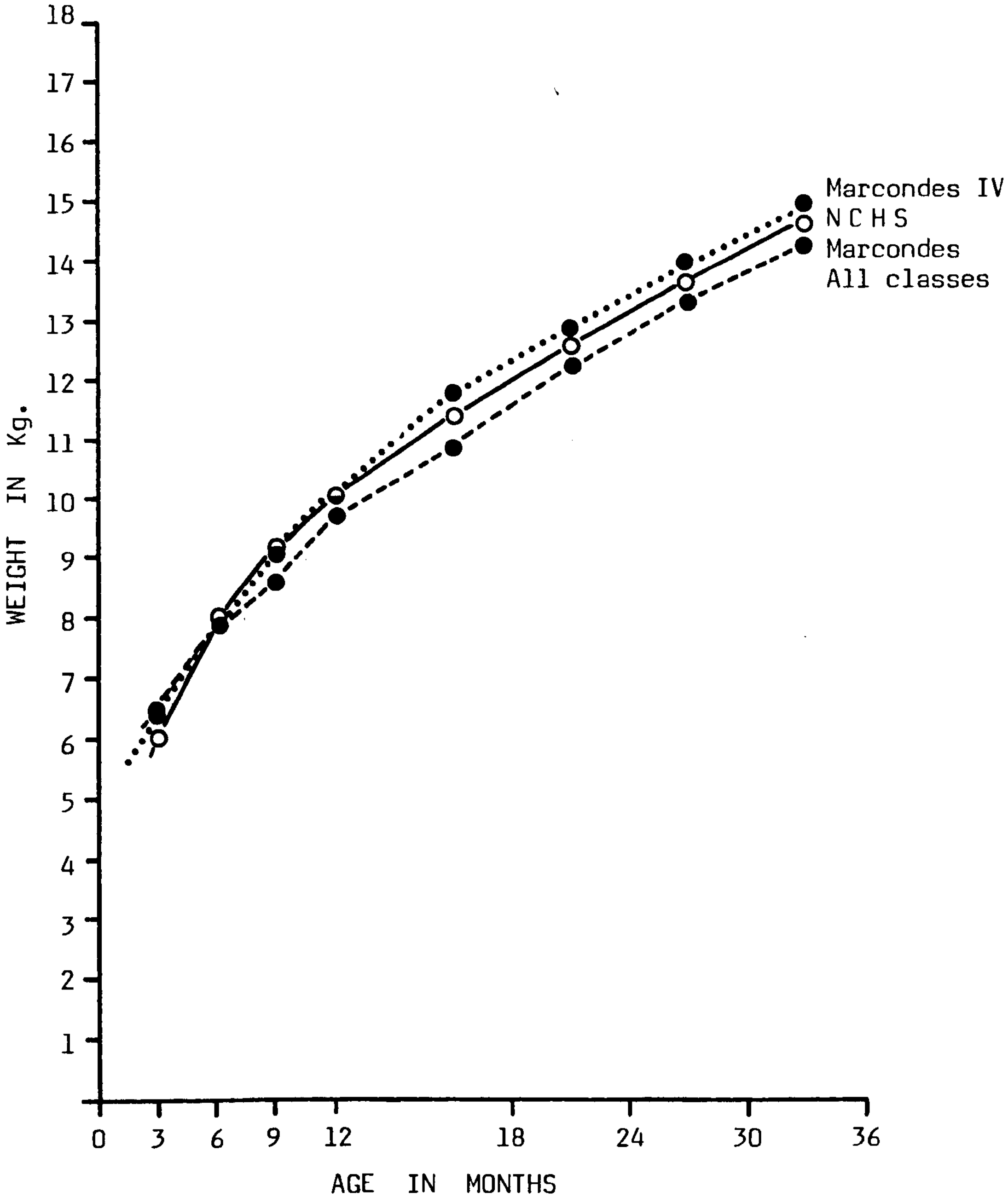
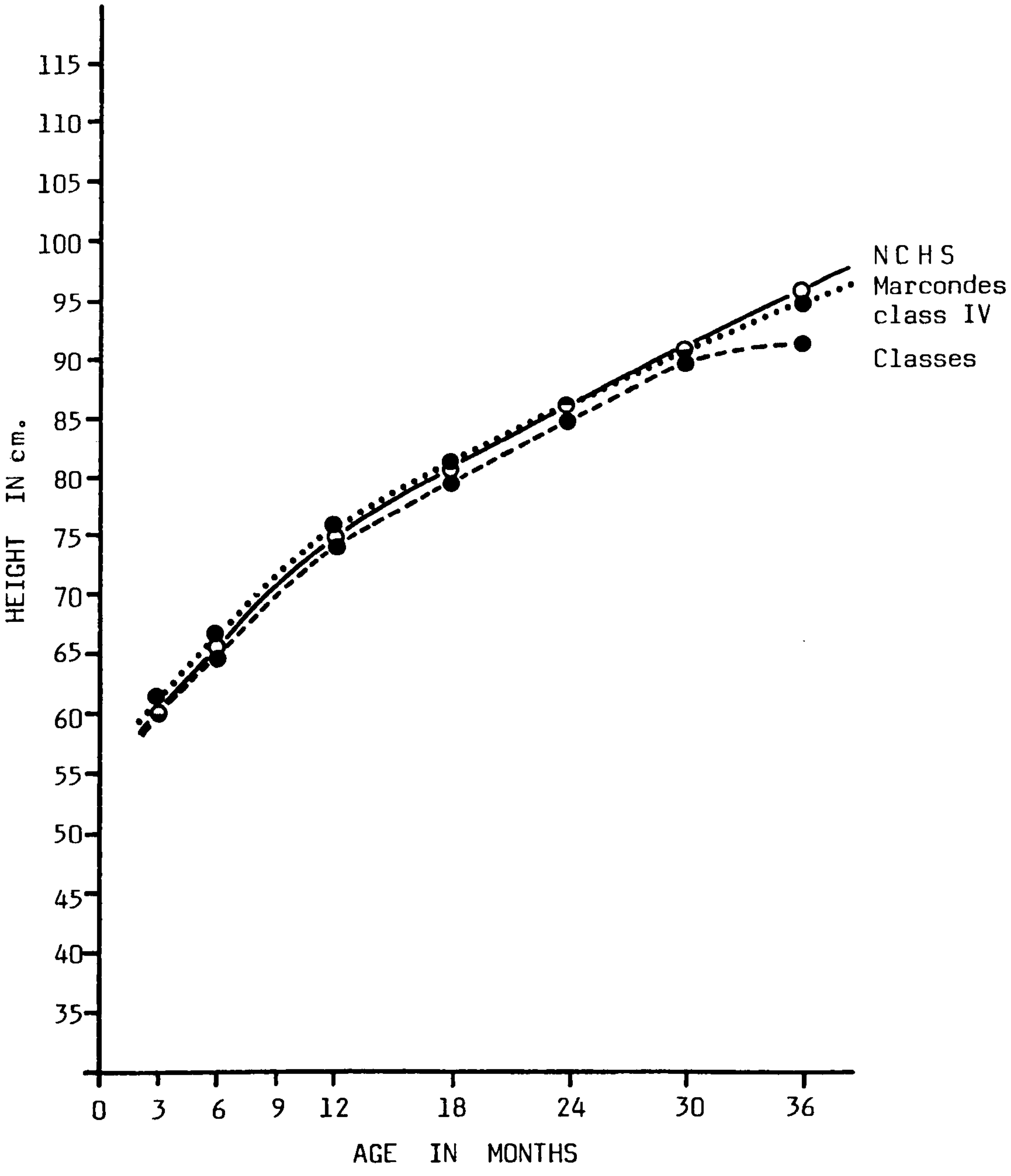


Fig. 2

Comparison of heights 50th centiles reference value for Brazilian class IV and classes with North American boys from 6 - 36 months of age.



receiving food aid a part of the needy population and this decision "would be unacceptable on ethical grounds" (112).

Moreover, "controlled" experiments in social settings are extremely difficult to set up. If a control population is too close to the target, there are spill over effects. On the other hand, if it is too far from the target group, differences in the environments confound the analysis, invalidating the comparison (53, 93).

Besides these methodological problems, other factors inherent in the programme structure prevent the use of a controlled design for evaluating the impact of supplementary feeding. The most important aspect refers to the screening procedure. In most of these programmes the recipients volunteer to participate, introducing a bias at the moment when they take a positive attitude and interest in receiving the food supplements. Thus, the factors which promote co-operation in the programme may also affect the expected changes in the outcome indicator (49, 53, 101).

Most attempts to evaluate the impact of food supplementation have been frustrated because of the theoretical principle that results should be expected from a control population (35). However, recently the need has been recognized to change or rather widen these concepts when applied to nutrition interventions. In a recent report by WHO it was stated that "even without a control group, an evaluation can still be carried out against precisely stated objectives" (112).

Siblings comparison studies have also been an alternative design used to evaluate the effectiveness of supplementary feeding programmes. These experimental studies had dealt largely with the effect of educational benefits of nutrition rehabilitation centres as measured by the nutritional status of siblings (8, 14, 108).

One of these studies has been presented by Webb et al. (108) in a follow-up of 25 children (12 months of age or over) and their younger siblings (less than 12 months of age). The mean increase in weight gain of 4.1% of normal weight was comparable to the 4.4% reported by Beaundry-Darisme and Latan (8). 21 months after being dischargedthere was a further increase of 2.8%, thus maintaining the improved nutritional status. Younger siblings showed a 16.3% improvement in weight-for-age standard over their older brothers and sisters. These results were considered as supportive of the educational objective of improving nutritional status of pre-school children by educating mothers.

More recently Brown (15) described the benefits of a nutrition centre in Rural Africa by a controlled study. Children from 5 to 24 months were matched for age, sex and nutritional status with control children from another village. Evaluations were carried out at three periods. The results showed that girls did not benefit from the programmes and boys improved weight-for-age and weight-for-height during their attendance. However, a year after discharge, the boys grew taller (1 to

3 cm) but not heavier, resulting in a deterioration in weight-for-height with reference to their controls.

The authors conclude that "such feeble results may be the sign that nutrition center programs should be abandoned and other means of nutrition intervention explored".

B. Cross-sectional vs Longitudinal

Cross-sectional studies are concerned with describing the characteristics of a population at a specific moment in time while longitudinal studes are concerned with describing how these characteristics change during a specific period of time (12).

In the evaluation of the nutritional impact of supplementation, data on changes in the nutritional status should be obtained by repeated measurements of the same individual. That is, on a longitudinal basis.

The most common technique in a longitudinal study is the plotting of serial measurements of either height or weight against age on a chart which already shows the standard. This technique has been successfully used for monitoring the nutritional status at individual levels. Alternatively, direct numerical comparisons of observed changes with a standard of change, form another common procedure.

Most of the evaluations of intervention programmes have been conducted on a cross-sectional basis, where different random samples are measured at different points of time.

Cross-sectional studies have had their main application in evaluation of the nutritional status of populations. Relative comparisons can be carried out between groups in different communities, regions or centres; and/or comparisons of each group with a reference standard to quantify deviations from normal.

Cross-sectional survey design has the advantage of being cheap, easy to conduct, and of course takes less time to execute and analyse than longitudinal studies (33). However the measurement of different individuals each time introduces a systematic bias in sampling. The variability between individuals in some indicators is large compared to the expected response of that indicator to intervention. Therefore, it results in a marked decrease in the sensitivity of the indicator (37, 49).

On the other hand, when the same individuals are evaluated on more than one occasion there is the advantage of the subjects acting as their own controls. In this case the variability of the mean change can be determined and because the precision of the estimated change between successive measurements is greater a smaller sample is required (49, 57).

The advantages presented by studies of this kind are counter balanced by difficulties and constraints such as high cost, logistic problems, reduction in the original sample and complex data analysis (112).

Some studies are intended to estimate both cross-sectional and longitudinal aspects of a population. The degree of the mixture should be determined by the relative accuracy with which the two aspects are to be measured (112).

The success of the evaluation relies basically on the adequacy of the study design in providing the requirements to reach established objectives.

C. Errors and precision of measurements

The errors associated with anthropometry are of two types: variable and systematic errors. Variable errors do not affect the mean of a distribution but will increase the spread about the mean. On the other hand systematic errors do not affect the variance of a distribution as much as the mean. In longitudinal studies, emphasising change, systematic error is not crucial, since the difference between measurements is the parameter of interest (49).

The degree of measurement precision required as well as the sensitivity of the indicator will vary according to who uses the information (93). An epidemiological analysis of the nutritional status of populations from developing countries is concerned with a relatively crude measure of gross deprivation. On consideration that we are dealing with a nutritionally deprived population, the degree of deficits is such that a highly developed and laborious but precise technique would be neither justifiable nor feasible in these areas.

Comparatively precise anthropometric measurements for clinical or specific research studies are frequently made in terms of fractions of inches or centimeters. Such data are often converted into less precise categories, e.g. third degree of malnutrition, or stunted but not wasted, which are of greatest use to programme planners, resources allocators and unsophisticated field workers (33, 93).

Based on the preceding consideration the need is felt for the development and testing of evaluation methodologies as an attempt to provide adequate instruments to evaluate supplementary feeding programmes.

The importance of evaluative research is greater in developing countries such as Brazil, where considerable investments have been made in public health affairs.

2.3. BRAZIL - AN OVERVIEW

Federative Republic of Brazil, the biggest country in Latin America, is located in a central part of South America. The surface area of 8,511,965 square kilometers makes it the fifth largest country in the world.

The population of Brazil according to the 1970 census was 93,139,031 inhabitants, being now estimated at 125,123,000 inhabitants and presenting a demographic density of 14.7 inhabitants per square kilometer.

It consists of a very young population with approximately half below 19 years of age.

The population of Brazil is heterogeneous and accurate anthropologic classification has been difficult to obtain.

Extensive racial mixing has produced a heterogeneous population. European, Indian and Negro stock has in the twentieth century been supplemented with Syrian and Japanese elements.

A great ecological variety shows different cultural and ethnic patterns which cause an irregular distribution of the population between the regions.

The Brazilian territory is divided into five major regions: North, North-east, South, South-east and Central West, which contain twenty one states, four territories and the Federal district (Figure 3).

One aspect of population growth in Brazil, is the increasing tendency to conglomerate. The powerful incentive to this trend is the industrial development and the diminished role of agricultural activities in the context of current economic policies.

Protein-Energy Malnutrition, the main public health problem in Brazil, is not a supply problem at national level. The problem is one of demand or insufficient purchasing power to meet requirements. Additional complications are loss of nutrients due to infection and infestation, caused by the low level of sanitation and overcrowding, and faulty dietary habits.

Fig. 3

Federative Republic of Brazil

The extreme inequality in the distribution of foods among different socio-economic groups is even more distorted by regional differences, the northeast area being the most affected.

Theoretically, Brazil has the means to overcome the challenge of malnutrition. It has a great potential of natural resources (fertile lands, rivers, lakes, oceans, etc.), as well as technological resources. Furthermore, it is not an over-populated country; on the contrary, most regions present a very low demographic density. However, the solution of the problem does not depend only on mobilization of natural resources and scientific and technological aids; it depends on a developmental process, which involves not only economic growth but also educational, ethical and social aspects. An increase of food production without changes in income distribution would not improve the nutritional level of the population since the great majority does not have the purchasing power to buy the food.

Official data about nutrition and socio-economic aspects of the Brazilian population often contain bias and do not fully meet the requirements of scientific rigour; therefore they cannot be relied upon for scientific studies (16).

Next, we will present a brief description of the northeast region in order to characterize the area from which our study has been drawn.

2.3.1 The Northeast region

The northeast region comprises 18% of the total area of Brazil, and 30% of the total population (Figure 3).

The northeast was the centre of European colonization, the heart of slavery and the place where plantations oriented toward export crops were first established. The soils of northeast Brazil are in general of low fertility and agriculture does not produce enough food to provide the people with a nutritionally adequate diet at local level (43).

Historically northeast Brazil has been synonymous with poverty, malnutrition, and social unrest. Two thirds of the region consists of "SERTÃO", a drought-prone territory, and the remaining one third is divided into the "AGRESTE", a semi-arid transitional tract, and the "ZONA DA MATA" a humid coastal strip.

The intermittent droughts, severe soil depletion, uneven land distribution and the general appalling conditions of subexistence have lead to a high and continuous rate of emigration to the surrounding large metropolitan areas. This migratory tendency has been increased in the last decade by the industrialization process in the cities.

According to official data (1971), 61% of the urban population and 63% of the rural population were unable to meet their nutritional requirements (22).

The high infant mortality and morbidity rates observed in this region are closely related to malnutrition. In Recife, 46.2% of the children who died before 5 years of age, were malnourished (80).

In contrast to the situation in other countries where malnutrition is highly prevalent, the health services in this area are comparatively abundant and well organised (9).

In spite of the large amount of literature on nutritional problems in the northeast area, there is a lack of precise quantitative information (59). Even basic data such as prevalence of malnutrition is not available.

Beghin has estimated that in one city of Pernambuco state approximately 20 to 25% of the children from 1 to 4 years of age present second or third degree malnutrition according to the Gómez classification (9).

2.4. BRAZILIAN NATIONAL FOOD AND NUTRITION POLICY

Brazil's development policy has been almost exclusively based on the aim of increasing economic growth, reinforced by a widespread acceptance of import substitution strategies aimed at achieving rapid industrialization, stimulated by a high level of tariff protection, import quotas and the rationing of foreign exchange.

The theory is that social policies should be postponed until a certain level of wealth is reached, when a significant part of the surplus should be used for redistributive purposes (52).

This model brought considerable economic growth, by a substantial increase of the domestic gross product; however, it failed to improve, and even caused a deterioration in the living conditions of most of the population. The increasing inequalities of distribution of national income by-passed a large segment of the population, and have been accompanied by the aggravation of poverty and malnutrition of a population already economically and culturally deprived.

By the beginning of the seventies, with the Brazilian economy in crisis, the social consequences of this model appeared more evident. A new policy then emerged to overcome the crisis at that time, the so-called "Second National Development Plan" (II PND).

When the government recognized that malnutrition was a main public health problem, it was important to introduce a conditioning factor in the economic model. However, the establishment and implementation of social policies would require not only a general consensus on the need for this option, it would also require that effective measures be taken to correct the direction of present policies. Thus, as a possible modification within the limits of the present policies, the government decided to take action in the consumption sector. Supplementary feeding programmes to assist selectively those groups most in need, and a price reduction of basic foodstuffs, were the policies selected to combat malnutrition.

In 1975, with the widening of II PND, the Council of Social Development (CDS), elaborated THE NATIONAL FOOD AND NUTRITION POLICY - PRONAN - , which was approved for the period 1976 to 1979 by presidential decree No. 77.116 of February 1976 (72). The PRONAN was seen also as a means of stimulating agricultural production through an institutionalized food market for small rural producers, who are the traditional suppliers of the majority of basic foodstuffs. Thus the Brazilian National Nutrition Policy - PRONAN - emerged as "Social programme with a specific area of intervention in the economic process", supported by the theory that "intensifying social actions would have a greater impact on improving living conditions of the population than, for example, an increase in wages" (53).

The PRONAN has, therefore, adopted the following basic lines of actions:

1. Supplementary Feeding, as an emergency measure of transitory nature;
2. Stimulating the rationalization of the system of production and marketing of basic foodstuffs in areas of low income population.

Besides these two main projects, there is a supply project which consists of setting up a "Sales System", supplying small wholesale units on the periphery of urban centres, and promoting subsidized prices for products such as rice, beans, manioc flour, corn meal, milk, fish, dough, eggs, oil and sugar. These food products originate from Cooperatives in priority areas, and from the Federal Government's stock. This project has a small coverage, being implemented only in two districts of Recife and, from 1979, in the cities of Salvador and Fortaleza.

The activities under the Food and Nutrition Policy have been implemented by the Ministries of Health, Education, Social Security and Agriculture. Other programmes have also been implemented and established, such as the School Feeding Programme (PNE), and other small specific programmes such as the Food Complementation Programme (PCA) of the Ministry of Welfare and Social Assistance, and the Workers' Feeding Programme (PAT) under the Ministry of Labour (71).

The combating of specific nutritional deficiencies, technological development, research and training of nutrition staff are also included in the policy's activities.

- Integrated into PRONAN are the World Bank Projects, which are mainly specific projects to assess the feasibility of nutrition intervention through the health and educational systems.

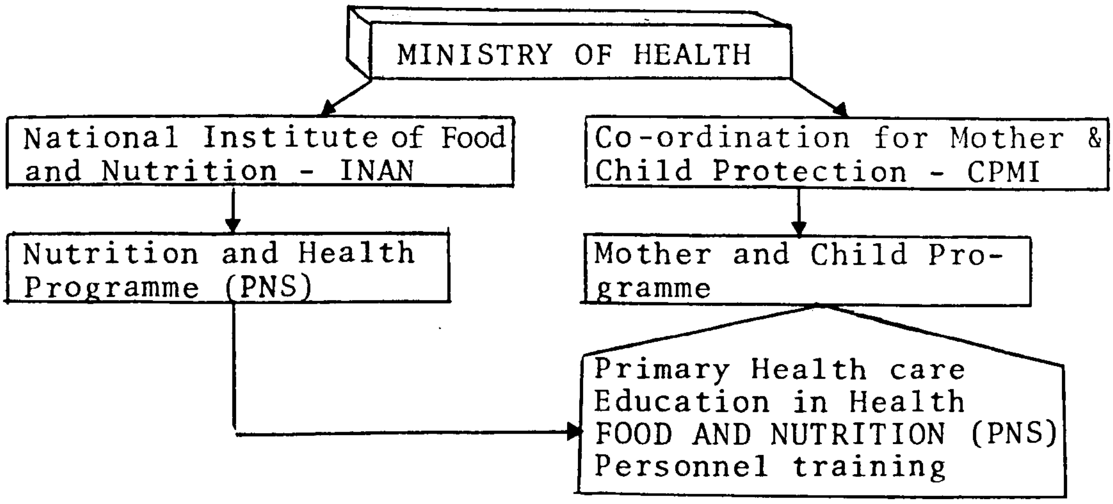
2.4.1 The National Nutrition and Health Programme (PNS)

a. Design

The National Food and Nutrition Policy is basically represented by a NATIONAL NUTRITION AND HEALTH PROGRAMME (PNS), which consists of a huge supplementary feeding programme, co-ordinated by the National Food and Nutrition Institute - INAN -, in collaboration with the States's Secretaries of Health. Thus the INAN established the priorities in receiving financial support, allocation of personnel and technological assistance to the different areas in the country according to their socio-economic conditions, in the following order: Northeast, North, Central West, Southeast, and South.

The definition of the priorities of particular districts in each state were decided by the State Secretary of Health. Priority was given to assistance to the slum areas round the main metropolitan centres, as well as to other urban centres at a low level of development (71).

The programme was planned to be a combination of Nutrition and Health, strengthening existing activities related to primary health care through the integration of two government projects, as shown in the following diagram:



These two programmes operate in an integrated form in Health Centres in communities of low socio-economic level.

The centres provide periodic medical checkups, food supplementation and vaccination against whooping cough, measles, tetanus, poliomyelitis, tuberculosis, and smallpox, as well as treatment for intestinal parasites and infectious diseases, and in some places facilities for treating the severely malnourished child suffering from acute dehydration.

b. Objectives

The National Food and Nutrition Programme, through extending activities of health and nutrition to a vulnerable group of poor population, expected to reach the following objectives:

- To provide favourable conditions for the normal growth and development of children.
- To increase the period of breast feeding.
- To reduce infant mortality rates.
- To reduce mortality rates of children under five years of age.
- To reduce stillbirth rates.
- To reduce low birth weight rates.

c. Target population

The target groups are the biologically vulnerable groups consisting of pregnant women, nursing mothers and children of more than six months and less than seven years of age, from families with low incomes, who request the services offered by the Health Centre and who agree to be enrolled in complementary health activities. All the qualifying members of a family which are considered at risk will be included as recipients. A child presenting a normal nutritional status but having a malnourished sibling will be enrolled as a preventive measure. The exclusion of children below six months of age was justified as an attempt to encourage breast feeding among the recipient mothers. On the other hand, during the breast feeding period the nursing mother will be a recipient. If the mother does not succeed in her attempt to breast feed her child, she will be discharged as a recipient and her child will be admitted instead, at any age.

Recipients will remain in the programme until the age of discharge for children, or, for nursing and pregnant women, until the criteria for discharge are fulfilled. Any recipient who fails to attend two consecutive appointments will be immediately eliminated from the programme.

d. The supplement

A group of basic foods normally consumed by the target population was selected, which consists of: milk, sugar, beans, corn meal and rice (73). The food distributed varies according to the kind of recipient to whom it is supplied. The following table shows the amount of food distributed to each group, in relation to the daily requirements for protein and energy.

Quantities of food and proportion of protein-calorie requirements per recipient per day

	Food supplement					Protein			Calories		
Recipients	Milk *	Sugar	Fuba **	Fecula ***	Bean	Require	Distributed		Require	Distributed	
	g	g	g	g	g	g	g	%	kcal	kcal	%
Pregnant	17	67	67	-	67	60	27	45	2,400	792	33
Nursing mother	17	67	67	-	67	68	27	40	2,600	792	30
Child 6-11 months	34	34	-	17	-	21	12	57	860	308	36
Child 1-6 years	17	67	34	-	17	28	13	46	1,500	498	33

* powdered skimmed milk
** corn flour
*** tuberroot flour

Source: Ministry of Health - National Institute for Food Nutrition (73).

Each recipient remains in the programme receiving monthly supplements as long as they want, provided that they attend the consultations regularly and are within the age range established.

e. Methods of operation

The child who requires the Health Centre services is admitted at reception, where a clinical record form is issued and then directed to the clinic. If the child has a complaint he is sent to the paediatric clinic; if he has not, to the well baby clinic.

After being examined in the appropriate clinic the child is sent to the nutrition clinic for nutritional evaluation and dietetic orientation. If he fulfils the requirements of the Supplementary Programme's screening procedure he is enrolled as a recipient. From admission the subsequent supplementations will be conditional on the regularity in attendance as well as the completion and follow-up of vaccination and health treatment. Anthropometric measurements are made according to standardized methods with standardised equipment. The children are weighed without clothes. A paediatric balance with 10 gram divisions is used for children under 18 months of age, and a standing balance for children older than 18 months. These balances are located at the nutrition clinic in each health centre.

Children up to 24 months are measured by standard procedures with a wooden infantometer and a galvanized steel scale graduated in centimetres and milimetres. This is a standard instrument for all health centres. For children older than 24 months standing height is measured with a common metric tape fixed to a wall perpendicular to the floor. An arm sliding at right angles is moved down to the child's head to take the reading.

Measurements of weight and height (or length) are assessed at every visit during the period of supplementation. Weight-for-age by the Gómez classification, modified by local standards, is evaluated at the time of admission.

Birth certificates must be available for the verification of each child's age, as a requirement for admission to the programme.

In spite of anthropometric measurements being adequately assessed and evaluated at the individual level against local standards (64), no evaluation of the programme as a whole has been made. Therefore there is no information available on the effect of this programme, neither nutritional effects (the direct and immediate objective of the programme), nor effects on health status (the ultimate objective of the programme).

The mere quantification of the food supplement distributed is an unreliable index of nutritional benefit in these groups, since it is unclear whether the food received is being used to feed the children and mother, for whom it was intended.

The data from this programme present the rare opportunity of having available anthropometric measurements adequately collected on a longitudinal basis in a large number of children from the same socio-economic condition and environment, receiving food supplementation and health care.

CHAPTER TWO

METHODOLOGICAL CONSIDERATIONS

1. DEFINITIONS

Papers on evaluation of nutrition interventions are very confused because of lack of consistency in definition of terms.

The terms employed in this study are basically used in the sense described by Shan and Pestronk (93) and are defined as follows:

- Activity: a function, operation or task performed by project personnel.
- Project: a site-related set of activities or initiatives undertaken towards a specific objective.
- Programme: a conceptual plan from which arise one or more projects.
- Nutrition programme: a programme which can be hypothesized or demonstrated to modify the nutritional well-being of a designated target group.
- Objective: output, purpose or goal.
- Outcome: a result or consequence.
- Assessment: an activity of appraisal or statement based on data collection and measuring techniques, which takes place at one or more points in time.
- Evaluation of planning and intervention programmes, is a process which involves numerous activities, in most of which a judgement process is formed based on measurements and comparison of programme activities and outcome.

- Impact evaluation: a type of evaluation which measures the extent to which desired purposes have been achieved.
- Research: activities undertaken to test the hypothesis which forms the links between the several levels of logical framework.
- Natural paired observations by birth: a sibling control of the same sex who is closest in age to the case child and is without the disease (24).
- Wasting: acute process of malnutrition characterized by a weight-for-height deficit below 80% of the reference (NCHS standard median).
- Stunting: chronic process of malnutrition characterized by a retardation of height in relation to age below 90% of the reference (NCHS standard median).

In relation to standards, differences between reference and standard were discussed in Chapter I, 2.2.2.1 (C)

2. DESCRIPTION OF THE AREA AND POPULATION

The study was carried out in the city of Salvador, capital of the State of Bahia. It is the largest state of the northeast region, approximately the size of France and has about 10 million inhabitants. Its capital, Salvador, was the centre of the colonization era and the first capital of Brazil. Most of the poor are still of African descent and this cultural heritage is reflected in their family patterns.

The population of the city of Salvador, as of most of the Brazilian cities, consists of migrants from smaller urban nuclei or rural areas. Generally, these new town inhabitants come to the capital seeking improvements in their living conditions, but because of economic and cultural deprivation they are "marginalized" by the society and prevented from being integrated into normal urban areas. Thus, they gather in the periphery of the cities, forming the so-called "sub-normal" areas, urban slums or shanty towns. The main feature of these areas is a deficiency in quality and quantity of public services (water supply system, electricity, sanitation, schools, etc.). The majority of the houses in these areas are built on leased land, presenting the typical standard of the poorest communities (78). The houses consist of one room constructed from cardboard, paper, wood from building crates, sticks or mud blocks. Some houses have a pit latrine but most of the people use open sewers or open spaces. The water is collected from public water standpipes.

The family income is very low; the money available for food is strictly limited, resulting in a very low per capita expenditure on food.

The children in these slum areas are affected by lack of safe water and insufficient or misguided parental care, factors which are particularly detrimental to young children. Most of the children in this area are born illegitimate; in a research carried out by LESSA in 1971 in one of the biggest slum areas of Salvador, it was reported that 61.2% of the pregnant women attending ante-natal care were single (60).

The infant mortality rate in Salvador showed a general tendency to descend throughout the period 1962 (129.8) to 1970 (73.6), rising in 1971 (98.3) to levels observed in 1964 (96.6 per 1000 live births). A similar tendency was encountered when neonatal mortality rates by gastroenteritis and other diarrhoeal diseases were studied (27).

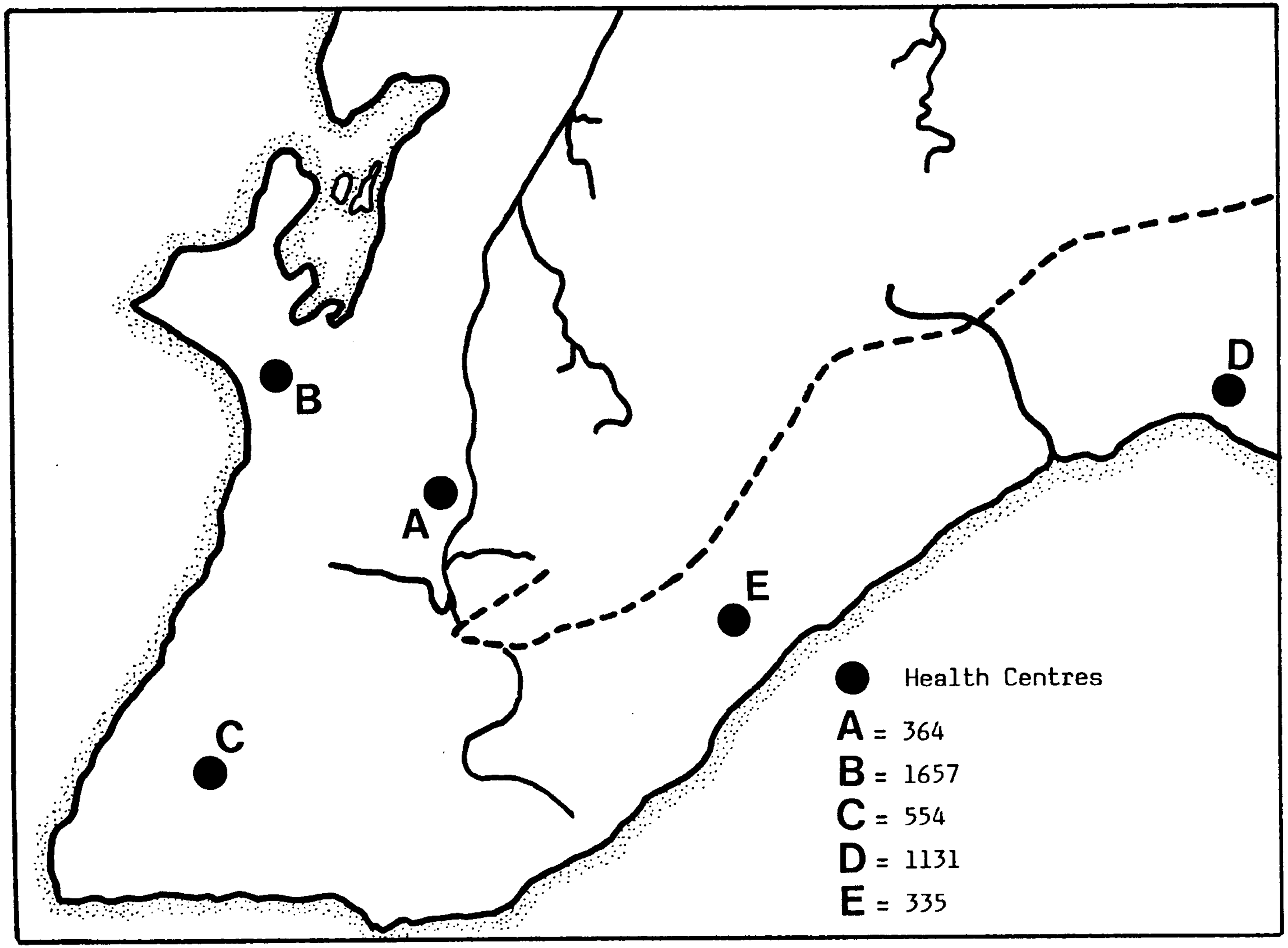
3. SAMPLE DESIGN

From the nine health centres of the city of Salvador (metropolitan area), five were selected for this study. The selection was based on the localization of health centres (slum areas), the number of staff available, and the quality and control of record keeping (Figure 4).

The children attending these health centres in slum areas are assumed to be of the same social class, race, economic level and parental education, and to have similar patterns of food consumption and environmental conditions. This assumption is based upon the following factors:

Fig. 4

City of Salvador and localization of Health Centres sampled.



a) The health services provided are markedly differentiated by social class. Private services for those who can afford it, or can claim to afford it, and public services provided by the government for the poor.

b) Due to the cultural background most of the poor are black or black mixed.

c) The dietary patterns are standardized by family income and cultural background.

d) Parental educational level is defined by socio-economic class.

The sampling frame was designed from records of children at the nutrition unit for each health centre.

All the children from 6 to 36 months old at the time of admission during 1976 to 1978, who had attended at least 6 months of supplementation, were selected. The initial sample consisted of 4061 children, presenting several degrees of malnutrition and their "normal" siblings.

In order to select the children within the age range chosen, the age of the child registered in the records was used. Later, aided by a computer programme, the exact age was calculated from the date of birth and date of admission. From this calculation 20 children were found to lie outside the age range defined by the study. Therefore, the sample was reduced to 4041 children. The numbers of children selected from each health centre, varied according to the capacity of the centre as well as the size of the community in which it was located. Figure 4 shows the localisation of the health centres and the distribution of sample.

Once the sample was defined a follow-up study of the different cohorts of children was carried out retrospectively from admission up to discharge from the programme.

4. COLLECTION OF DATA

Anthropometric and reference data were collected from all the children from the time of admission up to discharge.

Once a child was included in the sample frame, its nutrition record number was used to identify the medical record and anthropometric records, from which the data were taken. The data consisted of health centre nutritional record, clinical record, name, sex, date of birth, number of recipients in the family, data at the time of discharge, date at the time of admission into the programme, weight (kilogrammes), height (centimetres), dates of the subsequent evaluations with the corresponded weight and height measurements.

The number of evaluations per child varies according to the period that the child had been receiving the supplement, the number of missing consultations, or repairs to the equipment.

The assessment of height measurements as a routine procedure in this programme was only established during the second year of operation. Therefore many of the children in the sample did not have their height assessed at admission.

Having located the records the data was transferred to a coding sheet and verified by two different persons. When this procedure was completed, the coding sheets were sent for punching on computer cards at the Center for Data Processing of the Federal University of Bahia. The computer cards after verification, were transferred to the University of London Computer Centre for analysis.

5. DATA ANALYSES

The data have been analysed at three points during the study, and the results are presented in the following order:

5.1 FIRST PART - ADMISSION

This includes the definition of the characteristics of the study group before supplementation. It describes the composition of the sample frame, the different cohorts to be followed and presents the evaluation of the initial nutritional status of children admitted into the programme. Commonly used anthropometric indicators and methods of analysis are employed and analysed.

5.2 SECOND PART - DISCHARGE

The nutritional conditions of the children at discharge are analysed in this part. The nutritional status is analysed in relation to period of supplementation received and age of the children at admission.

5.3 THIRD PART - CHANGES IN THE NUTRITIONAL STATUS

The changes in the nutritional status of the different cohorts of children is estimated through a model of cross-tabulation for the evaluation of changes of anthropometric indicators before and after supplementation.

A specific analysis of the changes in the nutritional status is carried out in the group of children malnourished at the time of admission into the programme.

5.4 FOURTH PART - SIBLING STUDY

A sub-sample of mal-nourished children at admission and their normal siblings is analysed in this part in terms of differences in changes in the nutritional status.

5.5 GENERAL CONSIDERATIONS

Anthropometric measurements were first standardized individually for age and sex by expressing them as a percentage of the median values of NCHS standards (40).

The NCHS standards were available from a computer program containing a set of subroutines PCTL9Z specially developed by the Center for Disease Control (CDC) U.S. Public Health Service* for use in the evaluation of children (17). These subroutines, recorded on a magnetic tape were prepared to be used in an IBM computer, therefore a series of modifications were necessary in order to adapt these subroutines to the CDC 6600 computer of the University of London.

The Statistical Package for Social Sciences (SPSS) is used for the analyses.

The cleaning of data (consistency, ranges and checks) was done through the CONKER programme at the University of London.

The different children's ages at admission are stratified in three months groups, as recommended by Waterlow (107).

The nutritional status of the child will be inferred from weight-for-age, weight-for-height, and height-for-age indicators. Different methods or classification are used for these analyses.

Weight-for-age as a percentage of the standard is analysed by the Gómez classification as well as by Jelliffe classification. For weight-for-height and height-for-age, the intervals between grades of

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* I am grateful to Dr Michael Lane, CDC Atlanta, for kindly supplying these programs.

malnutrition are respectively 10% and 5%, which correspond approximately to 1 standard deviation.

A separate analysis has also been made in terms of SD-scores, and centile distributions.

The SD-score of a particular anthropometric indicator is given by the following formula:

$$\text{SD-score} = \frac{\text{Individual's value-median value of ref. pop.}}{\text{1 Standard Deviation value of the ref. pop.}}$$

Each anthropometric indicator analysed is presented as sex combined (both sexes), and sex specific (boys and girls).

The different phases of malnutrition are identified by Waterlow classification. The degree of wasting and stunting are calculated from the NCHS standard median. The cut-off point for wasting is 80% and for stunting 90% of the standard or below.

The significance of changes in nutritional status of children is assessed by the McNemar test (94). It is particularly applicable to those "before and after" designs in which each person is used as his own control.

The significance of any observed change by this method, is tested setting up a four-fold table of frequencies to represent the first and second sets of responses from the same individual.

The expectation under the null hypothesis is that half of the cases changed in one direction (Improved) and half the cases change in the other direction (Deteriorate).

Those cases who did not change their initial condition after supplementation are not considered in this test.

Under this hypothesis a formula for calculation is distributed approximately as chi-square with df = 1.

$$\chi^2 = \frac{(|D - I|)^2}{D + 1}$$

The significance of any observed value of χ^2 as computed by this formula, is determined by reference to χ^2 table with df = 1.

CHAPTER THREE

RESULTS

1. CONDITION OF CHILDREN AT THE TIME OF ADMISSION TO THE PROGRAMME

1.1 SAMPLE DISTRIBUTION

The sample of this study consists of 4041 children (2008 boys and 2033 girls) aged between 6 to 36 months at the time of admission to the supplementary feeding programme. The characteristics of these children in relation to age and sex are presented in Table 1.

The age distribution showed higher proportions of children who were below two years of age at the time of admission.

There was almost the same proportion of boys and girls in the different age groups, as well as in the total sample.

The mean age of the group was 16.7 ± 9.2 months. Similar means were observed for boys (16.4 ± 9.1 months) and girls (16.9 ± 9.2 months).

1.2 NUTRITIONAL STATUS OF CHILDREN AT THE TIME OF ADMISSION - ANTHROPOMETRIC ANALYSES

1.2.1 Distribution and Comparison of Mean Values with reference to the NCHS Standard

The following analyses present the nutritional status of Northeastern Brazilian children who were selected

Table 1. Number and percentage of children in the sample, by age and sex at admission to the programme.

Age Months	Boys		Girls		Both sexes		Cumulative
	N	% *	N	% *	N	% *	%
6 - 8.99	520	25.9	508	25.0	1028	25.4	25.4
9 - 11.99	334	16.6	282	13.9	616	15.2	40.6
12 - 14.99	221	11.0	215	10.6	436	10.8	51.4
15 - 17.99	151	7.5	157	7.7	308	7.6	59.0
18 - 20.99	135	6.7	155	7.6	290	7.2	66.2
21 - 23.99	131	6.5	159	7.8	290	7.2	73.4
24 - 26.99	147	7.3	154	7.6	301	7.4	80.9
27 - 29.99	116	5.8	120	5.9	236	5.8	86.6
30 - 32.99	111	5.5	131	6.4	242	6.0	92.6
33 - 36.00	142	7.1	152	7.5	294	7.3	99.9
Total	2008	49.7	2033	50.3	4041	100.0	

* Column percentage.

to receive supplementary feeding at the time of admission to the programme. In this section the characteristics of anthropometric indicators and methods of analysing nutritional status are considered in terms of prevalence and types of Protein Energy Malnutrition (PEM) in the children before being supplemented.

The group of children in the sample had a mean weight of 9.1002 ± 2.075 kg and a mean height of 73.25 ± 7.89 cm. The girls had slightly lower means for weight (8.924 ± 2.6 kg) and height (73.11 ± 8.03 cm) than the boys (weight 9.278 ± 2.69 kg; height 73.390 ± 7.75 cm). A complete set of tables of weight and height means, medians, standard deviations and coefficients of variation, by specific ages and sex are presented in Appendix II.

Figures 5 and 6 give a graphical comparison of the median weights and heights of the children by age and sex at the time of admission. The NCHS smoothed medians by sex are displayed for comparison.

Figure 5 shows that the children from the study had weight means close to the standard children up to the age of 6 months. From this age onwards weight deficits become greater, especially at older ages. As expected, the girls showed a lower weight than boys.

Figure 6 displays the height measurements of children at the time of admission. The height distribution shows a similar pattern to that of weight. The data clearly indicate that height retardation was established after 15 months of age, increasing progressively

Fig. 5

Median weight at the time of admission compared with NCHS standard.

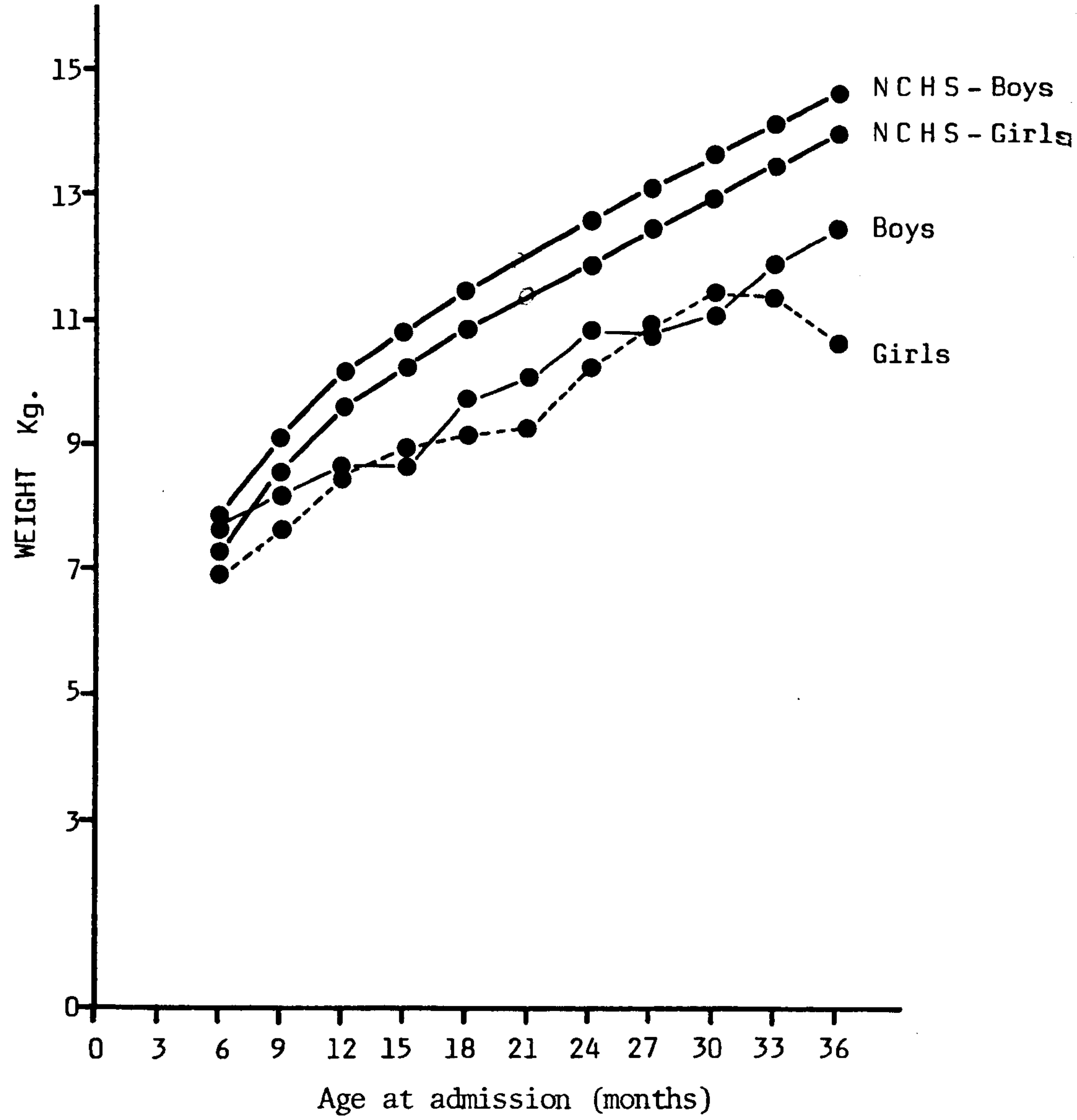
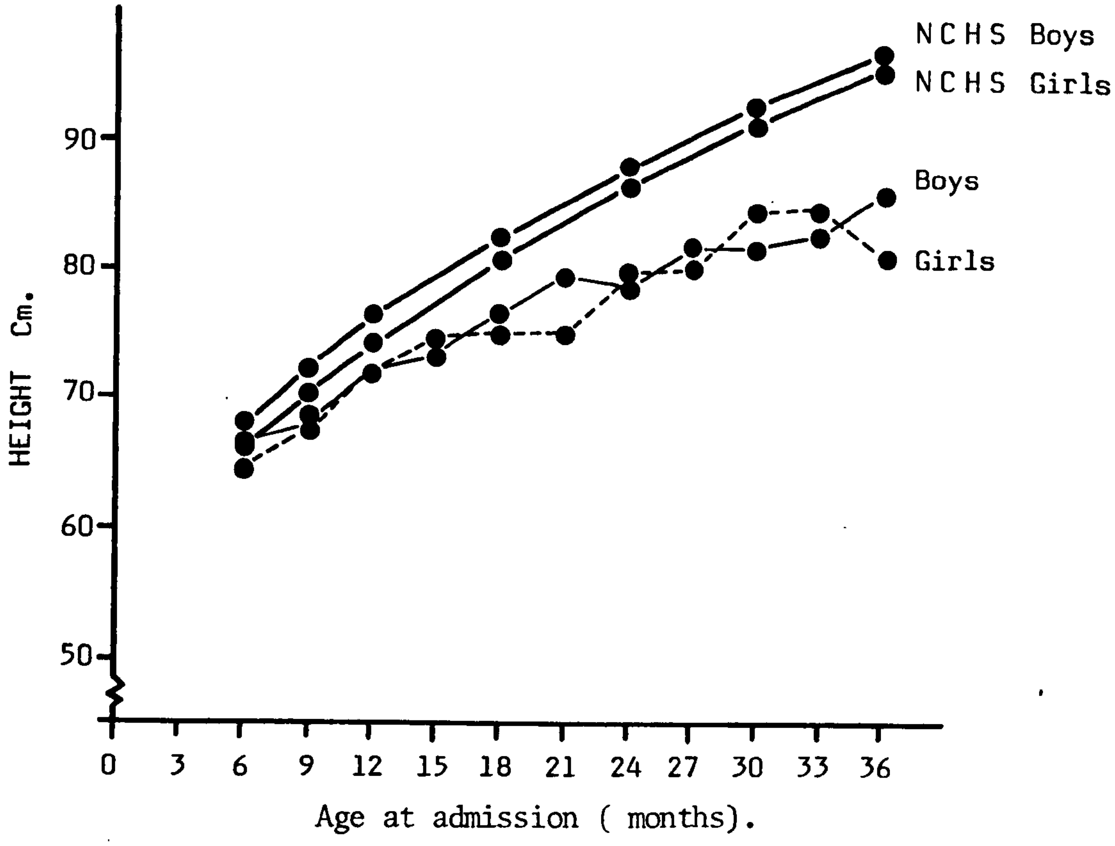


Fig. 6

Median height at the time of admission compared with NCHS standard.



as the children grew older. The height of the girls matched that of the boys up to the age of 12 months; thereafter, an irregular height growth pattern was observed. Again the girls seemed to be more affected than the boys at older ages.

1.2.2 Percentage Variation from Reference Median for Single and Combined Indicators

The percentage method has been widely used to determine the prevalence and severity of Protein Energy Malnutrition (PEM) of children. In this section the percentage methods for the different anthropometric indicators are analyzed according to commonly used classifications.

a) Weight-for-age

In intervention programmes weight-for-age has been the most commonly used indicator to screen participants. The results given by this indicator have been analyzed according to the classification of Gómez and Jelliffe (Chap. One, 2.2.1(A)). The purpose of using both classifications is to show that the same findings may lead to different conclusions, according to how they are classified.

The nutritional status of the children (both sexes) according to the Gómez classification is presented in Table 2. It is shown that 37.4% of the children had a normal weight-for-age at admission. Of the 62.6%

Table 2. Number and percentage of children (both sexes) at different ages of admission to the programme, according to their percent of standard* weight for age, Gomez classification.

Age	Percentage of Standard								Total
	> 90%		90 - 75%		75 - 61%		< 60%		
(months)	N	%	N	%	N	%	N	%	N
6 - 8.99	580	56.4	325	31.6	104	10.1	19	1.9	1028
9 - 11.99	242	39.3	242	39.3	101	16.4	31	5.0	616
12 - 14.99	135	30.9	204	46.8	84	19.3	13	3.0	436
15 - 17.99	95	30.8	139	45.1	61	19.8	13	4.2	308
18 - 20.99	78	26.9	127	43.8	65	22.4	20	6.9	290
21 - 23.99	76	26.2	141	48.6	61	21.0	12	4.1	290
24 - 26.99	89	29.6	152	50.5	49	16.3	11	3.6	301
27 - 29.99	64	27.1	113	47.9	48	20.3	11	4.7	236
30 - 32.99	65	26.9	116	47.9	49	20.2	12	5.0	242
33 - 36.00	88	29.9	139	47.3	56	19.1	11	3.7	294
Total	1512	37.4	1698	42.0	678	16.8	153	3.8	4041

* NCHS (40)

Normal	> 90
First	90 - 76
Second	75 - 61
Third	< 60

malnourished, 42.0% had first degree, 16.8% second degree and 3.8% third degree of malnutrition. When age distribution in relation to nutritional status is considered, it appears that younger children were better nourished than older ones. This is most apparent in the 6 to 12 months age group in all categories. In the older age groups there is a tendency towards a decrease in the proportion of normals, and an increase in the proportion of those with first degree malnutrition.

There is no clear tendency for second and third degree malnutrition.

A chi-square test showed a significant level of dependence between the age of the child and its nutritional status (χ^2 = 266.23, d.f. = 27, $P < 0.001$). However this relationship between age and nutritional state depended entirely on the normal group (χ^2 = 239.0, d.f. = 9, $p < 0.001$). Thus, no significant relationship was found between the prevalence of malnutrition and age of the child.

There was no significant difference between the nutritional status of boys and girls at admission (Tables 3 and 4).

Tables 5 to 7 present the nutritional status of the children by sex, in terms of percentage for standard weight-for-age according to Jelliffe's classification. From this group 37.4% of all children (both sexes) had a normal weight-for-age (Table 5). The malnourished group was classified as 30.7% mild, 19.7% moderate, 8.4% severe, and 3.8% very severe. The proportion of severely malnourished boys was slightly higher than that of girls

Table 3. Number and percentage of boys at different ages of admission to the programme according to their percent of standard* weight for age, Gomez classification.

Age	> 90%		90 -75%		75 - 61%		< 60%		Total
(months)	N	%	N	%	N	%	N	%	N
6 - 8.99	301	57.9	156	30.0	51	9.8	12	2.3	520
9 - 11.99	132	39.5	131	39.2	52	15.6	19	5.7	334
12 - 14.99	55	24.9	109	49.3	50	22.6	7	3.2	221
15 - 17.99	44	29.1	68	45.0	33	21.9	6	4.0	151
18 - 20.99	35	25.9	58	43.0	32	23.7	10	7.4	135
21 - 23.99	38	29.0	63	48.1	25	19.1	5	3.8	131
24 - 26.99	48	32.6	66	44.9	26	17.7	7	4.8	147
27 - 29.99	27	23.3	55	47.4	25	21.6	9	7.7	116
30 - 32.99	29	26.1	54	48.6	23	20.7	5	4.6	111
33 - 36.00	41	28.9	71	50.0	24	16.9	6	4.2	142
Total	750	37.3	831	41.4	341	17.0	86	4.3	2008

* NCHS (40)

Normal	>90%
First	90 - 75%
Second	75 - 61%
Third	<60%

Table 4. Number and percentage of girls at different ages of admission to the programme according to their percent of standard* weight for age, Gomez classification.

Age (months)	Percentage of Standard								Total
	> 90%		90 - 75%		75 - 61		< 60%		
	N	%	N	%	N	%	N	%	N
6 - 8.99	279	54.9	169	33.3	53	10.4	7	1.4	508
9 - 11.99	110	39.0	111	39.4	49	17.4	12	4.2	282
12 - 14.99	80	37.2	95	44.2	34	15.8	6	2.8	215
15 - 17.99	51	32.5	71	45.2	28	17.8	7	4.5	157
18 - 20.99	43	27.7	69	44.5	33	21.3	10	6.5	155
21 - 23.99	38	23.9	78	49.1	36	22.6	7	4.4	159
24 - 26.99	41	26.6	86	55.8	23	14.9	4	2.6	154
27 - 29.99	37	30.8	58	48.3	23	19.2	2	1.7	120
30 - 32.99	36	27.5	62	47.3	26	19.8	7	5.3	131
33 - 36.00	47	30.9	68	44.7	32	21.1	5	3.3	152
Total	762	37.5	867	42.6	337	16.6	67	3.3	2033

* NCHS (40)

Normal > 90%
First 90 - 76%
Second 75 - 61%
Third < 60%

Table 5. Number and percentage of children (boths sexes) at different ages of admission to the programme, according to their percent of standard weight for age, Jelliffe classification.

Age	Percentage of Standard										Total
	> 90		90 - 81		80 - 71		70 - 61		≤ 60		
(months)	N	%	N	%	N	%	N	%	N	%	N
6 - 8.99	580	56.4	241	23.4	136	13.2	52	5.1	19	1.8	1028
9 - 11.99	242	39.3	177	28.7	115	18.7	51	8.3	31	5.0	616
12 - 14.99	135	31.0	155	35.6	96	22.0	37	8.5	13	3.0	436
15 - 17.99	95	30.8	96	31.2	71	23.1	33	10.7	13	4.2	308
18 - 20.99	78	26.9	96	33.1	62	21.4	34	11.7	20	6.9	290
21 - 23.99	76	26.2	99	34.1	67	23.1	36	12.4	12	4.1	290
24 - 26.99	89	29.6	110	36.5	68	22.6	23	7.6	11	3.7	301
27 - 29.99	64	27.1	72	30.5	68	28.8	21	8.9	11	4.7	236
30 - 32.99	65	26.9	87	36.0	55	22.7	23	9.5	12	5.0	242
33 - 36.00	88	29.9	106	36.1	60	20.4	29	9.9	11	3.7	294
Total	1512	37.4	1239	30.7	798	19.7	339	8.4	153	3.8	4041

* NCHS (40)

(Tables 6 and 7). This picture is maintained in the different age groups, but the difference between the sexes were not significant.

A comparison of the Gómez and Jelliffe classifications of nutritional status is presented in Table 8. The differences in the prevalence of malnutrition are presented by sex. For comparative purposes the last two categories of Jelliffe's classification (70 - 60% and < 60%) have been combined.

The level of normality above 90% of the standard has not been modified by Jelliffe; therefore an equal number of children were observed in this group with both classifications. Mild forms of malnutrition however, vary considerably between the two classifications. According to Gómez 42.0% of the children were mildly malnourished, whereas by Jelliffe's classification this proportion is reduced to 30.7%. Thus, 11.3% of the children diagnosed as mildly malnourished by the Gómez classification were shown to be moderate (2.9%) and severe (8.4%) forms of malnutrition by the Jelliffe classification.

The choice of one of these classifications may become a decisive factor in evaluating the success of a programme, especially when used for screening populations. A clear example is presented in this work; if Gómez's classification is applied, a prevalence of 4.3% of severe malnutrition is obtained, whereas by Jelliffe's classification this prevalence is increased to 13.1%.

Table 6. Number and percentage of boys at different ages of admissio to the programme, according to their percent of standard weight for age, Jelliffe classification.

Age	Percentage of Standard										
	> 90		90 - 81		80 - 71		70 - 61		≤ 60		Tota
(months)	N	%	N	%	N	%	N	%	N	%	N
6 - 8.99	301	57.9	112	21.5	68	13.1	27	5.2	12	2.3	520
9 - 11.99	132	39.5	92	27.5	64	19.2	27	8.1	19	5.7	334
12 - 14.99	55	24.9	83	37.6	54	24.4	22	10.0	7	3.2	221
15 - 17.99	44	29.1	45	29.8	37	24.5	19	12.6	6	4.0	151
18 - 20.99	35	25.9	42	31.1	29	21.5	19	14.1	10	7.4	135
21 - 23.99	38	29.0	44	33.6	25	19.1	19	14.5	5	3.8	131
24 - 26.99	48	32.7	45	30.6	33	22.4	14	9.5	7	4.8	147
27 - 29.99	27	23.3	35	30.2	35	30.2	10	8.6	9	7.8	116
30 - 32.99	29	26.1	41	36.9	30	27.0	6	5.4	5	4.5	111
33 - 36.00	41	28.9	53	37.3	29	20.4	13	9.2	6	4.2	142
Total	750	37.4	592	29.5	404	20.1	176	8.8	86	4.3	2008

* NCHS (40)

Table 7. Number and percentage of girls at different ages of admission to the programme, according to their percent of standard weight for age, Jelliffe classification.

Age (months)	Percentage of Standard										Total
	> 90		90 - 81		80 - 71		70 - 61		≤ 60		
	N	%	N	%	N	%	N	%	N	%	N
6 - 8.99	279	54.9	129	25.4	68	13.4	25	4.9	7	1.4	508
9 - 11.99	110	39.0	85	30.1	51	18.1	24	8.5	12	4.3	282
12 - 14.99	80	37.2	72	33.5	42	19.5	15	7.0	6	2.8	215
15 - 17.99	51	32.5	51	32.5	34	21.7	14	8.9	7	4.5	157
18 - 20.99	43	27.7	54	34.8	33	21.3	15	9.7	10	6.5	155
21 - 23.99	38	23.9	55	34.6	42	26.4	17	10.7	7	4.4	159
24 - 26.99	41	26.6	65	42.2	35	22.7	9	5.8	4	2.6	154
27 - 29.99	37	30.8	37	30.8	33	27.5	11	9.2	2	1.7	120
30 - 32.99	36	27.5	46	35.1	25	19.1	17	13.0	7	5.3	131
33 - 36.00	47	30.9	53	34.9	31	20.4	16	10.5	5	3.3	152
Total	762	37.5	647	31.8	394	19.4	163	8.0	67	3.3	2033

* NCHS (40)

Table 8. Comparison of Gómez and Jelliffe classifications defining the nutritional status of children at admission

Nutritional status		Boys Gómez	Boys Jelliffe	Girls Gómez	Girls Jelliffe	Both sexes Gómez	Both sexes Jelliffe
Normal	N	750	750	762	762	1512	1512
	%	37.3	37.3	37.5	37.5	37.4	37.4
Mild	N	831	592	867	647	1698	1239
	%	41.4	29.5	42.6	31.8	42.0	30.7
Moderate	N	341	404	337	394	678	798
	%	17.0	20.1	16.6	19.4	16.8	19.7
Severe	N	86	262	67	230	153	492
	%	4.3	13.1	3.3	11.3	3.8	12.2

Analyses of the nutritional status by height indicators are presented in Tables 9 to 14. These analyses were carried out on a sample of 2129 children (50.3% boys and 49.7% girls), who had their height assessed at the time of admission.

b) Weight-for-height

Most of the children presented an adequate weight in relation to their height at the time of admission, irrespective of their age (Table 9) and sex (Tables 10 and 11).

Table 9 shows the children (both sexes) at different ages of admission to the programme. In this group, 76.7% had a normal weight-for-height, 17.8% had mild deficits and only 5.6% were wasted (80% weight-for-height).

The proportion of children who were normal at admission fell after 9 months of age and increased again from 30 months of age.

The chi-square test shows a significant level of dependency between age at the time of admission and degree of deficit ($\chi^2 = 44.9$, d.f. = 18,* $p < 0.001$), for both sexes combined.

The significance of this value was slightly higher in girls ($\chi^2 = 33.71$, d.f. = 18, $.025 > P < .05$) than in boys ($\chi^2 = 29.82$, d.f. = 18, $.01 > P < .025$).

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* The last two columns were grouped for the calculations.

Table 9. Number and percentage of children (both sexes) at different ages of admission to the programme, according to their percent of standard weight for height.

	Percentage of Standard								
Age	> 90		90 - 81		80 - 71		< 70		Total
(months)	N	%	N	%	N	%	N	%	N
6 - 8.99	478	83.3	70	12.2	17	3.0	9	1.6	574
9 - 11.99	256	70.9	72	19.9	26	7.2	7	1.9	361
12 - 14.99	170	74.2	49	21.4	7	3.1	3	1.3	229
15 - 17.99	112	72.3	29	18.7	11	7.1	3	1.9	155
18 - 20.99	104	72.2	32	22.2	5	3.5	3	2.1	144
21 - 23.99	113	76.9	27	18.4	6	4.1	1	0.7	147
24 - 26.99	106	75.2	27	19.1	6	4.3	2	1.4	141
27 - 29.99	77	68.8	31	27.7	2	1.8	2	1.8	112
30 - 32.99	93	81.6	16	14.0	5	4.4	-	-	114
33 - 36.00	122	80.3	25	16.4	5	3.3	-	-	152
Total	1631	76.6	378	17.8	90	4.2	30	1.4	2129

* NCHS (40)

No significant difference was found in the nutritional status (ages combined) between boys and girls (Tables 10 and 11).

c) Height-for-age

The nutritional status at admission in terms of height-for-age is presented in Tables 12 to 14.

In this group of children (both sexes), 40.7% had adequate height-for-age irrespective of their age. Mild retardation (95 - 90% of the standard) was found in 31.8%, moderate retardation in 17% and severe retardation in 10.5% of the total group. Thus, 27.5% of the whole group would be classified as stunted (height-for-age less than 90% of the reference median).

When the differences in prevalence by age groups were examined, it was shown that the height of younger children were less affected. From the group aged 6 to 9 months at the time of admission, 60.5% had an adequate height-for-age, whereas in the oldest group this proportion was only 24.3%. This was also confirmed by the severely retarded category, where a prevalence of 2.6% was found in the youngest group and 17% in the oldest group. In terms of ratio, severe height retardation was almost seven times commoner in the oldest children when compared with the youngest.

There were no significant differences in height-for-age between boys and girls (Tables 13 and 14).

Table 10. Number and percentage of boys at different ages of admission to the programme, according to their percent of standard weight for height.

Age (months)	Percentage of Standard								Total
	> 90		90 - 81		80 - 71		< 70		
	N	%	N	%	N	%	N	%	N
6 - 8.99	256	85.0	35	11.6	7	2.3	3	1.0	301
9 - 11.99	141	74.2	33	17.4	13	6.8	3	1.6	190
12 - 14.99	81	73.0	24	21.6	5	4.5	1	0.9	111
15 - 17.99	60	81.1	7	9.5	6	8.1	1	1.4	74
18 - 20.99	49	73.1	13	19.4	3	4.5	2	3.0	67
21 - 23.99	56	74.1	16	21.3	3	4.0	-	-	75
24 - 26.99	55	72.4	14	18.4	6	7.9	1	1.3	76
27 - 29.99	36	67.9	14	26.4	1	1.9	2	3.8	53
30 - 32.99	41	82.0	8	16.0	1	2.0	-	-	50
33 - 36.00	60	82.2	11	15.1	2	2.7	-	-	73
Total	835	78.0	175	16.4	47	4.4	13	1.2	1070

* NCHS (40)

Table 11. Number and percentage of girls at different ages of admission to the programme, according to their percent of standard weight for height.

Age (months)	Percentage of Standard > 90 N	%	90 - 81 N	%	80 - 71 N	%	< 70 N	%	Total N
6 - 8.99	222	81.3	35	12.8	10	3.7	6	2.2	273
9 - 11.99	115	67.3	39	22.8	13	7.6	4	2.3	171
12 - 14.99	89	75.4	25	21.2	2	1.7	2	1.7	118
15 - 17.99	52	64.2	22	27.2	5	6.2	2	2.5	81
18 - 20.99	55	71.4	19	24.7	2	2.6	1	1.3	77
21 - 23.99	57	79.4	11	15.3	3	4.2	1	1.4	72
24 - 26.99	51	78.4	13	20.0	-	-	1	1.5	65
27 - 29.99	41	69.5	17	28.8	1	1.7	-	-	59
30 - 32.99	52	81.3	8	12.5	4	6.3	-	-	64
33 - 36.00	62	78.5	14	17.7	3	3.8	-	-	79
Total	796	75.2	203	19.2	43	4.1	17	1.6	1059

* NCHS (40)

The chi-square test showed highly significant levels of dependency between age distribution and height-for-age in the group as a whole ($\chi^2 = 277.0$, d.f. = 27, $P < 0.001$), and in the two sexes separately ($\chi^2 = 161.25$, d.f. = 27, $P < 0.001$, for boys and $\chi^2 = 145.0$, d.f. = 27, $P < 0.001$ for girls).

The number and proportion of children below conventional cut-off points for the three indicators at different ages of admission are presented in Table 15.

Cut-off points to determine the prevalence of malnutrition according to weight-for-age have been defined as below 90% or below 80% of the standard.

Below the 80% level, 31.9% of the total group of children were classified as malnourished, whereas at the 90% level the prevalence almost doubled to 62.6%. Malnutriton defined as either 80% or 90% of the standard Weight-for-age, showed the lowest proportion in the youngest group (8 - 12 months of age) and the highest in the group aged 18 to 24 months.

Weight-for-height deficits were found in only 5.6% of the children. Clearly the proportion of wasted children decreased with increasing age at admission. Conversely the proportion of children stunted tended to increase with increasing age at the time of admission. Retardation in height was found in about 40% of the children aged between 18 to 36 months at the time of admission.

Table 12. Number and percentage of children (both sexes) at different ages of admission to the programme, according to the percent of standard height for age.

Age	Percentage of Standard								Total
	> 95		95-90		90-85		< 85		
(months)	N	%	N	%	N	%	N	%	N
6 - 8.99	347	60.5	154	26.8	58	10.1	15	2.6	574
9 - 11.99	174	48.2	112	31.0	50	13.9	25	6.9	361
12 - 14.99	89	38.9	86	37.6	36	15.7	18	7.9	229
15 - 17.99	50	32.3	62	40.0	29	18.7	14	9.0	155
18 - 20.99	39	27.1	48	33.3	26	18.1	31	21.5	144
21 - 23.99	25	17.0	48	32.7	41	27.9	33	22.4	147
24 - 26.99	37	26.2	42	29.8	42	29.8	20	14.2	141
27 - 29.99	40	35.7	30	26.8	25	22.3	17	15.2	112
30 - 32.99	29	25.4	42	36.8	18	15.8	25	21.9	114
33 - 36.00	37	24.3	52	34.2	37	24.3	26	17.1	152
Total	867	40.7	676	31.8	362	17.0	224	10.5	2129

* NCHS (40)

Table 13. Number and percentage of boys at different ages of admission to the programmes, according to their percent of standard height for age.

Age (months)	Percentage of Standard > 95 N	%	95 - 90 N	%	90 - 85 N	%	< 85 N	%	Total N
6 - 8.99	175	64.1	64	23.4	29	10.6	5	1.8	273
9 - 11.99	86	50.3	53	31.0	23	13.5	9	5.3	171
12 - 14.99	49	41.5	46	39.0	18	15.3	5	4.2	118
15 - 17.99	31	38.3	30	37.0	12	14.8	8	9.9	81
18 - 20.99	19	24.7	25	32.5	19	24.7	14	18.2	77
21 - 23.99	11	15.3	20	27.8	24	33.3	17	23.6	72
24 - 26.99	16	24.6	21	32.3	18	27.7	10	15.4	65
27 - 29.9	20	33.9	17	28.8	15	25.4	7	11.9	59
30 - 32.99	17	26.6	27	42.2	9	14.1	11	17.2	64
33 - 36.00	23	29.1	28	35.4	16	20.3	12	15.2	79
Total	447	42.2	331	31.3	183	17.3	98	9.3	1059

* NCHS (40)

Table 14. Number and percentage of girls at different ages of admission according to their percent of standard height for age.

Age (months)	Percentage of Standard								Total
	> 95		95 - 90		90 - 85		< 85		
	N	%	N	%	N	%	N	%	N
6 - 8.99	172	57.1	90	29.9	29	9.6	10	3.3	301
9 - 11.99	88	46.3	59	31.1	27	14.2	16	8.4	190
12 - 14.99	40	36.0	40	36.0	18	16.2	13	11.7	111
15 - 17.99	19	25.7	32	43.2	17	23.0	6	8.1	74
18 - 20.99	20	29.9	23	34.3	7	10.4	17	25.4	67
21 - 23.99	14	18.7	28	37.3	17	22.7	16	21.3	75
24 - 26.99	21	27.6	21	27.6	24	31.6	10	13.2	76
27 - 29.99	20	37.7	13	24.5	10	18.9	10	18.9	53
30 - 32.99	12	24.0	15	30.0	9	18.0	14	28.0	50
33 - 36.00	14	19.2	24	32.9	21	28.8	14	19.2	73
Total	420	39.3	345	32.2	179	16.7	126	11.8	1070

* NCHS (40)

d) Waterlow Classification

The type of malnutrition found at the time of admission was also identified by the Waterlow classification. The nutritional status was analysed in the whole sample (ages combined) (Table 16) as well as in three age groups (Tables 17 to 19). The tables show the sexes combined, but the results have been calculated according to the appropriate reference for each sex and exact age.

The cut-off points between "normal" and "malnourished" are taken as 80% for wasting and 90% for stunting.

The nutritional status of 68.8% of the children was acceptable at the time of admission.

A quarter of the children showed chronic malnutrition (stunted but not wasted), 3.6% acute malnutrition (wasted but not stunted) and only 1.8% acute plus chronic malnutrition (wasted and stunted). Similar proportions were observed for boys and girls analysed separately (Appendix III).

The variations in acuteness and chronicity of malnutrition according to the age of the children is analysed in Tables 17 to 19.

Table 17 shows the finding in the children aged between 6 to 12 months at the time of admission. Most of the children in this age group (79%) had an acceptable nutritional status at admission. Of the remainder, a considerably higher proportion had deficit in height (15.3%)

than in weight (4.9%). Combined forms, wasting and stunting were found in only 1% of the children.

The prevalence of the different types of malnutrition in children aged from 12 to 24 months at the time of admission, present a different pattern (Table 18). The general nutritional state of this age group was worse than in the younger age group. As we can observe from this table, 59.6% of the children could be classified as having an acceptable nutritional status at the time of admission, which is 19.4% less than in the younger group. Furthermore, stunting (34.5%) and severe forms of wasting plus stunting (2.4%), were twice as frequent in this age group. However, the proportion of wasted children (3.6%) was found to be slightly lower.

The third age group, formed for thoseadmitted between 24 to 36 months of age, presented similar prevalences to the group aged 12 to 24 months (Table 19). From this age group 59.2% of the children were found to have an acceptable nutritional status at admission. A small increase was observed in the proportion of stunted (36.5%) and wasted plus stunted children (3.2%). The proportion of those who were wasted in this age group (1.2%) was three times lower than in the second age group.

In summary, it was observed by these classifications that the proportions of children who were normal decrease with increasing age at the time of admission. Acute malnutrition (wasting) affected mainly the youngest age group, and its prevalence decreases with the increasing

Table 15. Number and proportion of children below the conventional cut-off points for three indicators, by age of admission in to the programme.

Age (months)	Total number	weight for age				Total number	weight/height		height/age	
		< 80%		< 90%			< 80%		< 90%	
		N	%	N	%		N	%	N	%
6 - 11.99	1644	404	24.6	822	50.0	935	59	6.3	148	15.8
12 - 17.99	744	263	35.3	514	69.1	384	24	6.2	97	25.3
18 - 23.99	580	231	39.8	426	73.4	291	15	5.1	131	45.0
24 - 29.99	537	202	37.6	384	71.5	253	12	4.7	104	41.1
30 - 36.00	536	190	35.4	383	71.4	266	10	3.8	106	39.8
Total	4041	1290	31.9	2529	62.6	2129	120	5.6	586	27.5

Table 16. Number and percentage of children aged between 6 to 36 months at admission, according to their nutritional status Waterlow classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total
		0	1	2	3	N
		% of expected weight for height				%
		>90%	90 - 80%	80 - 70%	<70%	
0	>90%	644 * (30.2)	165 (7.8)	37 (1.7)	21 (1.0)	867 (40.7)
1	95-90%	545 (25.6)	110 (5.2)	18 (0.8)	3 (0.1)	676 (31.8)
2	90-85%	282 (13.2)	60 (2.8)	17 (0.8)	3 (0.1)	362 (17.0)
3	< 85%	166 (7.8)	38 (1.8)	17 (0.8)	3 (0.1)	224 (10.5)
Total	n %	1637 (76.9)	373 (17.5)	89 (4.2)	30 (1.4)	2129 (100.0)

* Figures in brackets are % of whole sample.

Table 17. Number and percentages of children aged 6 to 12 months at admission according to their nutritional status, Waterlow Classification.

Grade of stunting	% expected ht/age	Grade of wasting 0	1	2	3	Total
		% expected wt/ht				N
		> 90%	90-80%	80-70%	< 70%	%
0	> 95%	429 (41.9)	100 (9.8)	24 (2.3)	14 (1.4)	567 (55.3)
1	95 - 90%	243 (23.7)	37 (3.6)	10 (1.0)	2 (0.2)	292 (28.5)
2	90 - 85%	98 (9.6)	17 (1.7)	6 (0.6)	1 (0.1)	122 (11.9)
3	< 85%	32 (3.1)	9 (0.9)	3 (0.3)	- -	44 (4.3)
Total	N	802	163	43	17	1025
	%	(78.2)	(15.9)	(4.2)	(1.7)	(100.0)

Table 18. Number and percentages of children aged 12 to 24 months at admission according to their nutritional status, Waterlow Classification.

Grade of stunting	% expected ht/age	Grade of wasting				Total
		0	1	2	3	N
		% expected wt/ht				%
		> 90%	90-80%	80-70%	< 70%	
0	> 95%	117	34	11	6	168
		(18.5)	(5.4)	(1.7)	(0.9)	(26.5)
1	95 - 90%	180	46	5	1	232
		(28.4)	(7.3)	(0.8)	(0.2)	(36.6)
2	90 - 85%	106	23	5	-	134
		(16.7)	(3.6)	(0.8)	-	(21.1)
3	< 85%	74	16	8	2	100)
		(11.7)	(2.5)	(1.3)	(0.3)	(15.8)
Total	N	477	119	29	9	634
	%	(75.2)	(18.8)	(4.6)	(1.4)	(100.0)

Table 19. Number and percentages of children aged 24 to 36 months at admission according to their nutritional status, Waterlow Classification.

Grade of stunting	% expected ht/age	Grade of wasting				Total
		0	1	2	3	
		% expected wt/ht				N
		> 90%	90-80%	80-70%	< 70%	%
0	> 95%	98 (20.9)	31 (6.6)	2 (0.4)	1 (0.2)	132 (28.1)
1	95 - 90%	122 (26.0)	27 (5.7)	3 (0.6)	- -	152 (32.3)
2	90 - 85%	78 (16.6)	20 (4.3)	6 (1.3)	2 (0.4)	106 (22.6)
3	< 85%	60 (12.8)	13 (2.8)	6 (1.3)	1 (0.2)	80 (17.0)
Total	N %	358 (76.2)	91 (19.4)	17 (3.6)	4 (0.9)	470 (100.0)

age of the children.

The proportion of stunting, and wasting plus stunting, increases with the increasing age of the children, the main increase being between the first and the second year of life.

Action Diagram

The Waterlow classification has been designed for epidemiological purposes, to be used as an aid for the definition of priorities and actions to be undertaken by an intervention.

The children from this study were classified by specific age groups according to the kind of action required at the time of admission to the programme.

Children who are above both cut-off points are classified as being of an acceptable nutritional status, and therefore, needing NO ACTION.

The children in the ACTION group are those who are wasted (< 80% weight-for-height standard). If they are also stunted, experience shows that they have a higher mortality risk (20).

The children who are classified as ?ACTION are those who are stunted only, and the reason for this ? is that we do not know which action if any, is indicated.

Table 20 shows that 68.8% of the children required NO ACTION, 3.7% ACTION, 25.6% ? ACTION and 1.9% PRIORITY, at the time of admission.

Table 20. Action diagram for children according to their nutritional status (Waterlow classification) by age of admission to the programme.

	NUTRITIONAL STATUS							
	W* 0 + 1		W 2 + 3		W 0 + 1		W 2 + 3	
Age	S* 0 + 1		S 0 + 1		S 2 + 3		S 2 + 3	
(months)	N	%	N	%	N	%	N	%
6 - 11.99	809	79.0	50	4.9	156	15.2	10	1.0
12 - 23.99	377	59.5	23	3.6	219	34.5	15	2.4
24 - 36.00	278	59.1	6	1.3	171	36.4	15	3.2
TOTAL	1464	68.8	79	3.7	546	25.6	40	1.9
	NO ACTION		ACTION		ACTION ?		PRIORITY	

* W= wasting.

* S= stunting.

0, 1, 2, 3 refer to the grades of malnutrition (see table 16).

Considering the age of these children this diagram shows children below two years of age requiring considerably more immediate action than older children. The proportions of children who required possible action and those who required priority action, increased with age.

1.2.3 Centile Distribution

Another way of analysing nutritional status is by centile distribution. However, the centile method has not been frequently used for assessment in intervention programmes because it involves the preparation of standard graphs and interpolation for centile values which would be more tedious than simply expressing each value as a percentage of the standard.

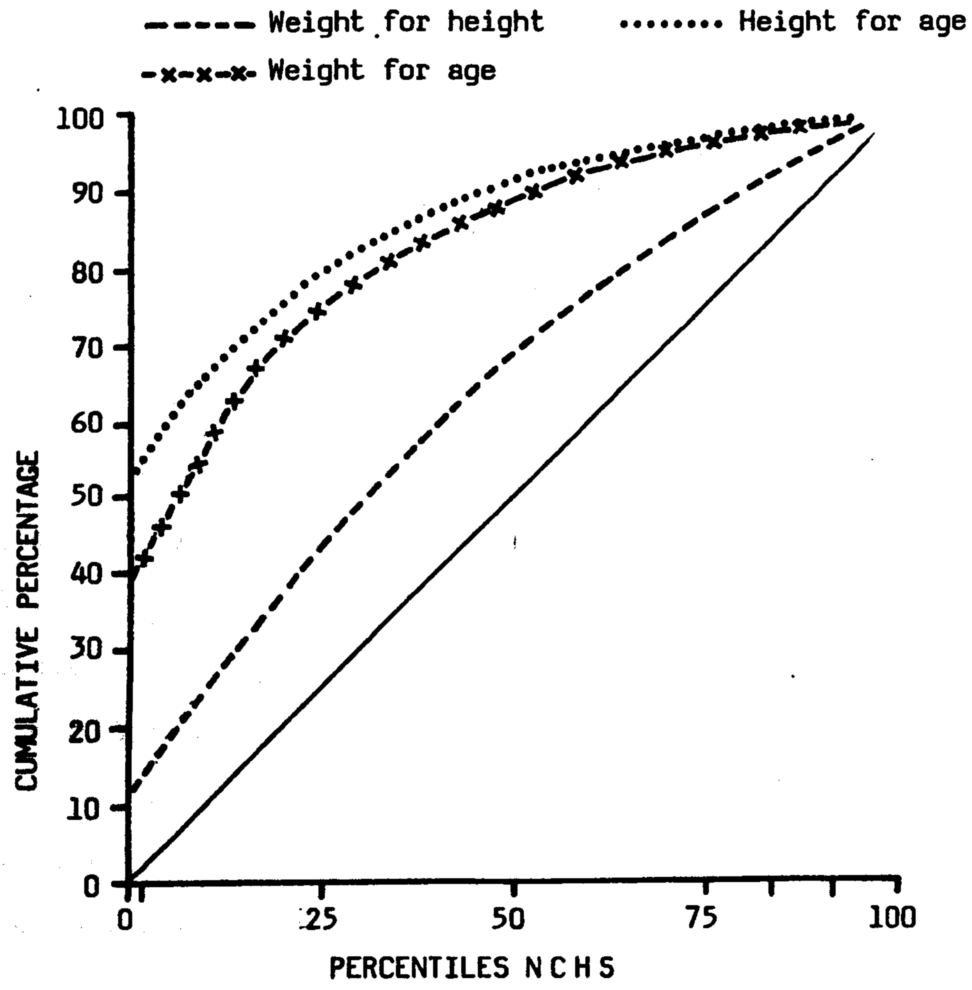
In this analysis a simple approach to centile methods is presented: firstly, as a frequency distribution of children at the standard centiles, and secondly in terms of decile distribution histograms.

Figure 7 displays a set of curves of the cumulative distribution of children according to centile of standard weight-for-age, weight-for-height and height-for-age. Basically they confirm the findings previously described by the percentage methods. The reference would be described by a line at 45° to the axes.

The curve showing weight-for-age runs almost parallel below the one of height-for-age, overlapping around the 70th centile. The weight-for-height curve

Fig. 7

Cumulative percentage of children aged 6 to 36 months according to standard percentiles for three indicators.



shows an almost linear shape, indicating only a small proportion of deficit. On the other hand, the height-for-age curve shows the greatest proportion of children in the lower centiles.

Figures 8 to 10 consist of a set of histograms which display the proportions of children by age groups according to a standard decile distribution for three anthropometric indicators. The expected standard distribution of 10% per decile has been drawn for reference.

Figure 8 presents weight-for-age decile distribution by age group of the children at admission. Regardless of the age group, the histogram shows a concentration of children at lower deciles. Consequently, lower proportions were observed above the 5th decile. Between the three age groups, the younger children 6 to 12 months of age, showed a better nutritional status, being the closest to the standard.

The older groups show a similar pattern at the lower deciles; however from the 2nd decile onward, the oldest group was clearly more affected.

The decile distribution of weight-for-height (Figure 9) indicates a relative adequacy of this indicator in the children studied. The highest proportion (22.5%) of children in the first decile were found in the group aged 12 to 24 months, while the youngest and the oldest groups had almost the same proportions: 16.5% and 16.4%. About 8% of the youngest children were found in the deciles between the 1st and the 6th decile, after which the proportions increased to become close to the standard. Up to the 5th decile the group aged between 12 to 24 months showed proportions closer to the standard.

From the 1st to the 5th decile the oldest group showed higher deficits in weight-for-height than the other two age groups. After that the deficits were less in those age groups.

Figure 10 shows an excess of children whose height-for-age lies in the lower ranges of the standard. It is clearly shown by this figure that severe retardation affected more of the children older than 12 months of age. The highest proportion of children above the 5th decile (23.1%) was found in the youngest group.

This analysis has shown a large concentration of children in the lower deciles for all three anthropometric indicators.

A complete set of tables containing separate data by sex and age at the time of admission for each anthropometric indicator has been included in Appendix IV.

1.2.4 Standard Deviation Scores

The third method used to classify the nutritional status of children is the standard deviation score (Tables 21 to 22).

The calculations of each child's appropriate SD-SCORE for the different indicators has been carried out by computer, through a set of sub-routines provided by

NCHS/CDC (17).

Normality has been defined by a cut-off point of -2 SD above the reference median.

Table 21 shows the SD-score for weight-for-age of children at admission by sex. The majority of the children's weights for age were above 2 SD-scores of the reference.

In general the boys seemed more affected by weight deficits than the girls.

Tables 22 and 23 show a combined cross-tabulation of weight-for-height and height-for-age adapted from the Waterlow classification (102).

The upper left quadrant of this table represents those children considered normal in terms of the NCHS/CDC reference. The upper right quadrant shows the percentage of children who are stunted, but not wasted. The lower left represents those who are wasted, but within normal limits of height-for-age. The lower right quadrant represents those children with the most severe nutritional problem: both wasting and stunting.

Table 22 shows that out of the 92.6% children whose weight-for-height SD-score was normal, 40.0% had height-for-age deficits. Severe wasting plus stunting was found in only 0.9% of the children.

The proportions of children by sex are presented in Table 23 in terms of percentages of the total sample for each sex.

Fig. 8

Weight for age decile distribution presented by the children according to their age at admission.

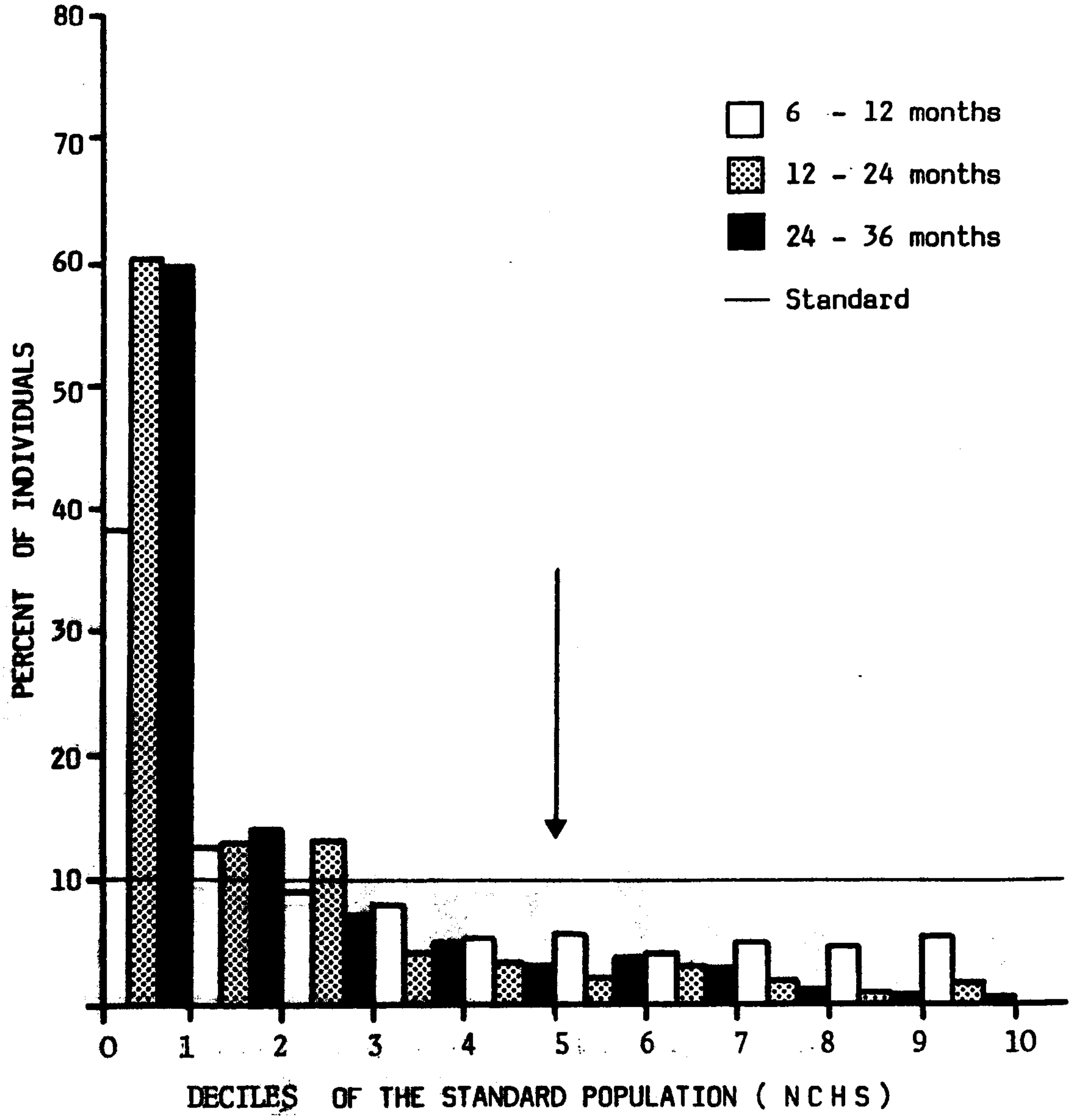


Fig. 9

Weight for height decile distribution presented by the children according to their age at admission.

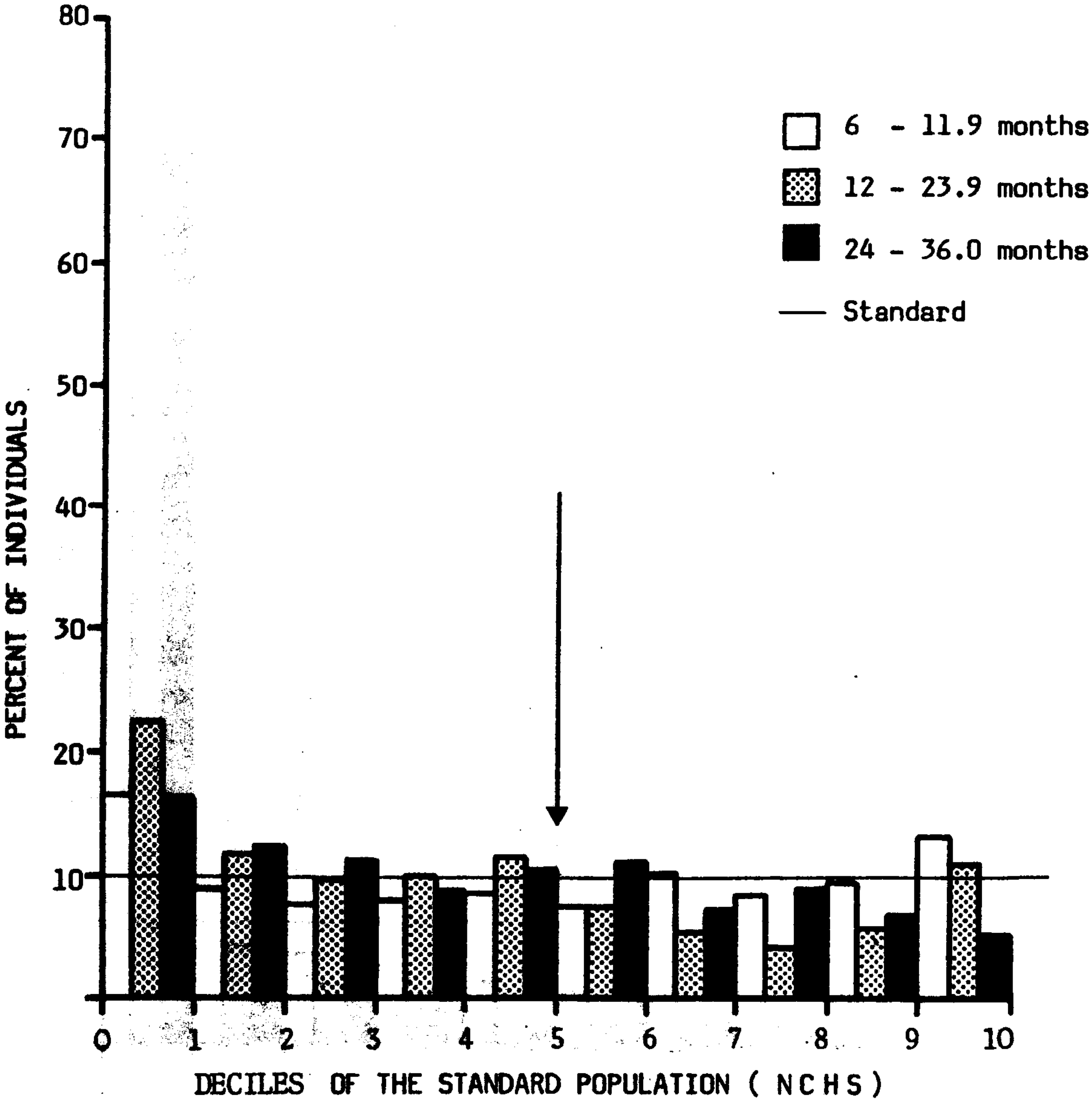


Fig. 10

Height for age decile distribution presented by children according to their age at admission.

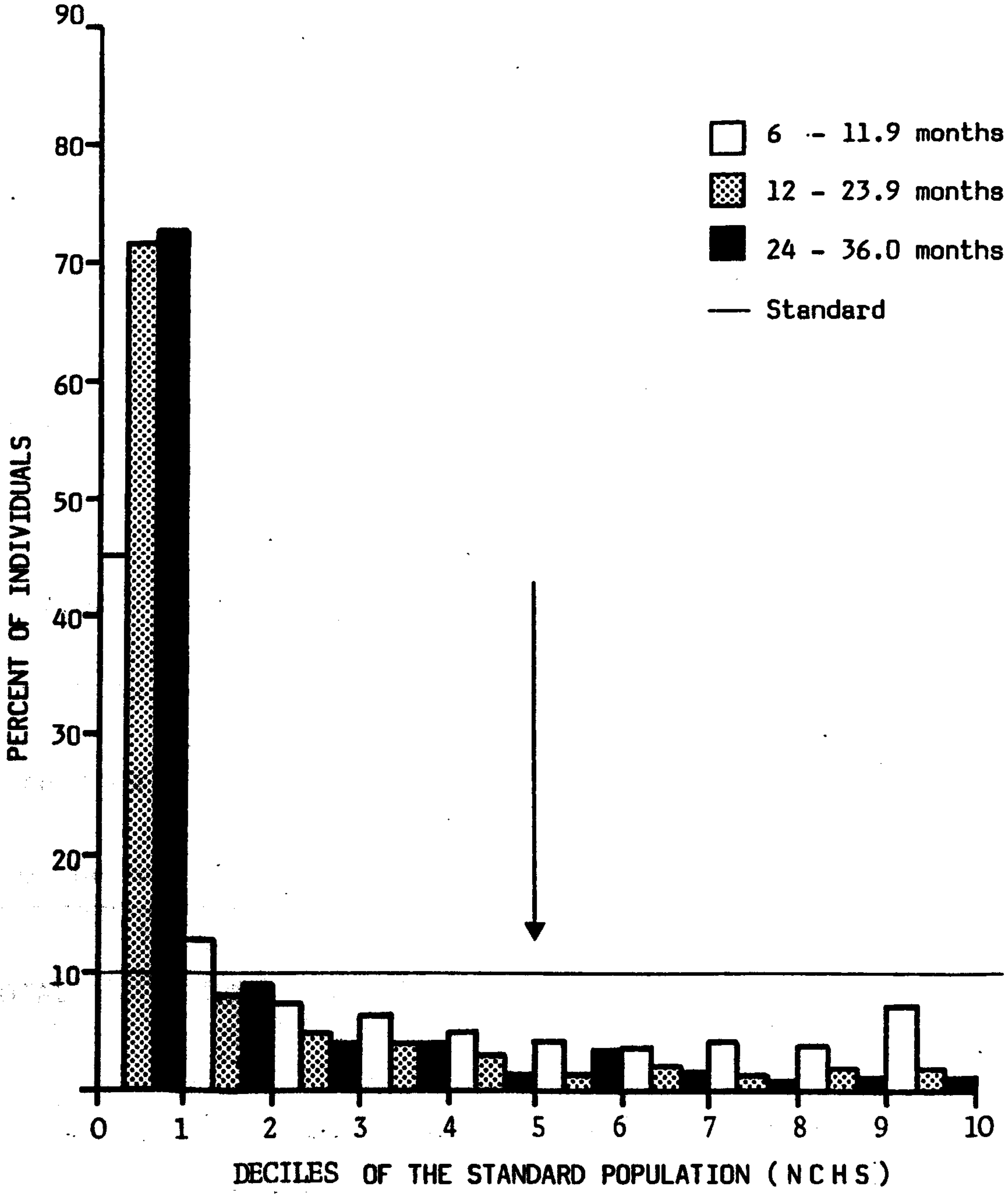


Table 21. Distribution of Stardand Deviation scores of weight for age in children aged 6 to 36 months at admission, by sex.

Weight for age	BOYS		GIRLS		BOTH SEXES	
SD scores	N	%	N	%	N	%
Above -2.00	1389	69.2	1482	72.9	2871	71.0
-2.00 to 2.49	216	10.8	224	11.0	440	10.9
-2.50 to 2.99	179	8.9	147	7.2	326	8.1
-3,00 or below	224	11.1	180	8.9	404	10.0
TOTAL	2008	100.0	2033	100.0	4041	100.0

Table 22. Distribution of Standard Deviation scores of height for age and weight for height in children aged 6 to 36 months at admission to the programme.

Weight for height SD scores	Height for Age SD Scores above -2.00	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below	TOTAL N %
above -2.00	1120 (52.6)	435 (20.4)	220 (10.3)	197 (9.3)	1972 (92.6)
-2.00 to -2.49	41 (1.9)	17 (0.8)	8 (0.4)	7 (0.3)	73 (3.4)
-2.50 to -2.99	16 (0.8)	6 (0.3)	7 (0.3)	8 (0.4)	37 (1.7)
-3.00 and below	37 (1.7)	5 (0.2)	1 (0.0)	4 (0.2)	47 (2.2)
TOTAL N	1214	463	236	216	2129
TOTAL %	57.0	21.7	11.1	10.1	100.0

Figures in bracket are percentage of the total sample.

Table 23. Percentage distribution of Standard Deviation-scores of height for age and weight for height in children aged 6 to 36 months at admission to the programme by sex.

Weight for height SD-scores	Sex	Height for age, SD scores				Total %
		above -2.00	-2.00 to -2.99	-3.00 to -3.99	4.00 & below	
above -2.00	Boys	50.8	20.1	10.7	10.6	92.1
	Girls	54.4	20.8	10.0	7.9	93.1
-2.00 to -2.49	Boys	1.9	1.1	0.4	0.7	4.0
	Girls	2.0	0.5	0.4	-	2.8
-2.50 to -2.99	Boys	0.7	0.3	0.2	0.4	1.5
	Girls	0.8	0.3	0.5	0.4	2.0
-3.00 and below	Boys	1.6	0.4	0.1	0.3	2.3
	Girls	1.9	0.1	-	0.1	2.1
TOTAL %	Boys	55.0	21.9	11.3	11.9	100.0
	Girls	59.1	21.6	10.9	8.4	100.0

The proportion of severely stunted but not wasted boys (11.3%) was higher than that of the girls (7.9%). Except in this category, no significant differences were observed between boys and girls.

1.3 SUMMARY OF FINDINGS AT THE TIME OF ADMISSION

1.3.1 Comparison of Methods of Analysis

A summary of the percentage of children diagnosed as malnourished, wasted or stunted by three indicators is presented in Table 24 for three methods of analysis. As can be observed in this table there was a marked difference in the proportions of malnourished children when different methods of analysis were employed.

The percentage method and the SD score give similar values for the proportion of children with deficits in weight-for-age, or weight-for-height, according to the cut-off points chosen. When the 5th centile is taken as a cut-off point, the proportions with deficits are higher. The 3rd centile, which is quite often used, might give a better fit.

The prevalence of deficits in height-for-age shows a different pattern with the three methods of analysis. The SD score gives a much lower proportion of stunted children than the percentage method. If the diagnosis of deficits is based on statistical grounds,

Table 24. Percentage of children diagnosed as malnourished, wasted or stunted by three anthropometric indicators and three methods of analysis. Cut-off points as shown. Results from both sexes and all ages combined.

	Weight for age % malnourished	Weight for height % wasted	Height for age % stunted
Less than 80% of reference median	31.9	5.6	-
Less than 90% of reference median	-	-	27.5
Below 5th Centile	39.2	11.2	52.0
SD Score -2 or below	29.0	7.3	42.9

i.e. represents children outside the "normal" range by conventional statistical criteria, then clearly the SD score is more appropriate, and the cut-off point of 90% used in the percentage method is unrealistically low .

1.3.2 Overall Conclusions

The findings presented in this section show that of the group of some 4,000 children as a whole, about 2/3 could be considered adequately nourished when they were admitted to the programme.

Deficits in weight-for-height (wasting) were commonest in the younger children. The prevalence of deficits in height-for-age (stunting) increased with increasing age at the time of admission. Deficits in weight-for-age followed closely those in height for age.

Part of this exercise has been to compare three methods of analysing the results given by anthropometric indicators: percentage deficit below reference median; centiles of the reference; and standard deviation score.

The proportion of children diagnosed as malnourished will depend, for each indicator, on the cut-off point chosen and on the method of analysis. From the statistical point of view the SD score would seem to be the method of choice, because the cut-off points (-2 SD) are less arbitrary.

2 CONDITION OF THE CHILDREN AT THE TIME OF DISCHARGE FROM THE PROGRAMME

The age range of the children at the time of discharge varied from 12 to 84 months of age, presenting a mean age of 40.3 ± 15.6 months for the whole sample. Similar means were found for boys (39.8 ± 15.5 months) and girls (40.8 ± 15.7 months).

The age distribution of the children at the time of discharge according to sex is presented in Table 25. It was observed that 54.8% of the children were discharged at ages below 42 months. There was almost the same proportion of boys and girls in the different age groups, except for a slightly higher proportion of girls leaving the programme at older ages.

2.1 PERIOD OF SUPPLEMENTATION

The children at the time of discharge had received supplementation for a minimum period of 6 months and a maximum of 48 months.

The period of supplementation in months corresponds to the number of supplements received by a child.

The mean period of supplementation for the group was 24.2 ± 11.6 months, being similar for boys (23.9 ± 11.4 months) and girls (24.4 ± 11.7 months).

The 1644 children admitted to the programme from 6 to 12 months of age had received supplementation for a

Table 25. Number and percentage of children according to their sex and age at discharge.

Age at discharge (months)	BOYS		GIRLS		BOTH SEXES		Cumulative
	N	%	N	%	N	%	%
12 - 17.99	110	5.5	104	5.1	214	5.3	-
18 - 23.99	244	12.2	232	11.4	476	11.8	17.1
24 - 29.99	241	12.0	220	10.8	461	11.4	28.5
30 - 35.99	276	13.7	266	13.1	542	13.4	41.9
36 - 41.99	253	12.6	270	13.3	523	12.9	54.8
42 - 47.99	266	13.2	262	12.9	528	13.1	67.9
48 - 53.99	206	10.3	214	10.5	420	10.4	78.3
54 - 59.99	157	7.8	181	8.9	338	8.4	86.7
60 - 65.99	121	6.0	137	6.7	258	6.4	93.1
66 - 84.00	134	6.7	147	7.2	281	7.0	100.0
TOTAL	2008	49.7	2033	50.3	4041	100.0	

Column percentages.

mean period of 22.1 ± 11.7 months. The 2397 children who were admitted at ages from 12 to 36 months, had received supplementation for a mean period of 25.6 ± 11.3 months.

The "t" test showed a significant difference between the mean periods of supplementation in these two age groups ($t = -9.58$, $P < 0.001$).

No differences were found between the children who started supplementation from 12 to 24 months and from 24 to 36 months.

Table 26 shows the number and proportion of children according to their age at the time of discharge by period of supplementation.

The period of supplementation has been stratified in intervals of 6 months. It is observed from this table that half the children had been supplemented for periods ranging from 6 to 23 months, and half between 24 to 48 months. Of the children who were discharged between 12 to 18 months of age, 94.4% had received from 6 to 11 supplements. Of those between 18 to 36 months, 69.0% (643/937) had received 12 or more supplements. Of those aged from 30 to 84 months at discharge, 70% had received more than 24 supplements.

2.2 NUTRITIONAL STATUS OF CHILDREN AT THE TIME OF DISCHARGE - ANTHROPOMETRIC ANALYSES

The nutritional status of the children at the time

Table 26. Number and percentage of children according to their age at discharge by period of supplementation.

Age at discharge	PERIOD OF SUPPLEMENTATION (months)														
	6 to 11		12 to 17		18 to 23		24 to 29		30 to 35		36 to 41		42 to 48		Total
(months)	N	% *	N	%	N	%	N	%	N	%	N	%	N	%	N
12 - 17.99	202	94.4	12	5.6	-	-	-	-	-	-	-	-	-	-	214
18 - 23.99	215	45.2	251	52.7	10	2.1	-	-	-	-	-	-	-	-	476
24 - 29.99	79	17.1	171	37.1	206	44.7	5	1.1	-	-	-	-	-	-	461
30 - 35.99	64	11.8	86	15.9	158	29.2	229	42.3	5	0.9	-	-	-	-	542
36 - 41.99	69	13.2	79	15.1	97	18.5	168	32.1	107	20.5	3	0.6	-	-	523
42 - 47.99	41	7.8	69	13.1	82	15.5	140	26.5	102	19.3	90	17.0	4	0.8	528
48 - 53.99	-	-	30	7.1	61	14.5	119	28.3	84	20.0	79	18.8	47	11.2	420
54 - 59.99	-	-	-	-	31	9.2	100	29.6	72	21.3	80	23.7	55	16.3	338
60 - 65.99	-	-	-	-	-	-	45	17.4	71	27.5	92	35.7	50	19.4	258
66 - 84.00	-	-	-	-	-	-	-	-	24	8.5	112	39.9	145	51.6	281
TOTAL	670	16.6**	698	17.2	645	16.0	806	19.9	465	11.5	456	11.3	301	7.4	4041

* Percentage in each row = per cent of children in each age group.

** Percentage in total row = per cent of children in the whole sample.

of discharge is analysed in terms of percentage variation from the standard for three anthropometric indicators in Tables 27 to 38.

2.2.1 Percentage Variations from Reference Median for Single and Combined Indicators

a) Weight-for-age.

The results for both sexes combined and for boys and girls separately are shown in Tables 27 to 29. Fewer than half of the children of both sexes were classified as normal on discharge, and about 12% still had second or third degree malnutrition.

However, the prevalence of moderate and severe forms of malnutrition (< 75% of reference) was reduced by 43% between admission (Table 2) and discharge (Table 27).

The chi-square test showed a significant level of dependency between the age of the children and their weight-for-age at the time of discharge ($\chi^2 = 55.77$, d.f. = 27, $P < 0.001$) (Table 27). The weight-for-age deteriorated with increasing age. No significant differences were found in the nutritional status of boys and girls (Tables 28 and 29).

Tables 30 to 32 similarly show the distribution of children at the time of discharge classified in 10% intervals of deficit in weight-for-age. If 80% of the reference weight-for-age is taken as the cut-off point between "normal" and "malnourished", some 23% of the children were still malnourished at the time of discharge. This proportion, however, represents a reduction of 29% in the prevalence of malnutrition between admission and discharge.

The chi-square test again showed a significant level of dependency between age of the children and variations in weight-for-age at the time of discharge ($\chi^2 = 54.28$, d.f. = 27, $P < 0.005$).

There was no significant difference in the nutritional status of boys and girls at the time of discharge (Tables 31 and 32).

b) Weight-for-height

In terms of weight-for-height, the results appeared to be much more satisfactory (Tables 33 to 35). Nearly 90% of the children at the time of discharge could be classified as normal (> 90% of reference) and only about 1% as malnourished (< 80% of reference). Thus, acute malnutrition (wasting) appears to have been virtually eliminated.

A possible association between age of the children and percentage of the standard weight-for-height was detected by a chi-square test ($\chi^2 = 30.44$, d.f. = 18, $0.025 < P < 0.050$). The association was found to be highly significant in the boys ($\chi^2 = 43.31$, d.f. = 18, $P < 0.001$). In the girls, however, there was no strong evidence of an association

Table 27. Number and percentage of children at discharge according to their percent of standard weight for age, Gomez classification.

Age at discharge (months)	PERCENTAGE OF STANDARD								Total
	> 90%		90 - 75%		75 - 60%		< 60%		
	N	%	N	%	N	%	N	%	N
12 - 17.99	119	55.6	72	33.6	22	10.3	1	0.5	214
18 - 23.99	203	42.6	217	45.6	54	11.3	2	0.4	476
24 - 29.99	219	47.5	191	41.4	46	10.0	5	1.1	461
30 - 35.99	267	49.3	218	40.2	50	9.2	7	1.3	542
36 - 41.99	229	43.8	228	43.6	61	11.7	5	1.0	523
42 - 47.99	223	42.2	246	46.6	50	9.5	9	1.7	528
48 - 53.99	158	37.6	213	50.7	46	11.0	3	0.7	420
54 - 59.99	143	42.3	151	44.7	43	12.7	1	0.3	338
60 - 65.99	90	34.9	135	52.3	32	12.4	1	0.4	258
66 - 84.00	105	37.4	140	49.8	33	11.7	3	1.1	281
TOTAL	1756	43.5	1811	44.8	437	10.8	37	0.9	4041

Table 28. Number and percentage of boys by age at discharge according to their percent of standard weight for age, Gomez classification.

Age at discharge (months)	PERCENTAGE OF STANDARD								Total
	> 90%		90 - 75%		75 - 60%		< 60%		
	N	%	N	%	N	%	N	%	N
12 - 17.99	56	50.9	37	36.6	16	14.5	1	0.9	110
18 - 23.99	95	38.9	116	47.5	31	12.7	2	0.8	244
24 - 29.99	117	48.5	99	41.1	22	9.1	3	1.2	241
30 - 35.99	137	49.6	117	42.4	18	6.5	4	1.4	276
36 - 41.99	111	43.9	116	45.8	23	9.1	3	1.2	253
42 - 47.99	115	43.2	123	46.2	25	9.4	3	1.1	266
48 - 53.99	74	35.9	104	50.5	27	13.1	1	0.5	206
54 - 59.99	53	33.8	79	50.3	24	15.3	1	0.6	157
60 - 65.99	42	34.7	59	48.8	19	15.7	1	0.8	121
66 - 84.00	41	30.6	71	53.0	19	14.2	3	2.2	134
TOTAL	841	41.9	921	45.9	224	11.2	22	1.1	2008

Table 29. Number and percentage of girls by age at discharge according to their percent of standard weight for age, Gomez classification.

Age at discharge	PERCENTAGE OF STANDARD								Total
	> 90%		90 - 75%		75 - 60%		< 60%		
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	63	60.6	35	33.7	6	5.8	-	-	104
18 - 23.99	108	46.6	101	43.5	23	9.9	-	-	232
24 - 29.99	102	46.4	92	41.8	24	10.9	2	0.9	220
30 - 35.99	130	48.9	101	38.0	32	12.0	3	1.1	266
36 - 41.99	118	43.7	112	41.5	38	14.1	2	0.7	270
42 - 47.99	108	41.2	123	46.9	25	9.5	6	2.3	262
48 - 53.99	84	39.3	109	50.9	19	8.9	2	0.9	214
54 - 59.99	90	49.7	72	39.8	19	10.5	-	-	181
60 - 65.99	48	35.0	76	55.5	13	9.5	-	-	137
66 - 84.00	64	43.5	69	46.9	14	9.5	-	-	147
TOTAL	915	45.0	890	43.8	213	10.5	15	0.7	2033

Table 30. Number and percentage of children (both sexes) at discharge, according to their percent of standard weight for age, Jelliffe classification.

Age at discharge	PERCENTAGE OF STANDARD										
	> 90		90 - 81		80-71		70-60		< 60		Total
(months)	N	%	N	%	N	%	N	%	N	%	N
12-17.99	119	55.6	59	27.6	22	10.3	13	6.1	1	0.5	214
18-23.99	203	42.6	168	35.3	84	17.6	19	4.0	2	0.4	476
24-29.99	219	47.5	145	31.5	68	14.8	24	5.2	5	1.1	461
30-35.99	267	49.3	161	29.7	88	16.2	19	3.5	7	1.3	542
36-41.99	229	43.8	175	33.5	84	16.1	30	5.7	5	1.0	523
42-47.99	223	42.2	188	35.6	87	16.5	21	4.0	9	1.7	528
48-53.99	158	37.6	149	35.5	93	22.1	17	4.0	3	0.7	420
54-59.99	143	42.3	122	36.1	56	16.6	16	4.7	1	0.3	338
60-65.99	90	34.9	92	35.7	65	25.2	10	3.9	1	0.4	258
66-84.00	105	37.4	105	37.4	58	20.6	10	3.6	3	1.1	281
TOTAL	1756	43.5	1364	33.8	705	17.4	179	4.4	37	0.9	4041

Table 31. Number and percentage of boys by age at discharge according to their percent of standard weight for age, Jelliffe classification.

Age at discharge	PERCENTAGE OF STANDARD										Total
	> 90		90-80		80-70		70-60		< 60		
(months)	N	%	N	%	N	%	N	%	N	%	
12-17.99	56	50.9	34	30.9	9	8.2	10	9.1	1	0.9	110
18-23.99	95	38.9	86	35.2	48	19.7	13	5.3	2	0.8	244
24-29.99	117	48.5	73	30.3	36	14.9	12	5.0	3	1.2	241
30-35.99	137	49.6	93	33.7	37	13.4	5	1.8	4	1.4	276
36-41.99	111	43.9	88	34.8	40	15.8	11	4.3	3	1.2	253
42-47.99	115	43.2	90	33.8	45	16.9	13	4.9	3	1.1	266
48-53.99	74	35.9	74	35.9	44	21.4	13	6.3	1	0.5	206
54-59.99	53	33.8	61	38.9	33	21.0	9	5.7	1	0.6	157
60-65.99	42	34.7	39	32.2	32	26.4	7	5.8	1	0.8	121
66- 84.00	41	30.6	52	38.8	32	23.9	6	4.5	3	2.2	134
TOTAL	841	41.9	690	34.4	356	17.7	99	4.9	22	1.1	2008

Table 32. Number and percentage of girls by age at discharge according to their percent of standard weight for age, Jelliffe classification.

Age at discharge	PERCENTAGE OF STANDARD										Total
	> 90		90-81		80-71		70-60		< 60		
(months)	N	%	N	%	N	%	N	%	N	%	N
12-17.99	63	60.6	25	24.0	13	12.5	3	2.9	-	-	104
18-23.99	108	46.6	82	35.3	36	15.5	6	2.6	-	-	232
24-29.99	102	46.4	72	32.7	32	14.5	12	5.5	2	0.9	220
30-35.99	130	48.9	68	25.6	51	19.2	14	5.3	3	1.1	266
36-41.99	118	43.7	87	32.2	44	16.3	19	7.0	2	0.7	270
42-47.99	108	41.2	98	37.4	42	16.0	8	3.1	6	2.3	262
48-53.99	84	39.3	75	35.0	49	22.9	4	1.9	2	0.9	214
54-59.99	90	49.7	61	33.7	23	12.7	7	3.9	-	-	181
60-65.99	48	35.0	53	38.7	33	24.1	3	2.2	-	-	137
66-84.00	64	43.5	53	36.1	26	17.7	4	2.7	-	-	147
TOTAL	915	45.0	674	33.2	349	17.2	80	3.9	15	0.7	2033

Table 33. Number and percentage of children (both sexes) at discharge, according to their percent of standard weight for height.

Age at discharge	PERCENTAGE OF STANDARD								
	> 90		90 - 81		80 - 71		< 70		Total
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	176	89.3	16	8.1	3	1.5	2	1.0	197
18 - 23.99	392	90.1	40	9.2	3	0.7	-	-	435
24 - 29.99	360	85.1	50	11.8	13	3.1	-	-	423
30 - 35.99	437	88.6	50	10.1	6	1.2	-	-	493
36 - 41.99	417	90.5	40	8.7	3	0.7	1	0.2	461
42 - 47.99	430	92.1	33	7.1	3	0.6	1	0.2	467
48 - 53.99	352	90.3	35	9.0	2	0.5	1	0.3	390
54 - 59.99	274	89.3	27	8.9	4	1.3	-	-	305
60 - 65.99	213	88.8	25	10.4	2	0.8	-	-	240
66 - 84.00	234	88.6	30	11.4	-	-	-	-	264
TOTAL	3285	89.4	346	9.4	39	1.1	5	0.1	3675

Table 34. Number and percentage of boys by age at discharge according to their percent of standard weight for height.

Age at	PERCENTAGE OF STANDARD								
discharge	> 90		90 - 81		80 - 71		< 70		Total
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	90	89.1	9	8.9	2	2.0	-	-	101
18 - 23.99	202	89.0	24	10.6	1	0.4	-	-	227
24 - 29.99	186	84.6	22	10.0	11	5.0	-	-	219
30 - 35.99	228	91.2	19	7.6	3	1.2	-	-	250
36 - 41.99	196	89.1	24	10.9	-	-	-	-	220
42 - 47.99	219	94.0	11	4.7	2	0.9	1	0.4	233
48 - 53.99	174	89.7	18	9.3	2	1.0	-	-	194
54 - 59.99	127	89.4	13	9.2	2	1.4	-	-	142
60 - 65.99	106	93.8	7	6.2	-	-	-	-	113
66 - 84.00	107	86.3	17	13.7	-	-	-	-	124
TOTAL	1635	89.7	164	9.0	23	1.3	1	0.1	1823

Table 35. Number and percentage of girls by age at discharge according to their percent of standard weight for height.

Age at discharge	PERCENTAGE OF STANDARD								Total
	> 90		90 - 81		80 - 71		< 70		
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	86	89.6	7	7.3	1	1.0	2	2.1	96
18 - 23.99	190	91.3	16	7.7	2	1.0	-	-	208
24 - 29.99	174	85.3	28	13.7	2	1.0	-	-	204
30 - 35.99	209	86.0	31	12.8	3	1.2	-	-	243
36 - 41.99	221	91.7	16	6.6	3	1.2	1	0.4	241
42 - 47.99	211	90.2	22	9.4	1	0.4	-	-	234
48 - 53.99	178	90.8	17	8.7	-	-	1	0.5	196
54 - 59.99	147	90.2	14	8.6	2	1.2	-	-	163
60 - 65.99	107	84.3	18	14.2	2	1.6	-	-	127
66 - 84.00	127	90.7	13	9.3	-	-	-	-	140
TOTAL	1650	89.1	182	9.8	16	0.9	4	0.2	1852

(χ^2 = 21.7, d.f. = 18, P > 0.10).

The nutritional status of boys and girls regardless of age was not significantly different (Tables 34 and 35).

c) Height-for-age

The nutritional status in terms of height-for-age showed a different pattern from that of previous indicators.

Table 36 shows that by the time of discharge the proportion of children who had mild retardation (37.7%) was higher than the proportion of children with a normal height-for-age (33.3%).

Chronic malnutrition, i.e. stunting, was found in 29.1% of the children at discharge.

The data does not show a significant increase in the prevalence of stunting with increasing age. Statistically, however, the ratio of severely stunted (< 85%) to normal children tends to increase with increasing age (χ^2 = 72.43, d.f. = 27, P < 0.001).

The results in boys and girls separately are shown in Tables 37 and 38. They do not differ significantly, nevertheless there is a higher prevalence of stunting in boys (32%) than in girls (26%).

d) Waterlow classification

In addition to the previous analyses the children

Table 36. Number and percentage of children by age at discharge according to their percent of standard height for age.

Age at discharge	PERCENTAGE OF STANDARD								Total
	> 95		95 - 90		90 - 85		< 85		
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	68	34.5	73	37.1	44	22.3	12	6.1	197
18 - 23.99	94	21.6	170	39.0	121	28.0	50	11.5	435
24 - 29.99	159	37.6	146	34.5	89	21.0	29	6.9	423
30 - 35.99	199	40.4	177	35.9	77	15.6	40	8.1	493
36 - 41.99	166	36.0	162	35.1	101	21.9	32	6.9	461
42 - 47.99	152	32.5	196	42.0	83	17.8	36	7.7	467
48 - 53.99	117	30.0	151	38.7	81	20.8	41	10.5	390
54 - 59.99	103	33.3	120	39.3	52	17.0	30	9.8	305
60 - 65.99	79	32.9	83	34.6	54	22.5	24	10.0	240
66 - 84.00	86	32.6	107	40.5	54	20.5	17	6.4	264
TOTAL	1223	33.3	1385	37.7	756	20.6	311	8.5	3675

Table 37. Number and percentage of boys by age at discharge according to their percent of standard heigh for height.

Age at discharge	PERCENTAGE OF STANDARD								Total
	> 95		95 - 90		90 - 85		< 85		
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	33	32.7	33	32.7	27	26.7	8	7.8	101
18 - 23.99	43	18.9	89	39.2	59	26.0	36	15.9	227
24 - 29.99	81	37.0	79	36.1	43	19.6	16	7.3	219
30 - 35.99	103	41.2	94	37.6	34	13.6	19	7.6	250
36 - 41.99	83	37.7	67	30.5	52	23.6	18	8.2	220
42 - 47.99	72	30.9	95	40.8	46	19.7	20	8.6	233
48 - 53.99	51	26.3	70	36.1	46	25.3	24	12.4	194
54 - 59.99	38	26.8	59	41.5	28	19.7	17	12.0	142
60 - 65.99	29	25.7	44	38.9	23	20.4	17	15.0	113
66 - 84.00	37	29.8	43	34.7	32	25.8	12	9.7	124
TOTAL	570	31.3	673	36.9	393	21.6	186	10.3	1823

Table 38. Number and percentage of girls by age at discharge according to their percent of standard height for age.

Age at discharge	PERCENTAGE OF STANDARD								Total
	> 95		95 - 90		90 - 85		< 85		
(months)	N	%	N	%	N	%	N	%	N
12 - 17.99	35	36.5	40	41.7	17	17.7	4	4.2	96
18 - 23.99	51	24.4	81	38.8	62	30.1	14	6.7	208
24 - 29.99	78	38.2	67	32.8	46	22.5	13	6.4	204
30 - 35.99	96	39.5	83	34.2	43	17.7	21	8.6	243
36 - 41.99	83	34.4	95	39.4	49	20.3	14	5.8	241
42 - 47.99	80	34.2	101	43.2	37	15.8	16	6.8	234
48 - 53.99	66	33.7	81	41.3	32	16.3	17	8.7	196
54 - 59.99	65	39.9	61	37.4	24	14.7	13	8.0	163
60 - 65.99	50	39.4	39	30.7	31	24.4	7	5.5	127
66 - 84.00	49	35.0	64	45.7	22	15.7	5	3.6	140
TOTAL	653	35.2	712	38.4	363	19.6	124	6.7	1852

have been classified according to the type of malnutrition at the time of discharge, as defined by the Waterlow classification (Tables 39 to 41).

Table 39 shows that in the group of children (both sexes), 70% were adequately nourished (grade 1 of wasting and stunting) at the time of discharge. Less than 1% were wasted but not stunted, whereas 28.7% were stunted but not wasted. The most severe form of malnutrition (wasting plus stunting) was found in only 0.4% of the children.

Height retardation was commoner in the boys at the time of discharge than in the girls (Tables 40 and 41).

Table 42 shows the nutritional status of the children at the time of discharge (Waterlow classification) ~~aceording~~ according to their sex and the period of supplementation. This table was summarised from Appendix V.

The data shows that in children supplemented for periods longer than 24 months, the proportion of malnutrition was lower.

The longer period of supplementation produced a greater reduction in the proportion of stunting in girls than in boys.

No case of severe malnutrition (wasting plus stunting) was observed in the girls who were supplemented for more than 24 months.

Table 39 Number and percentage of children at discharge, according to their nutritional status, Waterlow classification.

		Grade of wasting				Total
Grade of stunting	% expected height/age	0	1	2	3	N
		% expected wt/ht				%
		> 90%	90-80%	80-70%	< 70%	
0	> 95%	1082	116	20	4	1222
		(29.4)	(3.2)	(0.5)	(0.1)	(33.3)
1	95 - 90%	1261	116	8	-	1385
		(34.3)	(3.2)	(0.2)	-	(37.7)
2	90 - 85%	676	78	3	-	757
		(18.4)	(2.1)	(0.1)	-	(20.6)
3	< 85%	266	36	8	1	311
		(7.2)	(1.0)	(0.2)	(0.1)	(8.5)
TOTAL	N	3285	346	39	5	3675
	%	(89.4)	(9.4)	(1.1)	(0.1)	(100.0)

Table 40 Number and percentage of boys at discharge according to their nutritional status, Waterlow classification.

Grade of stunting	% expected height/age	Grade of wasting 0 % expected wt/ht > 90%	 1 90-80%	 2 80-70%	 3 < 70%	Total N %
0	> 95%	506	53	10	1	570
		(27.8)	(2.9)	(0.5)	(0.1)	(31.3)
1	95 - 90%	620	49	4	-	673
		(34.0)	(2.7)	(0.2)	-	(36.9)
2	90 - 85%	351	41	1	-	393
		(19.3)	(2.2)	(0.1)	-	(21.6)
3	< 85%	158	21	8	-	187
		(8.7)	(1.2)	(0.4)	-	(10.3)
Total	N	1635	164	23	1	1823
	%	(89.7)	(9.0)	(1.3)	(0.1)	(100.0)

Table 41 Number and percentage of girls at discharge according to their nutritional status, Waterlow classification.

		Grade of wasting				
Grade of stunting	% expected height/age	0	1	2	3	Total N
		% expected wt/ht				
		> 90%	90-80%	80-70%	< 70%	%
0	> 95%	576	63	10	3	652
		(31.1)	(3.4)	(0.5)	(0.2)	(35.2)
1	95 - 90%	641	67	4	-	712
		(34.6)	(3.6)	(0.2)	-	(38.4)
2	90 - 85%	325	37	2	-	364
		(17.5)	(2.0)	(0.1)	-	(19.7)
3	< 85%	108	15	-	1	124
		(5.8)	(0.8)	-	(0.1)	(6.7)
Total	N	1650	182	16	4	1852
	%	(89.1)	(9.8)	(0.9)	(0.2)	(100.0)

Table 42. Percentage of children aged 12 to 84 months by sex and period of supplementation according to their nutritional status at discharge from the programme, Waterlow classification. (n = 3675)

Sex	Period of Supplementation	Normal & Mild PEM	Wasted but not stunted	Stunted but not wasted	Wasted & Stunted
Boys	≤ 24	65.7	1.2	32.3	0.8
	> 24	69.1	0.4	30.4	0.2
Girls	≤ 24	69.6	1.2	28.8	0.3
	> 24	75.6	0.6	23.8	-
Both sexes	≤ 24	67.7	1.2	30.6	0.6
	> 24	72.4	0.6	27.0	0.1

2.2.2 Centile Distribution

The nutritional status of the children at the time of discharge is analysed in Table 43 for three anthropometric indicators, in relation to the centile distribution of the standard.

Retardation in height-for-age was very common at the time of discharge. More than half the children were below the 5th centile, and 81% below the 25th centile.

In relation to weight-for-age, 66% of the children were below the 25th centile. However, these children had a fairly adequate centile distribution of weight-for-height, the majority being around the 50th centile.

A detailed set of tables showing the centile distributions of these indicators by age and sex is presented in Appendix VI.

2.2.3 Standard Deviation Scores

The distribution of SD-scores for weight-for-age of children aged between 12 to 84 months at the time of discharge is presented in Table 44. It was found that 19% of the children were more than 2 SD-scores below the reference median weight-for-age, compared with 23% who were below 80% of the median weight-for-age (Table 30). The discrepancy between the two methods of

Table 43. Number and percentage of children at discharge according to standard centiles for three anthropometric indicators.

Percentiles	Weight/age		Weight/height		height/age	
ranges (P)	N	%	N	%	N	%
< 5	1189	29.4	139	3.8	2044	55.6
5 - 10	545	13.5	158	4.3	397	10.8
10 - 25	914	22.6	510	13.9	540	14.7
25 - 50	742	18.4	898	24.4	360	9.8
50 - 75	446	11.0	1085	29.5	204	5.5
75 - 90	142	3.5	523	14.2	73	2.0
90 - 95	27	0.7	153	4.2	17	0.5
95 - 100	36	0.9	209	5.7	40	1.1
Total	4041	100.0	3675	100.0	3675	100.0

Table 44 Distribution of Standard Deviation scores of weight for age in children aged 12 to 84 months at discharge, by sex.

Weight for age	BOYS		GIRLS		BOTH SEXES	
SD scores	N	%	N	%	N	%
Above -2.00	1628	81.1	1647	81.0	3275	81.0
-2.00 - 2.49	198	9.9	219	10.8	417	10.3
-2.50 to 2.99	104	5.2	100	4.9	204	5.0
-3.00 and below	78	3.9	67	3.3	145	3.6
TOTAL	2008	100.0	2033	100.0	4041	100.0

Table 45 Distribution of Standard Deviation scores of height for age and weight for height in children aged 12 to 84 months at discharge from the programme.

Weight for height SD scores	Height for age SD scores				Total
	above -2.00	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below	n %
above -2.00	1993	912	455	240	3600
	(54.2)	(24.8)	(12.4)	(6.5)	(98.0)
-2.00 to -2.49	27	9	5	6	47
	(0.7)	(0.2)	(0.1)	(0.2)	(1.3)
-2.50 to -2.99	12	2	2	1	17
	(0.3)	(0.1)	(0.1)	(0.0)	(0.5)
-3.00 and below	8	1	1	1	11
	(0.2)	(0.0)	(0.0)	(0.0)	(0.3)
Total n	2041	924	463	248	3675
%	(55.5)	(25.1)	(12.6)	(6.7)	(100.0)

Table 46 Percentage distribution of Standard Deviation scores of height for age and weight for height in children aged 12 to 84 months at discharge from the programme, by sex.

Weight for height SD scores	Sex	Height for age SD scores				Total %
		above -2.00	-2.00 to -2.99	-3.00 to -3.99	- 4.00 & below	
Above -2.00	Boys	51.0	26.1	12.9	7.8	97.8
	Girls	57.5	23.6	11.8	5.3	98.2
-2.00 to -2.49	Boys	0.6	0.2	0.2	0.3	1.4
	Girls	0.9	0.3	0.1	-	1.2
-2.50 to -2.99	Boys	0.4	0.1	0.1	0.1	0.5
	Girls	0.3	0.1	0.1	-	0.4
-3.00 and below	Boys	0.2	0.1	0.1	-	0.3
	Girls	0.2	-	-	0.1	0.3
Total %	Boys	52.2	26.4	13.3	8.2	100.0
	Girls	58.8	23.9	11.9	5.3	100.0

analysis is not large enough to be of any public health importance. However, a reduction of 10% was observed in the prevalence of malnutrition given by the SD-scores (weight/age) between admission and discharge. This difference mainly results from a reduction in the prevalence of severe forms (3 SD-scores below the reference), from 10% at admission to 3.6% at discharge. Similar proportions were observed in boys and girls.

Tables 45 and 46 show a cross-tabulation of SD-scores for weight-for-height and height-for-age in children aged from 12 to 84 months at the time of discharge. These tables again illustrate the high prevalence of stunting (19.2%) and the low prevalence of wasting.

3. CHANGES IN THE NUTRITIONAL STATUS OF CHILDREN BEFORE AND AFTER SUPPLEMENTATION

3.1 PERCENTAGE VARIATION FROM REFERENCE MEDIAN BY CROSS-TABULATION FOR SINGLE AND COMBINED INDICATORS

3.1.1 Changes in Nutritional Status by Period of Supplementation

Changes in the nutritional status of children in this study were detected through a cross-tabulation of the nutritional status at two points: Initial (before supplementation) and Final (after supplementation).

Figure 11 consists of a 2 x 2 table, in which columns represent the data on admission and rows the data on discharge of the same group of children. Each table shows the 16 possible combinations of the 4 initial and 4 final nutritional states.

Improvements are taken to mean a change from the initial condition of one or more grades. Conversely, changes down by one or more grades are taken to mean deterioration of the initial condition. The cut-off points are those described in previous sections.

Analysis of these tables is inevitably complicated, and to help in their interpretation a transparency has been prepared. The dotted diagonal area represents the group in which there was no change from their initial status. The blue column represents those who improved and entered the category of "normal". The upper green row represents those who deteriorated from their initially "normal" condition. In the remaining triangular areas are those groups that moved from one category of malnutrition to another. The last column on the right gives the initial totals (admission), and the bottom row the final totals (discharge).

The first part of this section analyses the changes in nutritional status of children for each anthropometric indicator, according to different classifications. Separate tables by sex for each indicator and period of supplementation have been included in Appendix VII. The data is presented in summarised form in Table 58.

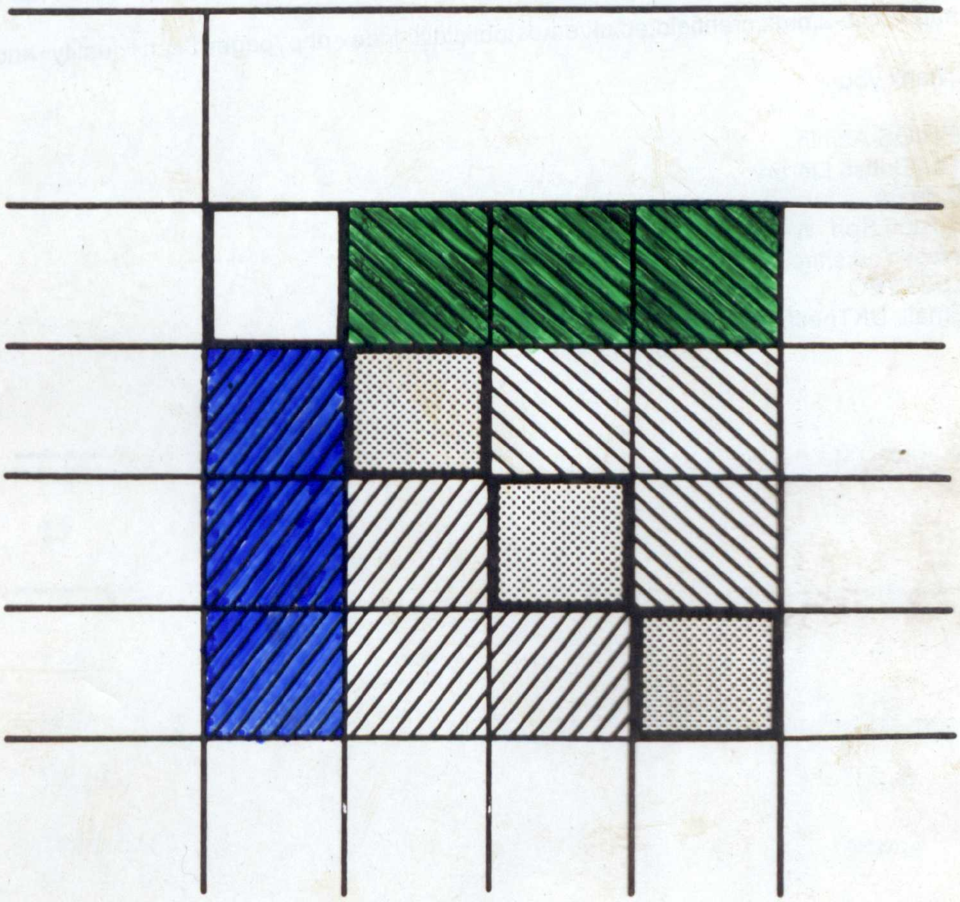


Fig. 11

Model of crosstabulation for the analysis of changes in Nutritional Status (nutritional outcome) of children attending the supplementary feeding programme.

	2nd point→ (discharge) 1st point↓ (admission)	Anthropometric indicator				TOTAL (Admission)
		Normal	I	II	III	
Anthropometric indicator	Normal	U	D	D	D	n %
	I	I	U	D	D	n %
	II	I	I	U	D	n %
	III	I	I	I	U	n %
	TOTAL (Discharge)	n %	n %	n %	n %	Total sample

U Unchanged

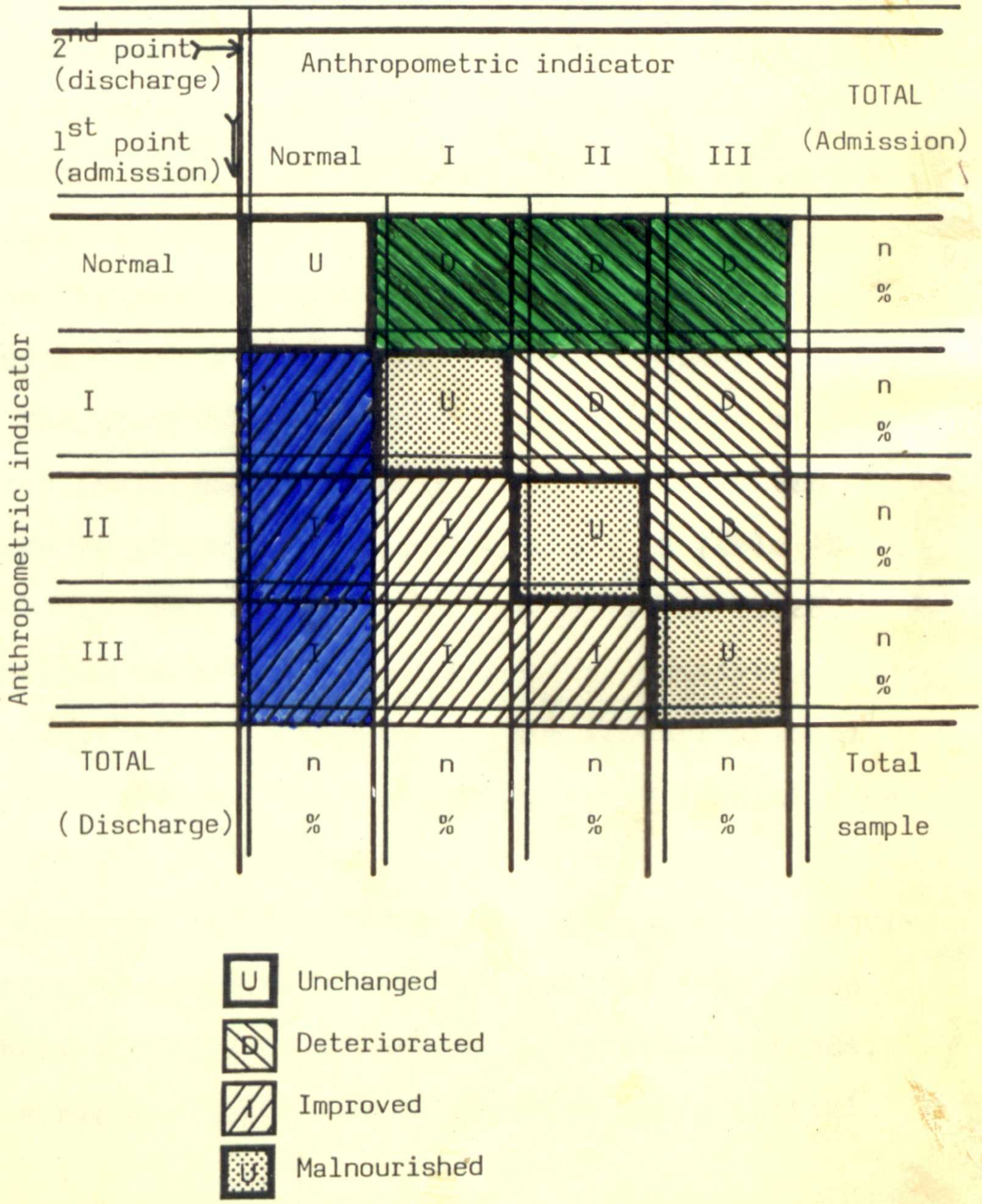
D Deteriorated

I Improved

▩ Malnourished

Fig. 11

Model of crosstabulation for the analysis of changes in Nutritional Status (nutritional outcome) of children attending the supplementary feeding programme.



	2nd point (discharge) →	Anthropometric indicator				TOTAL (Admission)
	1st point (admission) ↓	Normal	I	II	III	
Anthropometric indicator	Normal	U	D	D	D	n %
	I	I	U	D	D	n %
	II	I	I	U	D	n %
	III	I	I	I	U	n %
	TOTAL (Discharge)	n %	n %	n %	n %	Total sample

a) Weight-for-age

Following the same pattern of analysis of this indicator presented in previous sections, the Gómez and Jelliffe classifications are employed to define nutritional outcome.

Table 47 shows the outcome in children who received supplements from 6 to 24 months, as defined by Gómez classification. In this supplementation group, 66.4% of the children did not change their nutritional status (34.4% normal at the time of admission and 32% malnourished). Improvements were found in 19.6% of the children, most of them reaching normal values (10.8%). Most of the children who deteriorated (13.9%) had been admitted with a normal nutritional status (10.4%).

The group that received a longer period of supplementation (more than two years), who were admitted between 6 to 36 months of age are analysed in Table 48. The nutritional status of 56.7% of the children (both sexes) remained unchanged (23.7% normal at admission and 33.1% malnourished). Improvement from the nutritional status on admission was detected in 33.1% of the children and deterioration in 10.2%.

Although the proportion of children whose nutritional status remained unchanged is lower in this group than in those who were supplemented for shorter periods, there was a higher proportion of children whose initial

Table 47. Comparison of initial and final nutritional status in children (both sexes) starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age; Gómez classification

Initial	Final		Weight for age - Gómez classification				Total
			Normal	1st degree	2nd degree	3rd degree	N %
			> 90%	90-76%	75-60%	< 60%	
Weight for age Gómez classification	Normal > 90		693	203	7	-	903
			(34.4)	(10.1)	(0.3)	-	(44.9)
	1st degree 90 - 76%		198	509	64	2	773
			(9.8)	(25.3)	(3.2)	(0.1)	(38.4)
	2nd degree 75 - 60%		19	128	119	4	270
			(0.9)	(6.4)	(5.9)	(0.2)	(13.4)
	3rd degree < 60%		2	20	28	16	66
			(0.1)	(1.0)	(1.4)	(0.8)	(3.3)
	TOTAL	N	912	860	218	22	2012
		%	(45.3)	(42.7)	(10.8)	(1.1)	(100.0)

Table 48. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for age, Gómez classification.

	Final	Weight for age - Gómez classification				
		Normal	1st degree	2nd degree	3rd degree	Total N
	Initial	> 90%	90-76%	75-60%	< 60%	%
Weight for age Gómez classification	Normal > 90%	480	121	8	-	609
		(23.7)	(6.0)	(0.4)	-	(30.0)
	1st degree 90 - 76%	296	558	70	1	925
		(14.6)	(27.5)	(3.4)	(0.0)	(45.6)
	2nd degree 75 - 60%	62	235	105	6	408
		(3.1)	(11.6)	(5.2)	(0.3)	(20.1)
	3rd degree < 60%	6	37	36	8	87
		(0.3)	(1.8)	(1.8)	(0.4)	(4.3)
Total	N	844	951	219	15	2029
	%	(41.6)	(46.9)	(10.8)	(0.7)	(100.0)

malnutrition remained unchanged and a lower proportion of normals who remained normals. This finding may suggest that longer periods of supplementation do not necessarily produce a better outcome than the shorter ones in children already malnourished at the time of admission. This point will be analysed in more detail in the next section.

The results of weight-for-age by Jelliffe's classification are shown in Tables 49 and 50, and summarised in Table 58. Again the proportion of children improving with longer periods of supplementation was 1.5 times the proportion improving with the shorter period.

When one compares the results obtained by the Gómez and Jelliffe systems we find that Jelliffe's system gives a smaller proportion of children whose nutritional status remained unchanged; relatively more children either improved or deteriorated. This is because the cut-off points are closer together in the Jelliffe system, so that changes from one grade to another occur more readily. One could perhaps conclude that Jelliffe's system is more sensitive in detecting changes in nutritional status.

b) Weight-for-height

Nutritional outcome in terms of changes in weight-for-height, after supplementation is presented in Tables 51 and 52.

In the first group of children who were supplemented for 6 to 24 months (both sexes), 78.6% did not change their original nutritional status. In contrast to the outcome observed from weight-for-age, the largest proportion of children, as judged by weight-for-height, were initially normal (75.9%), and remained normal during this period of supplementation. Only 3.2% remained malnourished, and 6.0% deteriorated from their initial nutritional status. Of the 1§.4% who improved in weight-for-height, 12.5% reached normal values.

The second group of children was formed by those who were supplemented for more than two years, or who received more than 24 supplementations (Table 52). The status of 69.7% of the children remained unchanged, of whom 3.8% were slightly malnourished (weight-for-height 90% of standard), approximately a quarter of the children improved in weight-for-height, most of them (23.8%) reaching normal values. The greatest majority of the children who deteriorated (5.9%), had been initially normals.

Similar results were found for boys and girls in each supplementation group. However, when supplemented for shorter periods the girls seem to have responded slightly better than the boys, although the proportion of initially malnourished boys and girls who remained malnourished was the same (Appendix VII).

c) Height-for-age

The changes in height-for-age according to the period of supplementation are analysed in Tables 53 and 54.

Table 49. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age Jelliffe classification.

	Final	Weight for Age				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for age	> 90%	693	189	18	3	903
		(34.4)	(9.4)	(0.9)	(0.1)	(44.9)
	90 - 81%	177	311	91	10	589
		(8.8)	(15.5)	(4.5)	(0.5)	(29.3)
	80 - 71%	35	133	130	30	328
		(1.7)	(6.6)	(6.5)	(1.5)	(16.3)
	< 70%	7	34	76	75	192
		(0.3)	(1.7)	(3.8)	(3.7)	(9.5)
Total	N	912	667	315	118	2012
	%	(45.3)	(33.2)	(15.7)	(5.9)	(100.0)

Table 50. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 24 to 41 months, weight for age Jelliffe classification.

		Weight for age				Total
	Final	> 90%	90-81%	80-71%	< 70%	N %
Initial						
Weight for age	> 90%	480	105	23	1	609
		(23.7)	(5.2)	(1.1)	(0.0)	(30.1)
	90 - 81%	240	310	89	11	650
		(11.8)	(15.3)	(4.4)	(0.5)	(32.0)
	80 - 71%	94	186	165	25	470
		(4.6)	(9.2)	(8.1)	(1.2)	(23.1)
	< 70%	30	96	113	61	300
		(1.5)	(4.7)	(5.5)	(3.0)	(14.7)
Total	N	844	697	390	98	2029
	%	(41.6)	(34.4)	(19.2)	(4.8)	(100.0)

Table 51. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for height.

	Final	Weight for height				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for height	> 90%	985	63	6	-	1054
		(75.4)	(4.8)	(0.5)	-	(80.7)
	90-81%	145	34	9	-	188
		(11.1)	(2.6)	(0.7)	-	(14.4)
	80-71%	25	17	5	1	48
		(1.9)	(1.3)	(0.4)	(0.1)	(3.7)
	< 70%	6	3	5	2	16
		(0.5)	(0.2)	(0.4)	(0.2)	(1.2)
Total	N	1161	117	25	3	1306
	%	(88.9)	(9.0)	(1.9)	(0.2)	(100.0)

Table 52. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for height.

	Final	Weight for height				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for height	> 90%	450	32	5	1	488
		(65.9)	(4.7)	(0.7)	(0.1)	(71.4)
	90 - 81%	128	26	2	-	156
		(18.7)	(3.8)	(0.3)	-	(22.8)
	80 - 71%	26	4	-	-	30
		(3.8)	(0.6)	-	-	(4.4)
	< 70%	9	-	-	-	9
		(1.3)	-	-	-	(1.3)
Total	N	613	62	7	1	683
	%	(89.8)	(9.1)	(1.0)	(0.1)	(100.0)

Table 53. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 6 to 24 months, height for age.

	Final	Height for age				Total
Initial		95%	95-90%	90-85%	85%	N %
Height for age	> 95%	303	210	67	5	585
		(23.2)	(16.1)	(5.1)	(0.4)	(44.8)
	95 - 90%	58	209	129	17	413
		(4.4)	(16.0)	(9.9)	(1.3)	(31.6)
	90 - 85%	12	55	84	42	193
		(0.9)	(4.2)	(6.4)	(3.2)	(14.8)
	< 85%	6	10	31	68	115
		(0.5)	(0.8)	(2.4)	(5.2)	(8.8)
	Total N	379	484	311	132	1306
	%	(29.0)	(37.1)	(23.8)	(10.1)	(100.0)

Table 54. Comparison of initial and final nutritional status in children starting at 6 to 36 months of age, who received supplements for 24 to 48 months, height for age.

	Final	Height for Age				Total
Initial		> 95%	95-90%	90-85%	< 85%	N %
Height for age	> 95%	125	89	17	-	231
		(18.3)	(13.0)	(2.5)	-	(33.8)
	95 - 90%	70	110	33	11	224
		(10.2)	(16.1)	(4.8)	(1.6)	(32.8)
	90 - 85%	21	51	56	19	147
		(3.1)	(7.5)	(8.2)	(2.8)	(21.5)
	< 85%	9	13	24	35	81
		(1.3)	(1.9)	(3.5)	(5.1)	(11.9)
Total	N	225	263	130	65	683
	%	(32.9)	(38.5)	(19.0)	(9.5)	(100.0)

Of the children who were supplemented from 6 to 24 months (Table 53) 76.4% started with height-for-age above 90% of the standard, 16.7% became stunted by the time of discharge. Of those who were already stunted at the time of admission (23.6%), 6.4% improved from their initial condition, whereas 17.2% were still stunted after being supplemented. Thus, 34% of the children in this supplementation group were stunted at the time of discharge. Half of them deteriorated from an initial height-for-age above 90% of the standard, and the other half remained stunted.

The group who received a longer period of supplementation presented a better outcome (Table 54). The proportion of children with an initially adequate height-for-age who deteriorated, becoming stunted, was only 8.9% in this group. Of the children who were initially stunted (33.4% of the group), 13.8% improved, whereas 19.6% remained stunted.

It is important to notice that although a higher proportion of children improved in height-for-age when supplemented for longer periods, the proportion who remained stunted was higher and the total prevalence (29%) did not differ too much from that in children supplemented for shorter periods.

d) Waterlow classification

The Waterlow classification attempts to define nutritional status in terms of two indicators at the same time.

The analysis of the tables presented in this section follows basically the same procedure as that described before, when single anthropometric indicators were considered (Figure 11). Here, however, we examine changes in the type of malnutrition, which results in a rather more complex picture than does a change in the degree or severity of a single indicator. This complexity is particularly related to the definition of outcome in children initially stunted but not wasted, who became wasted but not stunted; and in those initially wasted but not stunted who became stunted but not wasted by the end of the supplementation. For these two kinds of outcome there is no evidence which may allow us to categorically define either of them as an improvement or deterioration of nutritional status. Therefore, a new category has been introduced which defines these changes as an "Uncertain nutritional outcome".

The changes in types of malnutrition (Waterlow classification) are shown in Tables 55 and 56, by period of supplementation, for both sexes together.

The results for the children who were supplemented for 6 to 24 months show that almost all the children whose nutritional status deteriorated (16%), were initially "normals" becoming "stunted but not wasted" by the end of the supplementation.

Table 55. Comparison of initial and final types of malnutrition (Waterlow Classification) in children starting between 6 to 36 months of age, who received supplemnts for 6 to 24 months.

FINAL INITIAL		Normal a	Wasted but not stunted b	Stunted but not wasted c	Wasted and Stunted d	TOTAL N %
Normal	a	737 (56.4)	7 (0.5)	201 (15.4)	1 (0.1)	946 (72.4)
Wasted but not stunted	b	18 (1.4)	9 (0.7)	15 (1.1)	- -	42 (3.2)
Stunted but not wasted	c	83 (6.4)	3 (0.2)	204 (15.6)	5 (0.4)	295 (22.6)
Wasted and Stunded	d	2 (0.2)	- -	17 (1.3)	4 (0.3)	23 (1.8)
TOTAL	N %	840 (64.3)	19 (1.5)	437 (33.5)	10 (0.8)	1306 (100.0)

Ht/age Wt/ht
a = >90% >80% of reference median.
b = >90% <80% " " "
c = <90% >80% " " "
d = <90% <80% " " "

Table 56. Comparison of initial and final types of malnutrition (Waterlow Classification) in children starting between 6 to 36 months of age, who received supplements for 24 48 months.

FINAL INITIAL	Normal a	Wasted but not stunted b	Stunted but not wasted c	Wasted and Stunted d	TOTAL N %
Normal	366 (53.6)	4 (0.6)	57 (8.3)	- -	427 (62.5)
Wasted but not stunted	21 (3.1)	- -	5 (0.7)	- -	26 (3.8)
Stunted but not wasted	85 (12.4)	4 (0.6)	128 (18.7)	- -	217 (31.8)
Wasted and Stunted	4 (0.6)	- -	9 (1.3)	- -	13 (1.9)
TOTAL N %	476 (69.7)	8 (1.2)	199 (29.1)	- -	683 (100.0)

	Ht/age	Wt/ht	
a =	> 90%	> 80%	of reference median
b =	> 90%	< 80%	" " "
c =	< 90%	> 80%	" " "
d =	< 90%	< 80%	" " "

Of the children who were malnourished at the time of admission (27.6%), more than half (17%) remained malnourished, 9% improved and 2% either deteriorated or had an uncertain outcome. Thus, those who were initially malnourished seemed to have presented a slightly better nutritional outcome than those who were initially normal.

The proportion of children who were stunted but not wasted was 23% on admission, and increased to 34% on discharge. Within the group who remained malnourished throughout, the most common change in nutritional status was a shift from wasting to stunting.

Results for the second supplementation group are presented in Table 56. In general it seemed that this group had a better nutritional outcome than the previous one. Thus, 37.5% of the group was initially malnourished, an improvement was observed in 17%, which is a higher proportion than that in the previous group. Also, the proportion of children who deteriorated from an initially "normal" nutritional status was much lower in this group (9%); most of them became stunted but not wasted (8.3%), as in the case of those who received fewer supplements.

In this group all the children who were still malnourished after being supplemented for more than two years, had become stunted but not wasted. The most severe form of malnutrition (stunting plus wasting) was not observed in children in this group, and the initial prevalence of chronic malnutrition (stunted but not wasted) was slightly reduced.

Of the children who deteriorated from their initial condition, the boys seemed to be more affected than the girls.

The proportion of children with an "Uncertain" outcome was the same whether supplemented for shorter or longer periods.

The definition of the nutritional condition of a child who is stunted but not wasted, has become a topic of discussion and there is need for a revision of concepts. Can we call such a child "small but healthy"? The answer to this question is of great importance in relation to intervention programmes and public health actions in developing countries.

In our sample it was found that 26% of the children aged 6 to 36 months from slum areas in Northeast Brazil were stunted but not wasted at the time they were admitted for supplementation. What is the outcome of these children after supplementation? As an attempt to offer some contribution to this topic, the changes in nutritional condition of children stunted but not wasted are analysed in Table 57 by sex and period of supplementation.

Most of the children remained stunted but not wasted after being supplemented either for shorter periods (69%) or longer periods (59%).

Clearly the group supplemented for longer periods had a better outcome.

Other evidence of the association of the better outcome with a longer period of supplementation is that

Table 57. Nutritional outcome on children stunted but not wasted at admission to the programme by sex, according to the period of supplementation. (N=512).

Sex	Period of Supplementation	IMPROVED (Normal)	UNCHANGED (S*/not W*)	DETERIORATED (W and S)	UNCERTAIN (W/not S)	TOTAL	
		a	b	c	d	N	%
Boys	⩽ 24	28.0	67.7	2.5	1.9	161	31.4
	> 24	35.6	61.5	-	2.9	104	20.3
Girls	⩽ 24	28.4	70.9	0.7	-	134	26.1
	> 24	42.5	56.6	-	0.9	113	22.1
Both sexes	⩽ 24	28.1	69.2	1.7	1.0	295	57.6
	> 24	39.2	59.0	-	1.8	217	42.4

	Height/age	Weight/ height		
a=	> 90%	> 80% of reference median.		
b=	> 90%	< 80%	"	"
c=	< 90%	> 80%	"	"
d=	< 90%	< 80%	"	"

* S= stunted
* W= wasted

none of the children who were supplemented for longer periods deteriorated from their initial condition.

The proportion of children who caught up their height-for-age leaving a deficient weight-for-height instead (uncertain outcome) was very low (1%), increasing slightly with longer periods of supplementation.

3.1.2 Summary of Findings

Table 58 summarises the results found in Table 47 to 56 and Appendix VII. It is clear from this data that the longer period of supplementation is associated with an increase in the proportion of children who improved their nutritional status.

Nutritional outcome in terms of weight-for-age by the Jelliffe classification showed a higher proportion of children whose nutritional status had improved or deteriorated when compared with the Gómez classification.

Weight-for-height showed the lowest proportion of children whose nutritional status had deteriorated. However, in contrast to the results from all other indicators, longer periods of supplementation did not reduce the proportion who deteriorated.

Height-for-age was the most affected indicator, presenting the highest proportion of deterioration; the boys were more affected than the girls.

Table 58. Proportion of children according to their nutritional outcome by sex and period of supplementation for different anthropometric indicators and methods of classification

Nutritional outcome	Sex	WEIGHT FOR AGE Gomez		WEIGHT FOR AGE Jelliffe		WEIGHT FOR HEIGHT		HEIGHT FOR AGE		W/H and H/age Waterlow	
		*<24	>24	<24	>24	<24	>24	< 24	> 24	< 24	> 24
UNCHANGED	Boys	65.3	58.8	57.2	52.8	79.7	69.4	48.7	46.3	72.0	72.3
	Girls	67.7	54.8	63.1	47.5	77.3	69.9	53.1	49.0	74.2	72.4
	Both	66.5	56.7	60.1	50.1	78.6	69.7	50.8	47.7	73.0	72.3
IMPROVED	Boys	20.2	31.4	25.1	35.0	13.8	24.4	14.5	26.2	9.4	17.0
	Girls	19.0	34.7	20.8	39.7	17.1	24.5	11.7	28.7	9.0	17.9
	Both	19.6	33.1	23.0	37.4	15.4	24.4	13.2	27.5	9.3	17.4
DETERIORATED	Boys	14.5	9.8	17.7	12.2	6.5	6.2	36.7	27.5	16.8	9.6
	Girls	13.3	10.5	16.1	12.8	5.5	5.6	35.2	22.3	15.9	8.3
	Both	13.9	10.2	16.9	12.5	6.0	5.9	36.0	24.7	16.4	8.9
UNCERTAIN	Boys	-	-	-	-	-	-	-	-	1.7	1.2
	Girls	-	-	-	-	-	-	-	-	1.0	1.4
	Both	-	-	-	-	-	-	-	-	1.3	1.3

* Period of supplementation, months.

Changes in the type of malnutrition given by the Waterlow classification showed a very small variation between periods of supplementation in the proportions of children whose initial condition remained unchanged.

The proportion of improvements in children supplemented either for shorter or longer periods was considerably lower than that found with single indicators. This is mainly because in this classification lower cut-off points are used to define malnutrition (90% height/age and 80% weight/height), and improvements of children with higher deficits were more unlikely to occur than those with mild malnutrition.

3.1.3 Significance of Changes in Nutritional Status

The significance of changes in the nutritional status of children analysed in Tables 47 to 56 (both sexes combined) and in Appendix VII (boys and girls) is defined by the McNemar test in Table 59.

The chi-square given by the McNemar test showed no significant changes in the weight-for-age of children who received up to 24 months supplementation. The boys in this group even showed a deterioration, being the sex apparently more affected. On the other hand the chi-square values found in this group supplemented for more than 24 months gave highly significant values for changes in weight-for-age.

Positive and significant changes in weight-for-height were found in both periods of supplementation. It

Table 59. McNemar test for significance of changes in nutritional status of children according to their sex and period of supplementation.

Sex	Supplem. (months)	Weight for age X^2	Weight for height X^2	Height for age X^2
Boys	$\leqslant 24$	0.02*ns	14.37▲	49.02▲*
	> 24	40.23▲	35.89▲	0.49 ns
Girls	$\leqslant 24$	0.59 ns	34.03▲	75.05▲*
	> 24	72.53▲	41.88▲	0.01 ns
Both Sexes	$\leqslant 24$	0.19 ns	46.73▲	118.51▲*
	> 24	112.02▲	77.74▲	0.17 ns

▲ = Higly significant improvement.

▲* = Higly significant deterioration.

ns = No significant improvement.

is clear that the higher chi-square values corresponded to those children supplemented for longer periods.

Height-for-age apparently was the most affected indicator. A negative change in the nutritional status, indicating deterioration, suggests that the chronic process of malnutrition, frankly established after the first 6 months of life, had not been significantly affected by the supplementation. Those who were supplemented for shorter periods were more affected, to the extent of a highly significant deterioration in both boys and girls. In the group supplemented for longer periods there was no significant improvement, or deterioration.

3.1.4 Effect of Age at Admission on Outcome

It has been clearly shown that the chronological age of the child plays an important and decisive role in the type and severity of malnutrition as well as for his survival.

The role which age plays in terms of the outcome of supplementary feeding is not so clear.

In this section, the effect of age at the time of admission on outcome is analysed according to period of supplementation (Tables 60 to 63). The complete set of tables is included in Appendix VIII.

a) Weight-for-age

The changes in weight-for-age by the Gômez and Jelliffe classifications are described in Tables 60 and 61, by age group and period of supplementation.

The nutritional status of children who were below one year of age at admission showed a pattern of change different from that of the older children. The youngest group showed the lowest proportion of improvements and the highest proportion of deterioration by both Gômez and Jelliffe classifications.

The proportion of children whose nutritional status remained unchanged after supplementation was similar in all three age groups.

The chi-square test showed a highly significant change in nutritional status between periods of supplementation (ages combined) ($\chi^2 = 97.01$, d.f. = 2, $P < 0.001$;* $\chi^2 = 101.63$, d.f. = 2, $P < 0.001$**), as well as between age groups (periods of supplementation combined) ($\chi^2 = 149.30$, d.f. = 4, $P < 0.001$,* $\chi^2 = 171.48$, d.f. = 4, $P < 0.001$).**

When Jelliffe's classification was employed, a higher proportion of children who improved their nutritional status was observed. The largest difference between these two classifications was found in the group admitted after 12 months of age.

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* Gômez classification

** Jelliffe classification

Table 60. Nutritional outcome in children according to age at admission and period of supplementation (Weight for age, Gomez classification).

Age at admission (months)	Period of Supplem.	NUTRITIONAL STATUS OUTCOME						TOTAL	
		IMPROVED		UNCHANGED		DETERIORATED			
		N	%	N	%	N	%	N	%
6-11.99	≤ 24	145	14.6	651	65.6	196	19.7	992	24.5
	> 24	163	25.1	388	59.5	101	15.5	652	16.1
12-23.99	≤ 24	151	26.4	274	65.2	48	8.4	573	14.1
	> 24	284	37.9	410	54.6	57	7.6	751	18.6
24-36.00	≤ 24	99	22.1	312	69.8	36	8.0	447	11.1
	>24	225	36.0	353	56.4	48	7.7	626	15.5
TOTAL		1067	26.4	2488	61.6	486	12.0	4041	100.0

Table 61. Nutritional outcome in children according to age at admission and period of supplementation. (Weigh for age, Jelliffe classification).

Age at admission (months)	Period of supplem.	NUTRITIONAL STATUS OUTCOME						TOTAL	
		IMPROVED		UNCHANGED		DETERIORATED			
		N	%	N	%	N	%	N	%
6-11.99	⩽ 24	165	16.6	591	59.6	236	23.8	992	24.5
	> 24	183	28.1	349	53.5	120	18.4	652	16.1
12-23.99	⩽ 24	182	31.8	333	58.1	58	10.1	573	14.1
	> 24	321	42.7	356	47.4	74	9.8	751	18.6
24-36.00	⩽ 24	115	25.7	285	63.8	47	10.5	447	11.1
	> 24	255	40.7	311	49.7	60	9.6	626	15.5
TOTAL		1221	30.2	2225	55.1	595	14.7	4041	100.0

b) Weight-for-height

The changes in weight-for-height are presented in Table 62.

The proportions of children whose nutritional status improved after being supplemented up to 24 months were similar in all age groups.

In all three age groups, longer supplementation produced a higher rate of improvement. The proportion of children who deteriorated from their initial nutritional status was considerably lower than the proportion who improved.

The highest proportion of children whose nutritional status remained unchanged, was found in the oldest age group.

The chi-square test showed significant changes in nutritional status between periods of supplementation (age combined) ($\chi^2 = 26.59$, d.f. = 2, $P < 0.001$), as well as between age groups (periods of supplementation combined) ($\chi^2 = 11.23$, d.f. = 4, $P < 0.05$).

c) Height-for-age

The nutritional outcome in terms of height-for-age, according to age of admission and period of supplementation, is presented in Table 63.

It can be observed that the youngest children who received shorter periods of supplementation had, again, the

Table 62. Nutritional outcome in children according to age at admission and period of supplementation (weight for height).

Age at admission (months)	Period of Supplem.	NUTRITIONAL STATUS OUTCOME							
		IMPROVED		UNCHANGED		DETERIORATED		TOTAL	
		N	%	N	%	N	%	N	%
6-11.99	≤ 24	101	15.7	504	78.3	39	6.1	644	32.4
	> 24	50	20.8	170	70.8	20	8.3	240	12.1
12-23.99	≤ 24	58	15.6	283	75.7	33	8.8	375	18.8
	> 24	72	28.2	172	67.4	11	4.3	255	12.8
24-36.00	≤ 24	42	14.6	239	83.0	7	2.4	288	14.5
	> 24	45	23.9	134	71.3	9	4.8	188	9.4
TOTAL		368	18.4	1502	75.5	119	6.0	1990	100.0

Table 63. Nutritional outcome in children accordingo to age at admission and period of supplementation (height for age).

Age at admission (months)	Period of Supplem.	NUTRITIONAL STATUS OUTCOME						TOTAL	
		IMPROVED		UNCHANGED		DETERIORATED			
		N	%	N	%	N	%	N	%
6-11.99	≤ 24	37	5.7	285	44.3	322	50.0	644	32.4
	> 24	47	19.6	107	44.6	86	35.8	240	12.1
12-23.99	≤ 24	80	21.3	193	51.5	102	27.2	375	18.8
	> 24	78	30.6	132	51.8	45	17.6	255	12.8
24-36.00	≤ 24	55	19.1	186	64.6	47	16.3	288	14.5
	> 24	63	33.5	87	46.3	38	20.2	188	9.4
TOTAL		360	18.1	990	49.7	640	32.2	1990	100.0

lowest proportion of improvements and the highest proportion of deterioration in height-for-age.

When the youngest children were supplemented for more than two years (second supplementation group) a better outcome was observed. The proportion who improved in this group was three times as high as in the previous one. In spite of this, the youngest group at admission was still the most affected by height retardation.

The proportion of children whose initial condition remained unchanged increased with increasing age of the children at admission. Of the children who started supplementation between 6 to 24 months, the proportion whose initial nutritional condition remained unchanged was not affected by the period of supplementation. Of those admitted at older ages (24 to 36 months), fewer remained unchanged when supplemented for longer periods.

In children below 12 months of age, who were supplemented up to 24 months, the proportion who deteriorated was 1.8 times higher than in those aged 12 to 24 months, and 3 times higher than in those aged from 24 to 36 months.

The possible reason for this is that more of the children in the older age-groups were already stunted at the time of admission to the programme.

A decrease in the proportion who deteriorated in height-for-age was found in the group aged 6 to 24 months at admission who received supplements for more than two years. This tendency was not observed in the oldest group.

The chi-square test showed a significant change in height-for-age between periods of supplementation (age combined) ($\chi^2 = 69.81$, d.f. = 2, $P < 0.001$) as well as between age groups (periods of supplementation combined) ($\chi^2 = 175.37$, d.f. = 4, $P < 0.001$).

The effects of age and period of supplementation for the two indicators, weight-for-height and height-for-age, are summarised in Table 64. As regards weight/height, the age has very little influence, but the longer the period of supplementation the greater the proportion who improved.

With height-for-age, the age at admission does seem to have an influence. The proportion who improved increases and the proportion who deteriorate decreases with increasing age. Again, the results are better with the longer period of supplementation.

3.1.5 Significance of Changes in Nutritional Status

Table 65 shows the results of the chi-squared test by McNemar's method for the significance of the changes in nutritional status of children analysed in Tables 60 to 63.

There was a significant deterioration in weight-for-age in the youngest group and a significant improvement in the other two groups.

Table 64. Nutritional outcome in terms of weight for height and height for age, according to age at admission and period of supplementation.

Outcome Supplementation months	IMPROVED		DETERIORATED	
	⩽ 24	> 24	⩽ 24	> 24
	%	%	%	%
WEIGHT/HEIGHT (age groups)				
6 to 11.99	16	21	6	8
12 to 23.99	16	28	9	4
24 to 36.00	15	24	2	5
HEIGHT/AGE (age groups)				
6 to 11.99	6	20	50	36
12 to 23.99	21	31	27	18
24 to 36.00	19	34	16	20

Table 65. McNemar test for significance of change of nutritional status of children according to their age at admission and period of supplementation.

Age of admission (months)	Supplem. (months)	Weight for age X^2	Weight for height X^2	Height for age X^2
6-11.99	≤ 24	22.48▲*	20.49▲	172.40▲*
	≥ 24	0.80 ns	12.19▲	9.56*
12-23.99	≤ 24	21.63▲	4.81	0.78 ns
	> 24	73.13▲	45.00▲	3.66 ns
24.36.00	≤ 24	13.44▲	27.00▲	0.02 ns
	> 24	73.83▲	24.92▲	0.67 ns

▲ = Highly significant improvements
▲* = Highly significant deterioration
ns = No significant improvements
* = Deterioration

In all age groups there were significant improvements in weight-for-height.

Height-for-age, in the group admitted between 6 and 12 months of age, showed a highly significant deterioration, regardless of the period of supplementation. No significant change was detected at older ages.

The results suggest that the children became stunted during supplementation, thus catching up their weight-for-height. One could say that it seemed to be a process of adaptation rather than an actual improvement in nutritional status.

3.1.6 Nutritional Outcome in Children Initially Malnourished

When nutritional outcome is analysed in the whole group, a very general picture is obtained, because if some children were normal on admission, the significance of changes in outcome was reduced. For example, if those children whose nutritional status remained unchanged were mainly normal initially, the implication is not the same as if the majority of the group was initially malnourished. Those two groups, however, would both be classified as unchanged.

Since the initially malnourished group is the main interest in this type of intervention, a specific analysis has been carried out in this section, of changes in the nutritional status of children malnourished at admission.

a) Weight-for-age

Table 66 presents changes in weight-for-age from an initial deficit according to the Gómez classification. It can be observed that 52% of the children whose weight-for-age was deficient at admission, stayed unchanged after supplementation was provided. Improvement was found in 42.2%, of whom half reached normal values. Deterioration from a deficient initial condition was detected in only 5.8% of the children.

The proportion of children who remained malnourished was fairly similar between the different age groups at admission. There was some evidence of a decrease in the prevalence of malnutrition with the longer period of supplementation.

In the youngest age-group (less than 12 months on admission), the proportion who deteriorated was twice as great as in the older group.

When the Jelliffe classification was used (Table 67), a lower proportion of children whose initial condition remained unchanged (41.6%) was observed.

The proportion of children whose initial status improved to normal by the Jelliffe classification was lower than that given by the Gómez classification. There is a clear tendency for the proportion improved to increase with increasing duration of supplementation. Likewise, the proportions of those whose malnutrition remained

Table 66 . Nutritional outcome in children with an initial deficit in weight for age*, according to age at admission and period of supplementation, Gomez classification.

Age at admission (months)	Period of supplementation (months)	NUTRITIONAL STATUS OUTCOME										Total	
		IMPROVED						UNCHANGED		DETERIORATED			
		To Normal		Parcial**		Total							
		N	%	N	%	N	%	N	%	N	%	N	%
6 - 11.99	≤ 24	82	(18.3)	63	(14.0)	145	32.3	263	58.6	41	9.1	449	17.8
	> 24	81	(21.7)	82	(22.0)	163	43.7	179	48.0	31	8.3	373	14.7
12 - 23.99	≤ 24	80	(21.4)	71	(19.0)	151	40.4	206	55.1	17	4.5	374	14.8
	> 24	150	(26.5)	134	(23.7)	284	50.2	259	45.8	23	4.1	566	22.4
24 - 36.00	≤ 24	57	(19.9)	42	(14.7)	99	34.6	175	61.2	12	4.2	286	11.3
	> 24	133	(27.7)	92	(19.1)	225	46.8	233	48.4	23	4.8	481	19.0
Sub- total		583	(23.1)	484	(19.1)								
Total						1067	42.2	1315	52.0	147	5.8	2529	100.0

* < 90% of the reference median.

** Improvements of an initial deficit which do not reach normal values.

Table 67. Nutritional outcome in children with an initial deficit in weight for age*, according to age at admission and period of supplementation. (Jelliffe classification).

Age at admission (months)	Period of supplementation (months)	NUTRITIONAL STATUS OUTCOME										Total	
		IMPROVED						UNCHANGED		DETERIORATED			
		To Normal		Parcial**		Total							
		N	%	N	%	N	%	N	%	N	%	N	%
6 - 11.99	≤ 24	82	(18.3)	83	(18.5)	165	36.7	203	45.2	81	18.0	449	17.8
	> 24	81	(21.7)	102	(27.3)	183	49.1	140	37.5	50	13.4	373	14.7
12 - 23.99	≤ 24	80	(21.4)	102	(27.3)	182	48.7	165	44.1	27	7.2	374	14.8
	> 24	150	(26.5)	171	(30.2)	321	56.7	205	36.2	40	7.1	566	22.4
24 - 36.00	≤ 24	57	(19.9)	58	(20.3)	115	40.2	148	51.7	23	8.0	286	11.3
	> 24	133	(27.7)	122	(25.4)	255	53.0	191	39.7	35	7.3	481	19.0
Sub-total		583	(23.1)	638	(25.2)								
TOTAL						1221	48.3	1052	41.6	256	10.1	2529	100.0

* <90% of the reference median.

** Improvements of an initial deficit which do not reach normal values.

unchanged, decreased in all age groups supplemented for longer periods.

The proportion of children whose initial malnutrition deteriorated was almost double that given by the Gómez classification. The youngest group was shown to be the most severely affected; the proportion who deteriorated was twice as high, as in the older children. Again, deterioration was less frequent in the group supplemented for longer periods.

b) Weight-for-height

The nutritional outcome of malnourished children in terms of weight-for-height according to age at the time of admission and period of supplementation is presented in Table 68.

A remarkable proportion of children reduced their initial deficit in weight-for-height (82.4%), most of them reaching normal values, particularly the group younger than 24 months on admission.

In the majority of the children who showed no improvement, the nutritional status remained unchanged. The proportion who deteriorated was very small.

c) Height-for-age

The analysis of changes in height-for-age (Table 69) shows that 30.7% of the children with an initial

Table 68. <u>Nutritional outcome in children with an initial deficit in weight for height*, according to age at admission and period of supplementation.</u>

Age at admission (months)	Period of supplementation (months)	NUTRITIONAL STATUS OUTCOME										TOTAL	
		IMPROVED						UNCHANGED		DETERIORATED			
		To Normal		Parcial**		Total							
		N	%	N	%	N	%	N	%	N	%	N	%
6 - 11.99	≤ 24	87	(70.7)	14	(11.4)	101	82.1	18	14.6	4	3.2	123	27.4
	> 24	49	(85.9)	1	(1.75)	50	87.7	7	12.3	-	-	57	12.7
12 - 23.99	≤ 24	47	(61.0)	12	(15.6)	59	76.6	13	16.9	5	6.5	77	17.2
	> 24	70	(87.5)	2	(2.5)	72	90.0	7	8.7	1	1.2	80	17.9
24 - 36.00	≤ 24	42	(79.2)	-	(-)	42	79.2	10	18.9	1	1.9	53	11.8
	> 24	44	(75.9)	1	(1.7)	45	77.6	12	20.7	1	1.7	58	12.9
	Sub-total	339	(75.7)	30	(6.7)								
	Total					369	82.4	67	14.9	12	2.7	448	100.0

* < 90% of reference median

** Improvements of an initial deficit which do not reach normal values.

Table 69. Nutritional outcome in children with an initial deficit in height for age*, according to age at admission, and period of supplementation.

Age at admission (months)	Period of supplementation (months)	NUTRITIONAL STATUS OUTCOME										Total	
		IMPROVED						UNCHANGED		DETERIORATED			
		To Normal		Parcial**		Total							
		N	%	N	%	N	%	N	%	N	%	N	%
6 - 11.99	≤ 24	16	(5.9)	21	(7.7)	37	13.6	128	47.2	106	39.1	271	23.1
	> 24	27	(21.9)	20	(16.3)	47	38.2	45	36.6	31	25.2	123	10.5
12 - 23.99	≤ 24	37	(14.9)	43	(17.3)	80	32.1	112	45.0	57	22.9	249	21.2
	> 24	43	(22.9)	35	(18.6)	78	41.5	92	48.9	18	9.6	188	16.0
24 - 36.00	≤ 24	23	(11.4)	32	(15.9)	55	27.4	121	60.2	25	13.4	201	17.1
	> 24	30	(21.3)	33	(23.4)	63	44.7	64	45.4	14	9.9	141	12.0
	Sub total:	176	(15.0)	184	(15.7)								
	Totals:					360	(30.7)	562	(47.9)	251	(21.4)	1173	(100.0)

* < 95% of reference median

** improvements of initial deficit which do not reach normal values deficit improved. Of this group, half reached normal values and half had a partial improvement.

The proportion of children whose height deficit improved was greater in the group supplemented for longer periods. Between the different age groups, the rate of improvement was greater in children admitted after their first year of life.

In the group whose height deficit remained unchanged (21.4%), the largest proportion was found in the oldest group supplemented for shorter periods.

The youngest children were apparently more affected by deterioration. When supplemented for shorter periods, the proportion who deteriorated was 1.7 times higher than in those aged between 12 to 24 months, and 3 times higher than those aged from 24 to 36 months on admission.

In the groups supplemented for more than two years, a smaller proportion deteriorated in height-for-age compared with the group supplemented for longer periods.

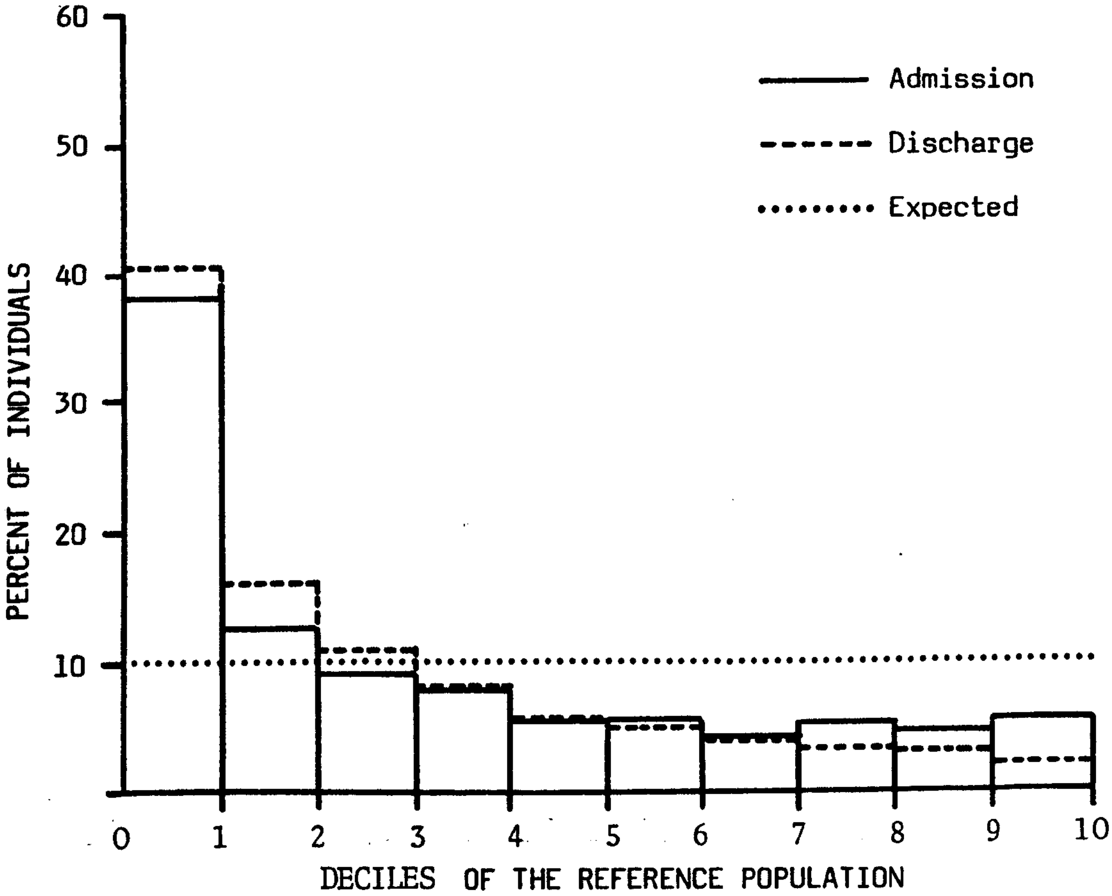
3.2 CENTILE DISTRIBUTION

The next section analyses changes in the nutritional status by the centile method. A graphical representation has been chosen, consisting of a set of histograms showing the decile distribution compared with the NCHS standard. (Figures 12 to 20).

Basically this method of analysis confirms the

Fig. 12

Weight for age decile distribution at admission and discharge for children admitted between 6 - 12 months of age.



finding given by the percentage methods.

The first indicator, weight-for-age, is presented by age groups in figures 12 to 14. In the youngest group, the deterioration in nutritional status is shown by an increase at discharge in the percentage of children at the lower deciles and by a decrease at the higher deciles. The children from 12 to 36 months showed a more severe initial nutritional condition than those below one year of age.

The decile distribution of weight-for-height (Figures 15 to 17), show the relative adequacy of this indicator at admission, improving after supplementation. In the youngest group there was a reduction at discharge in the percentage of children below the 1st decile, and increasing percentage in higher deciles. This clearly confirms the improvement in nutritional status, the expected values being exceeded from the 5th decile onwards.

The greatest improvement was shown by the 12 to 24 month age group, as represented by a remarkable reduction in the proportion of children at the lower deciles and an increase almost to expected values at the highest deciles.

The third age group showed similar changes, except that at higher deciles the number of children was less than that expected.

Height-for-age clearly showed a steady deterioration in the children below one year of age (Figure 18), improving slightly in older children (Figures 19 and 20).

Fig. 13

Weight for age decile distribution
at admission and discharge for children
admitted between 12 - 24 months of age.

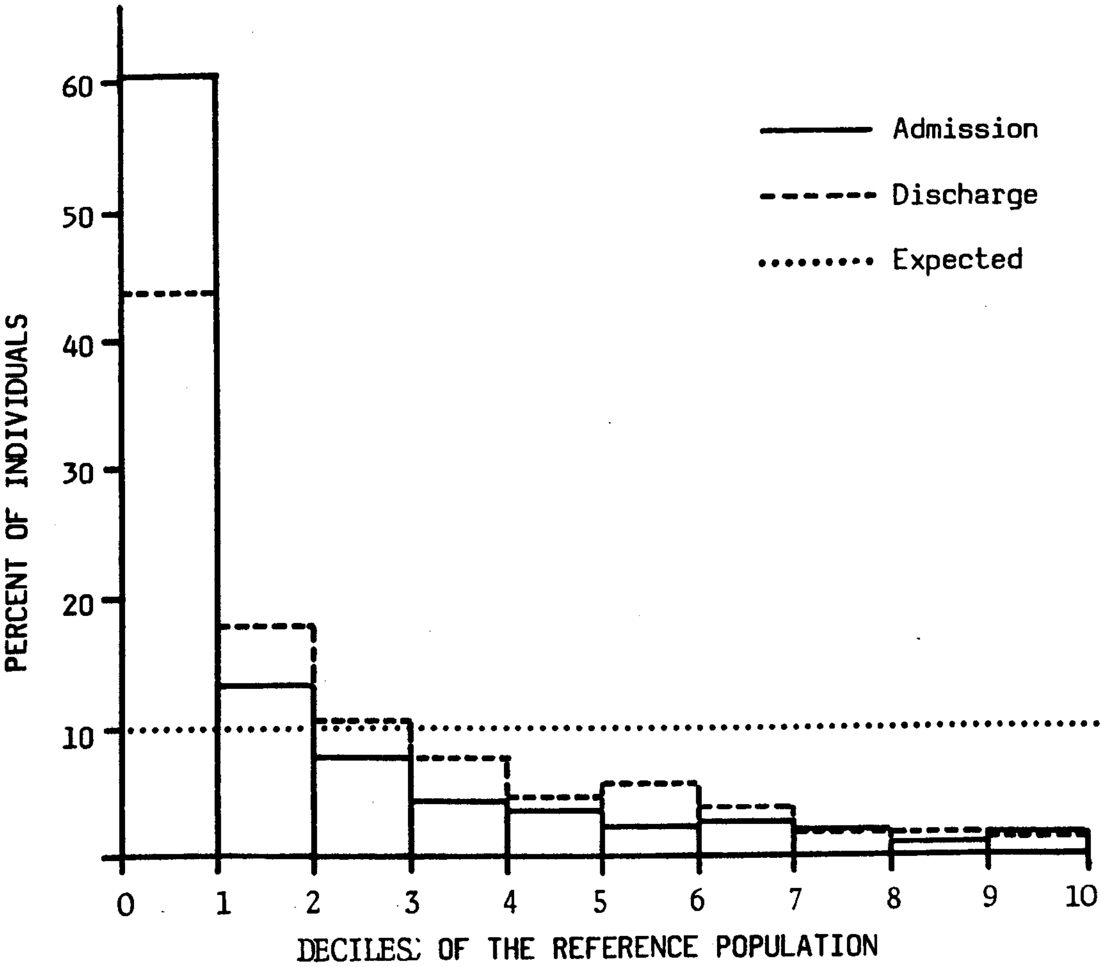


Fig. 14

Weight for age decile distribution at admission and discharge for children admitted between 24 - 36 months of age.

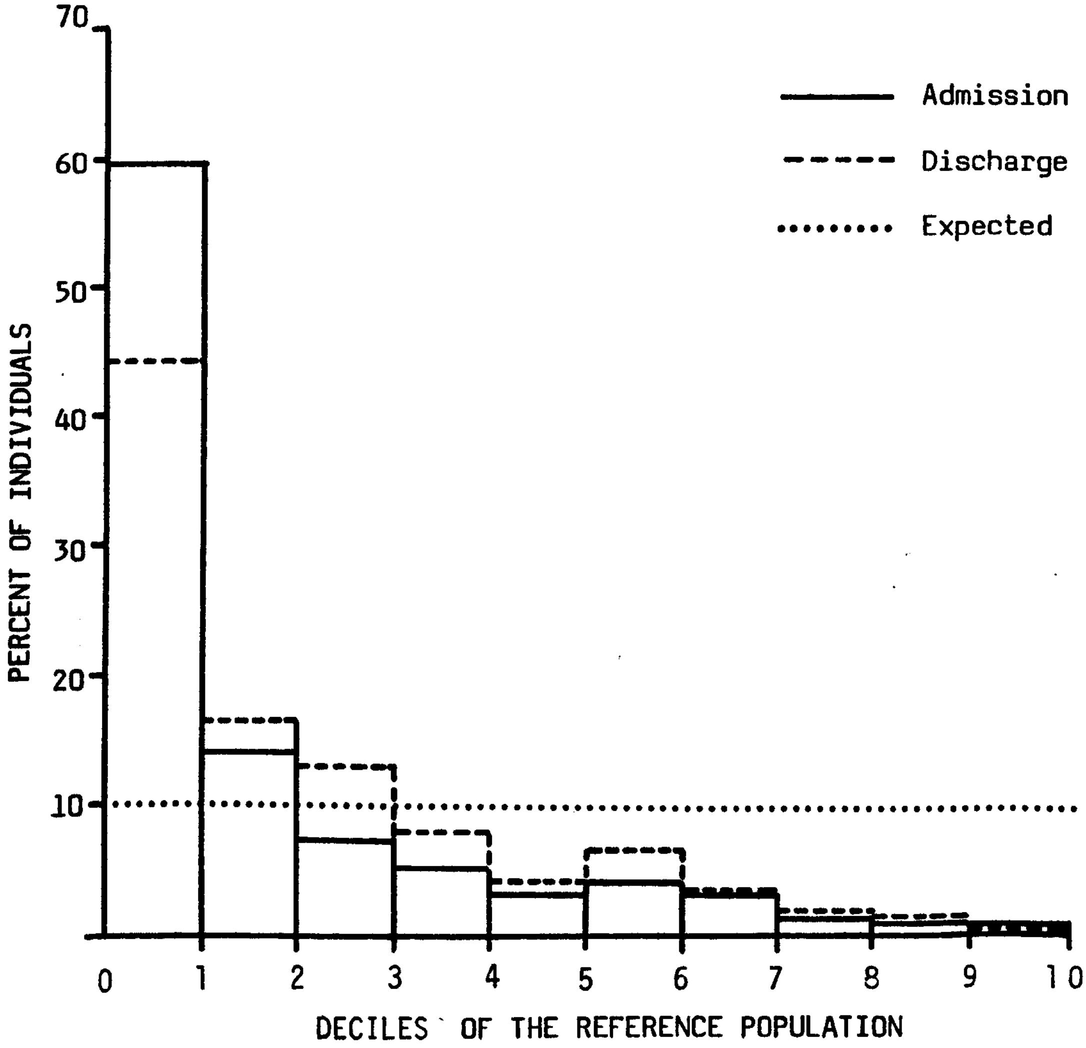


Fig. 15

Weight for height decile distribution at admission and discharge for children admitted between 6 - 12 months of age.

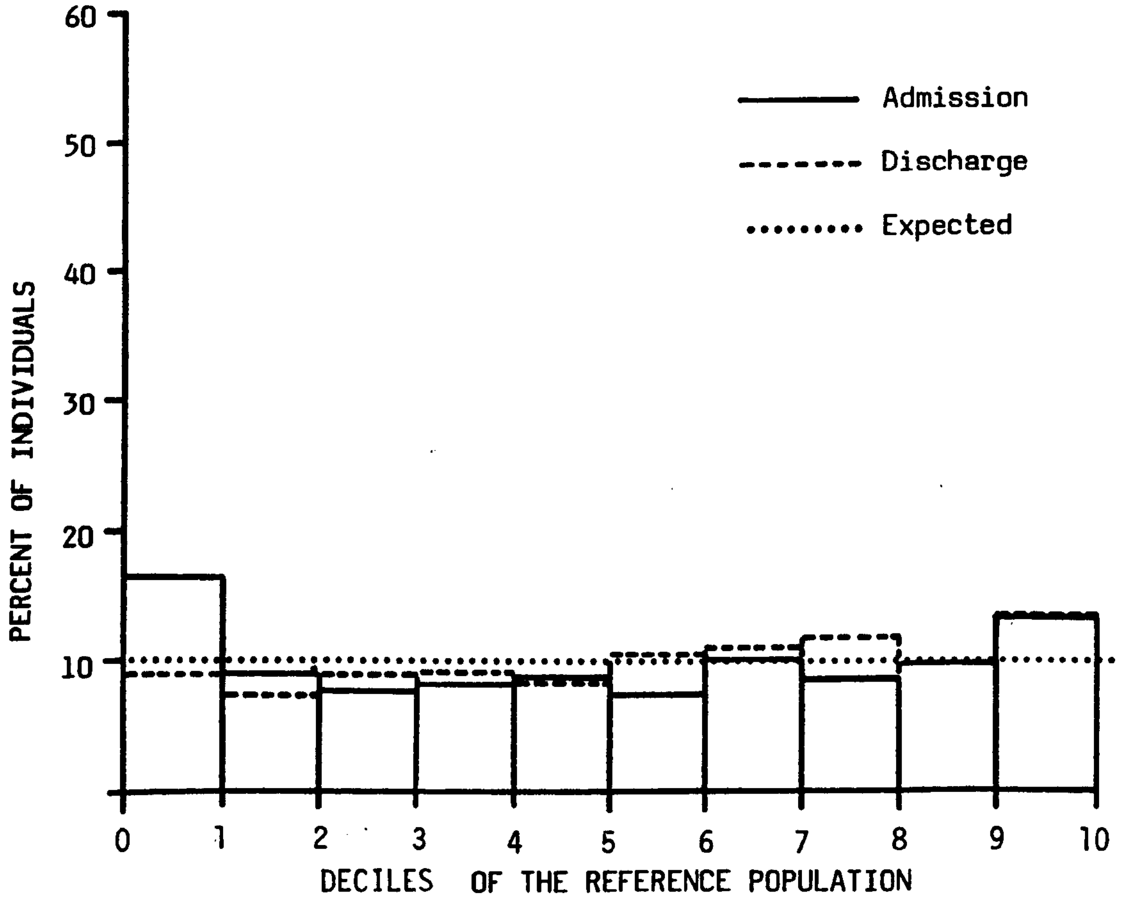


Fig. 16

Weight for height decile distribution at admission and discharge for children admitted between 12 - 24 months of age.

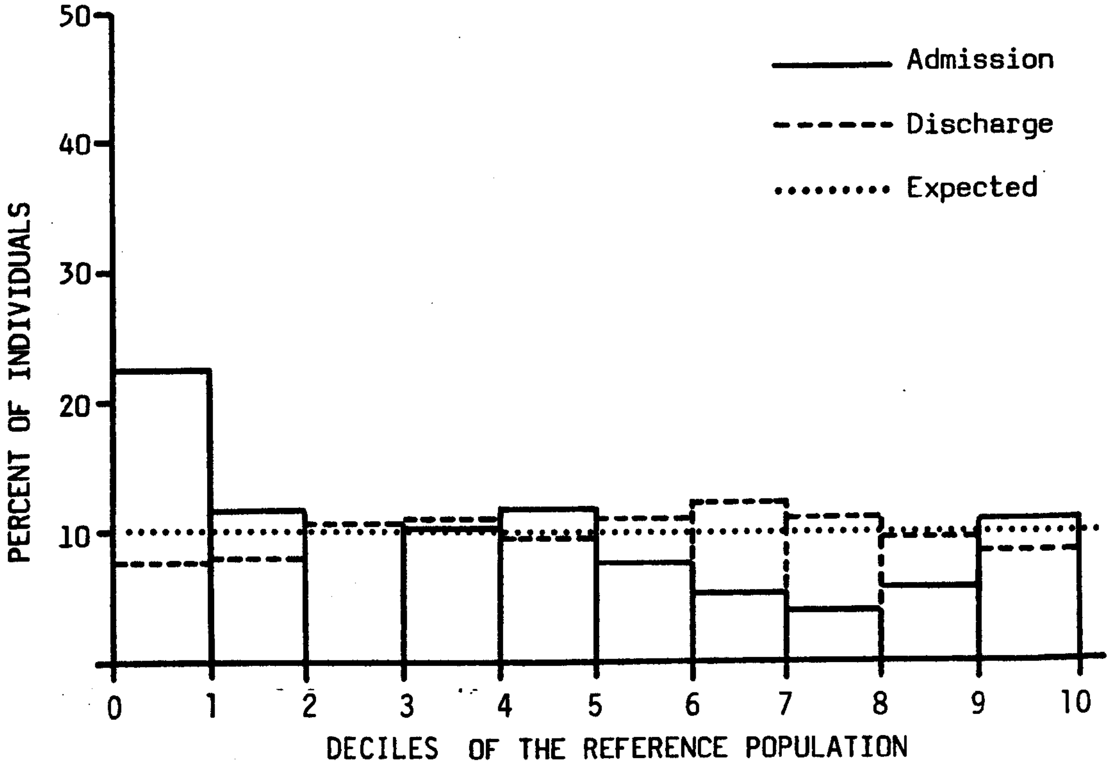


Fig.17

Weight for height decile distribution at admission and discharge for children admitted between 6 - 12 months of age.

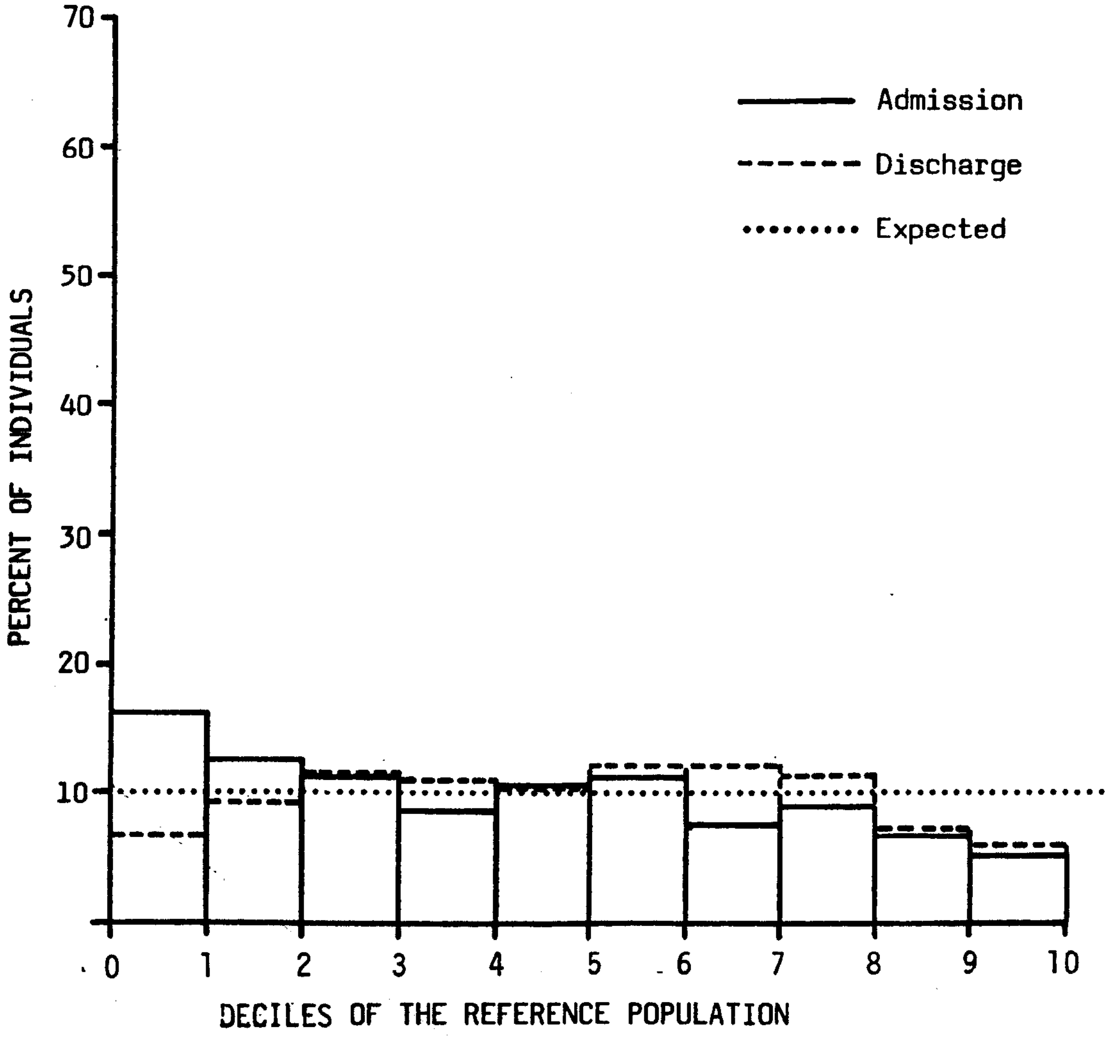


Fig. 18

Height for age decile distribution at admission and discharge for children admitted between 6 - 12 months of age.

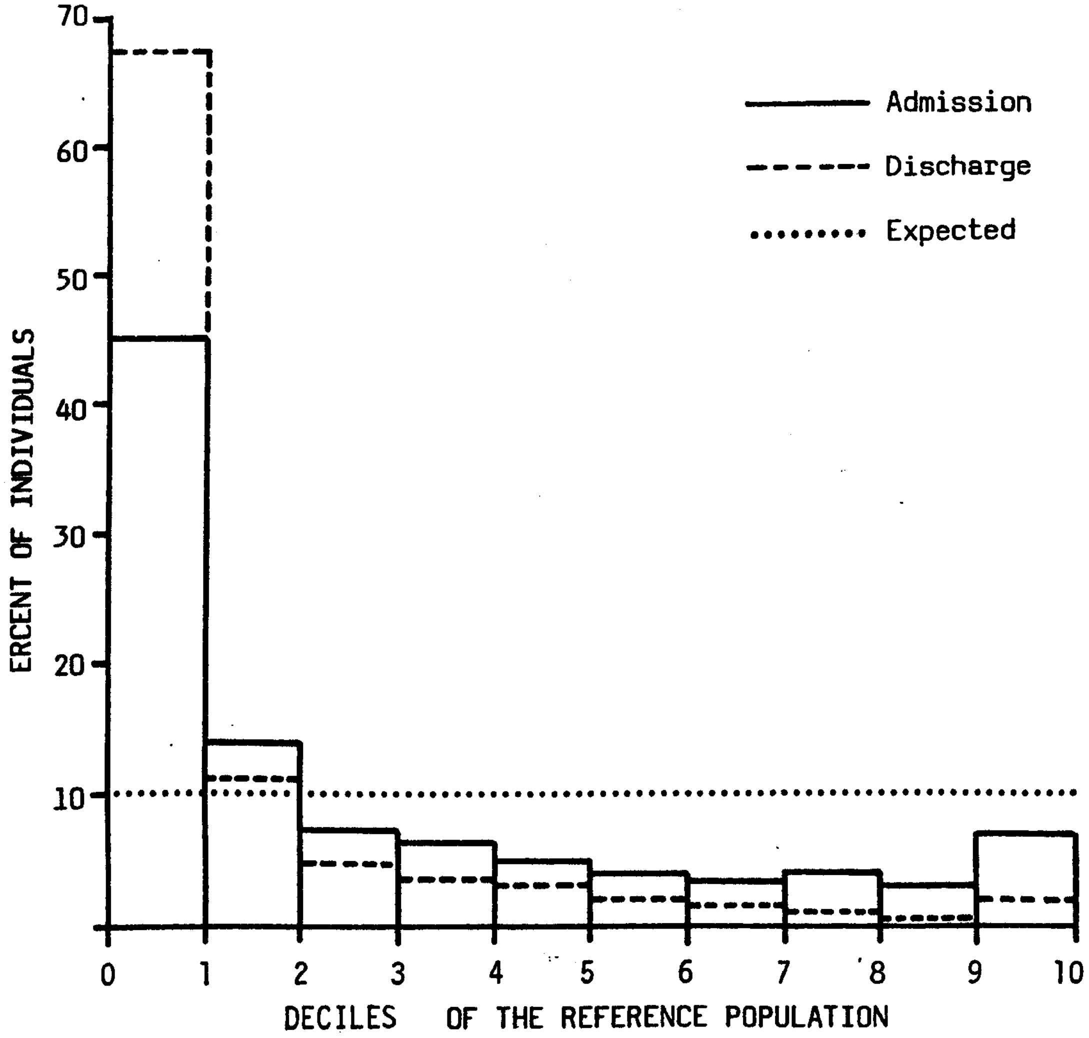


Fig. 19

Height for age decile distribution at admission and discharge for children admitted between 12 - 24 months of age.

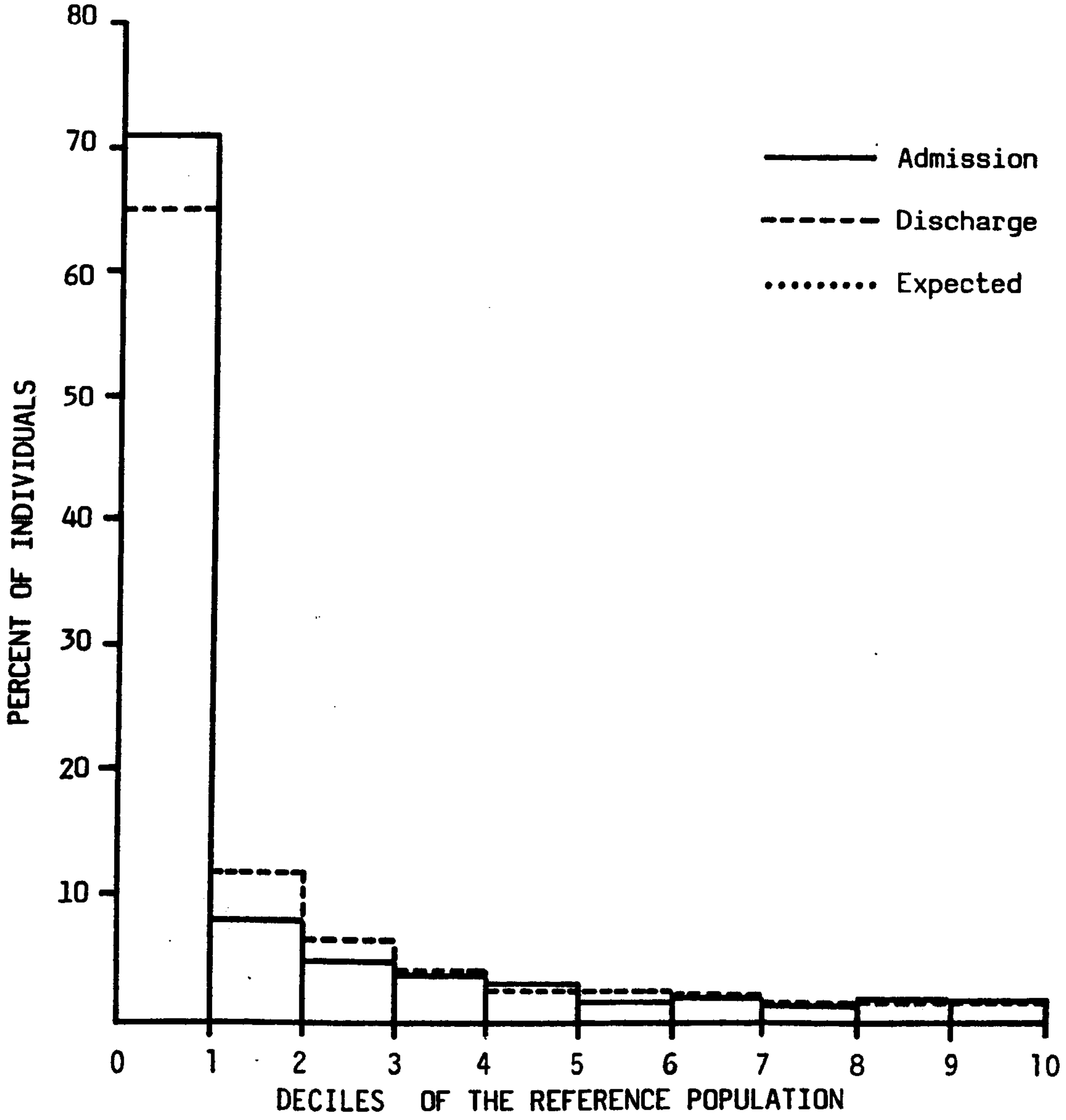
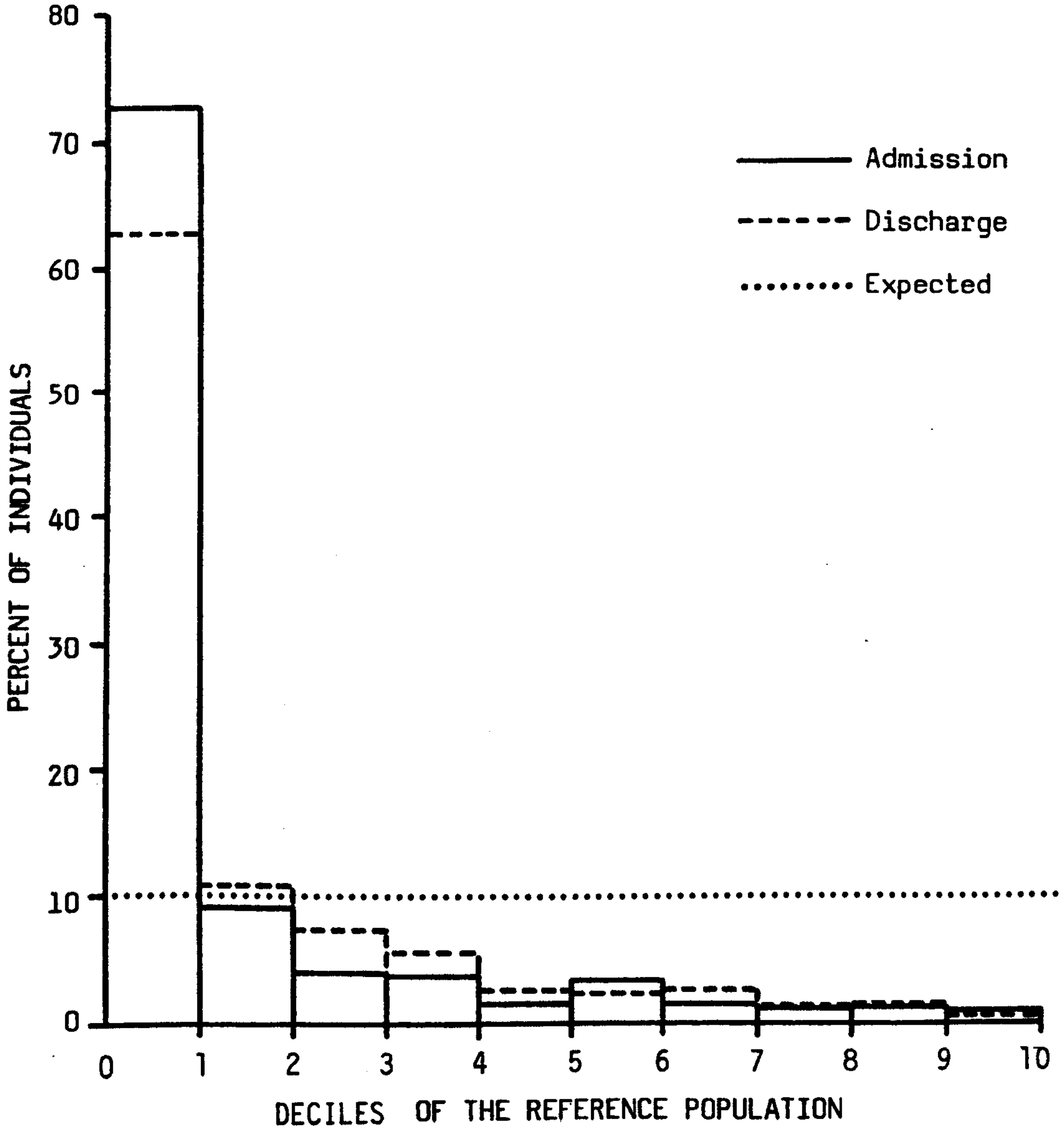


Fig. 20

Height for age decile distribution at admission and discharge for children admited between 24 - 36 months of age.



4. SIBLING STUDY

4.1 DESIGN

The nutritional status of a child is determined by the environmental factors to which it is exposed. Thus, a malnourished child in a family has been considered an index of risk of its siblings being affected by malnutrition. In this context, the Brazilian supplementary feeding programme has included the normal sibling of a malnourished child as a participant in the programme.

This section presents an additional analysis of the effectiveness of the nutritional programme by sibling comparison.

The main objective of this analysis is to determine to what extent a supplement given to a normal child will prevent it from becoming malnourished, even in an environment which is known to be adverse, as judged by the condition of its malnourished sibling.

Sibling studies provide a more precise unit for comparison, because the children are as alike as possible in several crucial aspects; therefore, biological and environmental variations are partially eliminated.

The sub-sample for this study has been drawn from the total sample of 4041 children previously presented. Aided by computer, the index child was defined as being the child in the family who had the lowest weight-for-age (all being less than 90% of standard) at the time of admission. Its sibling was a child in the same family of the same sex, who was the closest in age to the index child and had a normal weight for age (>90% of standard) at the time of admission. It was not possible to find any pair of which one member was normal and the other severely malnourished (grade III).

In this way a sub-sample of 222 natural pairs of children were formed. It consisted of 115 pairs of boys and 107 pairs of girls, aged from 6 to 36 months at the time of admission to the supplementary feeding programme.

4.2 RESULTS

4.2.1 Condition of the children and their paired siblings at the time of admission and discharge.

Since the children in this study were naturally paired by birth, their age at the time of admission to the programme varies. However, when the index child was admitted at a different time from its sibling or vice versa, their age at the time they were admitted may coincide or be similar.

The children were divided into three age groups at admission, 6 to 12 months, 12 to 24 months and 24 to 36 months of age. In general, the siblings were younger than the index cases; 66% were admitted between 6 to 12 months, compared with 34% of the index cases. The diagonal band in table 70 encloses index-sibling pairs who were in the same age-group at admission, amounting to 27% of the total.

Table 70 Number of index children and their paired siblings according to age at admission

INDEX age, months		SIBLINGS age, months			% of whole Total group	
		6-12	12-24	24-36	N	(both sexes)
6 - 12	Boys	23	7	4	34	34
	Girls	21	12	8	41	
12 - 24	Boys	37	5	13	55	44
	Girls	32	6	5	43	
24 - 36	Boys	22	1	3	26	22
	Girls	12	10	1	23	
Total	Boys	82	13	20	115	
	Girls	65	28	14	107	
% of whole group (both sexes)		66	19	15		

The mean weight and height of index children and their siblings are presented in figure 21 according to age at the time of admission.

A fairly similar pattern was observed in weight means on admission in both groups. The index children had lower weight means, since this was the criterion for the selection.

The mean height of the two groups showed an irregular pattern. Both index children and siblings showed a slow down in growth at around 15 months of age with a tendency to catch up later.

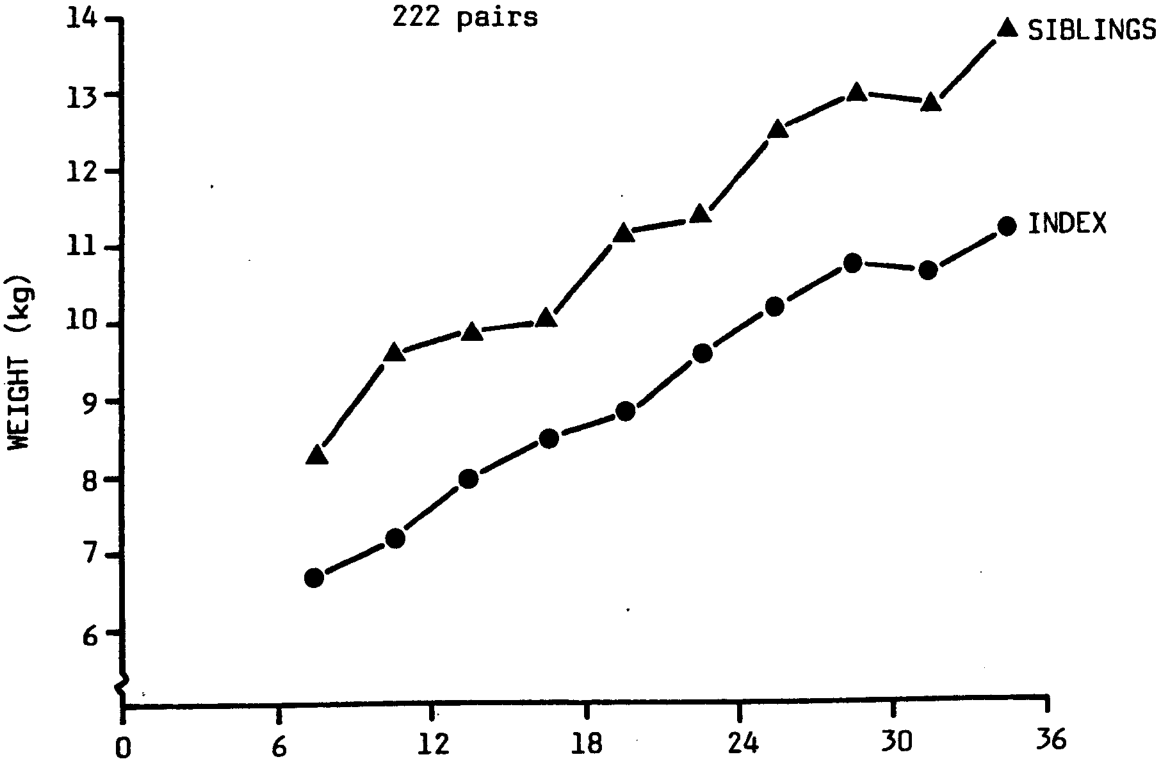
The nutritional status of index children and siblings at the time of admission and discharge is presented in table 71 in terms of mean percentage of standard for three anthropometric indicators. In addition mean age and period of supplementation have been included.

The group of children with deficit in weight-for-age (Index), were on average older at the time of discharge and had been supplemented for longer periods than their paired siblings.

The mean weight-for-age and weight-for-height in malnourished children at the time of admission (index), increases by the time of discharge although it still did not equal that of the siblings, the height-for-age decreased slightly. In the group of siblings lower means were observed at the time of discharge in all three indicators. Thus, as far as weight is concerned the index children seemed to improve, while their

Fig.21

Mean weight and height of index children and their paired siblings according to age at the time of admission.



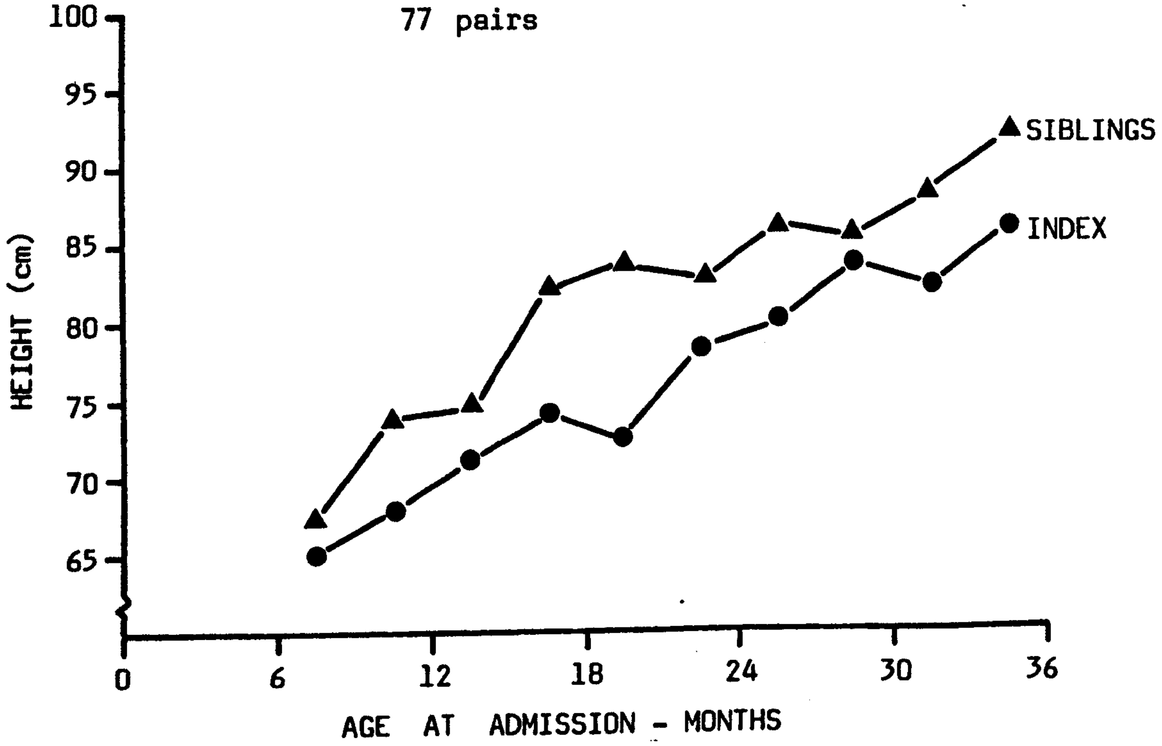


Table 71 Nutritional status of children (index) and their paired siblings at admission (A) and discharge (D).

		INDEX	SIBLING
		Mean ± S.D.	Mean ± S.D.
Age, months	(A)	17.7 ± 8.7	13.3 ± 8.6
	(D)	45.8 ± 15.4	35.8 ± 15.7
PERCENTAGE OF STANDARD			
Weight/age	(A)	79.7 ± 7.9	100.7 ± 9.0
	(D)	86.2 ± 9.2	95.5 ± 11.0
Weight/height	(A)	94.2 ± 10.7	105.2 ± 11.4
	(D)	99.1 ± 8.5	104.3 ± 12.4
Height/age	(A)	92.5 ± 6.3	98.7 ± 5.5
	(D)	92.3 ± 5.0	95.6 ± 4.9
SUPPLEMENTATION (months)		29.2 ± 0.8	23.5 ± 0.8

siblings deteriorated. The index cases remained unchanged in height (relation to the reference), while the height of the siblings fell slightly.

4.2.2 Nutritional outcome

The nutritional outcome in these pairs of children is shown in table 72 for boys (115 pairs) and for girls (107 pairs). Two aspects are of interest: the overall outcome, and the relationship of the outcome in the sibling to that in the index (or vice versa).

Regarding the overall outcome; most of the index children of both sexes, either remained unchanged (61%) or improved (33%), only 6% deteriorated. On the other hand, almost 30% of their siblings deteriorated.

Table 73 shows the values in table 72 re-arranged according to the 6 possible outcomes (for index cases: improvement, no change or deterioration; for siblings, no change or deterioration). Group A may be regarded as a successful outcome of the intervention; in the group B and C there is no overall change, the improvement in the index in C being counterbalanced by the deterioration of the sibling. Group D, E and F may all be regarded as failures. The table shows that in nearly half the pairs of children the intervention had no net effect; the remaining pairs were equally divided between successes and failures.

It is apparent from this table that in the majority of pairs, index child and siblings tend to

Table 72 Nutritional outcome of index children and their paired siblings.

Boys (115 pairs)

Index children	Siblings		
	Unchanged N-------N	Deteriorated N----------N	Total Index
Improved M------N	31	9	40
Unchanged M------N	46	22	68
Deteriorated M------MM	3	4	7
Total siblings	80	35	115

Girls (108 pairs)

Index children	Siblings		
	Unchanged N-------N	Deteriorated N----------M	Total Index
Improved M------N	31	3	34
Unchanged M------M	42	24	66
Deteriorated M------MM	5	2	7
Total siblings	78	29	107

Table 73 <u>Relation between nutritional outcome of index children and of their paired siblings. Both sexes together.</u>

OUTCOME	NUMBER	% of the whole group.
A. Index improved Sib. unchanged	62	27.9
B. Index unchanged Sib. unchanged	88	39.6
C. Index improved Sib. deteriorated	12	5.4
D. Index unchanged Sib. deteriorated	46	20.7
E. Index deteriorated Sib. unchanged	8	3.6
F. Index deteriorated Sib. deteriorated	6	2.7
Total	222	100.0

behave in the same way. Since the sibling was by definition well nourished it cannot, according to the criteria used, improve. Therefore, no change in the sibling, i.e. maintenance of good nutritional status, is taken as consistent with improvement in the index.

Thus we have:

<u>Consistent outcome</u>: Groups A+B+F = 70%

<u>Inconsistent outcome</u>: Groups C+D+E = 30%

Table 74 is a further attempt to examine the relationship between the outcome in index children and their siblings. The table shows, for each outcome group of index children, the proportion of siblings who deteriorated. The data suggests that when the index children improved, a smaller proportion of siblings deteriorated. The opposite comparison is shown in table 75. It shows, for each outcome group of siblings, the proportion of the corresponding index cases who remained unchanged or deteriorated. It is evident that when the siblings deteriorated, far fewer of the paired index cases improved.

These results, taken together, suggest a dependency between the outcome in the index children and their siblings. Statistically, this relationship is not significant in boys, but significant in girls (X^2=8.63, d.f. = 2, $0.01 < P < 0.025$).

4.2.3 <u>Effect on outcome of age of the index in relation to that of its sibling.</u>

The design of the study being to examine the

Table 74 Proportion of siblings, corresponding to each outcome group of index children, whose nutritional status deteriorates.

Number of index children in each outcome group	Boys	Girls	Percentage of corresponding group of sibs who deteriorated Boys	Girls
Improved	40	34	22.5	9
Unchanged	68	66	32	36
Deteriorated	7	7	57	29
	115	107		

Table 75 Proportion of index cases, corresponding to each outcome group of their siblings, whose nutritional status improved

Number of siblings in each outcome group.	Boys	Girls	Percentage of corresponding index cases who improved. Boys	Girls
Unchanged	80	78	39	40
Deteriorated	35	29	16	10

children naturally paired by birth, age differences occurred between the pairs.

In previous tables 70 and 71 the results have shown that siblings were younger than their malnourished index cases, most of them being below 12 months of age at admission. In this analysis we are concerned with the effect on outcome of the age of the index in relation to that of its sibling.

In order to produce a comparative analysis of outcome according to the index-sibling age relationship, the sample has been divided into three groups: Group A, sibling and index within the same age group, Group B, sibling younger than the index, and Group C sibling older than the index

Table 76 presents the nutritional outcome according to the age of the index in relation to that of its sibling. Because of the small number of pairs, this table shows sexes combined.

In the group in which the sibling remained unchanged after supplementation, the outcome in the initially malnourished index children was essentially the same, whether the index and sibling were in the same age group (A), or the sibling was younger (B). When the index child was younger its condition seemed to be more labile - a greater proportion improved but a greater proportion also deteriorated.

In the second group, corresponding to siblings whose condition deteriorated. The proportion of initially malnourished index children who improved was

Table 76. Nutritional outcome according to the age of the index child in relation to its sibling. (222 pairs).

	SIBLING											
Nutritional Outcome	UNCHANGED N---------N						DETERIORATED N---------M					
	(A)		(B)		(C)		(A)		(B)		(C)	
INDEX	N	%*	N	%	N	%	N	%	N	%	N	%
IMPROVED M------N	16	39.0	30	36.6	16	45.7	4	22.2	6	18.8	2	14.3
UNCHANGED M------M	24	58.5	48	58.5	16	45.7	13	72.2	23	71.9	10	71.4
DETERIORATED M------MM	1	2.4	4	4.9	3	8.6	1	5.6	3	9.4	2	14.3
Total siblings	41	100.0	82	100.0	35	100.0	18	100.0	32	100.0	14	100.0

(A) Sibling and index withing the same age group.
(B) Sibling younger than the index.
(c) Sibling older than the index.

* Outcome in index children, as a percent of number of children in each age and sibling group.

greater in Group A and least in Group C. The proportion who deteriorated showed the opposite pattern.

These results, taken in conjunction with those of table 75, suggest the following conclusions:

1. If deterioration of previously healthy siblings may be taken as an indicator of adverse home environment, this adverse environment counteracts the effect of the intervention, since a smaller proportion of the initially malnourished children respond favourably.

2. The effect of the adverse environment is more severe in young children. The proportion who improve is lower, and the proportion who deteriorate higher when the index child is younger than its sibling.

CHAPTER FOUR

DISCUSSION AND CONCLUSIONS

1. THE BRAZILIAN NATIONAL FOOD AND NUTRITION POLICY

The nutrition problem in Brazil, as in most developing countries is a consequence of socio-economic underdevelopment; thus, its solution will depend on the development of the country. Development, however, is clearly a slow complex process and malnutrition is affecting generations of children who cannot wait for it to occur. Generations have already had their productive capacity impaired by malnutrition and have been reduced in the early years of life by mortality correlated to malnutrition. Therefore immediate action is required to alleviate the effect of malnutrition on vulnerable groups.

Every developing country, including Brazil, has attempted several models for socio-economic development within the context of the direction of their policies; however most of them have failed. The Brazilian model of development has been no exception. The results were economic crises and the deterioration of living conditions of most of the population. As an attempt to alleviate the disastrous consequences of the model of development, a series of interventions emerged, among them, The National Food and Nutrition Programme.

In the food sector, incentives were offered to increase production and rationalization of marketing of basic food stuffs consumed by the poor. Along with this measure, a reasonable food supply was maintained through exchange between regions, and canalized via government stock.

In theory these mearures should help the people in need to meet their nutritional requirements. Certainly there has been more food in the market at "reasonable prices". The question is whether poor unemployed people facing an inflation rate of 120% a year are able to buy enough food to meet their nutritional requirements. This policy was obviously badly needed by the poor, whose desperately low purchansing power barely permit them to be spared from hunger, but unfortunately the expected successes seemed to be marred by lack of support.

In the nutrition sector measures were taken to implement the biggest supplementary feeding programme ever sponsored by a government from a developing country,the National Health and Nutrition Programme. Ideally this programme, as can be observed from the design presented in the introduction, has been carefully designed, planned and implemented. However, there is no available information about the effectiveness of this intervention.

In the design of the programme, there is some doubt about the sensitivity of the criteria used to screen the children, and whether children with the greatest nutritional deficits are full participants in the programme. To be eligible, to remain in the programme and to continue to receive the supplement, there must be a positive initiative from the parents, and this has been considered lacking just where the need for the programme is greatest.

This possible under-representation of children in greatest need has been reported mainly in rural areas where distance introduces a geographical bias and lack of information prevents mothers from taking advantage of the programme to get food for their needy children.

In urban areas, however, a different situation exists. Most of the poor and needy are concentrated in the slums of the cities, where health centers are located. Moreover mass communication media is one of the aspects of the "new modern life" most appreciated and valued by these new town dwellers. This aspect is particularly pronounced in relation to food, specially that of baby foods, so that the poor are the most vulnerable consumers.

Unfortunately developing countries, such as Brazil, do not have the necessary infra-structure and availability of qualified personnel to research specific aspects and basic priorities. Therefore, if one is dealing with socio-economically deprived communities, as in slum areas, for a mother to be poor, pregnant, or lactacting or to have a malnourished child in the family, is considered a type of screening sensitive enough for eligibility to receive supplementary food.

The programme design had considered more selective criteria of the candidates, to be applied in case of shortage of food supplement due to an increasing demand. However, in the area studied it was not necessary to enforce this selection. The availability of food supplement, however, was more likely to be the result of a high rate of drop-outs, rather than an increase in the supply.

Experience has shown that neglecting drop-outs and including more children in the programme, would neither help to include children in need previously missed, nor would improve the overall nutritional condition of the community. Furthermore, the cost of this policy would not justify the benefit if any, where there is a need to optimize resources.

Knowledge of the drop-outs and mortality of children attending a programme is basic to a full evaluation of the effectiveness of any intervention. Unfortunately, these aspects were beyond the scope of this study. It would make a crucial difference in drawing conclusions about the impact of the Brazilian programme, to know whether the drop-outs were normal or malnourished. However, some conclusion could be drawn if the drop-outs are in proportion to the distribution of children at the beginning of the programme. This assumption would hold, if all drop-outs were out-migrants from the area and if out-migration was independent of nutritional status.

If it is possible that the results of this study underestimate the value of the programme; it is also possible that in its absence the average nutritional status of the children would have deteriorated. It is also possible that some children improved,though not by enough to take them to a high category, and that the feeding programme prevented death from malnutrition related causes. However, our study does not allow us to read into the evaluation any further conclusion about the impact of the supplementary feeding programme, since the tracing of drop-outs was beyond its scope.

In the specific case of population immigrating from rural areas to the cities, as in Brazil, special attention should be paid to the educational aspects of the nutritional intervention. Our experience has shown that there is a great need for reinforcement of the importance and value of breast feeding, which has been badly affected by the "new modern life" of the cities. In addition, there is a forced changed in the food habits and feeding patterns imposed by the new living conditions of the urban areas.

2. EVALUATION OF NUTRITION INTERVENTION

2.1 RESEARCH DESIGN.

The objective of any nutrition intervention is to improve the nutritional status of target groups. Thus its evaluation is to determine whether there has been an improvement in the nutritional condition of children in the target community. Ideally, the programme should be preventing children from becoming malnourished. In order to evaluate the programme from this point of view it would be necessary to compare the nutritional status of children of a given age, who had been exposed to the programme, with that of children of the same age who had not been exposed to it. This type of evaluation is difficult since nutritional status is not the result of a single factor but of several factors inter-related with the environment. It would be necessary to control these confouding variables to determine whether the observed changes in the nutritional status of the recipients were likely to be due to the supplement or to other non-nutritional factors. However, ethical principles prevent the application of an experimental design for controlling confounding variables. The selection of controls would also be difficult because of the type of voluntary selection used in most such interventions.

Because of these difficulties it has been necessary to adopt an approach in which each child is used as its own control. The target group consists of children living in a deprived environment. The intervention provides supplementary food, nutrition orientation and primary health care, and is directed to the improvement of the nutritional condition of the children within their specific environment. Some of these children enter the programme in a malnourished state. Therefore one part of the evaluation is to find out whether these children improve.

In a second group of children the nutritional status is normal at the time of admission to the programme. We can find out whether these children deteriorate. What we cannot tell is whether the deterioration would have been more widespread, or worse, if the children had not been included in the programme. Thirdly, by comparing the progress of malnourished children with their well nourished sibs we can get some idea of the influence of the family environment.

The procedure adopted is therefore that of comparative cohort analysis. More evidence about the effectiveness of the intervention can be obtained by defining the cohorts according to the age of the child on admission and the period of supplementation.

A problem which always presents difficulty is reduction of the original sample produced by drop-outs during the follow-up. This is inevitable in any kind of long-term programme, specially in slum areas where there is a high mobility of the population.

2.2 INDICATORS AND METHODS OF ANALYSIS.

As discussed in the introduction, three questions have to be considered in the choice of indicators; arithmetic methods of analysing the results and systems of classifying or evaluating the results in order to assess the prevalence of malnutrition.

The basic indicators used in this study were weight and height in relation to age, and weight in relation to height. It was necessary to rely on the information collected at the health centers, and this did not include the measurements such as skinfold thickness, arm circumference or head circumference. It is doubtful whether these measurements would have contributed much to the evaluation, even if they had been available.

Three different methods of analysing the data have been used and compared: percent of reference standard, deviation scores and centiles. With the percent of reference method cut-off points for assessing the prevalence of malnutrition are inevitably arbitrary. With the SD-scores a cut-off point of -2SD below the reference median at least has some statistical meaning. Where the percent of reference and SD-scores give different results for the prevalence of malnutrition, the latter is to be prefered.

The centile method has the disadvantage that extreme variations are difficult to determine. In this study, as in most studies of malnourished populations, a large number of children fell far outside the range of the reference population, so that they could not be accurately classified by centiles. However, histograms showing the distribution of cases in deciles of the reference population provide a good picture of the nutritional state of the population under study.

Coming now to use of the indicators and system of classifying the results: two systems based on weight for age have been compared, that of Gómez and of Jelliffe. They differ only in separation of the cut-off points for the different grades of malnutrition. If improvement or deterioration are assessed by increment from one grade to another, the Jelliffe system tends to magnify the changes, because the cut-off points are closer together than in the Gómez classification. One cannot say that one system is better than the other. The important point is to make clear which is being used.

Weight-for-height is an important indicator, as a measure of acute and current malnutrition. However, in the present study this indicator was not very useful, except in a negative sense, because relatively few children were wasted.

Analysis of height-for-age has shown that retardation in growth (stunting) increases with increasing age of the child at the time of admission. This stunting, which some describe as "chronic malnutrition" is very common in children in Northeast Brazil.

The data presented in this study generally supports the view that the Waterlow classification gives considerably more information with regard to the type of malnutrition of differents groups of children than simply using the classification based on weight-for-age. However, since weight-for-age is a very widely used indicator, particularly when measurement of height is not possible; it is necessary to make comparisons between the two system. As far as prevalence rates are concerned the proportion of children below 36 months diagnosed as malnourished by the Waterlow classification (31%) was similar to the proportion diagnosed by the Jelliffe classification (32%); with a cut-off point at 80% of standard weight-for-age. The agreement found between these two estimates suggests that deficits of 20% in weight-for-age would provide a reasonable cut-off point for relative comparisons of the prevalence of malnutrition.

The Action Diagram (page 35) designed to establish types of action to be undertaken by an intervention has been used in this study as part of the exercise of testing the available methods for interventions. According to this diagram 69% of the children in the present sample needed No Action at the time of admission. However, it is important to bear in mind that most of these children were normal siblings of malnourished children. Within the epidemiological concept of risk, these children were considered in need of action. The criteria of judgement in the Action Diagram is based on the actual nutritional status of a child and therefore risk factors are not considered. Hence, caution is required in the application of the Action Diagram when risk factors are to be considered by the intervention.

3. RESULTS

The results of this study were derived from a large sample of children from urban slum areas in Northeast Brazil; therefore they will not be representative of all regions of the country.

If we consider that the children in each age group at the time of admission are on the whole a good representation of the children of that age group in the community, a fairly good indication of the nutritional condition of this area may be obtained. Beyond this point however, other selective factors are involved throughout the follow up, which prevent further inferences. The willingness of the parents to keep attending the programme might produce a further selection of the children who stayed receiving supplements for longer periods.

We hope that the chosen survey approach may be useful in enlightening some aspects of the evaluation of nutrition interventions.

3.1 NUTRITIONAL STATUS OF CHILDREN AT ADMISSION AND DISCHARGE.

The anthropometric analysis has shown that the children could mainly be described as moderately malnourished at the time of admission largely because of deficits in height. In general, malnutrition affected mainly older children.

The significant differences in nutritional status between boys and girls found in some places were not observed in the children here. The proportion of stunted children detected at the time of admission (27%) increased by the time of discharge (29%). Conversely the low proportion of wasting found on admission (6%) was considerably reduced by the time of discharge (1%).

Although there is an increase in the proportion of stunted children after supplementation, the pattern of height retardation in relation to the age of the child changes. Older children were no longer more affected than the younger ones. This finding suggests that the intervention had partially attenuated the effect of the process of chronic malnutrition.

The combination of these two types of malnutrition given by Waterlow (102), showed that the wasted but not stunted type initially found in 4% of the children, virtually disappeared after supplementation (0.8%). Stunting without wasting, however, increases from 26% to 29% between admission and discharge. Thus, the results show stunting without wasting as the predominant type of malnutrition found in Northeast Brazil.

It is known that if constraints in nutritient supply are encountered at a given rate of growth, the rate is slowed to bring demand into equilibrium with supply as an adaptative process. Are these children in fact "small but healthy"? To answer this question it is necessary to obtain independent evidence of functional impairement, oterwise the meaning of this kind of 'malnutrition' becomes extremely ambiguous.

Some evidence in respect of mortality has been provided by the study of Bangladesh children by Chen et al (20).

A high mortality was found at severe levels of stunting (height less than 85% of standard) but there was no difference in mortality between mild or moderately stunted children and normal children. However, more studies are necessary in respect of other individual biological functions (inmmune system, biochemical parameters, psychomotor function, intelligence quotient, etc).

The most severe type of malnutrition (wasting plus stunting) was found in only 2% of the children at the time of admission being reduced to 0.4% by the time of discharge. This finding confirms that there is not a severe nutritional problem in the group. This type of malnutrition reflects a long-term marginal undernutrition, coupled with superimposed acute food deprivation. This was not the picture observed in Northeast Brazilian children.

3.2 NUTRITIONAL OUTCOME.

The comparative analyses of outcome showed that 57% (39/68) of the children who were initially wasted but not stunted and 33% (168/512) of those stunted but not wasted, became normal after supplementation. This finding apparently suggests that those children whose height was adquate at the time of admission responded better to the intervention. It is evident that weight deficit is easier and quicker to catch-up than deficit in height. Thus, 65% (332/512) of the stunted but not wasted chldren did not change from their initial condition at admission; whereas, of the wasted but not stunted children only 13% (9/68) remained unchanged.

Acute malnutrition (wasting but not stunting) has been effectively reduced during the programme, but chronic malnutrition has not been signigicantly altered. This conclusion is supported by the fact that 29% of the children who initially had an adequate height became stunted by the time of discharge, although they maintained an adequate weight in relation to height.

One could hypothesize that if a child had managed to mantain an adequate height up to the time of admission, its intake before supplementation could not have been very deficient, and it is unlikely that extra food could increase its linear growth. A weight deficit in such a child could be due to recent and short-term reduction of intake, or to intercurrent infectious disease, in which case it would be temporary faltering, rather than malnutrition.

It is not surprising that this kind of weight deficit was quickly made good by the intervention.

On the other hand, a very large number of children particularly the older ones, were stunted at the time of admission. Smallnes in height in this area, as in most of the Latin American poor communities, is a product of poverty, of poor physical and socio-economic enviroments.

These children are not as far as we can see in clear and present danger of malnutrition as a pathological state of deficiency, entailing functional impairement. Therefore the major emphasis of the intervention should be directed towards improving poor environments rather than to individuals.

The importance of the environment in defining the nutritional status of the children was confirmed by the sibling study. It was found that the effect of the environment counteracts the effect of the intervention. There is a significant dependency between the outcome in the index child and its sibling.

Furthermore, 30% of initially normal siblings became malnourished inspite of being receiving food supplement and health care. This re-inforces the importance of the environment.

The intervention had less effect in younger children, who presented the lowest proportion of improvements and the highest proportion of deteriorations. (Tables 60 to 65). In addition the sibling study showed that the adverse effect of the environment was more severe when the malnourished child was younger than its sibling. This finding suggest that better results may be obtained from the intervention if priority is giving to children to children below 12 months of age.

On the whole the effect of the intervention is quite disapointing because the proportion who improve is small. Most of the children who deteriorated were initially well-nourished, indicating that the intervention had not been effective in protecting these children who were at risk of malnutrition. However, longer supplementation is clearly more effective.

Despite all the reservations about the true benefit of large scale programmes of this kind they should continue to be implemented because this is the only feasible means of tackling malnutrition within the exixting political context of Brazil. If these programmes are properly evaluated, some guidelines would be provided to improve their impact. From the Brazilian case, based on the results of this study, and from our experience in the area some recommendations with this aim are presented:

1. The disintegration of family nuclei and deprived social conditions, commonly observed in slum areas, have a decisive effect on child feeding and care. Therefore, these aspects should be considered in the intervention, requiring full participation of social workers along with the nutrition staff.
2. There is need for greater incetive towards the educational aspects of this programme. Nutritional education, specially promotion of breast feeding, needs to be reinforced and more incentives should be provided.
3. Systematic evaluation should be included as part of the programme design in order to obtain a monitoring system in each health center which would process the information at local level and be presented to the coordinators of the programme at national level.
4. The methods for analysing changes in the nutritional status of children should be standardized at the national level in order to assess the comparative benefits achieved in

the differents regions of the country.

5. Greater effort should be concentrated on checking the reproducibility of anthropometric measurements in order to ensure a valid, reliable and utilizable data base for the evaluation.
6. International standards should be adopted in order to obtain a better evaluation of the nutritional status of children and particularly to allow the results to be useful for nutrition workers at the international level.
7. Special priority should be given by the intervention to younger children (below 12 months of age).

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APPENDICES

(1)

Appendix I.

Comparison of height (length) 50th centile standard value for Brazilian (Marcondes) and U.S.A. children (NCHS) at selected ages by sex.

age (months)		BOYS						GIRLS					
			Marcondes by social class						Marcondes by social class			
	NCHS	Marcondes	IV	III	II	I	NCHS	Marcondes	IV	III	II	I
3	61.1	61.0	61.0	60.0	60.0	60.0	59.5	59.0	60.0	59.0	59.0	58.0
6	67.8	65.0	66.0	66.0	65.0	64.0	65.9	64.0	65.0	64.0	64.0	63.0
9	72.3	70.0	71.0	70.0	69.0	68.0	70.4	68.0	69.0	69.0	68.0	67.0
12	76.1	74.0	75.0	74.0	73.0	72.0	74.3	72.0	73.0	73.0	72.0	71.0
18	82.4	80.0	82.0	80.0	79.0	78.0	80.9	79.0	80.0	79.0	78.0	77.0
24	87.6	85.0	87.0	86.0	85.0	83.0	86.5	84.0	86.0	85.0	83.0	82.0
30	92.3	90.0	91.0	90.0	89.0	87.0	91.3	88.0	91.0	89.0	87.0	86.0
36	96.5	93.0	95.0	94.0	93.0	91.0	95.6	92.0	95.0	93.0	91.0	90.0

(2)

Comparison of weights (50th centile) standard values for Brazilian (Marcondes) and U.S.A. children (NCHS) at selected ages by sex.

age (months)	BOYS						GIRLS					
			Marcondes by social class						Marcondes by social class			
	NCHS	Marcondes	IV	III	II	I	NCHS	Marcondes	IV	III	II	I
3	5.98	6.45	6.39	6.61	6.32	6.15	5.40	5.87	5.90	5.93	5.83	5.65
6	7.85	7.58	7.84	7.69	7.43	7.13	7.21	7.09	7.24	7.23	6.96	6.73
9	9.18	8.58	9.08	8.67	8.42	8.00	8.56	8.14	8.40	8.34	7.94	7.67
12	10.15	9.47	10.12	9.56	9.30	8.78	9.53	9.05	9.43	9.29	8.81	8.49
18	11.47	10.98	11.76	11.09	10.78	10.13	10.82	10.56	11.14	10.83	10.26	9.85
24	12.59	12.23	13.00	12.38	12.00	11.27	11.90	11.76	12.51	12.02	11.44	10.93
30	13.67	13.30	13.99	13.48	13.02	12.26	12.93	12.78	13.66	12.99	12.43	11.84
36	14.69	14.26	14.87	14.46	13.92	13.18	13.93	13.68	14.68	13.84	13.31	12.66

(1)

Appendix II.
Means, median, standard deviation and coefficient variation of weight measurement by age and sex.

Age (months)	BOYS					GIRLS				
	n	$\bar{x}$	median	S.D.	C.V.	n	$\bar{x}$	median	S.D.	C.V.
6	215	7.566	7.601	1.289	17.041	207	6.997	6.899	1.276	18.234
7	157	8.096	8.047	1.259	15.555	169	7.337	7.297	1.216	16.567
8	148	8.018	8.002	1.485	18.522	132	7.574	7.445	1.203	15.881
9	120	8.109	8.145	1.489	18.361	123	7.535	7.520	1.234	16.377
10	111	8.397	8.197	1.436	17.252	85	7.742	7.801	1.428	18.445
11	103	8.628	8.620	1.648	19.105	74	8.191	8.102	1.482	18.090
12	81	8.821	8.630	1.472	16.691	85	8.606	8.510	1.399	16.256
13	72	8.525	8.705	1.360	15.951	68	8.486	8.550	1.484	17.482
14	68	8.997	9.097	1.448	16.097	62	8.453	8.502	1.131	13.382
15	40	8.828	8.605	1.473	16.682	68	9.022	8.955	1.728	19.155
16	63	9.385	9.498	1.607	17.122	48	8.710	8.998	1.294	14.856
17	48	9.345	9.385	1.453	15.552	41	8.864	9.100	1.195	13.486
18	38	9.633	9.715	1.954	20.284	58	8.927	9.105	1.558	17.448
19	46	9.442	9.410	1.798	19.086	42	9.298	9.300	1.600	17.212
20	51	9.575	1.550	1.545	16.136	55	9.378	9.500	1.562	16.653
21	50	10.064	10.103	1.345	13.367	53	9.234	9.587	1.543	16.707
22	41	10.219	9.994	1.658	16.230	55	9.981	9.604	1.430	14.325
23	40	10.510	10.003	1.941	18.446	51	9.331	9.500	1.424	15.262
24	47	10.584	10.793	1.694	16.000	56	10.302	10.285	1.339	12.995
25	51	10.384	10.403	2.027	19.517	47	9.965	10.100	1.659	16.649
26	49	11.137	10.995	1.623	14.572	51	10.549	10.650	1.504	14.252
27	37	10.841	10.760	1.571	14.489	38	10.813	10.900	1.758	16.256
28	33	9.849	9.995	2.073	21.053	42	10.990	10.995	1.473	13.399
29	46	11.187	11.315	1.422	12.713	40	10.417	10.330	1.369	13.140
30	38	11.447	11.110	1.533	13.389	44	11.153	11.400	1.791	16.057
31	39	11.665	11.750	1.672	14.075	42	11.150	11.492	1.983	17.789
32	34	11.126	11.500	1.897	17.052	45	10.802	10.998	1.578	14.607
33	34	11.715	11.905	1.671	14.265	42	11.465	11.350	1.702	14.845
34	40	12.261	12.300	1.881	15.341	45	11.889	11.972	1.753	14.746
35	39	12.178	12.021	1.607	13.196	39	12.114	11.900	1.926	15.902
36	29	12.139	12.400	1.715	14.131	26	11.200	10.525	2.178	19.445

2)

Means, median, standard deviation and coefficient variation of height measurements by age and sex.

Age (months)	BOYS					GIRLS				
	n	$\bar{x}$	Median	SD	C.V.	N	$\bar{x}$	median	SD	C.V.
6	129	66.4	66.5	4.6	6.94	100	65.0	64.9	3.9	6.11
7	88	67.6	67.3	4.1	6.05	97	66.0	64.4	4.0	6.04
8	84	68.0	67.7	4.9	7.17	76	67.7	66.9	5.6	8.33
9	66	68.6	68.4	4.6	6.82	79	67.6	67.2	4.8	7.18
10	70	70.1	69.5	4.8	6.84	47	69.1	69.2	4.5	6.45
11	54	70.6	71.9	4.8	6.76	45	71.1	70.8	6.1	8.65
12	49	71.3	71.9	4.0	5.59	41	71.6	71.9	4.2	5.89
13	35	71.7	71.9	5.5	7.71	47	70.9	70.7	3.9	5.61
14	27	73.2	73.7	4.9	6.72	30	72.2	71.5	4.5	6.19
15	24	73.9	73.3	6.1	8.32	38	74.6	74.5	5.5	7.37
16	27	74.5	75.3	4.2	5.59	22	72.8	73.2	5.3	7.28
17	23	73.7	74.3	4.8	6.47	21	74.1	74.3	3.8	5.10
18	19	76.1	76.4	6.3	8.29	25	74.4	74.8	4.4	5.92
19	23	74.8	76.0	7.3	8.82	21	75.3	76.0	6.4	8.45
20	25	77.7	78.3	4.6	5.91	31	74.9	74.8	5.8	7.69
21	26	78.2	79.6	4.0	5.06	28	74.6	74.8	4.6	6.12
22	27	76.4	77.3	4.8	6.22	24	76.8	76.5	4.5	5.85
23	22	79.5	78.5	6.8	8.56	20	77.2	76.5	4.7	6.09
24	25	78.2	77.8	5.8	7.42	24	79.2	79.5	4.4	5.53
25	27	78.7	80.3	6.2	7.94	19	79.2	79.0	4.8	6.09
26	24	81.2	81.8	4.3	5.34	22	77.0	76.1	5.9	7.63
27	14	81.5	81.5	5.0	6.16	16	82.3	80.0	6.9	8.47
28	18	80.5	81.8	6.9	8.66	19	83.7	83.6	4.6	5.48
29	21	83.9	85.0	5.5	6.52	24	80.7	80.5	6.6	8.24
30	16	81.5	81.5	5.4	6.62	22	84.1	84.5	4.1	4.87
31	22	82.0	83.0	6.4	7.83	23	81.3	83.0	6.6	8.14
32	12	82.6	83.8	5.1	6.16	19	81.1	83.7	7.2	8.90
33	14	84.7	82.5	6.5	7.69	28	84.3	84.8	6.6	7.88
34	20	83.6	85.5	7.6	9.13	17	85.5	84.7	4.5	5.29
35	23	84.9	85.3	6.2	7.34	23	86.8	86.0	6.9	7.95
36	16	84.7	85.5	5.8	6.85	11	81.7	80.7	5.7	7.03

Appendix III (1)

Number and percentage of boys aged between 6 to 36 months at admission according to their nutritional status,Waterlow Classification

Grade of Stunting	% of expected ht/age	Grade of wasting				Total N %
		0	1	2	3	
		% of expected weight for height				
		>90%	90 - 80%	80 - 70%	<70%	
0	>90%	319	75	18	8	420
		(29.8)	(7.0)	(1.7)	(0.7)	(39.3)
1	95 - 90%	283	50	11	1	345
		(26.4)	(4.7)	(1.0)	(0.1)	(32.2)
2	90 - 85%	140	31	6	2	179
		(13.1)	(2.9)	(0.6)	(0.2)	(16.7)
3	<85%	94	19	11	2	126
		(8.8)	(1.8)	(1.0)	(0.2)	(11.8)
Total	N	836	175	46	13	1070
	%	(78.1)	(16.4)	(4.3)	(1.2)	(100.0)

(2)

Number and percentage of girls aged between 6 to 36 months at admission according to their nutritional status, Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total
		0	1	2	3	N
		% of expected weight for height				%
		>90%	90 - 80%	80 - 70%	<70%	
0	>90%	325	90	19	13	447
		(30.7)	(8.5)	(1.8)	(1.2)	(42.2)
1	95 - 90%	262	60	7	2	331
		(24.7)	(5.7)	(0.7)	(0.2)	(31.3)
2	90 - 85%	142	29	11	1	183
		(13.4)	(2.7)	(1.0)	(0.1)	(17.3)
3	<85%	72	19	6	1	98
		(6.8)	(1.8)	(0.6)	(0.1)	(9.3)
Total	N	801	198	43	17	1059
	%	(75.6)	(18.7)	(4.1)	(1.6)	(100.0)

Appendix IV. (1)

Number and percentage of children by age at admission according to their weight for age standard percentiles (n = 4041)

	NCHS PERCENTILES															
Age	$< P_5$		P_5-P_{10}		$P_{10}-P_{25}$		$P_{25}-P_{50}$		$P_{50}-P_{75}$		$P_{75}-P_{90}$		$P_{90}-P_{95}$		$P_{95}-P_{100}$	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	223	21.7	105	10.2	173	16.8	209	20.3	152	14.8	95	9.2	25	2.4	46	4.5
9 - 11.99	238	38.6	67	10.9	107	17.4	93	15.1	69	11.2	20	3.2	7	1.1	15	2.4
12 - 14.99	186	42.7	59	13.5	89	20.4	41	9.4	31	7.1	18	4.1	4	0.9	8	1.8
15 - 17.99	144	46.8	43	14.0	50	16.2	41	13.3	20	6.5	5	1.6	2	0.6	3	1.0
18 - 20.99	142	49.0	36	12.4	54	18.6	34	11.7	14	4.8	5	1.7	2	0.7	3	1.0
21 - 23.99	149	51.4	40	13.8	44	15.2	32	11.0	13	4.5	9	3.1	2	0.7	1	0.3
24 - 26.99	138	45.8	42	14.0	49	16.3	37	12.3	28	9.3	4	1.3	1	0.3	2	0.7
27 - 29.99	119	50.4	37	15.7	27	11.4	31	13.1	19	8.1	3	1.3	-	-	-	-
30 - 32.99	117	48.3	27	11.2	52	21.5	28	11.6	12	5.0	4	1.7	2	0.8	-	-
33 - 36.00	129	43.9	37	12.6	67	22.8	27	9.2	27	9.2	5	1.7	1	0.3	1	0.3
Total	1585	39.2	493	12.2	712	17.6	573	14.2	385	9.5	168	4.2	46	1.1	79	2.0

(2)

Number and percentage of boys by age at admission according to their weight for age standard percentiles (n = 2008)

Age	N C H S P E R C E N T I L E S															
	$< P_5$		P_5-P_{10}		$P_{10}-P_{25}$		$P_{25}-P_{50}$		$P_{50}-P_{75}$		$P_{75}-P_{90}$		$P_{90}-P_{95}$		$P_{95}-P_{100}$	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	117	22.5	43	8.3	91	17.5	109	21.0	78	15.0	48	9.2	13	2.5	21	4.0
9 - 11.99	141	42.2	29	8.7	50	15.0	50	15.0	37	11.1	15	4.5	4	1.2	8	2.4
12 - 14.99	111	50.2	32	14.5	35	15.8	15	6.8	15	6.8	8	3.6	1	0.5	4	1.8
15 - 17.99	82	54.3	18	11.9	18	11.9	20	13.2	9	6.0	2	1.3	1	0.7	1	0.7
18 - 20.99	73	54.1	16	11.9	19	14.1	16	11.9	7	5.2	1	0.7	1	0.7	2	1.5
21 - 23.99	66	50.4	17	13.0	20	15.3	15	11.5	7	5.3	4	3.1	1	0.8	1	0.8
24 - 26.99	70	47.6	21	14.3	16	10.9	20	13.6	18	12.2	2	1.4	-	-	-	-
27 - 29.99	66	56.9	17	14.7	12	10.3	14	12.1	7	6.0	-	-	-	-	-	-
30 - 32.99	57	51.4	11	9.9	24	21.6	12	10.8	5	4.5	2	1.8	-	-	-	-
33 - 36.00	55	38.7	24	16.9	36	25.4	12	8.5	13	9.2	2	1.4	-	-	-	-
Total	838	41.7	228	11.4	321	16.0	283	14.1	196	9.8	84	4.2	21	1.0	37	1.8

(3)

Number and percentage of girls by age at admission according to their weight for age standard percentiles (n = 1059)

Age	NCHS PERCENTILES															
	$< P_5$		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	22	8.1	14	5.1	35	12.8	61	22.3	58	21.2	43	15.8	19	7.0	21	7.7
9 - 11.99	24	14.0	16	9.4	27	15.8	37	21.6	25	14.6	22	12.9	6	3.5	14	8.2
12 - 14.99	11	9.3	15	12.7	15	12.7	26	22.0	18	15.3	15	12.7	5	4.2	13	11.0
15 - 17.99	12	14.8	12	14.8	15	18.5	22	27.2	9	11.1	6	7.4	3	3.7	2	2.5
18 - 20.99	9	11.7	7	9.1	15	19.5	23	29.9	9	11.7	3	3.9	3	3.9	8	10.4
21 - 23.99	6	8.3	5	6.9	20	27.8	18	25.0	12	16.7	5	6.9	1	1.4	5	6.9
24 - 26.99	5	7.7	6	9.2	11	16.9	18	27.7	16	24.6	5	7.7	2	3.1	2	3.1
27 - 29.99	6	10.2	6	10.2	14	23.7	9	15.3	16	27.1	6	10.2	-	-	2	3.4
30 - 32.99	4	6.3	4	6.3	10	15.6	15	23.4	21	32.8	5	7.8	2	3.1	3	4.7
33 - 36.00	6	7.6	7	8.9	12	15.2	22	27.8	22	27.8	8	10.1	-	-	2	2.5
Total	105	9.9	92	8.7	174	16.4	251	23.7	206	19.5	118	11.1	41	3.9	72	6.8

(4)

Number and percentage of children by age at admission according to their weight for height standard percentiles (n = 2129)

	NCHS PERCENTILES															
Age	$< P_5$		P_5-P_{10}		$P_{10}-P_{25}$		$P_{25}-P_{50}$		$P_{50}-P_{75}$		$P_{75}-P_{90}$		$P_{90}-P_{95}$		$P_{95}-P_{100}$	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	44	7.7	28	4.9	66	11.5	125	21.8	144	25.1	84	14.6	30	5.2	53	9.2
9 - 11.99	54	15.0	29	8.0	54	15.0	72	19.9	67	18.6	44	12.2	13	3.6	28	7.8
12 - 14.99	32	14.0	22	9.6	29	12.7	61	26.6	35	15.3	22	9.6	6	2.6	22	9.6
15 - 17.99	24	15.5	14	9.0	25	16.1	43	27.7	23	14.8	11	7.1	9	5.8	6	3.9
18 - 20.99	18	12.5	14	9.7	30	20.8	38	26.4	21	14.6	4	2.8	7	4.9	12	8.3
21 - 23.99	20	13.6	10	6.8	31	21.1	36	24.5	24	16.3	14	9.5	3	2.0	9	6.1
24 - 26.99	15	10.6	12	8.5	24	17.0	32	22.7	23	24.1	15	10.6	5	3.5	4	2.8
27 - 29.99	12	10.7	11	9.8	28	25.0	25	22.3	23	20.5	10	8.9	-	-	3	2.7
30 - 32.99	7	6.1	5	4.4	20	17.5	33	28.9	32	28.1	10	8.8	3	2.6	4	3.5
33 - 36.00	13	8.6	10	6.6	24	15.8	40	26.3	39	25.7	18	11.8	1	0.7	7	4.6
Total	239	11.2	155	7.3	331	15.5	505	23.7	442	20.8	232	10.9	77	3.6	148	7.0

(5)

Number and percentage of boys by age at admission according to their weight for height standard percentiles (n = 1070)

Age					NCHS	PERCENTILES										
	$< P_5$		P_5-P_{10}		$P_{10}-P_{25}$		$P_{25}-P_{50}$		$P_{50}-P_{75}$		$P_{75}-P_{90}$		$P_{90}-P_{95}$		$P_{95}-P_{100}$	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	22	7.3	14	4.7	31	10.3	64	21.3	86	28.6	41	13.6	11	3.7	32	10.6
9 - 11.99	30	15.8	13	6.8	27	14.2	35	18.4	42	22.1	22	11.6	7	3.7	14	7.4
12 - 14.99	21	18.9	7	6.3	14	12.6	35	31.5	17	15.3	7	6.3	1	0.9	9	8.1
15 - 17.99	12	16.2	2	2.7	10	13.5	21	28.4	14	18.9	5	6.8	6	8.1	4	5.4
18 - 20.99	9	13.4	7	10.4	15	22.4	15	22.4	12	17.9	1	1.5	4	6.0	4	6.0
21 - 23.99	14	18.7	5	6.7	11	14.7	18	24.0	12	16.0	9	12.0	2	2.7	4	5.3
24 - 26.99	10	13.2	6	7.9	13	17.1	14	18.4	18	23.7	10	13.2	3	3.9	2	2.6
27 - 29.99	6	11.3	5	9.4	14	26.4	16	30.2	7	13.2	4	7.5	-	-	1	1.9
30 - 32.99	3	6.0	1	2.0	10	20.0	18	36.0	11	22.0	5	10.0	1	2.0	1	2.0
33 - 36.99	7	9.6	3	4.1	12	16.4	18	24.7	17	23.3	10	13.7	1	1.4	5	6.8
Total	134	12.5	63	5.9	157	14.7	254	23.7	236	22.1	114	10.7	36	3.4	76	7.1

(6)

Number and percentage of girls by age at admission according to their weight for age standard percentiles (n = 2033)

Age	NCHS PERCENTILES															
	$< P_5$		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	106	20.9	62	12.2	82	16.1	100	19.7	74	14.6	47	9.3	12	2.4	25	4.9
9 - 11.99	97	34.4	38	13.5	57	20.2	43	15.2	32	11.3	5	1.8	3	1.1	7	2.5
12 - 14.99	75	34.9	27	12.6	54	25.1	26	12.1	16	7.4	10	4.7	3	1.4	4	1.9
15 - 17.99	62	39.5	25	15.9	32	20.4	21	13.4	11	7.0	3	1.9	1	0.6	2	1.3
18 - 20.99	69	44.5	20	12.9	35	22.6	18	11.6	7	4.5	4	2.6	1	0.6	1	0.6
21 - 23.99	83	52.2	23	14.5	24	15.1	17	10.7	6	3.8	5	3.1	1	0.6	-	-
24 - 26.99	68	44.2	21	13.6	33	21.4	17	11.0	10	6.5	2	1.3	1	0.6	2	1.3
27 - 29.99	53	44.2	20	16.7	15	12.5	17	14.2	12	10.0	3	2.5	-	-	-	-
30 - 32.99	60	45.8	16	12.2	28	21.4	16	12.2	7	5.3	2	1.5	2	1.5	-	-
33 - 36.00	74	48.7	13	8.6	31	20.4	15	9.9	14	9.2	3	2.0	1	0.7	1	0.7
Total	747	36.7	265	13.0	391	19.2	290	14.3	189	9.3	84	4.1	25	1.2	42	2.1

(7)

Number and percentage of children by age at admission according to their height for age standard percentiles (n = 2129)

	NCHS PERCENTILES															
Age	$< P_5$		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	181	31.5	51	8.9	110	19.2	87	15.2	64	11.1	36	6.3	11	1.9	34	5.9
9 - 11.99	162	44.9	31	8.6	51	14.1	46	12.7	31	8.6	19	5.3	8	2.2	13	3.6
12 - 14.99	121	52.8	24	10.5	27	11.8	28	12.2	14	6.1	10	4.4	4	1.7	1	0.4
15 - 17.99	93	60.0	17	11.0	18	11.6	15	9.7	4	2.6	4	2.6	1	0.6	3	1.9
18 - 20.99	95	66.0	12	8.3	12	8.3	14	9.7	6	4.2	3	2.1	1	0.7	1	0.7
21 - 23.99	116	78.9	7	4.8	12	8.2	6	4.1	5	3.4	-	-	-	-	1	0.7
24 - 26.99	95	67.4	10	7.1	16	11.3	10	7.1	7	5.0	2	1.4	-	-	1	0.7
27 - 29.99	64	57.1	8	7.1	10	8.9	13	11.6	10	8.9	3	2.7	1	0.9	3	2.7
30 - 32.99	75	65.8	11	9.6	17	14.9	7	6.1	3	2.6	1	0.9	-	-	-	-
33 - 36.00	106	69.7	9	5.9	16	0.5	7	4.6	10	6.6	3	2.0	-	-	1	0.7
Total	1108	52.0	180	8.5	286	13.6	233	10.9	154	7.2	81	3.8	26	1.2	58	2.7

(8)

Number and percentage of boys by age at admission according to their height for age standard percentile (n = 1070)

Age	NCHS PERCENTILES															
	$< P_5$		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	103	34.2	31	10.3	57	18.9	43	14.3	29	9.6	12	4.0	5	1.7	21	7.0
9 - 11.99	96	50.5	11	5.8	27	14.2	24	12.6	17	8.9	5	2.6	4	2.1	6	3.2
12 - 14.99	64	57.7	11	9.9	15	13.5	9	8.1	9	8.1	2	1.8	-	-	1	0.9
15 - 17.99	50	67.6	10	13.5	7	9.5	4	5.4	-	-	1	1.4	1	1.4	1	1.4
18 - 20.99	43	64.2	5	7.5	9	13.4	4	6.0	2	3.0	3	4.5	1	1.5	-	-
21 - 23.99	59	78.7	3	4.0	6	8.0	4	5.3	2	2.7	-	-	-	-	1	1.3
24 - 26.99	49	64.5	7	9.2	9	11.8	6	7.9	4	5.3	1	1.3	-	-	-	-
27 - 29.99	32	60.4	1	1.9	6	11.3	10	18.9	3	5.7	1	1.9	-	-	-	-
30 - 32.99	33	66.0	5	10.0	9	18.0	2	4.0	1	2.0	-	-	-	-	-	-
33 - 36.00	52	71.2	7	9.6	7	9.6	3	4.1	3	4.1	1	1.4	-	-	-	-
Total	581	54.3	91	8.5	152	14.2	109	10.2	70	6.5	26	2.4	11	1.0	30	2.8

(9)

Number and percentage of girls by age at admission according to their height for age standard percentile (n = 1059)

Age	NCHS PERCENTILES															
	$< P_5$		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 - 8.99	78	28.6	20	7.3	53	19.4	44	16.1	35	12.8	24	8.8	6	2.2	13	4.8
9 - 11.99	66	38.6	20	11.7	24	14.0	22	12.9	14	8.2	14	8.2	4	2.3	7	4.1
12 - 14.99	57	48.3	13	11.0	12	10.2	19	16.1	5	4.2	8	6.8	4	3.4	-	-
15 - 17.99	43	53.1	7	8.6	11	13.6	11	13.6	4	4.9	3	3.7	-	-	2	2.5
18 - 20.99	52	57.5	7	9.1	3	3.9	10	13.0	4	5.2	-	-	-	-	1	1.3
21 - 23.99	57	79.2	4	5.6	6	8.3	2	2.8	3	4.2	-	-	-	-	-	-
24 - 26.99	46	70.8	3	4.6	7	10.8	4	6.2	3	4.6	1	1.5	-	-	1	1.5
27 - 29.99	32	54.2	7	11.9	4	6.8	3	5.1	7	11.9	2	3.4	1	1.7	3	5.1
30 - 32.99	42	65.6	6	9.4	8	12.5	5	7.8	2	3.1	1	1.6	-	-	-	-
33 - 36.00	54	68.4	2	2.5	9	11.4	4	5.1	7	8.9	2	2.5	-	-	1	1.3
Total	527	49.8	89	8.4	137	12.9	124	11.7	84	7.9	55	5.2	15	1.4	28	2.6

Appendix V. (1)

Number and percentage of children from 6 to 36 months of age at admission, who received supplementation for 6 to 24 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total
		0	1	2	3	N
		% of expected weight for height				%
		>90%	90 - 80%	80 - 70%	< 70%	
0	> 95%	503 (28.0)	55 (3.1)	15 (0.8)	3 (0.1)	575 (32.0)
1	95 - 90%	614 (34.2)	43 (2.4)	5 (0.3)	- -	662 (36.8)
2	90 - 85%	346 (19.3)	49 (2.7)	3 (0.2)	- -	398 (22.1)
3	< 85%	135 (7.5)	20 (1.1)	6 (0.3)	1 (0.1)	162 (9.0)
Total	N	1598	167	29	3	1797
	%	(88.9)	(9.3)	(1.6)	(0.2)	(100.0)

(2)

Number and percentage of children from 6 to 36 months of age at admission, who received supplementation for 6 to 24 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total
		0	1	2	3	N
		% of expected weight for height				%
		> 90%	90 - 80%	80 - 70%	< 70%	
0	> 95%	579 (30.8)	61 (3.2)	5 (0.3)	2 (0.1)	647 (34.5)
1	95 - 90%	647 (34.5)	73 (3.9)	3 (0.2)	- -	723 (38.5)
2	90 - 85%	330 (17.6)	29 (1.5)	- -	- -	359 (19.1)
3	< 85%	131 (7.0)	16 (0.9)	2 (0.1)	-	149 (7.9)
Total	N %	1687 (89.8)	179 (9.5)	10 (0.5)	2 (0.1)	1878 (100.0)

(3)

Number and percentage of boys from 6 to 36 months of age at admission, who received supplementation for 6 to 24 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting 0 % of expected weight for height >90%	1 90 - 80%	2 80 - 70%	3 < 70%	Total N %
0	>90%	247 (27.0)	25 (2.7)	9 (1.0)	- -	281 (30.7)
1	95 - 90%	307 (33.5)	23 (2.5)	2 (0.2)	- -	332 (36.2)
2	90 - 85%	180 (19.7)	26 (2.8)	1 (0.1)	- -	207 (22.6)
3	< 85%	81 (8.8)	9 (1.0)	6 (0.7)	- -	96 (10.5)
Total	N	815	83	18	-	916
	%	(89.0)	(9.1)	(2.0)	-	(100.0)

(4)

Number and percentage of boys from 6 to 36 months at admission, who received supplementation for 24 to 48 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total N %
		0	1	2	3	
		% of expected weight for height				
		> 90%	90 - 80%	80 - 70%	< 70%	
0	> 95%	259 (28.6)	28 (3.1)	1 (0.1)	1 (0.1)	289 (31.9)
1	95 - 90%	313 (34.5)	26 (2.9)	2 (0.2)	- -	341 (37.6)
2	90 - 85%	171 (18.9)	15 (1.7)	- -	- -	186 (20.5)
3	< 85%	77 (8.5)	12 (1.3)	2 (0.2)	- -	91 (10.0)
Total	N	820	81	5	1	907
	%	(90.4)	(8.9)	(0.6)	(0.1)	(100.0)

(5)

Number and percentage of girls from 6 to 36 months of age at admission who received supplementation for 6 to 24 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				
		0	1	2	3	Total
		% of expected weight for height				N
		> 90%	90 - 80%	80 - 70%	< 70%	%
0	> 95%	256 (29.1)	30 (3.4)	6 (0.7)	2 (0.2)	294 (33.4)
1	95 - 90%	307 (34.8)	20 (2.3)	3 (0.3)	- -	330 (37.5)
2	90 - 85%	166 (18.8)	23 (2.6)	2 (0.2)	- -	191 21.7
3	< 85%	54 (6.1)	11 (1.2)	- -	1 (0.1)	66 (7.5)
Total	N	783	84	11	3	881
	%	(88.9)	(9.5)	(1.2)	(0.3)	(100.0)

(6)

Number and percentage of girls from 6 to 36 months at admission, who received supplementation for 24 to 48 months, according to Waterlow Classification.

Grade of Stunting	% of expected ht/age	Grade of wasting				Total N %
		0	1	2	3	
		% of expected weight for height				
		> 90%	90 - 80%	80 - 70%	< 70%	
0	> 95%	320 (33.0)	33 (3.4)	4 (0.4)	1 (0.1)	358 (36.9)
1	95 - 90%	334 (34.4)	47 (4.8)	1 (0.1)	- -	382 (39.3)
2	90 - 85%	159 (16.4)	14 (1.4)	- -	- -	173 (17.8)
3	< 85%	54 (5.6)	4 (0.4)	- -	- -	58 (6.0)
Total	N	867	98	5	1	971
	%	89.3	(10.1)	(0.5)	(0.1)	(100.0)

Appendix VI (1)

Number and percentage of children by age at discharge according to their weight for age standard percentile

Age (months)	WEIGHT FOR AGE															
	P_5		P_5 - P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	50	23.4	24	11.2	44	20.6	50	23.4	30	14.0	9	4.2	2	0.9	5	2.3
18 - 23.99	151	31.7	55	11.6	109	22.9	81	17.0	39	8.2	28	5.9	3	0.6	10	2.1
24 - 29.99	146	31.7	52	11.3	95	20.6	66	14.3	60	13.0	28	6.1	5	1.1	9	2.0
30 - 35.99	142	26.2	61	11.3	112	20.7	121	22.3	70	12.9	25	4.6	6	1.1	5	0.9
36 - 41.99	153	29.3	70	13.4	119	22.8	103	19.7	63	12.0	8	1.5	4	0.8	3	0.6
42 - 47.99	143	27.1	80	15.2	132	25.0	98	18.6	52	9.8	19	3.6	2	0.4	2	0.4
48 - 53.99	141	33.6	51	12.1	100	23.8	64	15.2	50	11.9	11	2.6	3	0.7	-	-
54 - 59.99	90	26.6	61	18.0	73	21.6	66	19.5	36	10.7	9	2.7	2	0.6	1	0.3
60 - 65.99	94	36.4	40	15.5	59	22.9	41	15.9	21	8.1	2	0.8	-	-	1	0.4
66 - 84.00	79	28.1	51	18.1	71	25.3	52	18.5	25	8.9	3	1.1	-	-	-	-
Total	1189	29.4	545	13.5	914	22.6	742	18.4	446	11.0	142	3.5	27	0.7	36	0.9

(n = 4041)

(2)

Number and percentage of boys by age at discharge according to their weight for age standard percentiles

Age (months)	WEIGHT FOR AGE															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	29	26.4	16	14.5	20	18.2	21	19.1	16	14.5	5	4.5	2	1.8	1	0.9
18 - 23.99	88	36.1	29	11.9	52	21.3	40	16.4	18	7.4	12	4.9	1	0.4	4	1.6
24 - 29.99	78	32.4	26	10.8	43	17.8	35	14.5	39	16.2	11	4.6	3	1.2	6	2.5
30 - 35.99	56	20.3	38	13.8	68	24.6	60	21.7	33	12.0	14	5.1	6	2.2	1	0.4
36 - 41.99	71	28.1	33	13.0	58	22.9	55	21.7	30	11.9	3	1.2	2	0.8	1	0.4
42 - 47.99	68	25.6	42	15.8	68	25.6	56	21.1	21	7.9	10	3.8	1	0.4	-	-
48 - 53.99	66	32.0	28	13.6	54	26.2	31	15.0	21	10.2	3	1.5	3	1.5	-	-
54 - 59.99	49	31.2	29	18.5	36	22.9	26	16.6	13	8.3	3	1.9	-	-	1	0.6
60 - 65.99	47	38.8	21	17.4	22	18.2	21	17.4	9	7.4	-	-	-	-	1	0.8
66 - 84.00	46	34.3	25	18.7	32	23.9	22	16.4	9	6.7	-	-	-	-	-	-
Total	598	29.8	287	14.3	453	22.6	367	18.3	209	10.4	61	3.0	18	0.9	15	0.7

(n = 2008)

(3)

Number and percentage of girls by age at discharge according to their weight for age standard percentiles

	WEIGHT FOR AGE															
Age (months)	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	21	20.2	8	7.7	24	23.1	29	27.9	14	13.5	4	38.	-	-	4	3.8
18 - 23.99	63	27.2	26	11.2	57	24.6	41	17.7	21	9.1	16	6.9	2	0.9	6	2.6
24 - 29.99	68	30.9	26	11.8	52	23.6	31	14.1	21	9.5	17	7.7	2	0.9	3	1.4
30 - 35.99	86	32.3	23	8.6	44	16.5	61	22.9	37	13.9	11	4.1	-	-	4	1.5
36 - 41.99	82	30.4	37	13.7	61	22.6	48	17.8	33	12.2	5	1.9	2	0.7	2	0.7
42 - 47.99	75	28.6	38	14.5	64	24.4	42	16.0	31	11.8	9	3.4	1	0.4	2	0.8
48 - 53.99	75	35.0	23	10.7	46	21.5	33	15.4	29	13.6	8	3.7	-	-	-	-
54 - 59.99	41	22.7	32	17.7	37	20.4	40	22.1	23	12.7	6	3.3	2	1.1	-	-
60 - 65.99	47	34.3	19	13.9	37	27.0	20	14.6	12	8.8	2	1.5	-	-	-	-
66 - 84.00	33	22.4	26	17.7	39	26.5	30	20.4	16	10.9	3	2.0	-	-	-	-
Total	591	29.1	258	12.7	461	22.7	375	18.4	237	11.7	81	4.0	9	0.4	21	1.0

(n = 2033)

(4)

Number and percentage of children by age at discharge according to their weight for height standard percent

Age (months)	WEIGHT FOR HEIGHT															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	8	4.1	9	4.6	21	10.7	31	15.8	50	25.5	32	16.3	16	8.2	29	14.8
18 - 23.99	21	4.8	20	4.6	43	9.9	84	19.4	109	25.1	64	14.7	39	9.0	54	12.4
24 - 29.99	24	5.7	24	5.7	52	12.3	96	22.7	114	27.0	71	16.8	17	4.0	25	5.9
30 - 35.99	19	3.9	20	4.1	67	13.6	98	19.9	164	33.3	84	17.0	19	3.9	22	4.5
36 - 41.99	14	3.0	19	4.1	68	14.8	113	24.5	150	32.5	58	12.6	13	2.8	26	5.6
42 - 47.99	17	3.6	8	1.7	60	12.8	140	30.0	142	30.4	66	14.1	17	3.6	17	3.6
48 - 53.99	11	2.8	20	5.1	60	15.4	105	26.9	114	29.2	49	12.6	12	3.1	19	4.9
54 - 59.99	10	3.3	11	3.6	41	13.4	82	26.9	106	34.8	33	10.8	10	3.3	12	3.9
60 - 65.99	9	3.7	11	4.6	50	20.8	67	27.9	63	26.2	32	13.3	5	2.1	3	1.2
66 - 84.00	6	2.3	16	6.1	48	18.2	80	30.3	73	27.7	34	12.9	5	1.9	2	0.8
Total	139	3.8	158	4.3	510	13.9	896	24.4	1085	29.5	523	14.2	153	4.2	209	5.7

(n = 3673)

(5)

Number and percentage of boys by age at discharge according to their weight for height standard percentile

Age (months)	WEIGHT FOR HEIGHT															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	4	4.0	5	5.0	11	10.9	16	15.8	26	25.7	16	15.8	8	7.9	15	14.9
18 - 23.99	13	5.7	12	5.3	19	8.4	41	18.1	59	26.0	34	15.0	21	9.3	28	12.3
24 - 29.99	15	6.8	10	4.6	21	9.6	50	22.8	57	26.0	43	19.6	9	4.1	14	6.4
30 - 35.99	8	3.2	6	2.4	32	12.8	50	20.0	91	36.4	44	17.6	8	3.2	11	4.4
36 - 41.99	4	1.8	12	5.5	33	15.0	52	23.6	73	33.2	30	13.6	6	2.7	10	4.5
42-47.99	7	3.0	1	0.4	24	10.3	74	31.8	75	32.2	35	15.0	12	5.2	5	2.1
48 - 53.99	5	2.6	13	6.7	27	13.9	50	25.8	59	30.4	22	11.3	7	3.6	11	5.7
54 - 59.99	8	5.6	1	0.7	20	14.1	39	27.5	46	32.4	17	12.0	5	3.5	6	4.2
60 - 65.99	3	2.7	3	2.7	21	18.6	36	31.9	32	28.3	14	12.4	2	1.8	2	1.8
66 - 84.00	5	4.0	8	6.5	18	14.5	29	23.4	44	35.5	15	12.1	3	2.4	2	1.6
Total	72	3.9	71	3.9	226	12.4	437	24.0	562	30.8	270	14.8	81	4.4	104	5.7

(n = 1823)

(6)

Number and percentage of girls by age at discharge according to their weight for height standard percentil

Age	WEIGHT FOR HEIGHT															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	4	4.2	4	4.2	10	10.5	15	15.8	24	25.3	16	16.8	8	8.4	14	14.7
18 - 23.99	8	3.9	8	3.9	24	11.6	43	20.8	50	24.2	30	14.5	18	8.7	26	12.6
24 - 29.99	9	4.4	14	6.9	31	15.2	46	22.5	57	27.9	28	13.7	8	3.9	11	5.4
30 - 35.99	11	4.5	14	5.8	35	14.4	48	19.8	73	30.0	40	16.5	11	4.5	11	4.5
36 - 41.99	10	4.1	7	2.9	35	14.5	61	25.3	77	32.0	28	11.6	7	2.9	16	6.6
42 - 47.99	10	4.3	7	3.0	36	15.4	66	28.2	67	28.6	31	13.2	5	2.1	12	5.1
48 - 53.99	6	3.1	7	3.6	33	16.8	55	28.1	55	28.1	27	13.8	5	2.6	8	4.1
54 - 59.99	2	1.2	10	6.1	21	12.9	43	26.4	60	36.8	16	9.8	5	3.1	6	3.7
60 - 65.99	6	4.7	8	6.3	29	22.8	31	24.4	31	24.4	18	14.2	3	2.4	1	0.8
66 - 84.00	1	0.7	8	5.7	30	21.4	51	36.4	29	20.7	19	13.6	2	1.4	-	-
Total	67	3.6	87	4.7	284	15.4	459	24.8	523	28.3	253	13.7	72	3.9	105	5.7

(n = 1850)

(7)

Number and percentage of children by age at discharge according to their height for age standard percentil

Age	H E I G H T F O R A G E															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	109	55.3	25	12.7	31	15.7	15	7.6	7	3.6	4	2.0	-	-	6	3.0
18 - 23.99	303	69.5	43	9.9	38	8.7	34	7.8	9	2.1	2	0.5	2	0.5	5	1.1
24 - 29.99	229	54.1	39	9.2	57	13.5	38	9.0	36	8.5	12	2.8	3	0.7	9	2.1
30 - 35.99	253	51.3	41	8.3	82	16.6	58	11.8	31	6.3	15	3.0	6	1.2	7	1.4
36 - 41.99	249	54.0	44	9.5	70	15.2	50	10.8	33	7.2	9	2.0	3	0.7	3	0.7
42 - 47.99	260	55.7	48	10.3	75	16.1	42	9.0	27	5.8	10	2.1	1	0.2	4	0.9
48 - 53.99	227	58.2	42	10.8	51	13.1	42	10.8	18	4.6	7	1.8	1	0.3	2	0.5
54 - 59.99	150	49.2	50	16.4	49	16.1	25	8.2	18	5.9	11	3.6	-	-	2	0.7
60 - 65.99	131	54.6	29	12.1	38	15.8	30	12.5	9	3.7	2	0.8	1	0.4	-	-
66 - 84.00	133	50.4	36	13.6	50	18.9	26	9.8	16	6.1	1	0.4	-	-	2	0.8
Total	2044	55.6	397	10.8	541	14.7	360	9.8	204	5.5	73	2.0	17	0.5	40	1.1

(n = 3676)

(8)

<u>Number and percentage of boys by age at discharge according to their height for age standard percentiles</u>

	HEIGHT FOR AGE															
Age	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	58	57.4	13	12.9	14	13.9	10	9.9	4	4.0	1	1.0	-	-	1	1.0
18 - 23.99	165	72.7	22	9.7	16	7.0	18	7.9	3	1.3	1	0.4	1	0.4	1	0.4
24 - 29.99	122	55.7	19	8.7	29	13.2	19	8.7	16	7.3	8	3.7	3	1.4	3	1.4
30 - 35.99	127	50.8	20	8.0	46	18.4	30	12.0	15	6.0	6	2.4	4	1.6	2	0.8
36 - 41.99	115	52.3	20	9.1	38	17.3	23	10.5	17	7.7	3	1.4	3	1.4	1	0.5
42 - 47.99	132	56.7	24	10.3	38	16.3	22	9.4	10	4.3	5	2.1	1	0.4	1	0.4
48 - 53.99	123	63.4	17	8.8	24	12.4	16	8.2	9	4.6	4	2.1	-	-	1	0.5
54 - 59.99	75	52.8	27	19.0	22	15.5	8	5.6	8	5.6	2	1.4	-	-	-	-
60 - 65.99	69	61.1	14	12.4	12	10.6	14	12.4	3	2.7	1	0.9	-	-	-	-
66 - 84.00	73	58.9	14	11.3	21	16.9	13	10.5	3	2.4	-	-	-	-	-	-
Total	1059	58.1	190	10.4	260	14.3	173	9.5	88	4.8	31	1.7	12	0.7	10	0.5

(n = 1823)

(9)

Number and percentage of girls by age at discharge according to their height for age standard percentiles

Age	HEIGHT FOR AGE															
	P_5		P_5-P_{10}		P_{10}-P_{25}		P_{25}-P_{50}		P_{50}-P_{75}		P_{75}-P_{90}		P_{90}-P_{95}		P_{95}-P_{100}	
(months)	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
12 - 17.99	51	53.1	12	12.5	17	17.7	5	5.2	3	3.1	3	3.1	-	-	5	5.2
18 - 23.99	138	66.0	21	10.0	22	10.5	16	7.7	6	2.9	1	0.5	1	0.5	4	1.9
24 - 29.99	107	52.5	20	9.8	28	13.7	19	9.3	20	9.8	4	2.0	-	-	6	2.9
30 - 35.99	126	51.9	21	8.6	36	14.8	28	11.5	16	6.6	9	3.7	2	0.8	5	2.1
36 - 41.99	134	55.6	24	10.0	32	13.3	27	11.2	16	6.6	6	2.5	-	-	2	0.8
42 - 47.99	128	54.7	24	10.3	37	15.8	20	8.5	17	7.3	5	2.1	-	-	3	1.3
48 - 53.99	104	53.1	25	12.8	27	13.8	26	13.3	9	4.6	3	1.5	1	0.5	1	0.5
54 - 59.99	75	46.0	23	14.1	27	16.6	17	10.4	10	6.1	9	5.5	-	-	2	1.2
60 - 65.99	62	48.8	15	11.8	26	20.5	16	12.6	6	4.7	1	0.8	1	0.8	-	-
66 - 84.00	60	42.9	22	15.7	29	20.7	13	9.3	13	9.3	1	0.7	-	-	2	1.4
Total	985	53.2	207	11.2	281	15.2	187	10.1	116	6.3	42	2.3	5	0.3	30	1.6

(n = 1853)

Appendix VII (1)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age, Gómez classification

	Final	Weight for age - Gómez classification				
		Normal	1st degree	2nd degree	3rd degree	Total N
	Initial	> 90%	90-76%	75-60%	< 60%	%
Weight for age Gómez classification	Normal > 90%	339	109	4	-	452
		(53.1)	(10.6)	(0.4)	-	(44.1)
	1st degree 90 - 76%	104	257	32	2	395
		(10.1)	(25.1)	(3.1)	(0.2)	(38.5)
	2nd degree 75 - 60%	6	74	65	2	147
		(0.6)	(7.2)	(6.3)	(0.2)	(14.3)
	3rd degree < 60%	1	11	11	8	31
		(0.1)	(1.1)	(1.1)	(0.8)	(3.1)
Total	N	450	451	112	12	1025
	%	(43.9)	(44.0)	(1.2)	(1.2)	(100.0)

(2)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age, Gómez classification

		Weight for age - Gómez classification				
	Final	Normal	1st degree	2nd degree	3rd degree	Total N %
	Initial	> 90%	90-76%	75-60%	< 60%	
Weight for age Gómez classification	Normal > 90%	354	94	3	-	451
		(35.9)	(9.5)	(0.3)	-	(45.7)
	1st degree 90 - 76%	94	252	32	-	123
		(9.5)	(25.5)	(3.2)	-	(12.5)
	2nd degree 75 - 60%	13	54	54	2	123
		(1.3)	(5.5)	(5.5)	(0.2)	(12.5)
	3rd degree < 60%	1	9	17	8	35
		(0.1)	(0.9)	(1.7)	(0.8)	(3.5)
Total	N	462	409	106	10	987
	%	(46.8)	(41.4)	(10.7)	(1.0)	(100.0)

(3)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for age, Gómez classification

		Weight for age - Gómez classification				
	Final	Normal	1st degree	2nd degree	3rd degree	Total
	Initial	> 90%	90-76%	75-60%	< 60%	N %
Weight for age Gómez classification	Normal > 90%	237	57	4	-	298
		(24.1)	(5.8)	(0.4)	-	(30.3)
	1st degree 90 - 76%	123	281	31	1	436
		(12.5)	(28.6)	(3.2)	(0.1)	(44.4)
	2nd degree 75 - 60%	27	110	54	3	194
		(2.7)	(11.2)	(5.5)	(0.3)	(19.7)
	3rd degree < 60%	4	22	23	6	55
		(0.4)	(2.2)	(2.3)	(0.6)	(5.6)
Total	N	391	470	112	10	983
	%	(39.8)	(47.8)	(11.4)	(1.0)	(100.0)

(4)

Comparison of initial and final nutritional status (weight for age) in girls starting at 6 to 36 months of age, who received supplements for 24 to 48 months - Gómez classification

		Weight for age - Gómez classification				
	Final	Normal	1st degree	2nd degree	3rd degree	Total
	Initial	> 90%	90-76%	75-60%	< 60%	N %
Weight for age Gómez classification	Normal > 90%	243	64	4	-	311
		(23.2)	(6.1)	(0.4)	-	(29.7)
	1st degree 90 - 76%	173	277	39	-	489
		(16.5)	(26.5)	(3.7)	-	(46.7)
	2nd degree 75 - 60%	35	125	51	3	214
		(3.3)	(12.0)	(4.9)	(0.3)	(20.5)
	3rd degree < 60%	2	15	13	2	32
		(0.2)	(1.4)	(1.2)	(0.2)	(3.1)
Total	N	453	481	107	5	1046
	%	(43.3)	(46.0)	(10.2)	(0.5)	(100.0)

(5)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age

		Weight for Age				Total
Initial	Final	> 90%	90-81%	80-71%	< 70%	N %
Weight for age	> 90%	339	101	9	3	452
		(33.1)	(9.9)	(0.9)	(0.3)	(44.1)
	90 - 81%	94	147	43	6	290
		(9.2)	(14.3)	(4.2)	(0.6)	(28.3)
	80 - 71%	13	80	66	20	179
		(1.3)	(7.8)	(6.4)	(1.9)	(17.5)
	< 70%	4	20	46	34	104
		(0.4)	(1.9)	(4.5)	(3.3)	(10.1)
Total	N	450	348	164	63	1025
	%	(43.9)	(34.0)	(16.0)	(6.1)	(100.0)

(6)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for age

	Final	Weight for Age				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for age	> 90%	354	88	9	-	451
		(35.9)	(8.9)	(0.9)	-	(45.7)
	90 - 81%	83	164	48	4	299
		(8.4)	(16.6)	(4.9)	(0.4)	(30.3)
	80 - 71%	22	53	64	10	149
		(2.2)	(5.4)	(6.5)	(1.0)	(15.1)
	< 70%	3	14	30	41	88
		(0.3)	(1.4)	(3.0)	(4.2)	(8.9)
Total	N	462	319	151	55	987
	%	(46.8)	(32.3)	(15.3)	(5.5)	(100.0)

(7)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 24 to 41 months, weight for age

	Final	Weight for age				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for age	> 90%	237	48	12	1	298
		(24.1)	(4.9)	(1.2)	(0.1)	(30.3)
	90 - 81%	94	161	42	5	302
		(9.6)	(16.4)	(4.3)	(0.5)	(30.7)
	80 - 71%	48	84	81	12	225
		(4.9)	(8.5)	(8.2)	(1.2)	(22.9)
	< 70%	12	49	57	40	158
		(1.2)	(5.0)	(5.8)	(4.1)	(16.1)
Total	N	391	342	192	58	983
	%	(39.8)	(34.8)	(19.5)	(5.9)	(100.0)

(8)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for age

		Weight for age				Total
	Final	> 90%	90-81%	80-71%	< 70%	N %
Initial						
Weight for age	> 90%	243	57	11	-	311
		(23.2)	(5.4)	(1.1)	-	(29.7)
	90 - 81%	146	149	47	6	348
		(14.0)	(14.9)	(4.5)	(0.6)	(33.3)
	80 - 71%	46	102	84	13	245
		(4.4)	(9.8)	(8.0)	(1.2)	(23.4)
	< 70%	18	47	56	21	142
		(1.7)	(4.5)	(5.4)	(2.0)	(13.6)
Total	N	453	355	198	40	1046
	%	(43.3)	(33.9)	(18.9)	(3.8)	(100.0)

(9)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for height

		Weight for height				Total
	Final	> 90%	90-81%	80-71%	< 70%	N %
Initial						
Weight for height	> 90%	517	34	4	-	555
		(76.6)	(5.0)	(0.6)	-	(82.2)
	90 - 81%	64	18	6	-	88
		(9.5)	(2.7)	(0.9)	-	(13.0)
	80 - 71%	12	10	3	-	25
		(1.8)	(1.5)	(0.4)	-	(3.7)
	< 70%	3	1	3	-	7
		(0.4)	(0.1)	(0.4)	-	(1.0)
Total	N	596	63	16	-	675
	%	(88.3)	(9.3)	(2.4)	-	(100.0)

(10)

<u>Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 6 to 24 months, weight for height</u>

		Weight for height				Total
	Final	> 90%	90-81%	80-71%	< 70%	N %
Initial						
Weight for height	> 90%	468	29	2	-	499
		(74.2)	(4.6)	(0.3)	-	(79.1)
	90 - 81%	81	16	3	-	100
		(12.8)	(2.5)	(0.5)	-	(15.8)
	80 - 71%	13	7	2		23
		(2.1)	(1.1)	(0.3)	(0.2)	(3.6)
	< 70%	3	2	2	2	9
		(0.5)	(0.3)	(0.3)	(0.3)	(1.4)
Total	N	565	54	9	3	631
	%	(89.5)	(8.6)	(1.4)	(0.5)	(100.0)

(11)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for height

	Final	Weight for Height				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for height	> 90%	214	17	1	1	233
		(66.0)	(5.2)	(0.3)	(0.3)	(71.9)
	90 - 81%	60	11	1	-	72
		(18.5)	(3.4)	(0.3)	-	(22.2)
	80 - 71%	14	1	-	-	15
		(4.3)	(0.3)	-	-	(4.6)
	< 70%	4	-	-	-	4
		(1.2)	-	-	-	(1.2)
Total	N	292	29	2	1	324
	%	(90.1)	(9.0)	(0.6)	(0.3)	(100.0)

(12)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 24 to 48 months, weight for height

	Final	Weight for height				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for height	> 90%	236	15	4	-	255
		(65.7)	(4.2)	(1.1)	-	(71.0)
	90 - 81%	68	15	1	-	84
		(18.9)	(4.2)	(0.3)	-	(23.4)
	80 - 71%	12	3	-	-	15
		(3.3)	(0.8)	-	-	(4.2)
	< 70%	5	-	-	-	5
		(1.4)	-	-	-	(1.4)
Total	N	321	33	5	-	359
	%	(89.4)	(9.2)	(1.4)	-	(100.0)

(13)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 6 to 24 months, height for age

	Final	Height for age				Total
Initial		> 95%	95-90%	90-85%	< 85%	N %
Height for age	> 95%	150	107	31	4	292
		(22.2)	(15.9)	(4.6)	(0.6)	(43.3)
	95 - 90%	33	103	73	11	220
		(4.9)	(15.3)	(10.8)	(1.6)	(32.6)
	90 - 85%	9	26	37	22	94
		(1.3)	(3.9)	(5.5)	(3.3)	(13.9)
	< 85%	4	7	19	39	69
		(0.6)	(1.0)	(2.8)	(5.8)	(10.2)
Total	N	196	243	160	76	657
	%	(29.0)	(36.0)	(23.7)	(11.3)	(100.0)

(14)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 6 to 24 months, height for age

	Final	Height for age				Total
	Initial	> 95%	95-90%	90-85%	< 85%	N %
Height for age	> 95%	153	104	35	1	293
		(24.2)	(16.5)	(5.7)	(0.2)	(46.5)
	95 - 90%	25	106	56	6	193
		(4.0)	(16.8)	(8.9)	(0.9)	(30.5)
	90 - 85%	3	29	47	20	99
		(0.5)	(4.6)	(7.4)	(3.2)	(15.7)
	< 85%	2	3	12	29	46
		(0.3)	(0.5)	(1.9)	(4.6)	(7.3)
Total	N	183	242	151	56	631
	%	(29.0)	(38.3)	(23.9)	(8.9)	(100.0)

(15)

Comparison of initial and final nutritional status in boys starting at 6 to 36 months of age, who received supplements for 24 to 41 months, height for age

	Final	Height for Age				Total
Initial		> 95%	95-90%	90-85%	< 85%	N %
Height for age	> 95%	56	47	6	-	109
		(17.3)	(14.5)	(1.9)	-	(33.6)
	95 - 90%	32	44	20	7	103
		(9.9)	(13.6)	(6.2)	(2.2)	(31.8)
	90 - 85%	11	24	26	9	70
		(3.4)	(7.4)	(8.0)	(2.8)	(21.6)
	< 85%	3	6	9	24	42
		(0.9)	(1.9)	(2.8)	(7.4)	(13.0)
	Total N	102	121	61	40	324
	%	(31.5)	(37.3)	(18.8)	(12.3)	(100.0)

(16)

Comparison of initial and final nutritional status in girls starting at 6 to 36 months of age, who received supplements for 24 to 48 months, height for age

	Final		Height for Age			Total
Initial		> 95%	95-90%	90-85%	< 85%	N %
Height for age	> 95%	69	42	11	-	122
		(19.2)	(11.7)	(3.1)	-	(34.0)
	95 - 90%	38	66	13	4	121
		(10.6)	(18.4)	(3.6)	(1.1)	(33.7)
	90 - 85%	10	27	30	10	77
		(2.8)	(7.5)	(8.4)	(2.8)	(21.4)
	< 85%	6	7	15	11	39
		(1.7)	(1.9)	(4.2)	(3.1)	(10.9)
	Total N	123	142	69	25	359
	%	(34.3)	(39.6)	(19.2)	(7.0)	(100.0)

(17)

Comparison of initial and final types of malnutrition (Waterlow Classification) in boys starting between 6 to 36 months of age, who received supplements for 6 to 24 monts.

FINAL INITIAL	Normal	Wasted but not stunted	Stunted but not wasted	Wasted and stunted	TOTAL N %
Normal	371 (55.0)	3 (0.4)	106 (15.7)	1 (0.1)	481 (71.3)
Wasted but not stunted	10 (1.5)	4 (0.6)	9 (1.3)	- -	23 (3.4)
Stunted but not wasted	45 (6.7)	3 (0.4)	109 (16.1)	4 (0.6)	161 (23.9)
Wasted and Stunted	2 (0.3)	- -	6 (0.9)	2 (0.3)	10 (1.5)
TOTAL N %	428 (63.4)	10 (1.5)	230 (34.1)	7 (1.0)	675 (100.0)

(18)

Comparison of initial and final types of malnutrition (Waterlow Classification) in girls starting between 6 36 months of age, who received supplements for 6 to 24 months.

FINAL INITIAL	Normal	Wasted but not stunted	Stunted but not wasted	Wasted and Stunted	TOTAL N %
Normal	366	4	95	-	465
	(58.0)	(0.6)	(15.1)	-	(73.7)
Wasted but not stunted	8	5	6	-	19
	(1.3)	(0.8)	(1.0)	-	(3.0)
Stunted but not wasted	38	-	95	1	134
	(6.0)	-	(15.1)	(0.2)	(21.2)
Wasted and Stunted	-	-	11	2	13
	-	-	(1.7)	(0.3)	(2.1)
TOTAL N	412	9	207	3	631
%	(65.3)	(1.4)	(32.8)	(0.5)	(100.0)

(19)

Comparison of initial and final types of malnutrition (Waterlow Classification) in boys starting between 6 to 36 months of age, who received supplements for 24 to 48 months.

FINAL INITIAL		Normal	Wasted but not stunted	Stunted but not wasted	Wasted and Stunted	TOTAL N %
Normal		170	-	31	-	201
		(52.5)	-	(9.6)	-	(62.0)
Wasted but not stunted		9	-	1	-	10
		(2.8)	-	(0.3)	-	(3.1)
Stunted but not wasted		37	3	64	-	104
		(11.4)	(0.9)	(19.8)	-	(32.1)
Wasted and Stunted		2	-	7	-	9
		(0.6)	-	(2.2)	-	(2.8)
TOTAL	N	218	3	103	-	324
	%	(67.3)	(0.9)	(31.8)	-	(100.0)

(20)

Comparison of initial and final types of malnutrition (Waterlow Classfication) in girls starting between 6 to 36 months of age, who received supplements for 24 to 48 months.

FINAL INITIAL		Normal	Wasted but not stunted	Stunted but not wasted	Wasted and Stunted	TOTAL N %
Normal		196	4	26	-	226
		(54.6)	(1.1)	(7.2)	-	(63.0)
Wasted but not stunted		12	-	4	-	16
		(3.3)	-	(1.1)	-	(4.5)
Stunted but not wasted		48	1	64	-	113
		(13.4)	(0.3)	(17.8)	-	(31.5)
Wasted and Stunted		2	-	2	-	4
		(0.6)	-	(0.6)	-	(1.1)
TOTAL	N	258	5	96	-	359
	%	(71.9)	(1.4)	(26.7)	-	(100.0)

Appendix VIII (1)

Comparison of initial and final Nutritional status in starting at 6 to 12 months of age, who received supplements for 6 to 24 months.

	Final	Weight for age - Gómez classification				Total
		Normal	1st degree	2nd degree	3rd degree	N %
	Initial	> 90%	90-76%	75-60%	< 60%	
Weight for age Gomez classification	Normal > 90 %	388 (39.1)	150 (15.1)	5 (0.5)	- -	543 (54.7)
	1st degree 90 - 76%	74 (7.5)	210 (21.2)	39 (3.9)	1 (0.1)	324 (32.7)
	2nd degree 75 - 60%	7 (0.7)	45 (4.5)	47 (4.7)	1 (0.1)	100 (10.1)
	3rd degree < 60%	1 (0.1)	5 (0.5)	13 (1.3)	6 (0.6)	25 (2.5)
Total	N %	470 (47.4)	410 (41.3)	104 (10.5)	8 (0.8)	992 (100.0)

(2)

Comparison of initial and final Nutritional status in starting at 6 to 12 months of age, who received supplements for 24 to 48 months.

		Weight for age - Gómez classification				
	Final	Normal	1st degree	2nd degree	3rd degree	Total N
	Initial	> 90%	90-76%	75-60%	< 60 %	%
Weight for age Gómez classification	Normal >90%	209	62	8	-	279
		(32.1)	(9.5)	(1.2)	-	(42.8)
	1st degree 90 - 76%	60	153	29	1	243
		(9.2)	(23.5)	(4.4)	(0.2)	(37.3)
	2nd degree 76 - 60%	18	61	25	1	105
		(2.8)	(9.4)	(3.8)	(0.2)	(16.1)
	3rd degree < 60%	3	14	7	1	25
		(0.5)	(2.1)	(1.1)	(0.2)	(3.8)
Total	N	290	290	69	3	652
	%	(44.5)	(44.5)	(10.6)	(0.5)	(100.0)

(3)

Comparison of initial and final Nutritional status in starting at 12 to 24 months of age, who received supplements for 6 to 24 months.

	Final	Weight for age - Gómez classification				Total
		Normal	1st degree	2nd degree	3rd degree	N
	Initial	> 90%	90-76%	76-60%	< 60%	%
Weight for age Gomez classification	Normal >90%	168 (29.3)	30 (5.2)	1 (0.2)	- -	199 (34.7)
	1st degree 90 - 76%	70 (12.2)	168 (29.3)	15 (2.6)	1 (0.2)	254 (44.3)
	2nd degree 75 - 60%	9 (1.6)	56 (9.8)	34 (5.9)	1 (0.2)	100 (17.5)
	3rd degree < 60%	1 (0.2)	7 (1.2)	8 (1.4)	4 (0.7)	20 (3.5)
Total	N %	248 (43.3)	261 (45.5)	58 (10.1)	6 (1.0)	573 (100.0)

(4)

Comparison of initial and final Nutritional status in starting at 12 to 24 months of age, who received supplements for 24 to 48 months.

	Final	Weight for age - Gómez classification				Total
		Normal	1st degree	2nd degree	3rd degree	N %
	Initial	> 90%	90-76%	75-60%	<60%	
Weight for Age Gómez classification	Normal >90%	151	34	-	-	185
		(20.1)	(4.5)	-	-	(24.6)
	1st degree 90 - 76%	123	214	20	-	357
		(16.4)	(28.5)	(2.7)	- -	(47.5)
	2nd degree 75 - 60%	24	103	41	3	171
		(3.2)	(13.7)	(5.5)	(0.4)	(22.8)
	3rd degree < 60%	3	17	14	4	38
		(0.4)	(2.3)	(1.9)	(0.5)	(5.1)
Total	N	301	368	75	7	751
	%	(40.1)	(49.0)	(10.0)	(0.9)	(100.0)

(5)

Comparison of initial and final Nutritional status in starting at 24 to 36 months of age, who received supplements for 6 to 24 months.

		Weight for age - Gomez classification				
	Final	Normal	1st degree	2nd degree	3rd degree	Total N %
	Initial	>90%	90-76%	75-60%	<60%	
Weight for age Gómez classification	Normal > 90%	137	23	1	-	161
		(30.6)	(5.1)	(0.2)	-	(36.0)
	1st degree 90 - 76%	54	131	10	-	195
		(12.1)	(29.3)	(2.2)	-	(43.6)
	2nd degree 75 - 60%	3	27	38	-	70
		(0.7)	(6.0)	(8.5)	(0.4)	(15.7)
	3rd degree < 60%	-	8	7	6	161
		-	(1.8)	(1.6)	(1.3)	(36.0)
TOTAL	N	194	189	56	8	447
	%	(43.4)	(42.3)	(12.5)	(1.8)	(100.0)

(6)

Comparison of initial and final Nutritional status in starting at 24 to 36 months of age, who received supplements for 24 to 48 months.

			Weight for age - Gómez classification				
	Final Initial		Normal > 90%	1st degree 90- 76%	2nd degree 75-60%	3rd degree < 60%	Total N %
Weight for Age Gómez classification	Normal > 90%		120	25	-	-	145
			(19.2)	(4.0)	-	-	(23.2)
	1st degree 90 - 76%		113	191	21	-	325
			(18.1)	(30.5)	(3.4)	-	(51.9)
	2nd degree 76 - 60½		20	71	39	2	132
			(3.2)	(11.3)	(6.2)	(0.3)	(21.1)
	3rd degree > 60%		-	6	15	3	24
			-	(1.0)	(2.4)	(0.5)	(3.8)
	Total	N	253	293	75	5	626
		%	(40.4)	(46.8)	(12.0)	(0.8)	(100.0)

(7)

Comparison of Initial and Final Nutritional status in infants starting at 6 to 12 months of age, who received supplements for 6 to 24 months.

Initial	Final	Weight for Age - Jelliffe classification				Total
		> 90%	90-81%	80-71%	< 70%	N %
Weight for Age Jelliffe classification	> 90%	388	137	16	2	543
		(39.1)	(13.8)	(1.6)	(0.2)	(54.7)
	90 - 81%	63	126	53	8	250
		(6.4)	(12.7)	(5.3)	(0.8)	(25.2)
	80 - 71%	14	43	49	20	126
		(1.4)	(4.3)	(4.9)	(2.0)	(12.7)
	< 70%	5	11	29	28	73
		(0.5)	(1.1)	(2.9)	(2.8)	(7.4)
Total	N	470	317	147	58	992
	%	(47.4)	(32.0)	(14.8)	(5.8)	(100.0)

(8)

Comparison of Initial and final Nutritional status in infants starting 6 and 12 to months of age, who received supplements for 24 to 48 months.

		Weight for Age - Jelliffe classification				Total
Initial	Final	> 90%	90-81%	80-71%	< 70%	N %
Weight for Age Jelliffe classification	> 90%	209	50	19	1	279
		(32.1)	(7.7)	(2.9)	(0.2)	(42.8)
	90-81%	46	81	35	6	168
		(7.1)	(12.4)	(5.4)	(0.9)	(25.8)
	80-71%	25	47	44	9	125
		(3.8)	(7.2)	(6.7)	(1.4)	(19.2)
	< 70%	10	31	24	15	80
		(1.5)	(4.8)	(3.7)	(2.3)	(12.3)
Total	N	290	209	122	31	652
		(44.5)	(32.1)	(18.7)	(4.8)	(100.0)

(9)

Comparison of Initial and Final Nutritional status in children starting at 12 to 24 months of age, who received supplements for 6 to 24 months.

		Weight for Age - Jelliffe classification				Total
Initial	Final	> 90%	90 - 81%	80 - 71%	< 70%	N %
Weight for Age Jelliffe classification	> 90%	168	29	2	-	199
		(29.3)	(5.1)	(0.3)	-	(34.7)
	90-81%	65	101	20	2	188
		(11.3)	(17.6)	(3.5)	(0.3)	(32.8)
	80-71%	13	60	40	5	118
		(2.3)	(10.5)	(7.0)	(0.9)	(20.6)
	< 70%	2	13	29	24	68
		(0.3)	(2.3)	(5.1)	(4.2)	(11.9)
Total	N	249	203	91	31	573
	%	(43.3)	(35.4)	(15.9)	(5.4)	(100.0)

(10)

Comparison fo Initial and Final Nutritional status in children starting at 12 to 24 months of age, who received supplements for 24 to 48 months.

			Weight for Age - Jelliffe classification				Total
	Initial	Final	> 90%	90-81%	80-71%	< 70%	N %
Weight for Age Jelliffe classification	> 90%		151	30	4	-	185
			(20.1)	(4.0)	(0.5)	-	(24.6)
	90 - 81%		101	124	29	4	258
			(13.4)	(16.5)	(3.9)	(0.5)	(34.4)
	80 - 71%		36	77	58	7	178
			(4.8)	(10.3)	(7.7)	(0.9)	(23.7)
	< 70%		13	41	53	23	130
			(1.7)	(5.5)	(7.1)	(3.1)	(17.3)
	Total	N	301	272	144	34	751
		%	(40.1)	(36.2)	(19.2)	(4.5)	(100.0)

(11)

Comparison of Initial and Final Nutritional status in children starting at 24 to 36 months of age, who received supplements for 6 to 24 months.

		Weight for Age - Jelliffe classification				Total
Initial	Final	> 90%	90 - 81%	80 - 71%	< 70%	N %
Weight for Age Jelliffe classification	> 90%	137	23	-	1	161
		(30.6)	(5.1)	-	(0.2)	(36.0)
	90 - 81%	49	84	18	-	151
		(11.0)	(18.8)	(4.0)	-	(33.8)
	80 - 71%	8	30	41	5	84
		(1.8)	(6.7)	(9.2)	(1.1)	(18.8)
	< 70%	-	10	18	23	51
		-	(2.2)	(4.0)	(5.1)	(11.4)
Total	N	194	147	77	29	447
	%	(43.4)	(32.9)	(17.2)	(6.5)	(100.0)

(12)

Comparison of Initial and Final Nutritional status in children starting at 24 to 36 months of age, who received supplements for 24 to 48 months.

		Weight for Age - Jelliffe classification				Total
Initial	Final	> 90%	90-81%	80-71%	< 70%	N %
Weight fcr age Jellife classification	>90%	120	25	-	-	145
		(19.2)	(4.0)	-	-	(23.2)
	90 - 81%	93	105	25	1	224
		(14.9)	(16.8)	(4.0)	(0.2)	(35.8)
	80 - 71%	33	62	63	9	167
		(5.3)	(9.9)	(10.1)	(1.4)	(26.7)
	< 70%	7	24	36	23	90
		(1.1)	(3.8)	(5.8)	(3.7)	(14.4)
Total	N	253	216	124	33	626
	%	(40.4)	(34.5)	(19.8)	(5.3)	(100.0)

(13)

Comparison of Initial and Final Nutritional status in infants starting at 6 to 12 months of age, who received supplements for 6 to 24 months.

		Weight for Height				Total
Initial	Final	> 90%	90 - 81%	80 - 71%	< 70%	N %
Weight for Height	> 90%	486	33	2	-	521
		(75.5)	(5.1)	(0.3)	-	(80.9)
	90 - 81%	71	14	4	-	89
		(11.0)	(2.2)	(0.6)	-	(13.8)
	80 - 71%	14	8	2	-	24
		(2.2)	(1.2)	(0.3)	-	(3.7)
	< 70%	2	2	4	2	10
		(0.3)	(0.3)	(0.6)	(0.3)	(1.6)
	Total N	573	57	12	2	644
	%	(89.0)	(8.9)	(1.9)	(0.3)	(100.0)

(14)

Comparison of Initial and Final Nutritional status in infants starting at 6 to 12 months of age, who received supplements for 24 to 48 months.

Initial	Final	Weight for Height				Total
		> 90%	90 - 81%	80 - 71%	< 70%	N %
Weight for Height	> 90%	163	18	2	-	183
		(67.9)	(7.5)	(0.8)	-	(76.3)
	90 - 81%	34	7	-	-	41
		(14.2)	(2.9)	-	-	(17.1)
	80 - 71%	11	1	-	-	12
		(4.6)	(0.4)	-	-	(5.0)
	< 70%	4	-	-	-	4
		(1.7)	-	-	-	(1.7)
	Total	N 212	26	2	-	240
		% (88.3)	(10.8)	(0.8)	-	(100.0)

(15)

Comparison of Initial and Final Nutritional status in children starting at 12 to 24 months of age, who received supplements for 6 to 24 months.

	Final	Weight for Height				Total
Initial		> 90%	90-81%	80-71%	< 70%	N %
Weight for Height	> 90%	270	26	2	-	298
		(72.0)	(6.9)	(0.5)	-	(79.4)
	90-81%	38	12	5	-	55
		(10.1)	(3.2)	(1.3)	-	(14.6)
	80-71%	7	9	1	-	17
		(1.9)	(2.4)	(0.3)	-	(4.6)
	< 70%	2	1	2	-	5
		(0.5)	(0.3)	(0.5)	-	(1.3)
Total	N	317	48	10	-	375
	%	(84.5)	(12.8)	(2.7)	-	(100.0)

(16)

Comparison of Initial and Final Nutritional status in children starting at 12 to 24 months of age, who received supplements for 24 to 48 months.

			Weight for Height				Total
Initial		Final	> 90%	90% -81%	80 - 71%	< 70%	N %
Weight for Height	> 90%		165	7	2	1	175
			(64.7)	(2.7)	(0.8)	(0.4)	(68.6)
	90-81%		59	7	1	-	67
			(23.1)	(2.7)	0.4)	-	(26.3)
	80-71%		8	2	-	-	10
			(3.1)	(0.8)	-	-	(3.9)
	< 70%		3	-	-	-	3
			(1.2)	-	-	-	(1.2)
Total		N	235	16	3	1	255
		%	(92.2)	(6.3)	(1.2)	(0.4)	(100.0)

(17)

Comparison of Initial and Final Nutritional status in children starting at 24 to 36 months of age, who received supplements for 6 to 24 months.

Final Initial			Weight for Height				Total
			> 90%	90-81%	80-71%	< 70%	N %
Weight for Height	> 90%		229	4	2	-	235
			(79.5)	(1.4)	(0.7)	-	(81.6)
	90%-81%		36	8	-	-	44
			(12.5)	(2.8)	-	-	(15.3)
	80-71%		4	-	2	1	7
			(1.4)	-	(0.7)	(0.3)	(2.4)
	< 70%		2	-	-	-	2
			(0.7	-	-	-	(0.7)
Total		N	271	12	4	1	288
		%	(94.1)	(4.2)	(1.4)	(0.3)	(100.0)

(18)

Comparison of Initial and Final Nutritional status in starting at 24 to 36 months of age, who received supplements for 24 to 48 months.

		Weight for Height				Total
	Final	> 90 %	90 - 81%	80 - 71%	< 70%	N
Initial						%
Weight for Height	> 90%	122	7	1	-	130
		(64.9)	(3.7)	(0.5)	-	(69.1)
	90-81%	35	12	1	-	48
		(18.6)	(6.4)	(0.5)	-	(25.5)
	80-71%	7	1	-	-	8
		(3.7)	(0.5)	-	-	(4.3)
	< 70%	2	-	-	-	2
		(1.1)	-	-	-	(1.1)
Total	N	166	20	2	-	188
	%	(88.3)	(10.6)	(1.1)	-	(100.0)

(19)

Comparison of Initial and Final Nutritional status in infants starting at 6 to 12 months of age, who received supplements for 6 to 24 months.

		Height for Age				Total
Initial	Final	> 95%	95 - 90%	90 - 85%	< 85%	N %
Height for Age	> 95%	157	156	55	5	373
		(24.4)	(24.2)	(8.5)	(0.8)	(57.9)
	95 - 90%	15	78	72	14	179
		(2.3)	(12.1)	(11.2)	(2.2)	(27.8)
	90 - 85%	1	13	31	20	65
		(0.2)	(2.0)	(4.8)	(3.1)	(10.1)
	< 85%	-	1	7	19	27
		-	(0.2)	(1.1)	(3.0)	(4.2)
Total	N	173	248	165	58	644
	%	(26.9)	(38.5)	(25.6)	(9.0)	(100.0)

(20)

Comparison of initial and final nutritional status in infants starting at 6 to 12 months of age, who received supplements for 24 to 48 months.

	Final	Height for	Age		Total
Initial	> 95%	95-90%	90-85%	< 85%	N %
>95%	62 (25.8)	45 (18.8)	10 (4.2)	- -	117 (48.7)
Height for Age 95-90%	20 (8.3)	31 (12.9)	13 (5.4)	8 (3.3)	72 (30.0)
90-85%	6 (2.5)	14 (5.8)	10 (4.2)	10 (4.2)	40 (16.7)
< 85%	1 (0.4)	4 (1.7)	2 (0.8)	4 (1.7)	11 (4.6)
Total N %	89 (37.1)	94 (39.2)	35 (14.6)	22 (9.2)	240 (100.0)

(21)

Comparison of initial and final nutritional status in children starting at 12 to 24 months of age, who received supplements for 6 to 24 months.

Final Initial	Height for Age				Total N %
	>95%	95-90%	90-85%	<85%	
Height for Age >95%	81 (21.6)	34 (9.1)	11 (2.9)	- -	126 (33.6)
95-90%	28 (7.5)	64 (17.1)	41 (10.9)	3 (0.8)	136 (36.3)
90-85%	4 (1.1)	23 (6.1)	30 (8.0)	13 (3.5)	70 (18.7)
<85%	5 (1.3)	7 (1.9)	13 (3.5)	18 (4.8)	43 (11.5)
Total N %	118 (31.5)	128 (34.1)	95 (25.3)	34 (9.1)	375 (100.0)

(22)

Comparison of initial and final nutritional status in children starting at 12 to 24 months of age, who received supplements for 24 to 48 months.

		Final	Height for Age			Total N %
	Initial	> 95%	95-90%	90-85%	< 85%	
Height for Age	> 95%	40 (15.7)	24 (9.4)	3 (3.7)	- -	67 (26.3)
	95-90%	32 (12.5	49 (19.2)	12 (4.7)	3 (1.2)	96 (37.6)
	90-85%	6 (2.4)	18 (7.1)	25 (9.8)	3 (1.2)	52 (20.4)
	< 85%	5 (2.0)	5 (2.0)	12 (4.7)	18 (7.1)	40 (15.7)
Total	N %	83 (32.5)	96 (37.6)	52 (20.4)	24 (9.4)	255 (100.0)

(23)

Comparison of initial and final nutritional status in children starting at 24 to 36 months of age, who received supplements for 6 to 24 months.

	Final	Height for Age				Total
	Initial	> 95%	95-90%	90-85%	< 85%	N %
Height for Age	> 95%	65 (22.6)	21 (7.3)	1 (0.3)	- -	87 (30.2)
	95-90%	15 (5.2)	67 (23.3)	16 (5.6)	- -	98 (34.0)
	90-85%	7 (2.4)	19 (6.6)	23 (8.0)	9 (3.1)	58 (20.1)
	< 85%	1 (0.3)	2 (0.7)	11 (3.8)	31 (10.8)	45 (15.6)
Total	N %	88 (30.6)	102 (37.8)	51 (17.7)	40 (13.9)	288 (100.0)

(24)

Comparison of initial and final nutritional status in children starting at 24 to 36 months of age, who received supplements for 24 to 48 months.

	Final Initial	Height for age				Total N %
		> 95%	95-90%	90-85%	< 85%	
Height for Age	> 95%	23 (12.2)	20 (10.6	4 (2.1)	- -	47 (25.0)
	95-90%	18 (9.6)	30 (16.0)	8 (4.3)	- -	56 (29.8)
	90-85%	9 (4.8)	19 (10.1)	21 (11.2)	6 (3.2)	55 (29.3)
	< 85%	3 (1.6)	4 (2.1)	10 (5.3)	13 (6.9)	30 (16.0)
	Total N	53	73	43	19	188
	%	(28.2)	(38.8)	(22.9)	(10.1)	(100.0)