



Project:

“Reduction of the nutritional risk of the most vulnerable population affected by the flood of April 2003 in the City of Santa Fe, Argentina”

**NUTRITIONAL SURVEY OF CHILDREN
BETWEEN 6 AND 71 MONTHS OF AGE
AND SCHOOLCHILDREN
IN THEIR FIRST SCHOOL YEAR**

Final report

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1 INTRODUCTION AND CONTEXT

The Province of Santa Fe is situated in the east central area of Argentina. Its capital, the city of Santa Fe de la Vera Cruz, has a population of approximately 390.000 inhabitants and an area of 26.000 hectares.

This city is located on the vertex of the confluence of the rivers Paraná and Salado, and therefore, the possibilities of its territorial expansion are limited by the valleys of flooding of these watercourses and by the fluctuations of their freshets. In the past years, the increase of the extent and frequency of the freshets as well as the occupation of the flooding areas has increased the percentage of the population in vulnerability situation.

With regards to the regional economy, the province has:

- One of the largest milk production areas of the country;
- A green fruit and horticultural belt that provides the region with fresh products;
- An important poultry breeding and bee products production,
- Large areas devoted to grain cultivation and cattle breeding,

Since the last quarter of 2002 there have been, in the whole Province, much heavier rainfalls than their historical average which implied great economic losses with a very strong impact on the social aspects.

This situation became worse in April 2003 when the heavy rainfalls flooded the fields in the north of the province, even reaching urban areas, isolating communities, cutting primary and secondary roads, overflowing the river beds and damaging bridges.

As the culmination of this process, on the 28th and 29th April 2003, the city of Santa Fe suffered the worst floods in the country's history due to the overflow of the Salado river and because of this the provincial government decreed the Emergency State.

Vast areas dedicated to agriculture and cattle breeding became flooded causing significant losses in the soy, sorghum, meat and dairy products productions, among others.

The impact of the disaster on the population affected more than 130 thousand people immediately. During the first hours more than 30 thousand people were evacuated into public and private buildings (schools, stadiums, parishes, clubs, tents, etc.) and 23 deaths were reported.

In spite of the extent of the catastrophe and the amount of people affected, the number of people lodged in temporary shelters was reduced at a greater rhythm than expected, in such a way that up to the 21st August, the official data gave 1361 evacuated people distributed in 23 centres.

Facing this situation, the organization Acción Contra el Hambre, through financing of the Humanitarian Office of the European Commission (ECHO), began a nutrition emergency project with the aim of reducing the nutrition risk derived from the hydro catastrophe.

In this context, the first stage of the project “Reduction of the nutritional risk of the most vulnerable population affected by the floods of April 2003 in the city of Santa Fe, Argentina” consisted in carrying out a nutritional survey.

2 OBJETIVES

2.1 General Objective

To have reliable and suitable information about the relevant nutritional problems of the most vulnerable population in order to adapt the intervention strategies.

2.2 Specific Objectives

- To know about the nutritional status of children between 6 and 71 months of age taking into account anthropometrical and biochemical variables.
- To know about the nutritional status of children in first school year according to anthropometrical and biochemical variables.
- To know the breastfeeding prevalence of children under 2 years of age.

3 METHODOLOGY

3.1 Target population

The study was carried out in three different environments including the following populations:

- Flooded neighbourhoods: children between 6 and 71 months of age,
- Evacuated Centres: children between 6 and 71 months of age;
- Flooded schools: schoolchildren in their first year of the Basic General Education (EGB).

3.1.1 *Neighbourhoods*

a) Sample Plan

- *General Aspects*

A probabilistic sample of all the houses located in the flooded area, towards the west of the city, was designed. To determine the minimum size sample, the prevalence of anaemia was estimated in 25% and a precision of 6% for the population of children between 6 and 24 months of age was defined.

The formula (¹) used for the calculus was the following:

$$n = t^2 * \frac{(p * q)}{d^2}$$
$$n = 1.96^2 * \frac{(0.25 * 0.75)}{0.06^2} = 200$$

In this way, the size of the sample for children between 6 and 24 months of age should have been of 200, but taking into account that the design would be by conglomerates, it was necessary to apply the ED of 1.4, so, those under 2 years of age should be:

$$200 \times 1.4 = 280 \text{ children}$$

Knowing that children between 6 and 24 months of age correspond to approximately the 25% of the children under 6 years of age, we calculated the size of the final sample:

$$\frac{280 \times 100}{25} = 1120 \text{ children}$$

Supposing a loss of 7%, it was decided to focus on 1200 children. It is known that, in average, in the houses with children in these ages there are 1.5 children per house. Because of this, it was decided to carry out the study in 800 houses with children of these ages.

It is known, through the census data, that 1 out of 3 houses has resident children in the required ages; therefore in order to get 800 objective houses, 2400 houses should be contacted.

A sample by conglomerates, selfponderated (²) and stratified was designed.

The conglomerate was defined as the group of the houses that make up the Primary Unit (PU), which was composed by one block of buildings or a group of blocks of buildings. The design intended to capture the whole diversity of the population as of 40 PU with an average of 30 children in each one of them. On the other hand, compact segments were defined (blocks) in order to avoid great shifting of the equipment within each PU and with a similar number of houses, without dividing the blocks of buildings.

Regarding the stratification, the limited information available forced the use of the geographic variable (neighbourhoods and quarters) as the principal criteria.

¹ Being:
n = size of the sample.
t = parameter tied to the error risk, equal to 1.96 for an error risk of 5%.
p = expected anemia prevalence in the population.
q = 1- p, expected prevalence in children without anemia.
d = desired absolute precision.

² Each of the children in the whole area had the same probability of being selected.

The latter was complemented with data, which was provided by the Provincial Statistics and Census Institute (Instituto Provincial de Estadística y Censos - IPEC), referred to the time of the permanence of the water in the different affected areas.

- *Definition of the Units under study:*
 - Analysis Unit: Children between 6 and 71 months of age resident in the flooded areas
 - Sample Unit: Dwelling places in which these children live.

- *Definition of home and house:*
 - Home: is defined as the person or group of people who live under the same roof and share the food expenses.
 - Dwelling: is any structure that can be used as housing.

b) Stages for the sample design:

- *Collection of information of the flooded population and its corresponding cartography:*

In 2001 a Population and Housing Census was carried out in the whole country. At the time of the planning of the survey there was no processed data available for each locality/district. This is the reason why the age characteristics of the simple ages of the population of the city of Santa Fe could not be known with precision. However, the available information at provincial level, shows that there are a total of 3.000.701 people, of which 278.362 are children between 6 months and 5 years of age (9.3% of the total population). Each home has an average of 3.44 people. It was supposed that in the flooded area this number could be larger, but there was not enough information to make the proper calculation.

On the other hand, information produced by IPEC as of the Census of Evacuated People was available. According to that register, informed in July 2003, there are 22,968 houses affected by the floods, distributed in approximately 900 blocks of buildings, resulting in an average of 25.5 houses per block of buildings.

The cartography of the city of Santa Fe was also supplied by the IPEC. It showed the detail of the blocks, the radial census, the fractions of the census, neighbourhoods and quarters.

- *Definition and Stratification of the Primary Units (PU)*

The PU were defined based on the information and cartography supplied by the IPEC.

Every PU was formed, in general, by 2 or 3 blocks of buildings in order to approximate the desired quantity of houses. Some areas were difficult to limit on the site, mainly in the peripheral neighbourhoods, resulting bigger than expected. As the blocks of buildings have a very variable number of houses, the size of the PU also showed important differences.

- *Estimate of the number of houses to be contacted per Primary Unit.*

The estimate was carried out as of the following reasoning:

- Number of children to be surveyed: 1200 (30 children in each of the PU)
- Size of the PU (conglomerates):

$$\frac{20 \text{ houses } (^3)}{0.33^4 \text{ houses with children}} \rightarrow 60 \text{ houses per PU}$$

- *Selection of 40 Primary Units (also called sample points, SP)*

The PU showed a great variety of houses. The field work was simplified in the sense that there was no house selection process within the PU: all were selected.

As of the total number of houses affected by the floods and the number of houses per PU, the 400 PU were defined:

$$\frac{22.968 \text{ affected dwellings}}{60 \text{ dwelling/PU}} \rightarrow 400 \text{ PU}$$

From these 400 PU, 40 were selected with the same probability with the global sampling fraction of 1 in 10.

- *Cartography up-date and houses*

Before carrying out the survey, the assistant surveyors went through the 40 selected Primary Units with two objectives:

1. Verify the area and make a real map in case it would not match the provided cartography.
2. Identify the houses with children between 6 and 71 months of age.

To identify the houses, two lists were diagrammed in order to use them as “Surveyors Waybills”. Two population groups had to be registered on them separately.

³ 20 houses corresponding to 30 children (1.5 children per house)

⁴ 1 out of every 3 houses has resident children with the required ages

- Chart for the houses/dwellings with children between 6 and 71 months of age;
- Chart for the houses/dwellings without children between 6 and 71 months of age, with children but who rejected the carrying out of the survey and/or with absent members.

In each of the SPs the blocks of buildings were enumerated, and one of them was selected at random as the starting point, and it was determined that in every case the “northwest angle” of the chosen block would be the starting point.

3.1.2 Evacuated Centres

Due to the low number of evacuated people it was decided to carry out an exhaustive survey evaluating the universe of the children between 6 and 71 months of age that were staying at 23 centres.

3.1.3 Schools

Through the Statistics Office of the Ministry of Education all the public and private schools affected by the floods were identified (12 flooded and 2 in which 80% came from homes that had been flooded), in which all the children in their first school year were evaluated.

The total register of the first school year of the flooded schools was of 883 (with 829 real ones). Therefore, it was decided to survey the universe, that is, to all of the children .

The schools in which the study was carried out were the following:

Number of the school	Name of the school
1020005	Vicente Lopez y Planes
1020014	Nicolas Avellaneda
1020471	Juan Arzeno
1020570	Pascual Echagüe
1020809	Estanislao Lopez
1021111	Luis Borruat
1021258	Simon Bolivar
1021298	Monseñor.Zaspe
1020018	Falucho
1021299	Padre Catena
3021132	Cristo Obrero
3021174	Santa Lucia
3021224	Nuestra Señora de Itatí
3021196	Santa Rosa de Lima

3.2 Variables and indexes for the study

3.2.1 Sociodemographic Variables

- **Head of Home:**
It was stated if the head of the home was the father, mother, grandparents of the child, or another member of the family.
- **Family Composition:**
The total number of members and the number of children under 6 years of age was stated.
- **Characteristics of the dwelling:**
The type of dwelling (house, apartment, precarious house, hut, boarding house-hotel), its location (regular neighbourhood, social housing, shantytown, or other) and the number of rooms without considering the bathroom and kitchen, and the existence of a water closet with water discharge, were informed.
- **Preceding of Floods:**
To evaluate the degree of vulnerability to other floods, it was asked whether the family had had to evacuate at other times
- **Health Control Frequency:**
It was asked whether any type of health control had been carried out after the floods, and/or if the child had been weighed or measured after the floods.

On the other hand, **vulnerability** criteria as of the existence o 1 or more of the following categories were established:

- V1: The head of the home is not the father.
- V2: Type of dwelling: Hut, Precarious Dwelling, Boarding House-Hotel.
- V3: Environment: Slum.
- V4: Stacking higher or equal to 3.
- V5: No watercloset.
- V 6: Antecedents of evacuation due to floods.

3.2.2 Nutritional Variables

The nutritional variables included in the survey were: Anthropometrical (height and weight), biochemical (haemoglobin from capillar blood) and breastfeeding.

a) Anthropometrical:

The Height and weight evaluation was carried out according to the standards set by The Ministry of Health (⁵), using the national and international standards as reference (^{6,7}).

Weight:

For children between 6 months and 2 years of age a paediatric scale with a 10g precision was used and for those over 2 years it was used an electronic adult scale with a precision of 100g.

Height:

The children under 2 years of age were measured decubitus, the children between 2 and 4 years of age were measured decubitus and standing (in order to be able to compare the results with the national and international reference standards). As of 4 years of age all the measurements were taken in a standing position.

These variables of height and weight were related to age so as to build the following indicators Weight/Age, Height/Age, Weight/Height and Body Mass Index (BMI).

b) Biochemical:

Haemoglobin:

The haemoglobin determination was carried out from a capillary blood sample obtained by digital puncture and analysed in a portable spectrophotometer (Hemocue®) according to the techniques provided by the manufacturer and following bio security regulations of the Argentine Biochemical Foundation, based on the International Federation of Clinical Chemistry (IFCC).

c) Neonatal Antecedents

The birth weight was asked.

d) Breastfeeding:

To know about the **breastfeeding prevalence** in children under 2 years of age.

⁵ Ministry of Health: Manual for the Health Team training on Growth and Nutrition of Mothers and Infants. Mothers and Infants Health Division. Republic of Argentina, 1994

⁶ Cusminsky M; Castro E; Lejarraga H y col.: Arch Arg Pediatr, 79:281, 1980. Normal weight, height and head circumference charts from birth up to 12 years.

⁷ Hamill P; Drizd T; Johnson C et al: *National Center for Health Statistics. Growth curves for children, birth-18 years.* Vital and Health Statistics, Serie 11 N° 165. DHEW Publication, N° (PHS) 78-1650, Hyattsville, 1977.

3.3 Nutritional Indicators Classification Criteria

To carry out this report the indicators were expressed in z-score (⁸)

a) Weight/Age by sex:

- Underweight < -2 SD
- Normal -2 a +2 SD
- Overweight > + 2 SD

b) Height/Age by sex:

- Stunting or Growth retardation < -2 SD
- Normal -2 a +2 SD
- all Height Alta > + 2 SD

c) Weight/Height by sex:

- Wasting < -2 SD
- Normal -2 a +2 SD
- Overweight/Obesity > +2 SD

With the anthropometrics indicators the following nutritional diagnoses were established:

Growth Retardation: Height/Age relation less than –2SD of the reference average as a consequence of a prolonged micro and/or macronutrients deficiency.

Acute malnutrition or wasting: Weight/Height relation less then –2SD of the reference average, which corresponds to severe muscular mass loss as a consequence of a energy intake, lower than the requirements.

Obesity: Weight/Height relationship over +2DS of the reference average due to an excess of adipose tissue produced as a consequence of a energy intake higher than the requirements.

d) Haemoglobin value by age

This indicator diagnoses anaemia, defined as the decrease of the total circulating haemoglobin under the physiological limit of the individual, which varies according to age and sex.

⁸ Universal statistics criteria that express the standard deviation (DS) of a normal reference distribution.

To diagnose anaemia the corresponding international standards were followed (^{9 10}). The cut points are the following

- Children < 24 months:.....11.0 g/dl
- Children between 24 and 59 months... 11.1 g/dl
- Children between 60 and 95 months.... 11.5 g/dl
- Children between 96 and 143 months....11.9 g/dl

On the other hand, the World Health Organization (WHO) criteria was taken into account to evaluate the magnitude of the problem from the population point of view, which classifies the prevalence of anaemia in four levels (¹¹):

- *Severe* ≥ 40%
- *Moderate* 20-39.9%
- *Mild* 5-19.9%
- *Normal* ≤ 4.9%

In this way, the same document states that when the prevalence is higher than the 20% the need for intervention must be considered seriously.

e) Birth Weight

- Very Low Birth : < 1500 g
- Low Birth Weight: 1500 - < 2500 g
- Insufficient Birth Weight: 2500 - < 3000 g
- Normal Birth Weight: 3000 - < 4000 g
- High Birth Weight: ≥ 4000 g

f) Breastfeeding according to age in children under 2 years old of age

3.4 Information and Sensitisation Stage

Several meetings with officials and technicians of the Provincial Health and Education Ministries and with the Provincial and Local Community Promotion Office were held before carrying out the survey.

In the health area meetings were held with the Health Sub-Secretaryship, the V Health Direction, the Health Promotion and Protection Office with the coordination o Primary Attention, with all the Health Programmatic Areas of the city of Santa Fe (Cullen, Iturraspe, Sayago y Mirá y López) and with the directors of the health centres located in the flooded areas

⁹ UNICEF (1998). *Major Issues in the control of Iron Deficiency. The Micronutrient Initiative*. New York.

¹⁰ WHO (1994). *Indicators and strategies for iron deficiency and anaemia programmes*. Geneva.

¹¹ WHO (2001). *Iron Deficiency Anaemia. Assessment, Prevention and Control. A guide for programme managers*. WHO/NHD/01.3

Meetings were also held at the evacuated centres to inform about the carrying out of the children nutritional survey.

In the education area, workshops were held with the Public (Direction IV) and Private Education Offices as well as with the headmasters of the selected institutions in order to inform about the study that was going to be carried out.

Finally, all the parents and teachers of the first year schoolchildren were summoned in order to explain the importance of the study to them and to get their written authorization.

With the same goal, other meetings were held with all the Community Centres of the flooded area to inform about the study

On the other hand, a communicational strategy was made which intended to transmit, in a clear, concise and attractive way, the objectives of the study, the importance of being part of it, its seriousness and the institutional backing.

The strategy was based on three principal elements:

- ❖ **Brochures:** They contained basic information about the characteristics of the survey and the participating institutions. These were handed out to parents, to those responsible for the children and to teachers during the informative meetings.
- ❖ **Posters:** They repeated the principal message of the brochure, which invited to participate in the study to find out whether the children were growing healthy, reproducing their same style and design. They were placed in health centres, in the Community Centres . In the selected blocks of buildings, and in every one of the schools selected for the study.
- ❖ **TV and radio Message:** The spots were broadcasted by MA LT10, eleven local MF and community radios and by television Channel 13.

3.5 Material preparation for the survey development

a) Equipment Acquisition

The equipment needed for the development of the survey was calculated. In order to do so several companies were consulted about the equipment that would make up the kit for the fieldwork.

According to the offers received in relation to the requirements of the job, the following were bought:

- 10 Mechanical scales for small children, CAM brand with acrylic tray to weigh small children of up to 2 years of age or 20kg weight error +/- 10gr).
- 11 electronic scales San Up brand, for adults up to 150 kg (error +/- 100gr).
- 10 HemoCue® equipments for the haemoglobin determination.
- 10 craft made aluminium height/length measuring bars specially designed for this project.

b) Composition of the kit for the surveying team

It consisted of the purchase of the necessary elements for the fieldwork. These elements had to be part of the kit the teams had to take to the different places in which the task was developed in order to carry out the data collection.

c) Equipment mobility

Mobility for each team was available in order to mobilise the equipment easier and to guarantee the security while the study lasted.

3.6 Data Collection Instruments

For the collection of information three types of forms were designed to collect the following data:

a) **Survey Forms for the neighbourhoods**

The survey was carried out in the homes of the children of the selected ages and was answered by their mother, father or another adult responsible for the home. The structured questionnaire asked about the following:

- General Information: Date of the survey and name of the surveyors.
- Identification of the dwelling: Survey identification number and address.
- Information about the family: Relationship between the informant and the child, characterization of the home head according to sex and home structure.
- Characteristics of the dwelling and home¹²: Type, environment, number of rooms, type of watercloset.
- Data of the children: Name and surname, birth date, sex and birth weight
- Preceding of Floods: If the child was evacuated during the last flood and how many days, last medical consult and last anthropometrics evaluation, antecedents of other floods.
- Nutritional Evaluation: Anthropometrics (weight and height) and blood test (haemoglobin level).
- Diet of the child under 2 years of age: Queries about food consumed in the day prior to the survey.

¹² In order to categorise dwellings and houses the indexes proposed by the Statistics and Census National Institute were used. Mentioned indexes allow to identify homes and inhabitants according to one of the conditions of Unsatisfied Basic Needs. The data recorded allowed to classified homes according to overcrowdings and sanitary conditions.

b) Survey Forms for the evacuated centres

- General Information: Date of the survey and name of the surveyors.
- Identification of the centre: Identification number in the survey and centre address.
- Information about the family: Relationship between the informant and the child, according to sex and home structure.
- Data of the child: Name and surname, date of birth, sex and weight at birth.
- Preceding of Floods: If the child was evacuated during the last flood and yes, how many days, last medical control and last anthropometrical evaluation, antecedents of other floods.
- Nutritional Evaluation: Anthropometrics (weight and height) and blood test (haemoglobin level).
- Diet of the child under 2 years of age: Queries about the food intake in the day prior to the survey.

c) Survey Forms for the schools

- General Information: Date of the survey and name of the surveyors.
- Identification of the school: Name, identification number and school address.
- Data of the child: Name and surname, date of birth, sex and weight at birth.
- Nutritional Evaluation: Anthropometrics (weight and height) and blood test (haemoglobin level).

In some cases, due to the weather conditions or to the child/family resistance it was not possible to weight the child naked, for that reason the survey form included a check-list to record the items of cloth with which the weight was taken.

3.7 Selection and Training of the Surveyor Teams

Assistant surveyors:

Students and volunteers with previous experience in domiciliary surveys were summoned. The training given to the surveyors was carried out during the 5th and 6th August and approached those aspects referred to the institutional frame and to the inherent objectives of the study. The categories included in the form (dwelling, family head, type and house location, etc.) were conceptualised. The training theoretical contents were complemented with dramatization techniques, which included: surveyors' placement on field, presentation or approach when in domicile, survey application and closure.

Nutritionist Surveyors

In the first place, qualified nutritionists resident in the Province of Santa Fe were summoned. And then those from other provinces, such as from Buenos Aires and from Misiones.

In the training workshops aspects referred to the institutional frame and the proper objectives of the study, nutritional anthropometrics and the filling out of the different questionnaires were approached.

A Training Handbook designed specially for the survey and containing the stipulated standards for the field work was used.

In order to minimize negative values that could affect the study, dramatizations referred to the moment and way in which the blood extraction would be suggested were also carried out.

For the blood extraction by digital puncture and the use of the Hemocue® (portable spectrophotometer) the technical-professional personnel of the equipment supplier explained and trained the adequate technique.

Before ending the training ah workshop was carried out together with the assistant surveyors in order to set common criteria for the approach when in domicile as for the filling out of the different forms.

3.8 Nutritionist Standardization

A standardization was carried out with children from Health Centres and Nurseries of different areas of the capital city, according to the WHO “precision” and “accuracy” technique.

For the precision and accuracy study, 4 nutritionists carried out from 4 to 6 measurements and 5 nutritionists between 8 and 9. These differences were caused by the place and time availability at the visited Health Centres and the tiredness of the children. In all of the cases average values for weight with 60.81g precision and accuracy of 66.70 g (normal less than 100g), were registered; for height the average value for precision was of 0.49cm and for accuracy 0.52 (normal lower than 0.50). This last average was affected by the measurements of two of the participants to whom more technique training was suggested

3.9 Field work Organization

The field work was differentiated according to the scenario:

3.9.1 *Neighbourhoods*

1) Pilot Survey

The pilot survey was carried out in Santo Tomé. At first the assistant team carried out the house identification, after that the nutritionists carried out the survey in the previously identified homes. As of the results obtained, the corresponding adjustments in content, the questionnaire organization and the field work were made.

2) Dwelling Identification:

A team of assistant surveyors went through the Sample Points (SP) selected in the Sample Design (40 SP in all) identifying all of the houses in which children over 6 and under 71 months of age lived (taking the 15th August as the cut-off date).

This first contact was used to give information about the survey, leave brochures, and at the same time inform that the team would visit the home on the following days.

3) Carrying out of the Survey

The dwellings identified by the assistant surveyors (those in which children between 6 and 71 months of age lived) were visited by the surveyors teams consisting of the assistant surveyor and the nutritionist.

In those SP with a small number of children, only one team was appointed and in the more numerous ones 2 to 3 teams were appointed.

A supervisor assisted the field work every three surveyor teams, to guarantee the quality of the results obtained.

Once the data collection had been made, and prior to leave the sample point, the team coordinators carried out the confrontation and consolidation of the information collected in the surveys. If there were any differences, they returned to the dwelling and corrected or ratified the data.

3.9.2 Evacuated Centres

After an agreed coordination with the sanitary authorities and those responsible for each evacuated centre, a visit was made on the date and time scheduled. At the same time as the children of the determined ages for the study were identified, the survey, the measuring and the haemoglobin determination were carried out.

3.9.3 Schools

After agreeing with the directors upon the date and time, the field work consisted in the attendance of the teams to the selected schools. A space was given to the teams to perform the survey, weight and height measurements, and blood extraction by digit puncture for the determination of haemoglobin were carried out. The team visited every school up to 3 times in order to complete the greater possible number of the target population.

3.10 Coordination with Official Institutions

As of the design proper of the study up to its implementation, a fluid articulation with the health, education and community promotion was established.

In order to make the derivation of the cases of anaemia easier, a specific chart, which was given to the parents, was made for the health team of the referred sanitary centre. It was also achieved that the social-sanitary teams “Accompanying the People” visited the anaemic children to give them treatment if necessary.

With regards to the study in schools, the Health Prevention and Promotion Office of the Province supplied the “card for children in school age” of the Ministry of Health, which was properly filled out with the weight, height and haemoglobin value data.

3.11 Data Processing and Analysis

For the data input, a specific program was developed. The data was processed using the computer programs SPSS (Statistical Package for Social Science), EpiInfo6 and NUTRI 1.4.

At a first stage, as an exploratory analysis the principal study variables were worked out. After that, bivaried tables were built to calculate Chi² in order to establish the statistic associations among variables. On the other hand, average significance tests were carried out for the z-score – discriminating by socio-demographic variables, using the normal distribution and the Student Test. The significance level was set at $p < 0.05$.

To guarantee the greater reliability of the data, a double entry and a subsequent crossing of the bases was made in order to identify possible errors

3.12 Ethic Aspects

In all of the surveyed cases a written authorization from parents or those responsible for the children was required. In the same sense, the confidentiality of the data was guaranteed.

4 RESULTS

The results will be presented according to the different scenarios in which the study was carried out: a) Neighbourhoods, b) Evacuated Centres and c) Schools

4.1 Neighbourhoods

4.1.1 *Final Size of the Sample*

A total of 1125 children were surveyed. 11 of them were not included in the analysis because they were older or younger than the target population. In this sense, the sample final size was 1114 boys and girls, surveyed in 799 homes located in 755 houses.

4.1.2 *Sociodemographic aspects*

55.3% of the houses were located in regular neighbourhoods, 39.7 in shantytowns (precarious neighbourhoods or settlements), and 0.3% in social housing, having left a minimum portion (4.7%) in which no data was recorded.

The percentage of boys and girls was of 52.9% and 47.1% respectively, leaving a sex ratio of 1.1. The values in most of the age groups are kept within the acceptable rank for a homogenous population. (0.8-1.2), with the exception of those between 6 and 12 months of age and those between 48 and 59 months of age. (Table No. I)

**Table No. I:
 Distribution by sex and age**

Age in months	Boys		Girls		Total		Sex Ratio
	n	%	n	%	n	%	
6 a 12	54	60.0	36	40.0	90	8.1	1.5
13 a 23	117	55.5	94	44.5	211	18.9	1.2
24 a 35	104	50.5	102	49.5	206	18.5	1.0
36 a 47	95	46.8	108	53.2	203	18.2	0.9
48 a 59	115	56.9	87	43.1	202	18.1	1.3
60 a 71	104	51.5	98	48.5	202	18.1	1.1
Total	589	52.9	525	47.1	1114	100.0	1.1

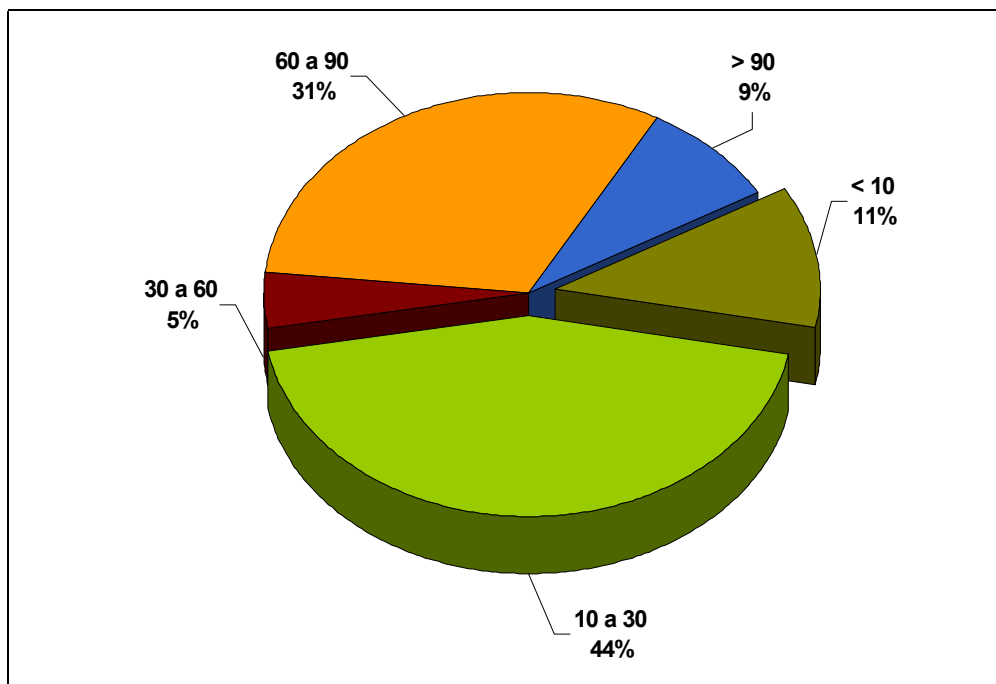
With regards to socioeconomic variables, 93.1% of the homes present at least one of the defined vulnerability criteria. Analysing each of them separately we observe that the higher percentage shows overcrowded houses. (Table No. II)

**Table No. II:
 Vulnerability criteria**

Vulnerability Criteria	n	%
V 1 (Home head is not the father)	740	66,4
V 2 (Housing: hut type, precarious house boarding house-hotel)	651	60.0
V 3 (Shantytown or settlement)	440	41.1
V 4 (Overcrowded houses >3)	734	67.1
V 5 (No water closet)	597	53.6
V 6 (Evacuation antecedents due to floods)	49	4.6

With regards to the number of days of evacuation, it is observed that the greater portion of those surveyed was out of their house for 30 or less days. (See Graph N°. 1)

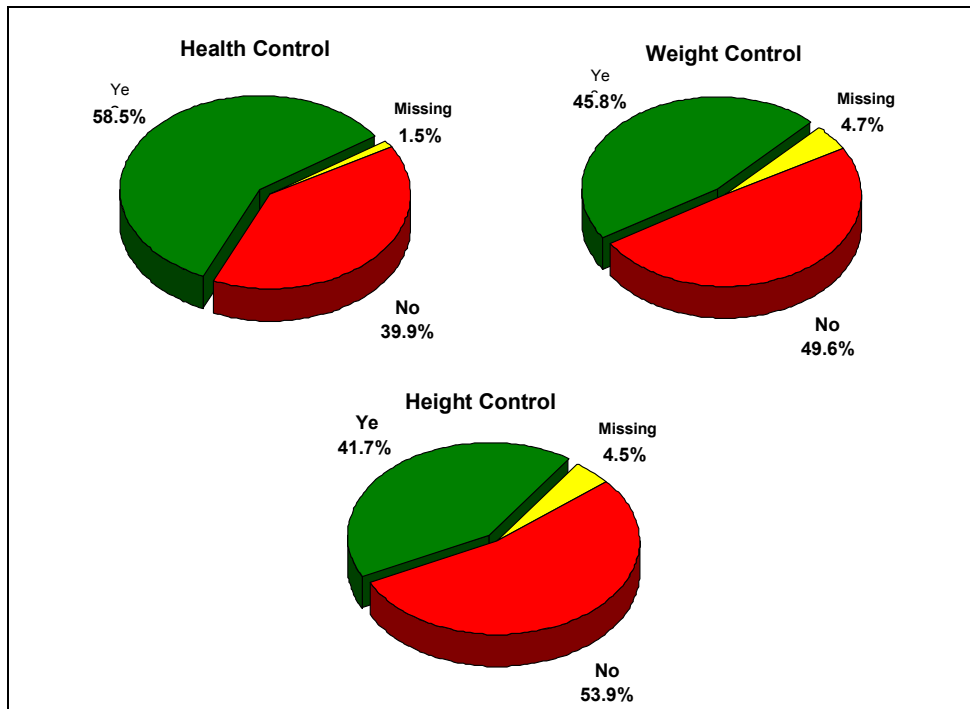
Graph No. 1
Days evacuated



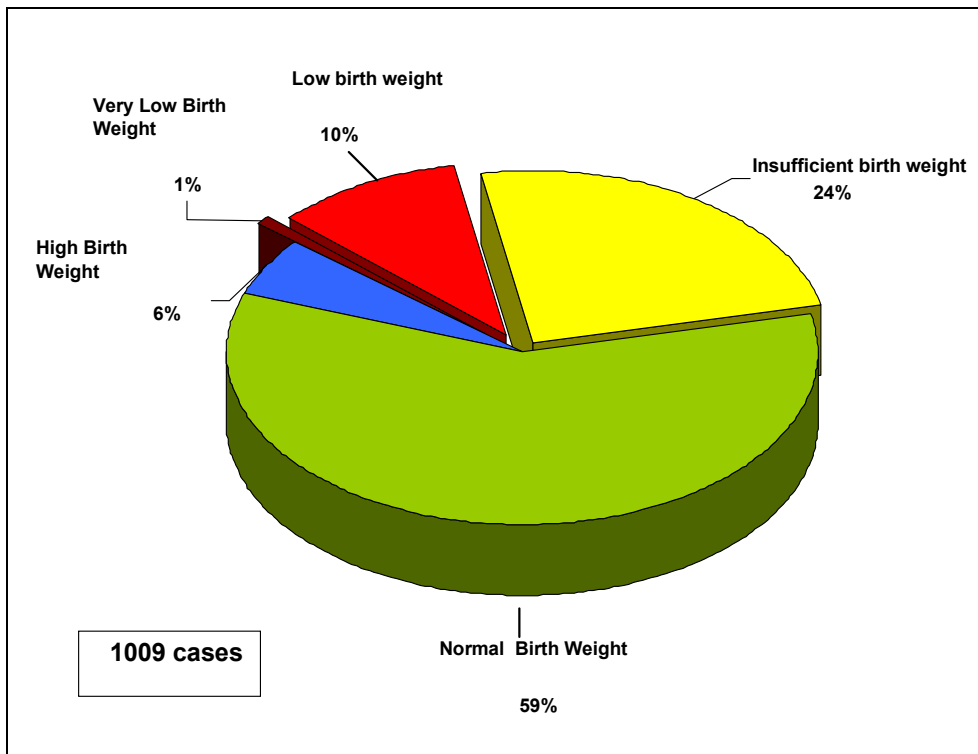
Another analysed aspect was health and anthropometrical controls, which the surveyed children underwent since the moment of the floods up to the date of the study. In this sense, it is observed that nearly 60% had a health control, while the proportion that was weighed and/or measured fluctuates from 41 and 45 % (Graph No. 2)

Of all the surveys carried out, in 1009 information about the birth weight was obtained, resulting in 11% with low or very low weight and 24% of insufficient weight, that is to say that 35% of the boys and girls were born with a lower weight than desired. (Graph No. 3)

Graph No. 2
Anthropometrics and health controls

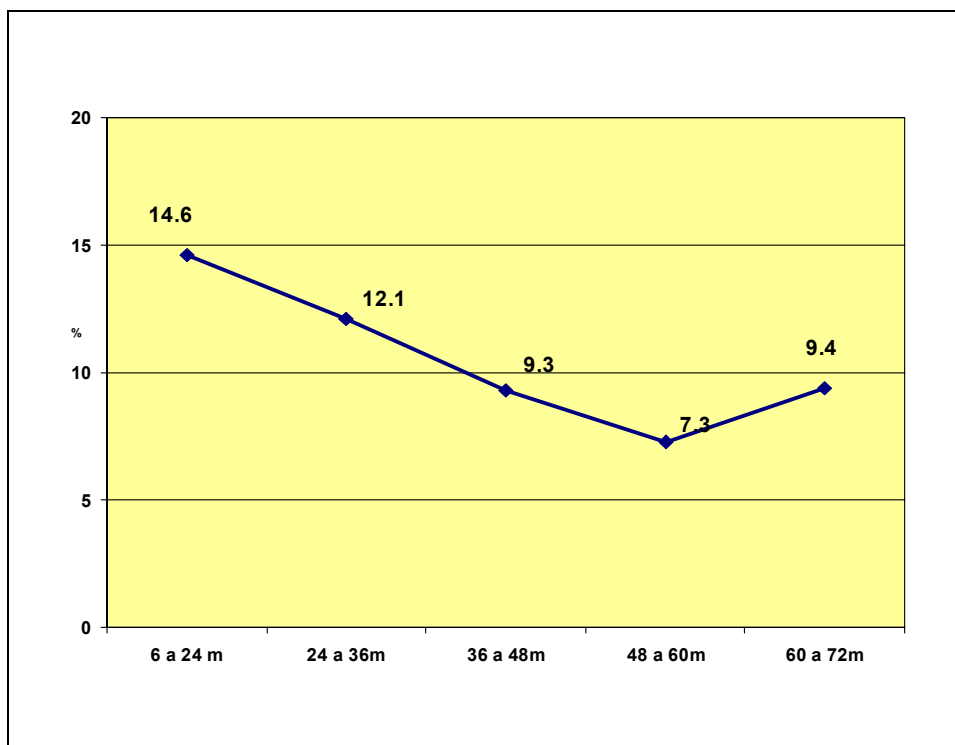


Graph No. 3
Distribution of children according to weight at birth



The results of low birth weight by age show that children under 2 years of age represents the age group with a higher percentage of children with this nutritional problem, observing a decreasing curve as the age groups increase (Graph No. 4)

Graph No 4:
Relation of low birth weight (<2500 g) by age group.

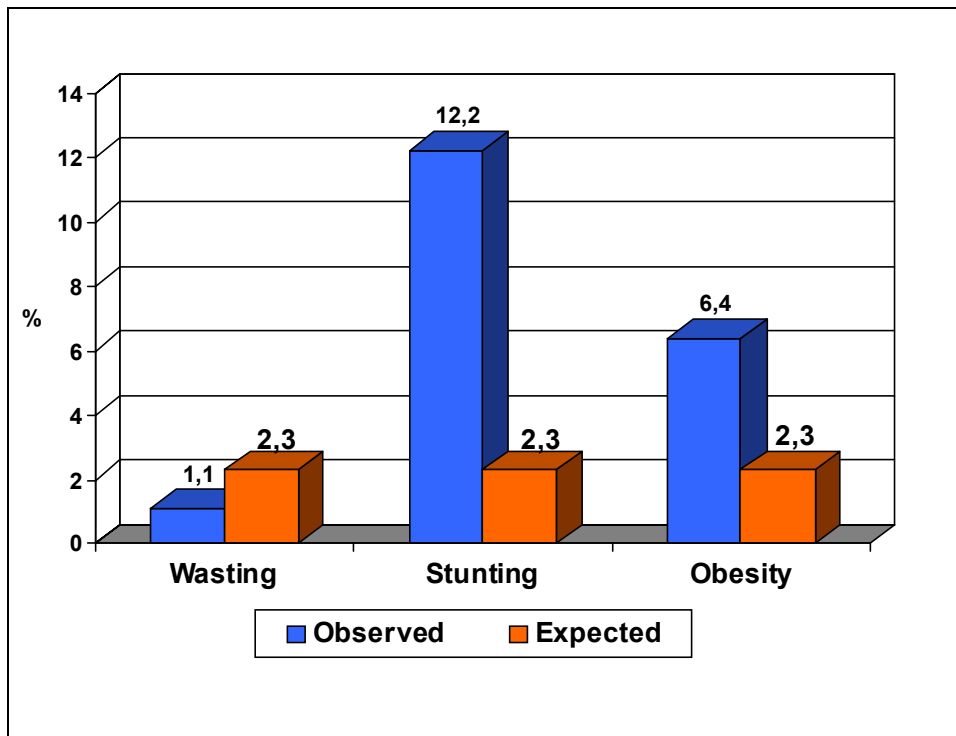


4.1.3 Food-Nutritional Aspects

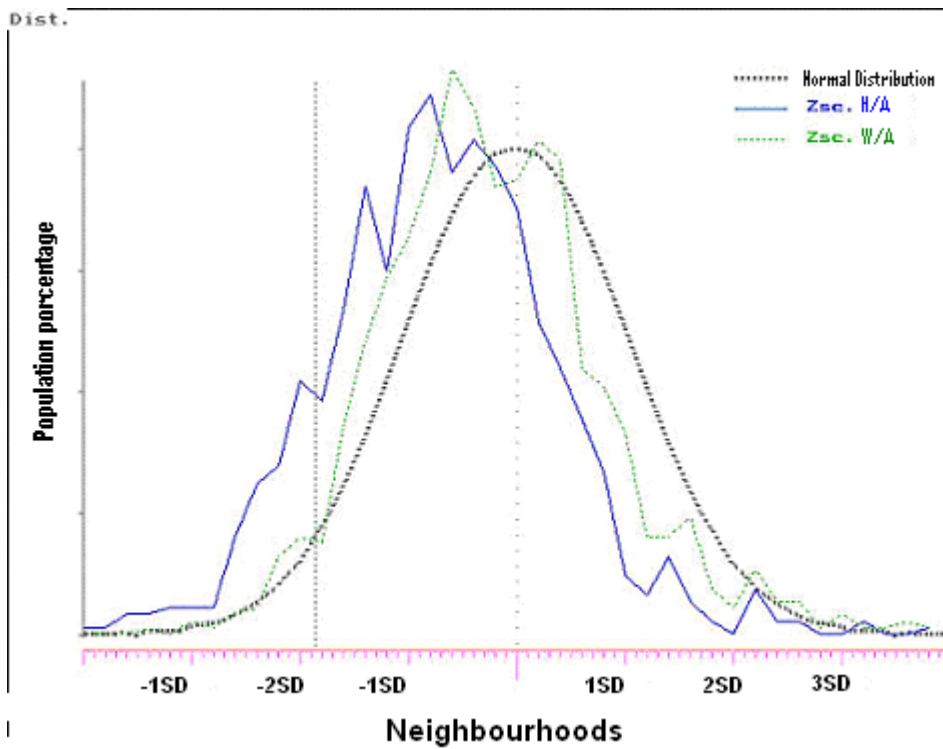
The anthropometrical results show that the proportion of children with acute malnutrition is much lower than expected, while in the case of height retardation and obesity the situation is exactly opposite (Graph No. 5)

In the same sense, when the results obtained are compared to the normal distribution of international standards (Graph No.6), a shift towards the left on H/A index (z-score average =-0.67) and W/A (z-score average=-0.21) is observed and towards the right on the W/H (z-score average=+0.33)

Graph No. 5
Stunting, wasting and obesity prevalence



Graph No. 6
Population distribution curve according to W/A and H/A



On the other hand, the analysis of the anthropometrical results according to age shows a greater deficit of W/A and H/A in children under 3-4 years.

Table No. III:
Relation of weight to age, by age groups.

Age in months	< -2 DE		-2 y +2 DE		> +2 DE	
	n	%	N	%	N	%
6 a 12	3	3.3	81	90.0	6	6.7
13 a 23	12	5.8	185	89.8	9	4.4
24 a 35	10	5.0	185	91.6	7	3.5
36 a 47	7	3.5	188	94.0	5	2.5
48 a 59	6	3.0	187	92.6	9	4.5
60 a 71	8	4.0	186	92.5	7	3.5
Total	46	4.2	1012	91.9	43	3.9

Table No. IV:
Relation of height to age, by age groups.

Age In months	< -2 DE		-2 y + 2 DE		> +2 DE	
	n	%	N	%	n	%
6 a 12	11	12.2	75	83.3	4	4.4
13 a 23	39	19.4	153	76.1	9	4.5
24 a 35	18	9.3	172	88.7	4	2.1
36 a 47	18	9.0	177	88.9	4	2.0
48 a 59	18	9.0	181	90.0	2	1.0
60 a 71	23	11.4	176	87.6	2	1.0
Total	127	11.7	934	86.0	25	2.3

Table No. V:
Relation of Weight to Height, by age groups.

Age In months	< -2 DE		-2 y + 2 DE		> +2 DE	
	n	%	N	%	n	%
6 a 12	0	0.0	81	90.0	9	10.0
13 a 23	6	3.0	180	90.5	13	6.5
24 a 35	2	1.0	184	94.8	8	4.1
36 a 47	1	0.5	191	95.5	8	4.0
48 a 59	1	0.5	184	91.5	16	8.0
60 a 71	2	1.0	181	90.5	17	8.5
Total	12	1.1	1001	92.3	71	6.5

No statistically significant differences among the different anthropometrical indicators and the sex variable are observed.

On the other hand, for the H/A indicator an association by the vulnerability condition is observed, varying the statistical significance according to the used criterion, giving the following results: overcrowded houses $p < 0.001$, environment $p=0.01$ and type of housing $p<0.001$.

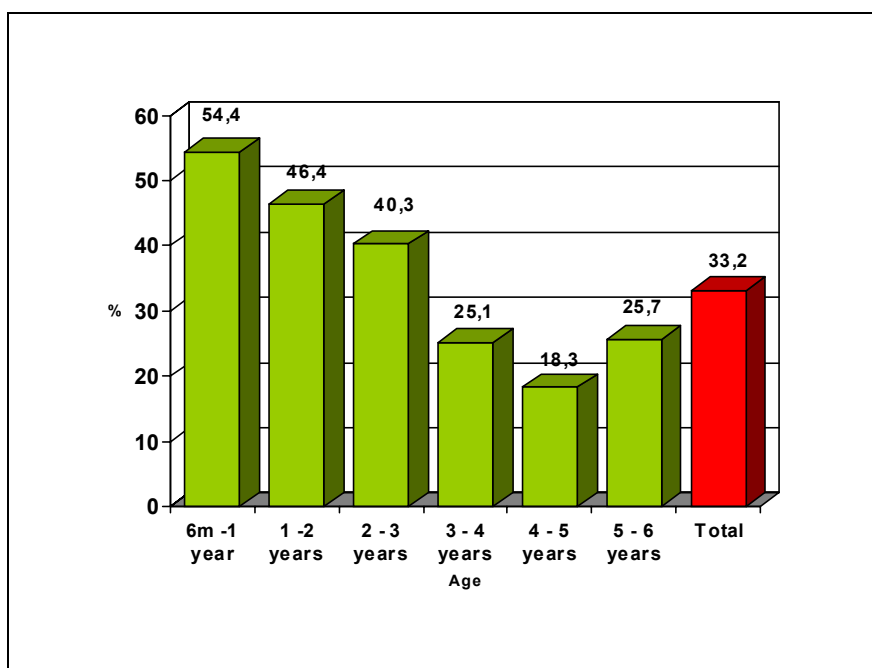
In relation to the W/H index, no statistically significant association is observed in the with the vulnerability condition, neither for obesity nor for wasting.

With respect to the biochemical variable, it is observed that 33.2% of children present anaemia (Table VI and Graph No. 7) and the most affected group is the one of children under 2 years of age, with values around the 50% (Graph No. 8)

Table No. VI:
Prevalence of anaemia by age and sex.

Age in Months	Boys				Girls				Total Anaemic		Total not Anaemic	
	Anaemic		Not anaemic		Anaemic		Not anaemic		N	%	N	%
	n	%	n	%	n	%	N	%				
6 a 12	37	68.5	17	31.5	12	33.3	24	66.7	49	54.4	41	45.6
13 a 23	61	52.1	56	47.9	37	39.4	57	60.6	98	46.4	113	53.6
24 a 35	42	40.4	62	59.6	41	40.2	61	59.8	83	40.3	123	59.7
36 a 47	20	21.1	75	78.9	31	28.7	77	71.3	51	25.1	152	74.9
48 a 59	19	16.5	96	83.5	18	20.7	69	79.3	37	18.3	165	81.7
60 a 71	32	30.8	72	69.2	20	20.4	78	79.6	52	25.7	150	74.3
Total	211	35.8	378	64.2	159	30.3	366	69.7	370	33.2	744	66.8

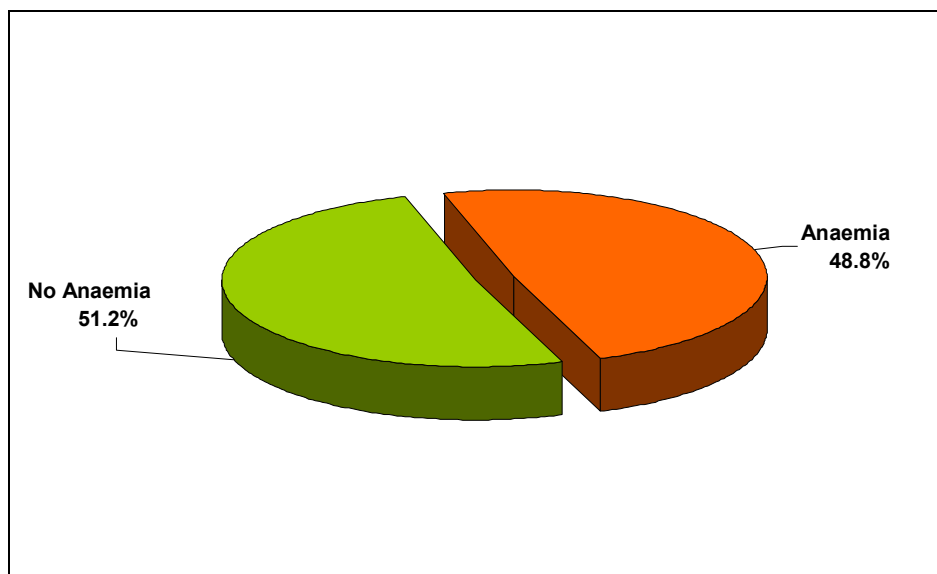
Graph No. 7
Prevalence of anaemia by age and sex groups



On the other hand, when analysing the prevalence of anaemia by sex, a statistically significant difference ($p=0.05$) in detriment of the boys is observed, who present a prevalence of anaemia of 35.8% against 30.3% for the girls.

A similar association is also observed regarding the vulnerability condition and anaemia, varying the statistical significance according the used criteria, so, overcrowded houses $p=0.02$, environment $p=0.001$ and type of housing $p=0.0009$, without finding statistical significance with the criteria V1 in which the home head is not the father.

Graph No. 8
Prevalence of anaemia in children under 2 years of age

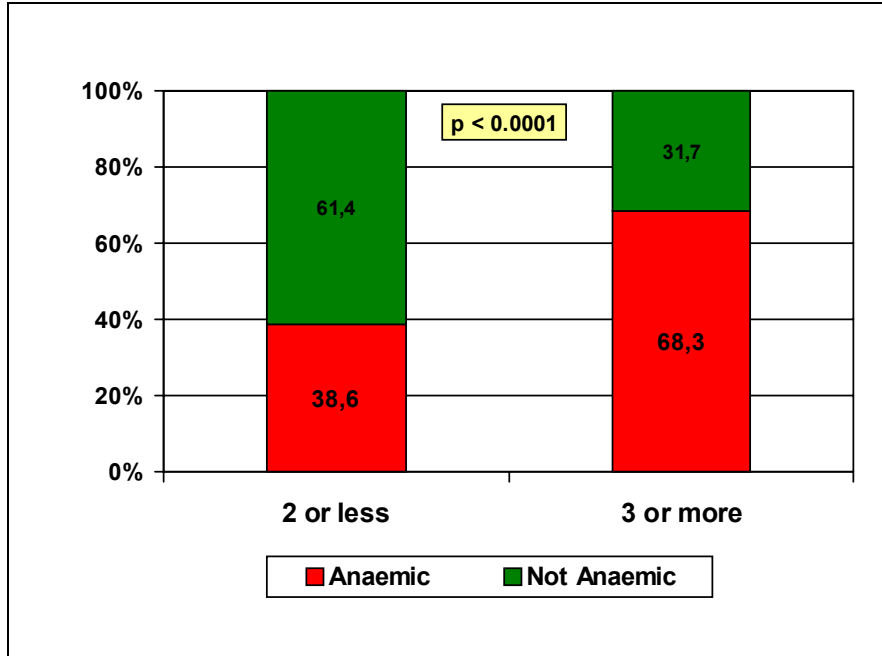


No statistically significant association between anaemia and stunting, wasting or obesity is observed, while the proportion of anaemic children is higher in children with antecedents of low or insufficient birth weight than in those of normal or high weight (32.6%) ($p=0.5$)

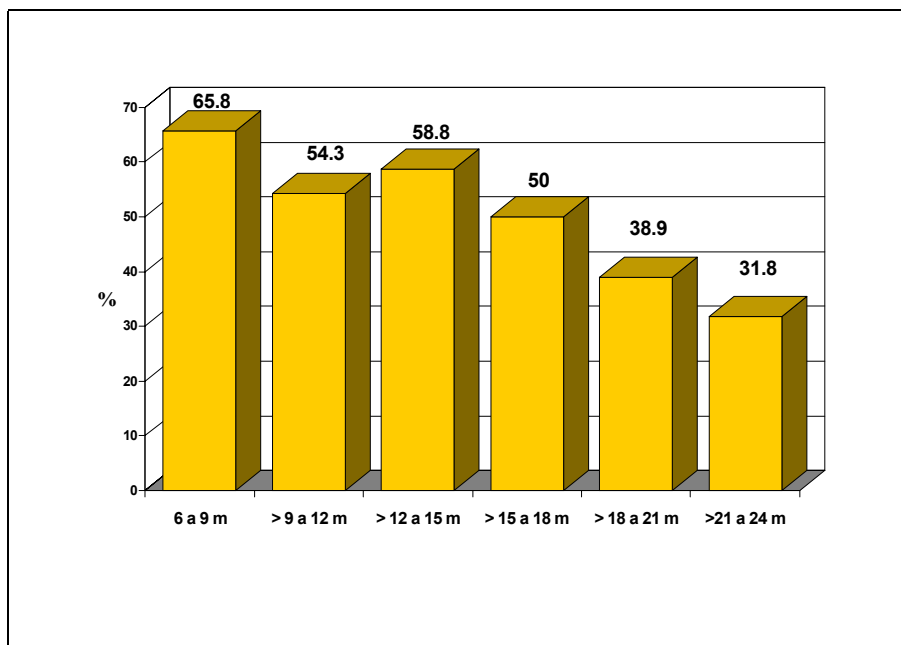
Taking the homes as analysis unit, it is observed that in the 40.9% there are anaemic children, nevertheless, when observed differentiated, those homes with up to two members under 6 years of age with respect to those that have 3 or more of that age group, the percentages are 38.6% and 68.3% respectively, this difference being highly significant. (Graph No. 9).

With regards to breastfeeding, it is observed that breastfeeding duration is acceptable, with a homogeneous tendency, except for the age group between 9 and 12 months. (Graph No.10)

Graph No. 9
Prevalence of anaemia in homes, by number of members under 6 years of age



Graph No. 10
Prevalence of breastfeeding by age groups



4.2 Evacuated Centres

4.2.1 *Target Population*

218 boys and girls were surveyed in 23 evacuated centres. With respect to the anthropometrical variables, there were 3 surveys without height data recorded and 4 without weight data recorded, while for the biochemical variables 205 samples were obtained.

4.2.2 *Sociodemographic aspects*

The distribution by sex was homogeneous ((50,5% boys and 49,5% girls) for the whole sample, with a sex ratio of 1.0. the same was observed for each of the analysed age groups, except for the age group between 6 and 12 months, in which there is a higher proportion of boys (Table No. VII)

Table No. VII.
Distribution by sex and age

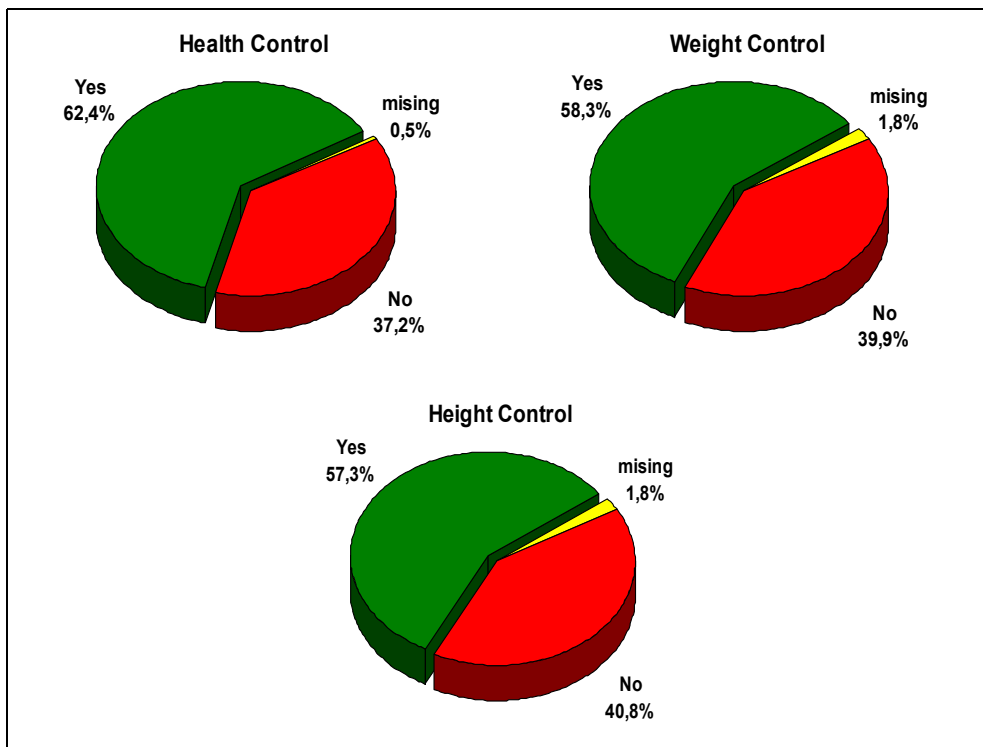
Age in months	Boys		Girls		Total		Sax ratio
	n	%	N	%	n	%	
6 to 12	18	62.1	11	37.9	29	13.3	1.6
13 to 23	19	52.8	17	47.2	36	16.5	1.1
24 to 35	22	52.4	20	47.6	42	19.3	1.1
36 to 47	16	41.0	23	59.0	39	17.9	0.7
48 to 59	17	42.5	23	57.5	40	18.3	0.7
60 to 71	18	56.3	14	43.8	32	14.7	1.3
Total	110	50.5	108	49.5	218	100.0	1.0

Another aspect analysed was the health and anthropometrical control of the surveyed children from the last floods to the date of the study. In this sense, it is observed that more than 62% underwent the health control, while the percentage of those measured and/or weighed was of about 57% (Graph No. 11)

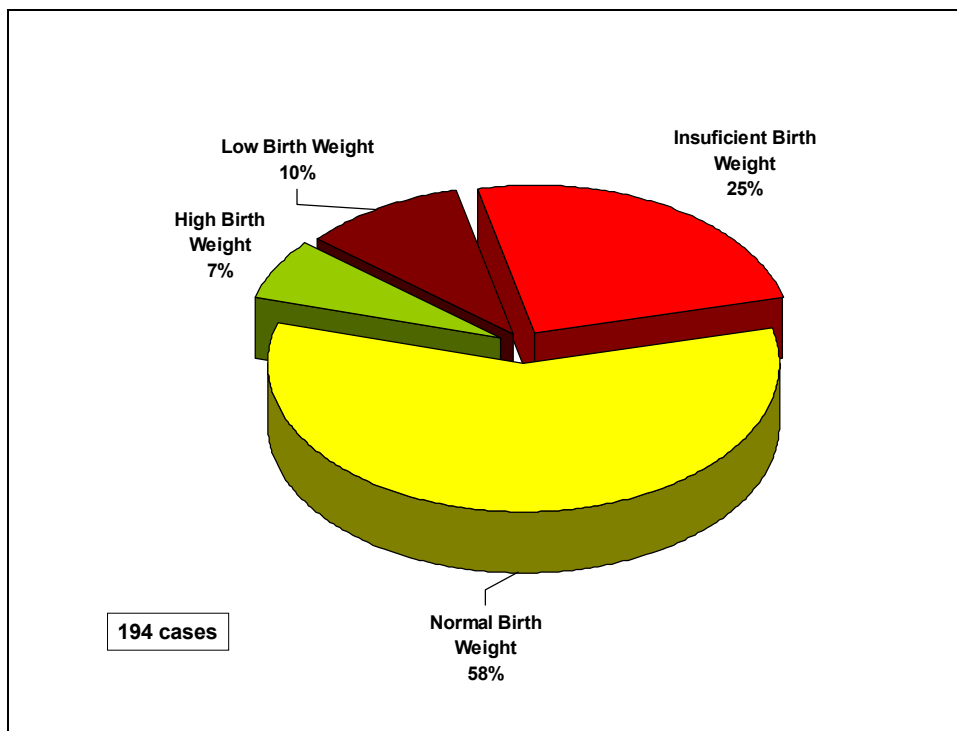
On the other hand, 8.7% of those surveyed belonged to families that had been evacuated on other occasions due to the floods.

Of the total number of surveys carried out, information about the birth weight was obtained in 194 cases, showing 10% low weight, and 25% with insufficient weight, that is to say, more than 1/3 of the children were born with a lower weight than desired.

Graph No. 11
Health and anthropometrical controls

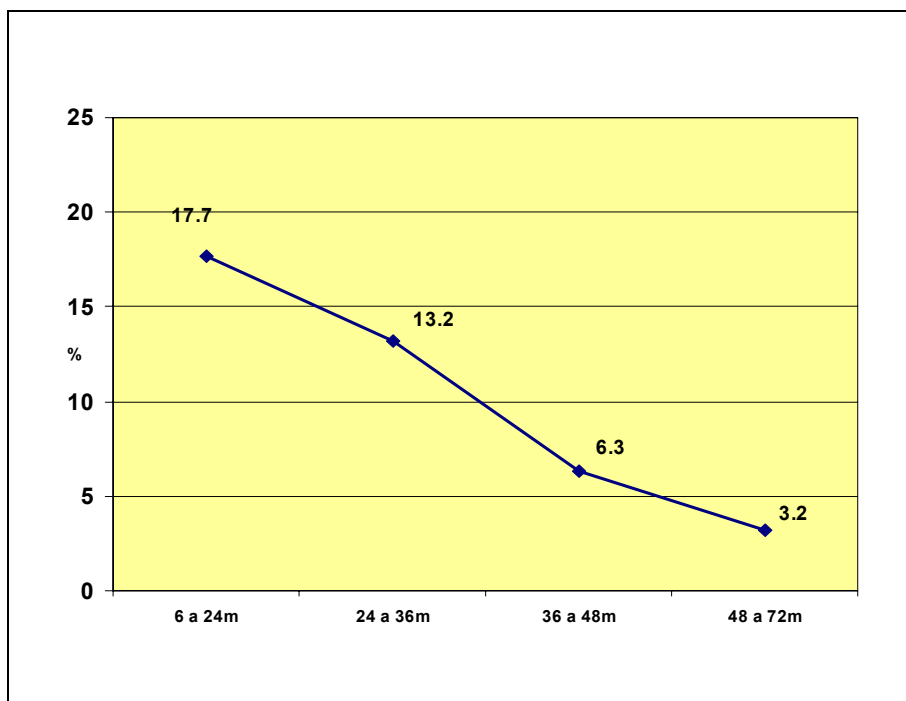


Graph No. 12
Distribution of children by birth weight.



The results of the birth weight by age show that the children under 2 years of age are the group with a higher percentage of low birth weight (Graph No. 13)

Graph No. 13
Low weight at birth (<2500 g) by age group

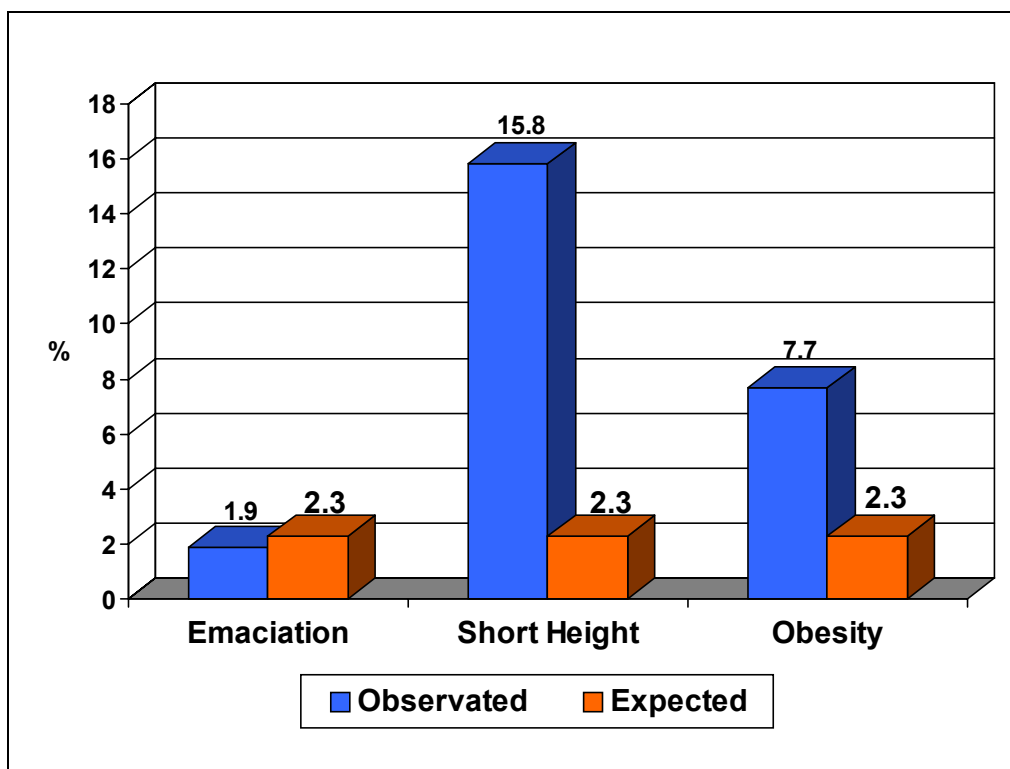


4.2.3 Food-Nutritional aspects

The anthropometrical results show that the proportion of children with acute malnutrition is much lower than expected, while in the case of stunting and obesity the situation is exactly the opposite. (Graph No. 14)

When the results obtained are compared to the normal distribution of the international standards, it is observed a shift towards the left on the H/A indicators (z-score average =-1.03 and -0.37 respectively) and towards the right on the W/H (z-score average=+0.4) (Graph No. 15)

Graph No. 14
Prevalence of emaciation, short height and obesity



On the other hand, the analysis of the anthropometrical results by age shows a greater incidence in the age group of children between 1 and 3 years of age. (Table VIII).

Graph No. 15
Population Distribution Curve according to W/A and H/A

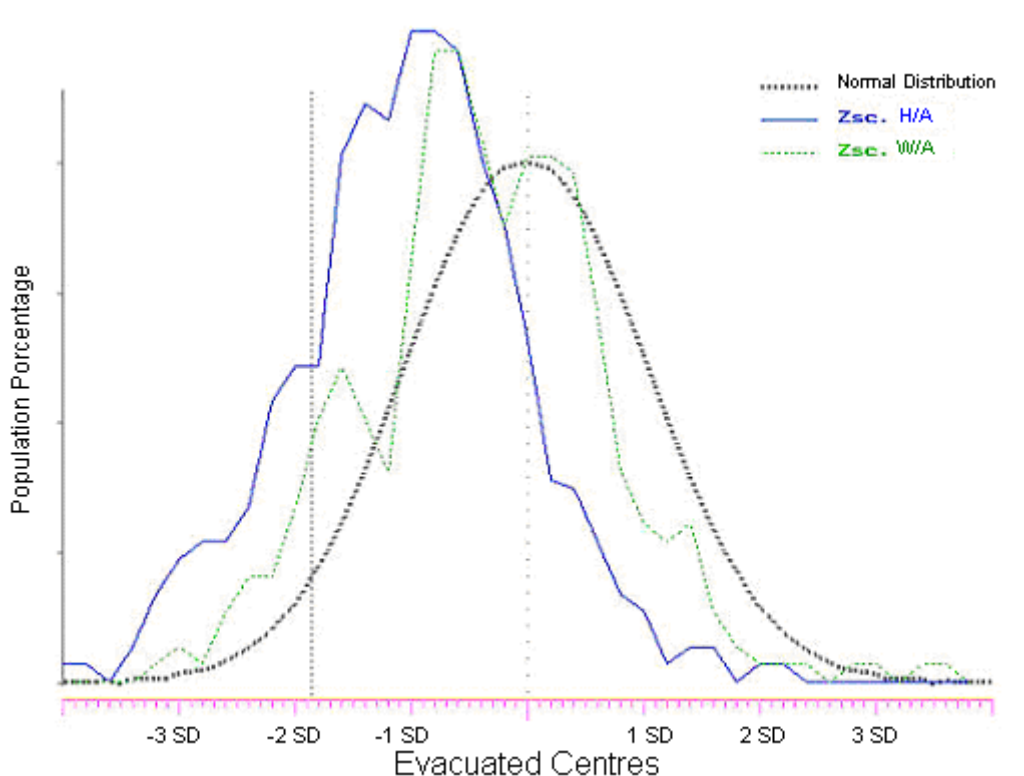


Table No. VIII
Weight for age relation, by age groups.

Age In months	< -2 DE		-2 y +2 DE		> +2 DE	
	n	%	N	%	n	%
6 to 12	1	3.4	28	96.6	0	0.0
13 to 23	4	11.1	31	86.1	1	2.8
24 to 35	4	9.5	37	88.1	1	2.4
36 to 47	1	2.6	37	94.9	0	0.0
48 to 59	1	2.5	35	87.5	2	5.0
60 to 71	1	3.1	30	93.8	1	3.1
Total	12	5.7	198	94.7	5	2.4

Table No. IX
Height for age relation by age groups

Age in months	< -2 DE		-2 y +2 DE		> +2 DE	
	n	%	N	%	N	%
6 to 12	4	13.7	24	82.8	1	3.4
13 to 23	10	29.4	24	70.6	0	0.0
24 to 35	6	15.0	33	82.5	1	2.5
36 to 47	5	13.5	32	86.5	0	0.0
48 to 59	4	10.8	33	89.2	0	0.0
60 to 71	4	12.5	28	87.5	0	0.0
Total	33	15.8	174	83.2	2	1.0

**Table No. X:
 Height for Weight relation by age groups.**

Age In months	< -2 DE		-2 y +2 DE		> +2 DE	
	n	%	N	%	N	%
6 to 12	0	0.0	27	93.1	2	6.9
13 to 23	2	5.9	28	82.3	4	11.8
24 to 35	1	2.5	39	97.5	0	0.0
36 to 47	0	0.0	36	97.3	1	2.7
48 to 59	1	2.7	30	81.1	6	16.2
60 to 71	0	0.0	29	90.6	3	9.4
Total	4	1.9	189	90.4	16	7.7

In relation to the anthropometrical indicator H/A and the sex variable, there is a statistically significant difference ($p=0.03$) in detriment of the boys that show a 21.3% of low height with respect to the girls that show 10.6%. In the rest of the anthropometrical indicators no statistically significant differences are observed with the sex variable.

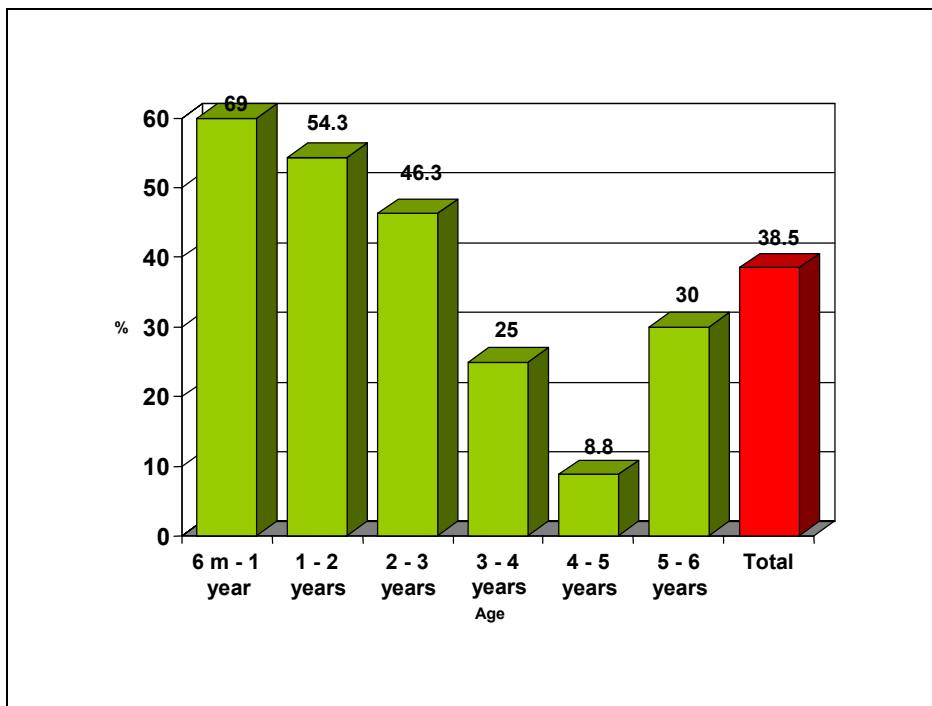
With respect to the biochemical variable, it is observed that 38.5% of the total of children present anaemia, and the most affected group is that of those under 2 years of age showing values higher than 60% ($p<0.0001$) (See Table XI and graphs 16 and 17).

When analysing the prevalence of anaemia by sex, no statistically significant difference is observed.

**Table No. XI:
 Prevalence of anaemia according to age**

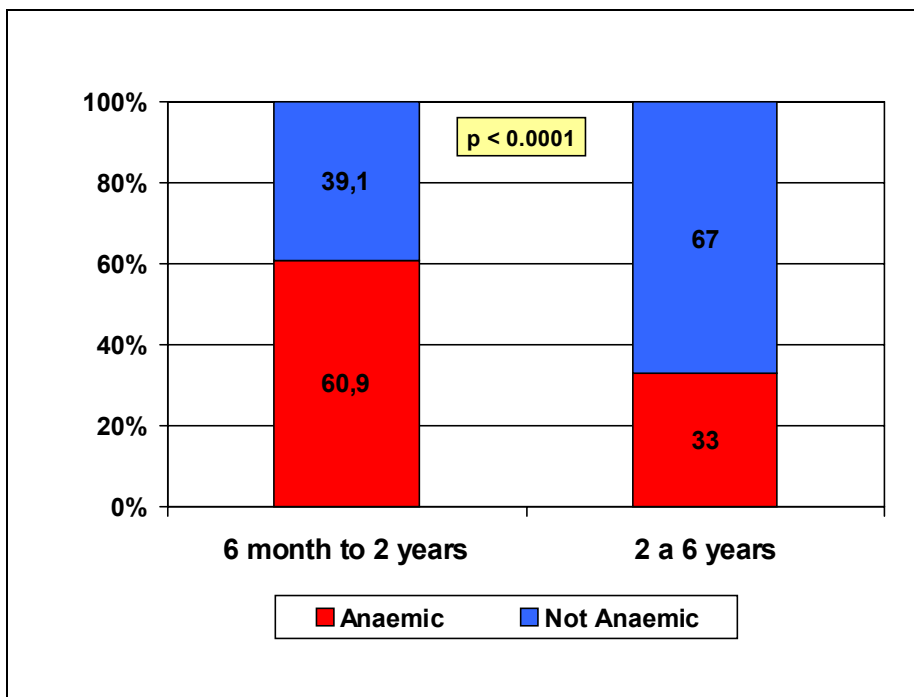
Age In months	Anaemic		Not Anaemic		Total	
	n	%	N	%	n	%
6 to 12	20	69.0	9	31.0	29	14.1
13 to 23	19	54.3	16	45.7	35	17.1
24 to 35	19	46.3	22	53.7	41	20.0
36 to 47	9	25.0	27	75.0	36	17.6
48 to 59	3	8.8	31	91.2	34	16.6
60 to 71	9	30.0	21	70.0	30	14.6
Total	79	38.5	126	61.5	205	100.0

Graph No. 16
Prevalence of anaemia by age groups and total



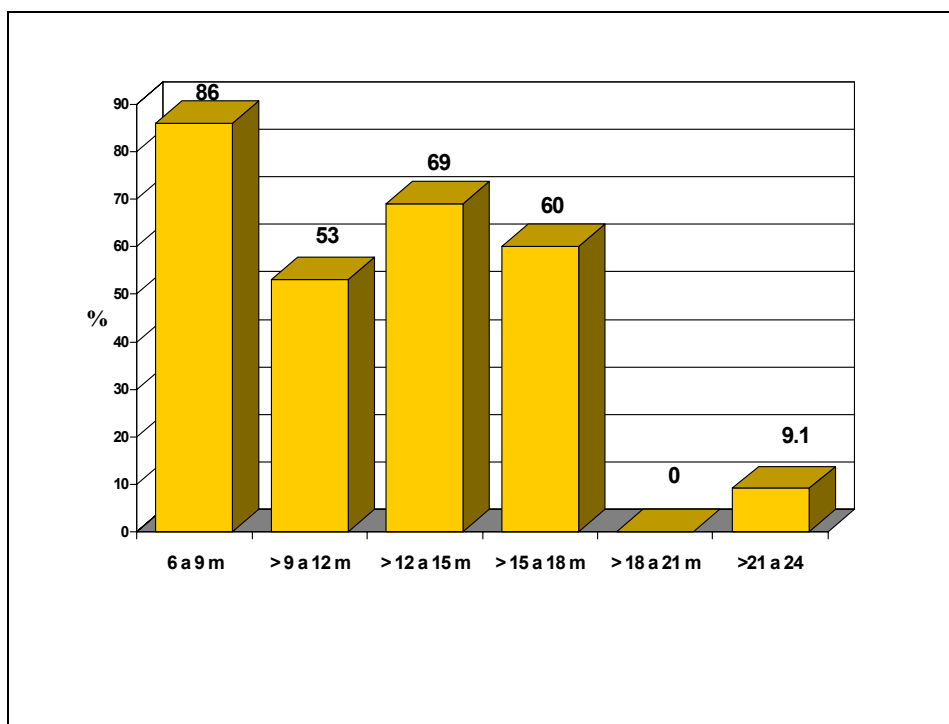
Graph No. 17

Prevalence of anaemia in children over or under 2 years of age



With respect to breastfeeding, it is observed that breastfeeding duration is acceptable, with a homogeneous tendency, except in the group of children between 9 and 12 months of age. (Graph No. 18)

Graph No 18
Prevalence of Breastfeeding by age groups



4.3 Schools

4.3.1 Target Population

626 schoolchildren in their first year were surveyed at 14 schools that had been flooded. From this amount, 11 registers were eliminated from the anthropometrical analysis because there were some data missing, while for the biochemical variable in 24 cases no blood sample was recorded.

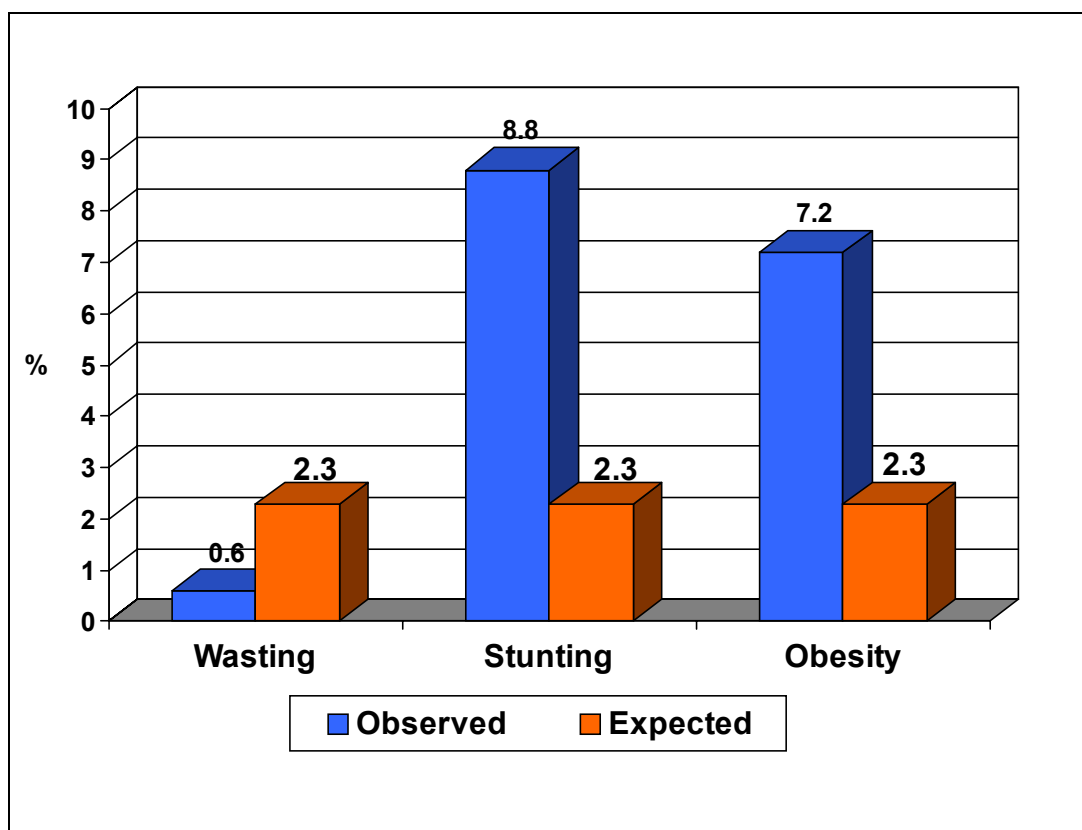
4.3.2 Sociodemographic aspects

The distribution by sex was homogeneous ((49,3% boys; 50,7% girls) for the whole sample, showing a sex ratio of 1.0. This relation is kept constant for the children with the corresponding age for the first school year (5-7 years of age) but in children over 7 years of age, a greater proportion of boys was found (sex ratio between 1.5 and 1.8)

4.3.3 Food-nutritional aspects

The anthropometrical results show that the proportion of children with acute malnutrition is much lower than expected, while in the case of stunting and obesity the situation is exactly the opposite (Graph No. 19)

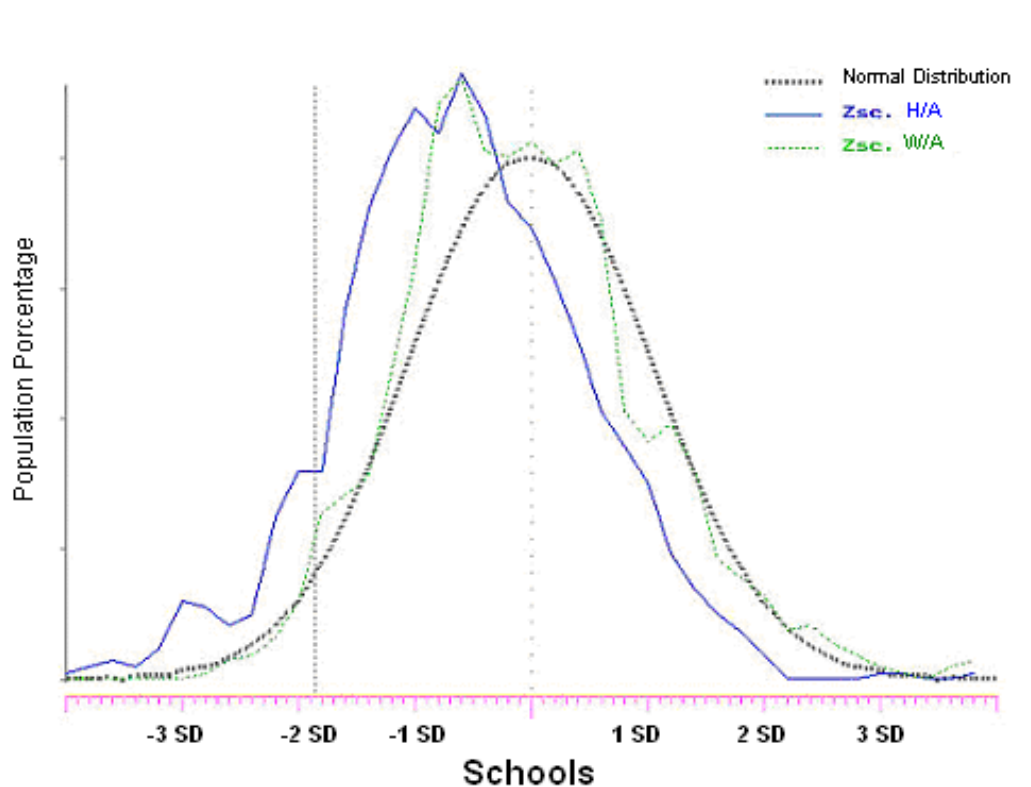
Graph No 19
Prevalence of wasting, stunting and obesity



In the same sense, when the results obtained are compared to the normal distribution of the international tables (Graph No.20), a shift towards the left on the H/A index (z-score average =-0.5) is observed and towards the right on the W/H (z-score average=+0.6)

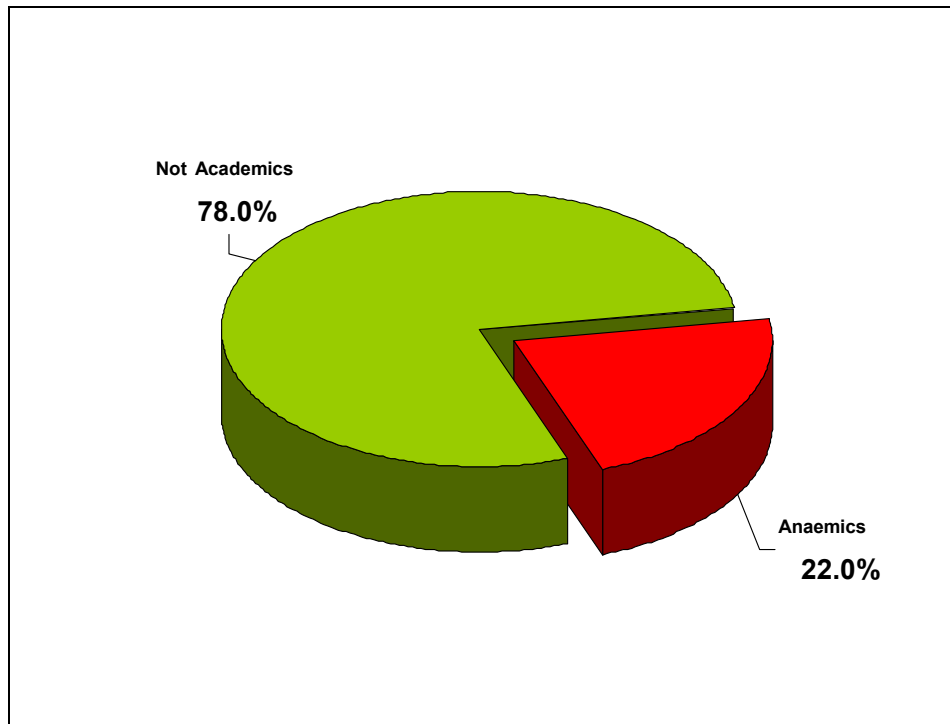
With respect to the Height/Age index, there is a statistically significant difference ($p=0.0002$) in relation to sex, in detriment of the boys, who present a prevalence of low height of 13% against 4.6% of the girls

Graph No. 20
Population Distribution Curve by W/A and H/A

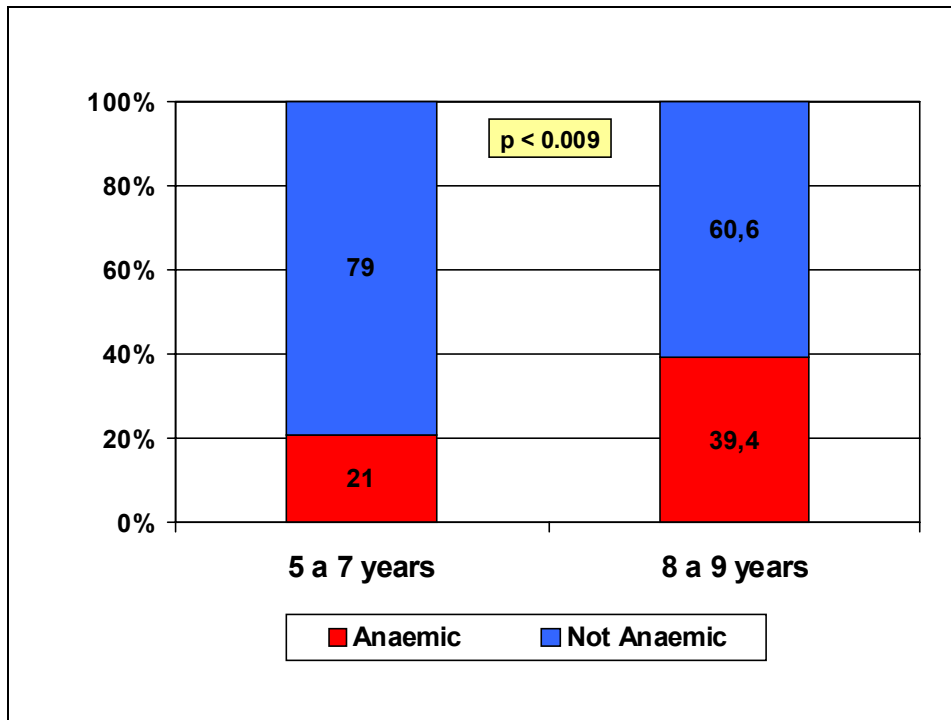


With respect to the biochemical variable, anaemia was observed in 22% of the total of boys and girls, observing no difference according to sex (Graph 18). Where a highly significant difference was found, was between anaemia and age, as the prevalence in boys and girls between 5 and 7 years of age was of 21% while for those between 7 and 9 years of age it was of 39.4% ($p=0.009$) (Graph No.21)

Graph No. 21
Prevalence of anaemia in schoolchildren



Graph No. 22
Prevalence of anaemia in schoolchildren over and under 7 years of age.



5 DISCUSSION

What has to be taken into account first is that based on the characteristics of the sample, the results obtained representative of all children living in the flooded area of the city of Santa Fe.

On the other hand, the socio-economic variables of the homes studied show that the target population corresponds to what was expected, in the sense that **more than 93% presented at least one of the chosen vulnerability criteria**

Health and anthropometrical controls for children in the survey carried out, both in homes and at Evacuated centres, show a considerable deficit taking into account the relevance of guaranteeing at least one weight and height control to the whole population of children after the floods.

A fact that has to be emphasized is that the prevalence of **low birth weight is higher than the national average, almost duplicating the value in some age groups**. This could be a consequence of the growing deterioration, during the past years, of the socio-sanitary condition of the population, as **the low birth weight in children born during the period 1997-98 exceeds in about 50% to those born in 2002-03**.

With regards to the anthropometrical evaluation in all the environments studied, a **wasting prevalence lower than expected** is observed, while the **stunting and obesity appear as highly relevant nutritional problems**. In this sense, it is important to emphasize that these findings fully agree with the other population studies carried out in the country

This nutritional profile, consequence of different factors, among which bad food habits (diets rich in fat, fizzy drinks, etc.) and sedentary lifestyle stand out, alert the need to develop preventive-promotional actions not only from the health services but also from schools and different social programs.

The other highly significant element was the **high prevalence of anaemia in all the groups studied**, which is consistent with the nutritional profile described in several studies carried out in the country, where iron deficiency anaemia is one of the main nutritional problems of mothers and infants population. However, it is important to point out that, in the case of the study in Santa Fe, **the values found exceed between 3 and 10 times what was expected in a normal population**.

On the other hand, this nutritional disorder not only clearly reflects a **very long term food insecurity** situation and the **vulnerability of a fundamental right**, but also an **enormous mortgage for the development of those children and thus the whole society**.

In fact, **iron deficiency has deleterious consequences regard the growth and development of the children** because it directly affects the growth of the brain and the of the whole nervous system interconnections. When this situation arises **during the first years of life a neurological damage is produced compromising almost in an irreversible way the intellectual capacity of that individual**.

In the case of the schoolchildren, **the presence of anaemia is strongly associated with learning difficulties**, and consequently, a **greater school failure** as shown in the

studies carried out by UNICEF in the provinces of Chaco and Mendoza where it was observed that the deficiency through anaemia was associated to a lower school performance.

With respect to the homes, a fact to be taken into account is **the significant higher proportion of anaemic children in those houses in which there were more than 2 children under 6 years of age**. This information is very valuable and has to be taken into account when the priority of the families for which a more detailed and continuous follow-up is decided.

A similar fact was observed in those schoolchildren who presented a **higher percentage of anaemia when their age exceeded the expectations for the school year they were in**. This finding would make the existing association between anaemia and performance at school evident, without pretending to establish direct cause-effect relation.

Finally, it is remarkable that **children at the Evacuated centres present a higher prevalence of anaemia, stunting and obesity than those who returned home earlier**. A possible explanation for this is that the population that still persisted at the Evacuated Centres at the time the study was carried out is the one that presents a greater degree of socioeconomic vulnerability. Likewise, added or not to what has been said, it could be that the quality of the food offered at the Centres is insufficient in quality and/or quantity.

6 CONCLUSIONS AND RECOMMENDATIONS

The results of the study confirm that the principal nutritional problems of the infant population (children between 6 and 71 months of age and school children) are the **stunting, overweight and anaemia**. On the other hand, the obtained data reveals problems in the health coverage of the most vulnerable groups (children and pregnant women).

As of these results, the following ways of action are recommended:

- ***Strengthening of the nutritional surveillance of children under 6 years of age and pregnant women.***

The proposal is to maintain and strengthen the proactive “house to house” work, carried out by the health promoters in order to capture the hidden demand and continue a tighter follow up of those groups with high socio-sanitary risk.

- ***Supplement all the children of the Evacuated Centres and first grade schoolchildren in of the targeted schools with ferrous sulphate.***

Weekly administration of iron constitutes an effective tested strategy and a way to prevent and treat ferropenic anaemia at a low cost.

➤ ***Evaluate the need of supplementing with ferrous sulphate schoolchildren of different areas of the province.***

In order to evaluate the pertinence and necessity of extending the intervention to other groups of schoolchildren, it is recommended to carry out a nutritional survey to a representative sample of schoolchildren of the whole province.

➤ ***Improvement of the food quality distributed at the Evacuated Centres***

It is proposed to carry out periodical bromatological controls, as well as, adjustments of the menus according to the nutritional requirements of the most vulnerable groups, giving special emphasis in the iron content.

➤ ***Review of School menus***

As in the previous case, it is important to adapt the food services to the nutritional requirements of schoolchildren, emphasizing the iron content.

➤ ***Develop actions oriented to reduce overweight and obesity***

To do this it will be important to intensify food and nutritional education activities developed during the project; especially those bound to the Planut, software developed by the Panamerican Health Organization that allows calculating the food best buy, combining food-nutritional criteria with the cost of the products. Likewise, actions to reduce sedentary lifestyle of children, teenagers and adults must be taken.

➤ ***Include infant developmental and school performance variables in future nutritional studies.***

Even though the association between nutrition and neurological development is widely proven, the possibility of including these variables in future nutritional studies performed in the country, will allow moving forward in establishing a crucial topic like this. At the same time, a base line to evaluate the impact of future interventions considering a wider integrity criterion will be offered