FINAL TECHNICAL REPORT

SOCIAL AND BIOLOGICAL IMPACT FOLLOWING THE INTRODUCTION OF HOUSEHOLD PIPED WATER IN RURAL GUATEMALA

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CONTENTS

I. INTRODUCTION

Prior to the International Drinking Water Supply and Sanitation Decade, 1981-1990, it was generally accepted that improved access to safe drinking water was associated with improved health, specifically, less diarrhea and diarrheal mortality. Many investigations during the decade showed that improved access to safe water had a small impact at best, less that the impact for improved sanitation and better hygiene practices, which is associated with the use of more water. Recently, it has been documented that improved access to water may be associated with other health impacts such as reductions in intestinal helminths, skin diseases, guinea worm and schistosomiasis (Esrey et al, 1991) as well as improvements in nutritional status. Others have suggested that access to improved water in associated with time (Burger et al, 1995) and energy (White et al, 1972; Okun, 1988) savings if water is brought closer to the home. These savings could result in improved health and nutrition of populations by improving birth weight of children, more time in food production and preparation, more time in child care, and more time and energy into productive activities that generate income, which could be directed toward health and nutritional well-being of family members.

Until recently, these estimated savings and benefits have been theoretical. The present study attempted to measure these savings and the potential for better health and nutritional status of community members.

II. PURPOSE AND OBJECTIVES

A. Statement of Purpose

This study proposes to evaluate the social and biological impacts of piped water supplies by comparing the maternal time and energy saved in collecting piped versus unpiped water and their redistribution as well as the health and nutrition differences, in order to promote health and nutrition interventions.

B. Specific objectives

There are six specific research objectives:

1. To encourage participation from the local community to assess the community water system and the general patterns of labor/time allocation of women in the community.

2. To document, from a user (emic) perspective: a) beliefs and attitudes towards water and its use, b) water-related activities, c) the extent of participation in the local water committee and other components of the water project, d) type and amount of water used regularly and for what purposes and e) perceived effort and duration of specific activities.

3. To quantify the total amount of energy expended, level of activity and activity pattern associated with water- and non-water related activities.

4. To document time savings related to piped water supplies by measuring the time spent on water and non-water related activities performed by women during the day and how the time saved is allocated to specific activities.

5. To assess the health and nutrition differences between mothers and children with and without piped water supplies.

6. To estimate dietary intake among preschool children and adult women from the communities with and without piped water.

III. ORGANIZATION OF THE REPORT

The report is organized by objective. The overall methods for the study are presented in the methods section below. The detailed research methods, however, are included in the section related to each objective. Under each objective, the results and in some cases the implications are also presented. A final results chapter integrates findings from several of the objectives. The discussion chapter summarizes the overall findings and discusses the implications in terms of research and programmatic issues. Finally, the results of the dissemination of results workshop are presented. The workshop was held in Guatemala City, 30 September 1994.

IV. METHODS

1. Study design

The basic design was to compare differences in community perspectives, time allocation, energy expenditure, and health and nutrition parameters between three communities with piped water (WPW) at the household level and three communities with no piped water (NoPW). In communities WPW households have water coming out of a faucet located in the patio, a few meters away from the house. These communities are also called communities with in-house piped water, with improved water supply or intervention communities. Improved water supply refers to the availability of and accessibility to water; it does not refer to its quality, as water does not generally undergo any treatment in these systems. In communities with NoPW households have to obtain water from a spring or public tap, located at considerable distance from the house. Communities with NoPW were considered control communities.

Data on all variables were collected and compared across two seasons given that there are differences in water availability between them: the rainy season (from May/June to October) and the dry season (from November to May).

In each of the six study communities, a sample of 16 household was selected. For most of the objectives the same sample was used; for objective 3 a subsample was chosen. The study population and sampling methods described below are pertinent to all objectives, except where noted.

2. Study population

The population from which the sample was drawn inhabits the rural northwestern highland region of Guatemala. In the last five years, over 300 communities in this region, ranging in size from 35-200 households, have installed a piped water supply system. An additional 300 communities are expected to install similar water supply systems in the next five years.

Community selection was done in coordination with the "Programa de Agua y Saneamiento del Altiplano" (PAYSA) a USAID-funded and Ministry of Health executed water and sanitation project working in the department of Totonicapán. Their information on communities that already had water and those scheduled to have it in the next two years was especially valuable. The study communities were selected by the following procedure. First, potential communities were categorized according to the two comparison groups: control communities (NoPW) and piped water communities (WPW) that have had the

improved piped water supply system for at least 2 years. The criteria used for assessing comparability between NoPW and WPW communities were: size of the community (100-200 households) and access to transportation and health care. (see **Table 1**)

Once all the potential communities within each group were identified, twelve were further selected and visited. Local Water Committee members, authorities and health promoters were contacted in each community. Project information was provided and those communities that met the selection criteria and were willing to participate were identified. As any one community is different from another, at least two communities within a comparison group (Blum et al 1983) were required. Resources and time allowed for the selection of three communities within each comparison group WPW and NoPW. Some of the characteristics of the study communities such as distance to the Municipal center, house distribution, topography, accesibility and access to communication media, are presented in Table 1.

In each of the six communities, a sample of 16 households, each with a child under 36 months of age, was purposively selected (see below). Random selection was not always feasible given the interest of the communities water committees collaborating with the selection of the participant families.

In each household, the mother was the primary informant, although some data on other household members were also collected (see PA1-form, Appendix 1). The child under 36 months of age was considered the index child for several of the variables included. Where there were two children under 36 months in the household, the oldest of the two was considered the index child.

3. Sampling

Sample sizes for major variables tested were calculated using the following standard formula for the comparison of two independent groups:

$$n_i = 2*(Z_\alpha + Z_\beta)^2*s^2/d^2, \text{ where}$$

n_i = sample size per comparison group,
2 = constant when 2 independent groups are compared,
Z_α = 1.645 (constant associated with type I error rate of 0.05 one-tailed),
Z_β = 1.28 (constant associated with type II error rate of 0.10 - 90% power),
s = standard deviation,
d = expected differences between groups.

One-sided comparisons were used because two-sided comparisons implied that no alternative hypothesis could be described. It was *a priori* hypothesized that mothers in the communities WPW would expend less energy than mothers in the communities with NoPW. The latter were expected to spend more total time on water fetching and other domestic activities requiring water, while the former were expected to spend more time on income-generating activities. The above formula was reduced to:

$$n_1 = 17.11*(s^2/d^2).$$

Thus, for a comparison of any given variable, all that was needed was the ratio of the standard deviation to the expected difference. This was obtained for the major variables, total energy expenditure expressed as a daily average, and time allocation, expressed as percent of time in any one activity. For energy expenditure, a recent study in Guatemala (Stein et al 1988) reported a standard deviation of 186 kcal/day for a group of low socioeconomic women. It was theoretically proposed that a difference in energy expenditure between mothers from WPW and NoPW communities could be of about 400 kcal/day. If only sixty percent of this difference were to be detected (240 kcal/day), this resulted in a sample size of 10.3 or approximately 11 subjects per group or a total of 22 mothers per season. The final sample was rounded-up to 24 mothers in order to have some room for possible losses of information.

For time allocation studies relevant information was lacking. On the basis of time allocation studies in Asia and Africa (none were found for Central or South America), women spend anywhere from 0.07 to 5.8 hours a day collecting water and fuel (McGuire and Popkin 1990). These figures indicated a great variability, and as such they were not indicative of Guatemala. Nevertheless, hypothetical calculations were made. Assuming that women spent about 2 hours a day collecting water (2 round trips of 30 minutes each way), the net savings in time by having piped water close to the house was calculated to be about 2 hours. Converting these times to a percentage of a 12 hour day, to calculate a standard deviation, results in a s/d ratio of 1.66. Plugging this number into the sample size formula above resulted in 48 time allocation observations per group. This implied that 16 mothers had to be observed per community per season, making a total of 96 cases.

It was decided to study 3 communities per group therefore, in each community 16 families were selected for inclusion in the study. A subsample of four families within each community was selected for the energy expenditure studies (objective 3).

In the second round of data collection, during the dry season, one of the NoPW communities had to be replaced by another similar NoPW community. The

previous community had the water system installed before the planned date. Also, a few mothers were not the same from one season to the other. The changes are documented in the Appendix 3.

4. Data collection instruments

Several collection instruments were used in the study. Table 2 summarizes the instruments used by objective. A sample of each form is included in the Appendix 1. Each form used for data collection had a specific form number. For example, form PA-3 was used to record the time spent throughout the day. These form numbers are quoted in the results section to identify the source of information used.

5. Field workers training

Field workers were carefully trained in all data gathering procedures during one month previous to the first data collection period. The training process followed for each of the project components was performed in the same study area of Totonicapan and is described below for each type of information gathered. Training and testing of methods and instruments were conducted in non-study communities, communities similar to those studied.

Observation

Training on observation entailed some theoretical background, knowledge of the project, indoor practice and field practice. During the practical activities, field workers took part in the pre-testing of instruments and actively participated in the improvement of the instructions manuals.

Standardization of observers was a priority. Therefore, observers did many practice observations as a group and in pairs recording their observations independently. Training was considered satisfactory when agreement between observers reached above 85% (most of the time it was above 90%). Throughout the study, to insure good quality of the data, field supervisors continued to do some observations concurrently with observers and calculating agreement.

Interview

Training of field workers on interviewing was performed for the knowledge, attitudes and practices (KAP's) and the morbidity interviews. It also included indoor and field practice.

Dietary interview

The dietary interviews were carried out by the Field Supervisor (Martha Burdick) and the research assistant worker (Blanca Sulecio), both of whom have received previous technical training from INCAP and have had sufficient field practice. A standardization exercise for coding and calculation techniques was carried out between the two of them prior to beginning the collection of data.

Anthropometry

A standardized procedure was used to obtain weight and height of children and mothers. Standardization practices were performed with a group of 10 children in order to calculate accuracy and reliability of the measurements. This method calculates accuracy by comparing the measurements obtained by the trainees with those of the supervisor (considered the standard). Reliability is calculated from the repeated measurements made in the same child twice. Accuracy of 50 g in weight and 2 mm in height was obtained. Reliability of the measurements was also appropriate, reaching values over 90% in most cases.

Heart rate monitoring

The field workers were trained in the use and setting of the heart rate monitors (Uniq-Cic or Vantage models). In addition, the technical personnel were trained in the use of the interface and the computer programs until complete confidence was reached.

6. Data collection

The first round of data collection was conducted during the rainy season from May to October, 1993 and the second; from mid-January until May 1994, during the dry season. At the beginning of each period of data collection, the first activity conducted was a meeting with the group of 16 women from each community to explain/remind in a detailed manner the study objectives and to obtain their informed consent and collaboration. During a second meeting with

the participating women and children a focus group discussion was conducted, and anthropometric measurements (height/length and weight) were performed on each mother and index child. Also, a child morbidity recall interview was conducted individually with each woman. Finally, the subsample of 4 women per community, were dosed with doubly labelled water (DLW). The subsequent data collection home visits by the field workers and by those performing the dietary interviews were scheduled with each mother on this occasion.

During the following two weeks in each community, four field workers made two visits each to four families and the two dietary interviewers made two visits each to eight families. All the visits were scheduled so that they were not conducted on the same nor consecutive days.

At the end of both data collection period, a general meeting was held in each community with all participating families and the water committee members, in order to obtain feedback on our presence/work in the community as well as to acknowledge their participation and kind collaboration.

During each data collection period, free medical services were offered to all community members.

7. Data cleaning and recording

Data cleaning started before the data were recorded in the computer in both periods. Field supervisors and investigators reviewed all completed forms to check for inconsistencies, missing data, unclear numbers, etc. After the computer recording of the data, a second data cleaning process was performed using distribution of frequencies. Outliers ($> \pm$ 3 S.D.) were detected using Proc Freq and Proc Univariate from the SAS statistical software.

8. Time frame of the study

The study had a total duration of 23 months, from February 1993 to December 1994. Two months were spent in preparatory activities, about 10 months were spent in data collection, 7 months were spent in data processing and analysis, and around 4 months in progress report and final report preparation. A workshop to present the preliminary results of the study to interested international organizations, non-governmental and governmental organizations was held on 30 September 1994.

CRONOGRAM OF PROJECT ACTIVITIES

	1993											1994											
Activity	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Selection of communities, obtaining materials, testing procedures	*	*	*																				
Hiring and training			*	*																			
Data collection					*	*	*	*	*			*	*	*	*	*							
Data processing									*	*	*					*	*	*					
Data analyses										*	*						*	*	*	*			
Report writing											*	*									*	*	*
Dissemination																					*	*	*

V. RESULTS

General characteristics of the sample

The family composition interview (Form PA-4) provided information on the characteristics of the families studied, such as, age distribution, number of persons per family, sex distribution, schooling, age and occupation of the head of the family, which are presented in the Appendix 2. In the dry season, the 96 households studied there were 691 persons (681 wet season), most of whom were younger than 14 years old (56.5%), and approximately 39% in the economically productive age range (14-50 years old). Individuals of over 50 years of age constituted no more than 5% of the total. Families were mainly composed of 6-8 persons (NoPW 7.3 ± 2.4, range 3-13 members and WPW 7.1 ± 2.3, range 3-11 persons). Only 25% of the families studied had 5 or less members. The distribution by sex was fairly the same, where 49.2% were men and 50.8% women. No differences in gender proportions were observed in any of the age groups. In regard to schooling, 32% of the persons surveyed were illiterate, showing a slightly higher proportion (38.1%) in the NoPW communities. Most of the population had between 1-3 grades of primary education (40.8%), only few had secondary school education (3.6%), although it tended to be more frequent in the WPW group. There were no significant differences between the two groups in the age of the head of the family. About 25% of them were between 15-24 years old, about 21% were between 25-30 years old and about one third (34.7%) had more than 35 years of age. Regarding occupation, heads of family were mostly artisans (25.3%), followed by specialized workers (21.0%), day-laborers (17.9%), merchants (16.8%), laborers (10.5%) and housewives (3.2%). Most of the family heads were men. There were some differences in occupations between groups; communities with NoPW had more heads of family dedicated to agricultural laboring (31% more) and specialized workers (21% more). Similarly, heads of WPW communities were mainly artisans dedicated to handicrafts fabrication (textiles). The situation described above was virtually the same in the wet season.

Regarding the women studied, their age, weight and height are provided in **Tables 3 and 4**, for the total sample of 96 women and for the subsample of 24 women in the total energy expenditure study, respectively. The data are presented for the two seasons and for the two types of communities WPW and NoPW. There were no significant differences in age, weight or height between the two seasons and two types of communities in the total sample, although women in the NoPW group in both seasons were somewhat lighter than women in the WPW group. Compared to the sample, women in the subsample were fairly similar.

Housing characteristics has been frequently used as a proxy for socioeconomic status. In this study, information was obtained by means of a simple direct observation on the following: materials used in the construction of the roof, walls and floor of the

house; number of rooms, separate kitchen, and form of cooking; electricity and the presence of animals and some household appliances.

Significant differences between communities WPW and NoPW in both seasons were found in the number of rooms, electricity, form of cooking, and material of the floor as shown in Table 5. All these differences indicate better housing conditions in the WPW communities than in the control group. While it is likely that these differences preceded the differences in the water status of these communities, it is also possible that improvements in water supply allowed for improvements in house construction. This information was not obtained.

RESULTS BY OBJECTIVE

1. OBJECTIVE 1:

> To encourage participation from the local community to assess the community water system and the general patterns of labor/time allocation of women in the community.

This first objective was aimed at making the study which can be considered as intensive and invasive, more agreeable to community members.

Methodology

Several activities were planned to obtain community participation in the study: community meetings, participatory mapping, graphics, and other consultation and discussions with community members. However, due to time constraints on the part of community members, community participation was obtained with the cooperation of water committees, local authorities and health promoters. Meetings with them provided useful information.

Results

Meetings held with water committees were successful in obtaining their approval and the community's participation. The water committees helped in the selection of the sample of 16 families in each community.

Water Committees

In communities without water, the formation of a water committee is a prerequisite to start a project to introduce piped water in a community. The water committee identifies an adequate source of water, obtains permission

from small and big landowners to tap source and pass water pipes, makes contacts with government program and technicians, etc. Once the water is introduced, a water maintenance committee starts its operation. Water committees in NoPW were very active in mobilizing the communities to work in the water project. Committees are composed almost exclusively by males. In Choquí women reported that they were presently performing all agricultural activities because all men were working in the water project excavating a 16 km long ditch for water pipelines.

Water sources

Table 6 shows the main sources of water for the two types of communities. In the wet season, all sample households in WPW communities had a working tap in their yard or patio. NoPW communities obtained their water mainly from a spring (50%) and from a public tap (Pamalin). As mentioned earlier, Pamalin did not participate in the second round of data collection in the dry season. This modification accounts for the change in main water sources in the dry season. While most household in WPW continued to obtain water from in-house taps, 83% of households in NoPW obtained their water from a spring. Five houses in NoPW had access to an irrigation in-house tap connection, but in most cases it was not working during the home visits, obtaining their water also from a spring source. For the purpose of description of the different sources it will be mentioned as "in-house tap" in Table 6.

Information obtained from members of the water committees in NoPW communities in regard to distances to water sources, number of "trips" made, and total time needed to get water for the household is presented in Table 7. Communities with NoPW fetched their water from sources located at a distance of 0.5 to 3.0 km from the house. Reports on the number of trips made to the water source vary a great deal depending on the informant, as well as the information on whether daily trips are made or not. The reports on time spent in each trip are more consistent. According to these reports women would spend from one and a half to 5 hours a day fetching water. More time is spent fetching water during the dry season than during the rainy season, as some sources dry up and other more distant ones are sought. More information regarding time spent in water fetching will be presented below.

2. OBJECTIVE 2:

To document from a user (emic) perspective: a) beliefs and attitudes towards water and its use, b) water-related activities, c) the extent of participation in the local water committee and other components of the water project, d) type and amount of water used regularly and for what purposes and e) perceived effort and duration of specific activities.

Methodology

Focus groups were conducted with participating women, before other data collection activities took place. All the topics of interest were addressed in these group discussions. In addition, topics were discussed with a few key informants in each community.

Structured spot observations of water and hygiene conditions in the home, conducted twice (at the beginning and at the end of the 8-hour observation) during each visit, complemented the information. In all, four spot observations were conducted in each home. Spot observations focused on a few aspects of the mother, the index child, water vessels, cooking and eating ware, domestic animals and the latrine that could be unobtrusively observed in about 5 minutes. Aspects observed are indicative of behaviors. The form used to record the observation is presented in the Appendix 1.

Other open or unstructured observations were conducted throughout the duration of the visits and the study. These provided narrative accounts that are used to illustrate and interpret findings.

Results

Motivations for having water

The motivations expressed by women in NoPW communities to have piped water in their household patio/ premises were those of saving time and effort (energy). Men also mentioned that the saving time and effort on the part of women, who are the persons mainly responsible for fetching water, was an important rationale for having water.

Some women mentioned being able to water plants and animals as other benefits of having in-house piped water. The benefits on health and nutrition were mentioned much less. Nevertheless, members of Water Committees did mention health and nutrition benefits, probably resulting from the contact they

already have had with water and sanitation personnel of the water and sanitation project (PAYSA). At the same time, one of them explained that people had to be "bothered" with (educational) talks in order to be able to have their water system.

Those women from communities WPW expressed that the benefits of having piped water were that they had "more time now" for other domestic activities, that they "do not waste their time", "did not get too tired", "did not spend all their strength fetching water". Thus, benefits were also mostly perceived in terms of time and effort saved. Time saved was perceived as being used in domestic activities such as cleaning, washing, mending clothes, taking better care of children (especially washing). Involvement in income-generating activities was not mentioned as resulting from having piped water. In one community, women expressed that having water meant less risk in the lives of children who did not have to go to the river for bathing.

Women in communities WPW mentioned that with piped water there had been changes in their activities. The activities changing as a result of having piped water were: more sweeping (water is used to prevent dirt from rising) and cleaning, washing all the kitchen utensils, washing kitchen and eating utensils soon after they are used and more often, bathing and washing children more often, adults also washing and bathing more frequently, washing clothes at home, washing clothes more often, and planting vegetables at home.

Emic perspective on water and activities

Women in the communities studied categorize water in different ways according to the source and the intended use. As shown in **Table 8**, in NoPW, women think of their water as "inside" and "outside" water. Inside water is kept inside the house in the kitchen or where cooking is performed. Traditionally inside water was kept in earthen jars which are still preferred. However, earthen jars are being rapidly replaced by plastic jars. Inside water is used for food preparation, cooking and drinking purposes and for other uses in the kitchen such as washing a few dishes. Most available water is kept inside the house.

Outside water is kept in plastic containers on the patio. It is used to give water to animals and for cleaning purposes (washing dishes, pots and pans included). In NoPW communities laundry is not performed in the house, but in the spring or river where they fetch the water.

In communities with improved water supply (WPW), women classify the water into inside; pila or washing basin; and tap water. Some women still keep some water in the kitchen or where cooking is performed to use in food preparation

and cooking. However, most water is kept outside, in the cement washing basin if they have one. Water in the basin is used for washing dishes and clothes. A few women still do their laundry at a communal basin/tap or river. Tap water is preferred for drinking as it is considered cleaner and is carried from the tap to the kitchen. Assessing whether water is clean or not has to do with the appearance of water. It is clean if it looks clean, is transparent in color and free of particles or small animals.

These differences in storage and uses of water between the two types of communities were captured in the observations of water and hygiene conditions. In communities with improved water supply, water is kept mostly outside the house (see **Figures 1 and 2**, for 1993 and 1994 data, respectively), while in communities without improved water supply, water is kept mostly inside (**Figures** 3 and 4, for 1993 and 1994, respectively). Also, dishes were found on the floor in communities without improved water supply, while there were no dishes on the floor, but in the washing basin in homes with improved water supply and basin (**Figure** 5 and 6, for 1993 and 1994, respectively).

Women participating in focus groups were asked to free-list all the activities that they carry out daily. **Table 9** presents all the activities listed. Activities mentioned in all communities were food preparation activities especially of maize which is the staple food, domestic activities such as washing clothes and cleaning, tending domestic animals, and agricultural activities. Weaving was mostly mentioned in the WPW communities and water fetching in the NoPW communities.

After activities were listed, women were asked to indicate which activities required more effort on their part. Those activities were: fetching wood for the fire, fetching water (in communities without improved water supply), preparation of food for animals (which often requires grinding on the stone and then carrying food where animals are), house cleaning (sweeping), and washing clothes. Except for sweeping, all these activities are carried out outside the house. For the most part, these activities were mentioned as also requiring more time to perform. Finally, these activities were also mentioned as hard for pregnant women in the last month of pregnancy and proscribed during the postpartum period for at least two weeks.

Activities that, according to women, do not require as much effort are: making the cooking fire (although some women mentioned "suffering from the heat of the fire"), washing "nixtamal"[1], preparing food or beverages, washing dishes, tending a small business (such as a store), and going to the grinding mill.

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[1] *Nixtamal is maize that is cooked with water and lime (cal). It has to be washed after being cooked and before being taken to the grinding mill.*

These activities are mostly carried out inside the house (except for going to the grinding mill). **Table 10** presents the perceived effort involved in activities reported by women.

Women were asked which of the activities conducted required water, and which required larger amounts of water. Activities mentioned to require water were: preparation of food and beverages, the cooking of nixtamal, washing the nixtamal, the making of "tamalitos"[2] which requires washing corn leaves or corn husks (or "dobladores" in Spanish) which was always listed as a separate activity, preparing food for animals including watering animals, house cleaning (sweeping and mopping), washing dishes and washing clothes. In general, women agreed that the activities that require more water are washing clothes and cooking and washing the nixtamal, in that order. The data are presented in **Table 11.**

3. OBJECTIVE 3:

To quantify the total energy expenditure, level of activity, and activity pattern associated with water and non-water related activities.

Methodology

The study considered the use of two types of methodologies for the estimation of energy expenditure; heart rate monitoring and doubly labelled water.

a. Heart rate monitoring

This method is based on the minute by minute recording of the heart rate as an expression of the circulatory and muscular effort. To store and analyze the information, the subjects used a comfortable device consisting a radio frequency chest belt and a wrist watch-type receiver (UNIQ-CIC model 8799 and Vantage model). The monitors were worn continuously during 8 hours by all subjects, except for the subsample of 24 women having measurements of energy expenditure which were monitored during

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[2] *In this region of Guatemala, maize is prepared more commonly in the form of tamales than in the form of tortillas. Ground maize is placed in corn leaves or corn husks (depending on the season), tied and cooked for about 30-45 min. Women mentioned that tamales require less attention from them than making tortillas as they can be left in the pot to cook. Tamales can be reheated, and usually are reheated for breakfast. They constitute the core of a meal.*

17-24 hours. Each subject wore the heart rate monitors in two non-consecutive days which were averaged for each of the study periods. The stored information was downloaded from the receiver via a computer interface. The data was scanned, stored and analyzed using ad-hoc computer designed programs; manufacturer software for downloading and scanning and SAS language program for editing and energy expenditure calculations.

The physical effort of each individual at any period in the day can be described, either by looking at the specific values or by categorizing them in relation to the estimated maximum heart rate according to age (Astrand and Rodahl, 1977). The physical activity intensity level was classified according to the following categories:

Basal:	Heart rate during sleeping time
Sedentary:	< 30% maximum heart rate
Moderate/Active:	30-50% maximum heart rate
Intense/Very active:	> 50% maximum heart rate

b. **Heart rate monitoring estimates of energy expenditure**

In order to estimate the energy expenditure, a calibration test that relates the heart rate to oxygen consumption was performed in the subsample of 24 women. The procedure consisted of the simultaneous assessment of heart rate and the oxygen consumption during three sedentary activities; lying down, sitting and standing and, five exercises of increasing intensity. The average oxygen consumption for the three sedentary activities was used for all the activities below the average point between the standing heart rate and the first exercise. A regression equation was calculated for the non-sedentary activities and was applied to all heart rates above this cut-off point.

The methodology used is graphically described in Figure 7.

c. **Doubly labelled water**

All mothers in the sub-sample were dosed with water labelled with two stable isotopes; deuterium and oxygen-18. The two isotopes once equilibrated in the body are excreted in combination with all water and carbon dioxide losses. This method was developed in the 1950s (Lifson et al 1955) and refined in the 1960s (Lifson and McClintock 1966). The doubly-labelled water (DLW) method is considered the most precise

method to estimate the usual energy expenditure. It consists of the administration of an oral dose of water labelled with the stable isotopes deuterium and oxygen-18. Subjects received an oral dose of 0.05 g ^2H_2O/kg and 0.15 g $H_2{}^{18}O$/kg after an overnight fast and collection of a pre-dose, baseline urine sample. Post-dose fasting urine samples were collected 4 hours later (equilibration period). Daily, for the following 12 days, mid-morning urine samples were collected. These samples did not require a previous fasting period. Urine samples were collected in small tightly capped vials of 10 ml and stored momentarily in a domestic freezer. Later, urine samples were stored at -20°C until the end of the study when they were sent to The Dunn Nutrition Unit of the University of Cambridge, England, to perform the DLW analysis. Isotope enrichment levels are measured using a VG Isogas Aquasira dual isotope-ratio mass spectrometer (VG Isogas Ltd. Middlewich, Cheshire, U.K.). The measurement of energy expenditure requires the calculation of the rate of disappearance of each isotope. Since oxygen-18 shows the rate of H_2O plus CO_2 production and deuterium only H_2O production, CO_2 can be calculated by difference between the two rates. Unfortunately the deuterium data failed to reach an appropriate concentration, therefore only the oxygen-18 information will be used but to assess body composition; total body water, lean body mass and fat mass in the sample of women.

Results

1. Heart rate monitoring

The amount of time devoted to activity levels in the subsample group (monitored during 17-24 hours in two occasions), divided by type of community and study periods, is shown in Table 12. Basal heart rate activity, equivalent to sleeping time, was on average virtually the same for both groups across seasons differing by no more than 2-3 min. Time spent on sedentary activities by the NoPW communities, was significantly lower by 253 min in the wet (4.2 hours) and 228 min (3.8 hours) in the dry season, compared to the WPW communities. Similarly, the amount of time spent in active chores was 240 and 209 min higher (4.0 and 3.5 hours) in the NoPW versus WPW communities.

Both groups were more active in the dry season by about 1.4 and 1.9 hours, for the NoPW and WPW communities, respectively. As percentage of the observed time, the same figures for NoPW and WPW communities, corresponded to 42.6 vs 25.7% of the time spent being active during the wet season and 48.3 vs 32.9% of the time during the dry season.

2. Energy expenditure by heart rate monitoring

The calculated energy expenditure is shown in Table 13. More energy was expended in the without water communities in both seasons, although the difference was lower during the dry season. The median difference was 636 kcal in the wet season and 484 kcal in the dry season, respectively. The mean difference was slightly lower with 517 and 357 kcal, both reaching statistical significance.

The energy expenditure, expressed as multiples of the Basal Metabolic Rate (METs), is shown in Table 14. Indices around 1.5 are considered as sedentary, values greater than 2.5 correspond to very active people. The group of mothers studied can be considered as being very active because their MET was 2.5 or more for those without water and around 2.0 for the group having water. Another way to look at these figures is by comparing the percentage of the daytime spent being sedentary or active. During the wet season, mothers from without water communities spent almost two thirds (67.1%) of the day in active duties, whereas the other group spent almost a quarter of the daytime (26.7%) in active duties. As mentioned below, physical demands increased during the dry season in both groups, raising the active time to 79.2 and 53.5% of the daytime for communities without and with water, respectively. Energy expenditure will not be available (see below).

3. Total body water and body composition

The first lot of samples had been analyzed at the Dunn Nutrition Unit in Cambridge and the results showed a very low amount of deuterium which did not allow to calculate the rate of disappearance of this isotope because the doses was too diluted. As mentioned in the method section, the information from both isotopes in the doubly labelled water is required to calculate energy expenditure. In spite of this, the information on body composition given by oxygen-18 is highly valuable since it allowed to estimate the body stores of energy and protein in the body. Thus, the information on total body water (TBW), body fat (as fat mass and percent of body weight) and fat-free mass, is shown in Table 15. Individual values obtained are given in the Appendix 8.

Implications

The high rate of energy expenditure found in both types of communities implies that the mothers are involved in physically demanding activities. They should get this energy supply from the diet in order to maintain their energy balance and nutritional status. The energy expenditure was significantly higher on average/median for the NoPW communities by 517/636 kcal in the wet season and by 357/484 kcal/day in the dry season. Because the median is higher than the mean, this imply that half the women in the NoPW group spend more than 636 kcal daily than the WPW group. The NoPW group was more active spending 4 to 3.5 hours more (wet and dry season, respectively) than the WPW group. This level of energy savings (around 20% of the energy spent) are very important from a biological point of view, considering that water introduction could have a stronger impact on mother's energy balance compared to a food program or supplement intervention.

4. OBJECTIVE 4

To document time savings related to improved water supplies by measuring the time spent on water and non-water related activities performed by women during the day and how the time saved is allocated to specific activities.

Methodology

The method used for the time allocation objective was structured time-interval observations. To conduct observations trained observers arrived at each household early in the morning and observed the mother's activities for 8 consecutive hours. Two of these visits were made in each season. The 8-hour observation period was subdivided into 49 ten-minute intervals. Observers wore a watch that beeped every 10 minutes. When the watch beeped, the observer recorded the activity (up to three) being performed by the woman along with other information such as location, body position, and who was taking care of the index child. The activities recorded Major activity codes were represented by the following categories:

1) food preparation,
2) food consumption,
3) household work (including fetching water),

4) child care,
5) health-seeking,
6) productive (income-generating) activities,
7) leisure and socialization activities,
8) other
9) not observed.

Under each major category specific activities were coded, which allowed for the aggregation or disaggregation of data as needed. A copy of the observation instrument and the activity codes used are found in the Appendix 1.

Measurements of the amounts of water used in activities requiring water such as food preparation, watering plants or animals, hygiene practices, etc. were made in both type of communities, those without and those with improved water supply. This activity was performed by an English tutorial student (Mr. Adam Hirst), he walked around the community and measured the amount of water used by the mother at the precise moment of his visit. Thus, not all women sampled were assessed and not all activities were equally sampled, because measurements were opportunistic. Women were visited in a separate occasion (not during the structured 8-hour observation period), the amount of water used was measured directly with measuring jars or receptacles with a known volume (number of observations are given in **Table 19**).

Results

Women's activities

Activities more frequently observed are shown in **Table 16** for WPW and NoPW. Two visits in the wet season (1993) and two in the dry season (1994), respectively, were carried out. Carrying a baby was observed to be simultaneously performed with several other activities. The only difference between WPW and NoPW communities is in the higher prevalence of the activity "mother preparing thread or weaving" for income in WPW communities, especially during the dry season.

Estimations of the amount of time spent in each activity, whether the activity was coded as first, second or third activity, were obtained by multiplying each frequency of the activity by 10 minutes (because they were recorded at 10 minute intervals and it was assumed that the women performed the activity during the whole time interval). For each woman, time spent in each activity was added up for the two observations in each season. Total time spent in each activity was divided by the number of women (or the number of women performing the activity) and then by two (for the two visits) to obtain the mean

time spent in each activity during two 8-hour observations. Data on individual activities was aggregated to calculate the mean time spent for categories of activities.

Figures 8 and 9 present the mean time devoted by women to the different categories of activities in wet and dry seasons, respectively. In the wet season, women in NoPW communities devoted a mean of 156 min (in 8 hours observed each time) to domestic activities (including water fetching) compared to 111 min spent by women in communities WPW; thus, there was a 45 min difference which is statistically significant. Again, in the dry season, women in NoPW communities devoted a mean of 149 min to household work while the women in communities WPW devoted a mean of 89 min to those activities, that is, fully a one hour difference. Moreover, women in WPW communities devoted more mean time to productive activities than women in NoPW communities (71 vs 45 min in the wet season and 96 vs 30 min in the dry season, the latter difference being statistically significant).

The type of productive activities performed and their frequencies are shown in **Table 17** for NoPW and WPW communities for 1993 and 1994. All activities were observed in both types of communities but the frequencies are twice as high for the WPW ones. The difference is more evident in 1994 (dry season) when water becomes more scarce and more time is devoted to fetching it than in 1993 (wet season). For the activity "preparing threads/weaving", WPW communities invested about 50 min more in the wet season and over two hours more in the dry season compared to the NoPW communities.

Time spent fetching water

Although more time was spent in domestic activities in NoPW communities than in WPW communities, the data from observations did not show as many water fetching instances as expected. In the dry season, for instance, water fetching outside the house was observed once in WPW communities during two 8-hour observations in each house and 47 times in communities in NoPW communities (approximately in half of the households during each observation period). Possible explanations for the lower than expected number of water fetching episodes are that 1) women fetched water early morning and late evening hours when they were not being observed or 2) that it is possible that women avoided fetching water during the time observers were in the house so that observers would not get tired from accompanying them.

In addition to time-interval observations, every instance of water fetching (whether it came during the timed observation or not) was recorded in the forms (this is, continuous observation). The number of times water was carried

was higher using this information, but still not as high as expected (Table 18).

In individual interviews women were asked how many times a day they fetched water and how long each round trip took. The data is also presented in Table 18. Women reported to spend a mean of 85 minutes (one hour and 25 minutes) in 1993 and 112 minutes (one hour and 52 minutes) in 1994 collecting water, but the variability is considerable (coefficient of variation 85%).

In conclusion, it is clear that women in NoPW communities spent at least one and a half hour a day collecting water in the wet season and almost two hours in the dry season. Also the time used in income-generating activities was clearly less for women in NoPW communities.

Amount of water used

In all, 101 observations (32 in NoPW and 79 in WPW communities) were made in which amounts of water used were measured. No observations could be made in one of the NoPW communities. The mean and median amount of water used for different activities are shown in Table 19. It can be observed that, in general, for the same activities, women in NoPW communities use less water than women in communities WPW. Moreover, activities such as mopping or watering the floor, watering plants or washing hair were not observed in communities WPW.

The activity found to consume the largest amount of water was washing clothes, which is in agreement with women's reports. The amount of water used for laundry in NoPW communities could not be assessed because women wash their clothes in a river or in a communal basin. In structured observations washing clothes was observed a mean of 32 times in WPW and 27 times in NoPW communities in the wet season and a mean of 19 times in WPW and 14 times in NoPW communities in the dry season which indicates water shortage in both types of communities during the latter season. Most of these times, however, women in communities with NoPW washed clothes in a river and women in communities WPW washed clothes at home in the washing basin or stone.

To calculate the mean amount of water used, for each women, water activities observed during and 8-hour observation period were multiplied by the median amount of water used for each activity (according to measurements made in each type of community) and then added up for the two observations in each season, divided by the number of women and divided by two. Figure 10 shows the mean consumption of water per woman/ family during an 8-hour observation period for WPW and NoPW communities, in wet and dry seasons. The difference in the amount of water used between NoPW and WPW

communities is striking (111 liters and 82 liters in wet and dry seasons, respectively). **Figure 11** shows the same data, but excluding clothes washing; although not as extreme (22 liters and 21 liters in wet and dry seasons, respectively), the difference is still important and statistically significant. An average load of water is a "tinaja" of approximately 15 liters, therefore such a difference means another 1.3 trip/day. It can be observed that the reduction in water consumption between seasons in WPW communities is mostly accounted for by the reduction in frequency/ water spent in laundry.

Location and body position during observations

As mentioned, the codes used to register women's activities included the location of the woman at the moment and her body position. It was expected that this information could complement that on energy expenditure and eventually be used as a simplified measure. **Table 20** shows the mean frequency of women's activities at each location during 8-hour observations. Most activities took place inside the house. The only difference observed between WPW and NoPW communities is in the larger mean number of activities outside the house in the latter. **Table 21** shows the mean frequency of women's activities in each body position. Most activities were performed sitting down or kneeling, followed by standing. The only difference between WPW and NoPW communities is a higher frequency of walking activities in the latter, suggesting a higher level of activity in NoPW communities.

OBJECTIVE 5:

To assess the health and nutrition differences between mothers and children with and without piped water supplies.

Methods

Morbidity: During the meeting held with all mothers at the beginning of each study period, mothers were asked to recall any signs or symptoms of disease observed in the index child during the seven days prior to the interview. The form used had the option to record up to four different diseases, signs or symptoms observed by the mothers. On each case; duration, treatment and present condition was recorded.

Health/Morbidity was coded as follows:

0= Healthy
1= Fever
2= Diarrhea (simple)
3= Diarrhea with mucus and blood
4= Vomiting
5= Respiratory infection
6= Measles
7= Mumps
8= Rubella
9= Whooping cough
10= Hepatitis
11= Others

For each of the above morbidity episodes, the treatment was recorded as follows:

0= None
1= At home
2= Pharmacy
3= Health post
4= Private doctor
5= Traditional heeler
6= Midwife / health promotor
7= Hospital

Health conditions of the child at the interview was coded as:

0= Healthy
1= Still sick
2= Recovered
3= Not applicable

Medical assistance was provided three times a week to all members of the community by the project's medical doctor acting as field director (Vinicio Ramirez)

In order to complement the health and nutritional assessment, an individual interview was conducted with each woman regarding their beliefs and practices (reported) about diarrhea causation, prevention, use of oral rehydration salts (ORS) and use of health resources, both traditional and modern. Also, during the 8-hour observation period, instances (up to six) of handwashing by the mother, especially the way in which handwashing was performed, were

recorded when they occurred and not at the time-interval observation when the observer's watch beeped.

Anthropometry: In the same form, body weight (kg), height/length (cm) and age was recorded for the index child and the mother. Precision of the measurements and standardization were performed as described before under "field workers training".

Maternal body weight was measured using a bathroom-type scale (SECA, sensitivity of 100 g) previously calibrated with a test weight. Children were weighed on an infant scale (SALTER, 25 kg capacity and 100 g sensitivity). Clothing was discounted from the actual weight by weighing the clothing later on the same day or the following days after the measurements.

Height was measured using a wooden stadiometer specially designed at INCAP. Its sensitivity is 1 mm and its has a sliding platform to measure height according to the standard technique (WHO manuals). In the small children; less than 2 years old, length was measured instead of standing height. The same anthropometer was used but the instrument was located on a table or a platform. Again standard techniques were carefully observed.

Prior to the beginning of the second round of data collection, a second training-refreshment period was performed with all team members.

Nutritional status of the children was classified according to NCHS (WHO, 1989) standard for the following indices; weight for age (W/A), weight for height (W/H) and height for age (H/A). Z scores were calculated and classified in the following categories:

Undernourished:	<-2 SD
Normal:	-2 +2 SD
Excess:	> +2 SD

Mother's nutritional status was assessed according to the body mass index (BMI) calculated as:

$$BMI = \text{Weight (kg)} / [\text{Height (m)}]^2$$

BMI was classified according to the following categories:

Excess:	>25 ($kg/m^{2)}$
Normal:	20-25
Underweight	20-18.5
Undernourished:	<18.5

Results

Morbidity

The morbidity found in the index children (by a 7 day recall) is shown in **Table 22.** The most prevalent disease was the upper respiratory infection in both study periods affecting approximately 16 and 25% of the children in the wet and dry season, respectively. No striking differences were observed in the morbidity pattern of children from NoPW or WPW communities in any of the study periods. Most of the children were healthy; 62.5 and 54.7% in both seasons conversely, 37.5% of them were ill in the wet season and 45.2% during the dry season. Diarrhea alone or associated with upper respiratory infections, was not highly prevalent.

Health beliefs and practices

Differences were expected in health beliefs and practices of women in WPW and NoPW communities given educational efforts conducted by water and sanitation projects that mainly included talks to mothers. However, the comparison between WPW and NoPW communities in this respect did not show major differences.

Table 23 shows hygiene-related causes of child diarrhea mentioned by mothers in both types of communities. The one most frequently mentioned was "the child eats dirty food". No consistent differences were found between WPW and NoPW communities. Most mothers stated that diarrhea in children is preventable (above 95% in all communities). **Table 24** shows specific preventive measures mentioned by mothers. The child's handwashing was the one most frequently mentioned. Significantly more women in NoPW communities mentioned boiling water, washing dishes well, covering drinking water.

Most mothers knew about ORS (above 90% in all communities) and about two thirds of them could give a partially correct explanation of their rehydrating effect. Also, most mothers stated that they continue breastfeeding and feeding

a child ill with diarrhea. Two thirds of the women reported having used ORS at any time for a child diarrhea episode, but only about one fourth reported having used them during the last child diarrhea episode in the family. Again, no differences were found between WPW and NoPW communities. There was a slight increase in the reported use of ORS between seasons.

The most important difference in the utilization of health resources (see **Table 25**) is the significantly larger percentage of mothers in WPW communities who said that they did not use any resource (none) when children were ill, (wet and dry seasons) and during the last child illness episode (dry season). There is no explanation for that difference. The pharmacy and the health post appear to be the resources used more often. The use of private physicians was reported to be low and seems to be on the decrease from wet to dry season. Use of folk curers is also low. Although midwives provide prenatal and postnatal care and attend most births in these communities, their utilization for child illnesses was reported to be low. Finally, non governmental institutions (NGOs) practically do not provide health services in these communities.

Handwashing

Mothers were asked at what times was handwashing more important. As can be observed in Table 26 most mothers mentioned before eating. Significantly more mother in WPW than in NoPW communities mentioned washing hands after defecation/ using the latrine (in 1993 and 1994) and after diapering a baby (in 1993).

The usual form of handwashing in rural communities is to put water in a small plastic recipient, dip hands in it, rub hands together, rinse hands in the same water and dry hands with any piece of cloth available. It was expected that as part of water and sanitation projects, women would wash their hands in an improved way using running tap water, soap and a clean cloth for drying.

According to observations, every time a woman washed her hands (up to six times), the mode of washing was noted and the mother given one point on three key steps: using running water, using soap, and drying hands with a clean cloth. Adding those points provided a handwashing score, where 0 meant that she had not followed any of the steps and 3 meant that she had followed all correct steps. **Figures 12 and 13** show the mean scores for two visits in 1993 and 1994, respectively. All scores are very low indicating that on the average women did not wash their hands in the improved way. However, in the WPW communities scores were significantly higher than in the NoPW communities.

Maternal Nutritional Status

Nutritional status is presented in Table 27 for the whole sample in both seasons and for the subsample studied for energy expenditure. The majority of the mothers had a body weight in the normal body mass range (both groups were on average within 21-22 kg/m^2), implying that presently their body weight is appropriate to their height. Although they are short in stature; mean height: 144 cm, their body mass is proportionate to the small body size: mean weight 44 kg. Few mothers were classified as undernourished, but they represented a relatively low proportion of the total (4-5%). Mothers in the without water group had moderately more weight deficit but only during the wet season (2.1 vs 8.3%). Mothers in the communities having piped water were three times more overweight than the other group (6.3 vs 18.8%) in the wet season. Similarly, although in the dry season the difference was less, it was approximately twice as high in the other group (10.4 vs 19.1%). This situation was not very different for the subsample studied for energy expenditure.

Nutritional status of the children

As described earlier, children's nutritional status was classified according to three different indices; weight- for-age, height-for-age and weight-for-height. The results obtained by these indices are shown in **Table 28.** Nutritional status did not show any significant seasonal difference, except for a raise of about 10% in the prevalence of undernourished children from the WPW communities in the wet season. Children from NoPW communities showed more prevalence of chronic deficit in weight and height retardation (although not statistically significant), specifically during the wet season. The highest height for age deficit found for without water communities (95.7 vs 83.0%), was the only statistically significant difference in nutritional status between the children of the two groups. It is important to mention that the seasonal changes comparisons within community groups are somewhat biased considering one NoPW community was replaced in the dry season and that 7 children, mainly from the WPW communities (5 cases) were replaced. (see Appendix 3 for detailed information)

Implications

The morbidity pattern of children showed that most of the illnesses were respiratory infections and not diarrhea or intestinal diseases. Neither the introduction of water nor the season, had an impact on children's morbidity or nutritional status. Nutritional status both of the children and their mothers showed that undernutrition is mainly due to a chronic undernutrition process

(since their body weights are proportionate to a reduced body size). Thus, the study group is mainly a stunted population with an undernutrition which began most likely from the infant years of rapid growth rate.

The information presented has programmatic implications for the selection of beneficiaries for children's supplementary food programs which should be done by using not only present (W/H) but present and past nutritional indices in combination if the most high risk children are to be identified and further growth deterioration is to be prevented.

OBJECTIVE 6

To estimate dietary intake among preschool children and adult women from the communities with and without piped water.

Methods

The technique being used was a 24-hour dietary recall, which included an extensive interview with the person who prepared the family's food (usually the mother) as well as direct weighing of ingredients/foods encountered in each household. The dietary interview and food-weighing were performed on two different days for each family, obtaining intake information on three different levels; the family, the mother, and the index child.

This information (combining intake data with food weights) allowed us to determine the nutritive value of the foods consumed and their contribution to the families', mothers' and children's diets. Also, combining this information with that of the study group census (age, sex, physiological state), adequacy of the dietary intake was calculated in respect to energy, protein, vitamin A, iron and calcium and other nutrients. In order to arrive at a level of adequacy, a comparison was made between the reported intake of the family, mother, and index child and the recommended daily allowances for each particular age group and the specific nutrients aforementioned. Families, mothers and children found to have an intake less than 75% of their daily requirements were classified as having deficient intake.

Energy requirements and nutrient's recommendations used have been adjusted to the Central America region by INCAP. The values used to calculate adequacy of the intake are shown in the Appendix 4.

Results

Dietary intake of the mother and child will be presented in three different ways;

1. Amount of food consumed by the mother and the child.
2. Main energy and nutrients sources in the diet.
3. Adequacy of the energy and nutrient intakes.

1. Amount of food consumed

The diet was quite similar in the two types of communities. As can be seen in **Table 29**, the greatest amount of food consumed is maize reaching about 800 g per day. Beans were not an important component of the diet in rural families. The same was observed in children's diet eating about 165 g of maize/day.

2. Main energy and nutrients suppliers in the diet.

The analysis of nutrient intake of children has been divided in two groups since the younger the child the greater the chance he/she is still being partially breastfed. The information collected in this study does not allow to estimate the amount of milk intake. Therefore, children known to have been breastfed were excluded from the data shown in **Table 30**. Nine children from WPW and seven children from NoPW were excluded for this reason. Mean energy and nutrient intake was very similar in children, independently of the type of community and season. In spite of this, nutrient intake tended to be slightly higher in the communities with water.

Most of the energy, protein, iron and vitamin-A in mothers' diet was mainly supplied by maize and other vegetable sources; maize provided within 60-80% of the energy, protein, calcium, and iron intake, and 40% of vitamin A. There were no significant differences between the two types of communities (see **Figure 14**). In children's and mother's diet, energy was mainly derived from CHO (75-80%), followed by Fat (12-16%) and finally Protein (10-11%). Details can be found in Appendix 5. Foods that represented the most important proportion of energy and protein intake are shown in Figures 14 to 17. Energy intake was on average around 500-700 kcal in the small children and within 800-900 kcal in the older group. Protein intake was within 18-20 g per day in both groups. Maternal intake of energy and nutrients is shown in **Table 31**.

Their energy intake was approximately 2500 kcal in all both groups and seasons, except for the NoPW communities in the dry season which reached 2799 kcal. Apart from this, both groups tended to be remarkably similar in their nutritional intake, both within and across seasons.

3. Adequacy of the energy and nutrients intake

Nutritional intake of children as percent of their requirements/allowances is shown in Table 32. More children have deficit in vitamin A and energy than the other nutrients, followed by calcium and iron. Protein was less deficient but still affecting an important proportion of the children. Insufficient dietary intake was found most prevalent in the youngest group of children.

In general, NoPW communities had a higher proportion of children with a deficient diet during the wet season but the opposite was found during the dry season (specially in the younger children). The proportion of 13-23 months children within the adequate nutrient intake category got reduced in almost all nutrients during the wet season in both community groups. Adequacy of nutrient intake in the older group was fairly similar for the between-community groups comparison, although NoPW communities were more deficient in energy and calcium in the wet season, and protein and iron in the dry season.

The majority of mothers were in the range of adequate nutrient intakes, with the exception of Vit. A, which was low (**Table 32**). Within 70-96% of the mothers did not get enough vitamin A, tending to worsen in the wet season. Deficiency of the different nutrients was more prevalent in the dry season. Comparing the two groups of communities, NoPW group had a greater proportion of mothers with a deficient intake of energy (12.5 vs 4.2%), protein (22.9 vs 10.7%) and calcium (25.0 vs 14.9%). The overall prevalence of deficient intake observed for all nutrients; except Vit. A, was low. .

More details on dietary intake can be found in the appendix 5.

Implications

As mentioned earlier the staple food in these communities is maize which was consumed in high quantities by mothers (approximately 800 g/day) in order to fulfill their daily energy and nutrients needs. The majority of the mothers were able to have an adequate diet. Children were not so fortunate because they were unable to eat enough maize "tamalitos"2 to fulfill their daily requirements. This type of food is a hard paste, made of cooked maize with no added sugar or other ingredient. Children are not able to eat more tamalitos because of its

consistency and maybe its taste. This food can be appropriate for adults consumption because they eat it combined with other foods, but not for children who can hardly eat more than one or two tamalitos per meal, especially the younger ones. It is necessary, therefore, to improve children's dietary quantity and quality by introducing more foods, specifically from animal origin and/or to promote the modification of children's diet by changing maize from its paste consistency into a liquid preparation such as "atole", which is expected to be more accepted and consumed in higher amounts by the child (specially because it contains sugar, which is another source of energy). As mentioned before, all index children were weaned children. Although few children in the sample continue to be breastfed after one year of age, we do not know how much it could contribute to some nutrients intake after that age. Considering that the family and mothers' diet were adequate in the majority of cases, it may be there is some room for improvement of intra-family distribution specially of animal origin foods.

The most important dietary deficiency was Vit A. which can imply that this population is truly lacking this vitamin or, that better information is needed to improve our food composition data base, mainly in regards to their carotenoids contents and its biological availability.

Although the studied children were mostly one year old and over, it is fair to assume that the dietary situation of smaller children can be worse, especially during the rapid growth period if the diet can not be varied and mothers are unable to adjust its consistency and taste for the small child. The above reasoning leads us to the need for a practical education program at the community level.

Apart from few exceptions, closer access to water did not make a significant difference in food intake. Furthermore, nutrient intake was very similar in both community groups within the same season. Regards to seasonality, it seemed to be a higher nutritional deficit in the dry season, both in children and mothers diets.

VI. INTEGRATION OF FINDINGS

1. Integration of heart rate information and type of activities performed by the mothers.

From the heart rate information, a significantly higher energy expenditure in the NoPW group was found compared to the WPW communities in both study periods. The main source explaining this difference was the amount and type of physical activity. In order to describe which were these activities, frequency of known high effort activities were calculated from the timely observation record (PA3-form). **Table 34** shows that activities such as carrying water (by study design), grinding, carrying wood or a heavy object, walking to/from the field, cutting wood and others, were most frequently performed with an overall ratio of 2.1 and 3.2 times higher in the NoPW mothers in the dry and wet seasons, respectively.

In women's reports they indicated that activities which were conducted outside of the home generally required more effort than those conducted inside the home. Mothers from NoPW communities performed more activities outside the house, thus, mother's estimation agreed with the energy expenditure and activity observation data.

2. Relationship between dietary energy and expenditure

The information obtained on energy expenditure and intake, can be related to see if the mothers were in energy balance. Although this is generally made at the individual level, our information allowed on average comparisons only. The relationship between energy intake and expenditure is shown in **Figure 18 and 19.** It can be seen that there was a close relationship between the two variables in both periods. Overall therefore, the women studied were in energy balance; those mothers expending a higher amount of energy, ate correspondingly more dietary energy as a compensatory effect. This means a greater food and economic demands in the NoPW families and will make them more prone to dietary imbalances. If such imbalance is maintained for some time, the effects will be seen in mothers and infants nutritional status. From the data obtained, mothers in both community groups were able to fulfill their energy needs (although there is a deficit of Vit A and Fe intake) and no difference was found in their nutritional status (see **Table 31 and 33).**

3. Water availability and hygiene practices and its relationship with nutritional status and morbidity.

No clear relationship was found in terms of hygiene practices and children's nutritional status and/or morbidity. Children did not have a different pattern of illness or differences according to their nutritional status. The hygiene scores given to handwashing differed between the two groups (better in the WPW group), but the score was very low in both of them. There were no differences in other hygiene practices, however.

The only documented difference between the two groups of communities was on water storage and dish washing. While families in NoPW group depend on reduced amounts of water stored inside the house, families WPW keep water in cement basins outside the house and use tap water for drinking and cooking. Also dishes are washed infrequently in NoPW households, thus they were more frequently observed lying/placed dirty on the floor. In the WPW households, dishes are kept in the cement basin and usually washed soon after use. Observations of latrine maintenance in WPW communities (most NoPW houses did not have a latrine) indicate low standards of hygiene.

VII. DISCUSSION

Families in NoPW communities appear to be of lower socioeconomic conditions than families in WPW communities as indicated by house conditions and material possessions. Also, activities of NoPW heads of household are more "traditional" (in subsistence agriculture) than those of WPW heads of households. Communities with NoPW are somewhat more disperse, more distant from municipal center and services. Although it seems that the differences in economic conditions preceded piped water introduction, it is most likely that with improved water supply those changes in economic conditions were increased and the gap between communities became wider. For example, Patulup (Community No.6, WPW group) and Choquí (Community No.5, NoPW group), both are located in the Municipio San Bartolo Aguas Calientes, Totonicapán. Patulup is closer to the municipal center, most heads of families are merchants (they go to sale their products to other departments), several have now migrated to the U.S. and send money to their families. Together, the increased availability of cash income and the availability of piped water, have induced a great improvement in the construction materials and the design of the houses. In Choquí, most male heads are agricultural laborers, none of them has migrated outside the community. In terms of organization, the Water Committee there is the first formal community group organized. It is worth noting that both communities share the same road access and they are no more than two kilometers distant from each other.

The results of this study allow to propose a positive social and biological impact of water improvement in rural communities since there were differences in the amount of time and effort that mothers do not need to expend once water is available in the household premises. The amount of time saved ranged between 1.5 and 2 hours on average which contribute to the difference of 400-500 kcal less in energy expenditure on WPW mothers. Also it favored socialization which allow mothers to share their problems, solutions, life expectancies, community organization, etc.

From a biological point of view, the difference in energy expenditure in NoPW vs WPW was higher than the estimated detectable amount (240 kcal) and similar to other comparable studies where the extra amount required is about 600 kcal (UNICEF report Nepal study, 1994). Besides from getting the energy expenditure information, this study demonstrated that it is possible to use a simple measurement such as the heart rate monitoring to assess the physical activity pattern and to estimate the energy expenditure in a rural female population without interfering in their normal daily life. The only problem should be that it needs a calibration against oxygen consumption, although this can also be done by simplified methods. Reliability of the heart rate measurements was assessed by the comparison between the two measurements performed for each subject in both seasons. A high level of agreement on the average values was found within communities for each season (see Appendix 9). This method has been tested in relation to other more accurate measurements such

as the doubly labelled water and on average, it has been found to correspond very closely (Díaz et al. 1991, Livingstone et al 1992).

Using the estimates provided by the FAO/WHO report on energy requirements (FAO/WHO, 1985), it can be estimated that with the activity level observed, this population needs aproximately 2,000 kcal per day which is 200-800 kcal lower than the average estimated from heart rate measurements for any of the types of communities. This is very important because FAO/WHO estimates did not discriminate between the two types of communities, although their physical activity pattern was taken into account (see Appendix 9).

Regards to the replacement occurred for one of the NoPW communities which had the water installed earlier, special care was given for the selection of a comparable community. Given that it is extremely difficult to find two similar communities, comparability was assessed in terms of degree of organization, access to the main road and size of the community (number of households). Both communities were comparable in all respects, except on the distance to the municipal center and its topography (see Table 1). It should be bearded in mind that the study design allowed to search for group comparisons but not for differences in individual communities. Thus the only one comparison which will be somewhat biased, is the between seasons comparisons because it will not be a true longitudinal change. Nevertheless, nutritional status, dietary intake, energy expenditure, health and other variables measured were similar for the replacement (Pachichup) vs replaced (Pamalín) community.

VIII. SUMMARY OF MAIN FINDINGS

1. **There is no clear relationship between water introduction and health.**

   a. Water is generally not perceived as a health intervention by community members, especially women.
   b. No health impact (in traditional terms) between groups.
   c. Use of water and hygiene practices were better in WPW groups, although handwashing was inappropriate in both groups.
   d. Increasing quantity of water availability did not make hygiene more effective in terms of morbidity or nutritional status.

2. **Water is perceived as an intervention to provide convenience, time savings and reduction in mother's effort.**

   a. Time was saved in collecting water, at least one hour.
   b. Once water is available in the household premises, activities are re-organized; more time in productive (income generating) activities, more time in socialization and more time in food preparation.
   c. Less time in strenuous activities such as carrying water or carrying the child on the back.

3. **Water had little effect on nutritional status of mothers and children.**

   a. Nutritional status of children is chronically deficient in both groups.
   b. Nutritional status of mothers is relatively adequate in both groups. Specially interesting was the finding of more overweight mothers in WPW group (also less active, see below).

4. **Water reduced energy expenditure/requirements.**

   a. Less time in physically active duties (3.5-4.0 hours) which produce lower energy requirements.
   b. Energy savings (400-500 kcal) which can be used either to perform some energy-demanding productive activities, or to make food intake commensurate with reduced energy expenditure.

5. **Water reduced mother dietary needs.**

   a. Reduction in energy expenditure can contribute to a reduction in the family's food requirements.

b. In spite of the agreement between energy intake and expenditure in mother's diet, nutrients deficiencies of Protein, Ca, Vit A and Fe were prevalent.
c. Diet was highly deficient in children (mainly in energy with >75% deficiency), but not as high in mothers (4-12% deficiency).
d. The staple food was maize providing more than two thirds of the energy and nutrients intake, both in children and mothers.

IX. IMPLICATIONS: RESEARCH AND PROGRAMS

1. Effects of water are varied and go in different directions; social (for example more time for socialization), nutrition (lower energy demands), economic (more time for productive activities). Water introduction can be used as the strategy to implement other type of activities to promote communities' development.

2. In traditional water and sanitation programs, user perspectives are not fully understood nor their reasons to demand water. Motivations for improved water supplies have to do with convenience and time and effort savings. Thus. hygiene education is usually viewed as an imposition.

3. User's perspective should be considered in water and sanitation programs in order to get the maximum benefit and community participation.

4. A dialogue (three way) between communities and their needs, donors and their objectives and national organizations and their programs, is needed.

5. Water benefits are not completely known and documented.

6. There is a great potential for innovation in water projects; for example:

   a. More time for new, improved and alternative activities for the mother.
   b. Dietary needs reduction (food saved) in mothers by water introduction can be redistributed to children.
   c. Education programs should include aspects other than health and sanitation. For instance, food and nutritional education components.

   d. Water and sanitation (W&S) promoters could receive training in other areas besides W&S, such as in primary health prevention and treatment of some common diseases, tourism, agriculture and others.

X. WORKSHOP

A workshop on the social and biological impact of improved water in rural Guatemala was held on Friday, 30 September. It was attended by UNICEF, Guatemala as well as other organizations representing different sectors. A list of the participants is attached (see Appendix 6).

The workshop had two major objectives: 1) share results of the investigation on social and biological impacts of rural water supply improvements and 2) stimulate discussion of the results and how they relate to programs. The workshop was a success, and it can serve as a model for future inter-sectoral and inter-agency workshops. The material could be adapted to the existing in house training material. In the morning, the results from the study were reported by the investigators. These results focused on two aspects of improved water, the social and the biological impacts. For the social aspects, three major topics were addressed: user views, time savings, and amount of water used for what purposes. For the biological aspects, 5 major topics were addressed: energy expenditure, activity level, health status, nutritional status, and dietary intake.

The main findings were summarized as presented above under the preceding chapter. The findings prompted three working groups to convene in the afternoon to discuss the results in light of the following assumptions given that: 1) water will still be demanded by communities, 2) water programs will continue, 3) benefits are broad, 4) links exist with other sectors, and 5) different agencies will continue their work. The three topics, or working groups, are shown below. Within the first two working groups both intersectoral (interdisciplinary) and interagency (integrated view) views were to be considered. In the third group a paradigm for intersectoral work was presented, and this group worked on completing this task. The broad benefits, programmatic issues, and their priorities were discussed. Within each group a series of questions were posed to prompt discussion.

Group 1 - Implication of findings for present programs (short term view)

Questions considered:

1. How relevant is the information presented to your institution?
2. How can the information presented be put into practice?
3. Are these results worthy of incorporating into programs?
4. What are the important elements of the results necessary to develop an integrated program?
5. What issues/ideas are you not addressing in your present activities?
6. Can these ideas/issues be included or linked in your present program?

Report Back:

Question 1. Information presented was very relevant. There is a discrepancy between community motivations for water (i.e. convenience, save time and effort) and motivations of health programs. There is a need to merge both approaches in health education with both a promotion and development component.

2. The results presented needs to be combined with the perspective of the views of programs.

3-4. It would be useful. There is a need for integrated approaches (interagency and intersectorial). There is a need for decentralization so that alternative programs are designed and implemented at the local level.

5-6. We are not taking into consideration the ideas about women's energy expenditure and her role in taking care of the family. Actually women are contributing enormously in the food security situation of their families, in hygiene and sanitation and health care. To capitalize on energy and time saved with piped (household) water, actions should be integrated with other programs.

Group 2 Implications of findings for future programs (long term view)

Questions considered:

1. How relevant is the information presented to your institution?
2. How can the information presented be put into practice?
3. What areas do you address in your institution?
4. What sectors (disciplines) should establish linkages?
5. Which sector (s) should take the lead role?
6. What partners should be included in the program?
   Government and NGOS, Communities, Technical assistance, agencies, Funding agencies, Evaluation agencies.
7. What partner (s) should take the lead role and why?
8. What constraints exist to working with other institutions in general and in water sector?
9. What constraints exist to incorporating the results into future programs (your own or other institutions with the present resources or foreseen resources available)?

Report Back:

Questions

1-2 The information presented lends support to water and sanitation programs. It helps strengthen the position of these programs in the future.

The findings on the saving of energy and time have implications for water and sanitation programs because they indicate that development should be part of them. Water and sanitation can be only the first step in other development projects.

Interventions should not be implemented in isolation of other programs or needs of communities. It is clear that water and sanitation are just part of the larger picture with all the other variables (health, education, nutrition, agriculture, etc.).

Interventions are necessary to make better use of women's time. But it is women themselves who should be asked what they want to do with their time.

Programs should make people aware of the cost and value of water.

Proposals need to be prepared in order to further develop these ideas.

3-4 Programs should be integrated considering: women, health and development. Sectors should not be working in isolation of each other.

5-6-7 Leadership belongs to the community. Besides the community, the Ministries of Health, Education, Agriculture, the NGOs, the Regional Development Councils (Consejos Regionales de Desarrollo) should be working together. They asked where is the Secretaría Hidraúlica and RASSCA in this meeting?

8 The most important limitation in working with other institution are jealousy, individual egos, and the specific agendas of different agencies. For example, the location of water supplies in one agency may be a public location, whereas in another it may be a household connection.

Group 3 Completion of water paradigm figure (see Appendix 7).

Questions considered:

1. How relevant is the information presented to your institution?
2. How can the information presented be put into practice?
3. Complete the diagram shown during the presentation. Be as comprehensive as possible, then prioritize activities within each sector/discipline.
4. What are the broader benefits worth working toward?
5. How many disciplines/sectors should be involved?
6. What are the programmatic issues that need to be considered?
7. Are guidelines necessary for intersectoral/ interagency programs?
8. If yes, guidelines for what and who should develop them?

Report back:

The group discussed the issue of why water and sanitation (W&S) was in the center of the diagram. Nutritionists (2 in this group) are opposed to this way of presenting things, because it could lead one to believe that providing water to communities solves all their problems. It was decided, though, to leave W&S in the center for the exercise. Other views in favor of W&S at the center: water is a priority for all communities. When one conducts the exercise of asking in the community what are their needs, if they do not have an adequate, convenient supply of water they mention it as their first need. Second is usually good roads.

The information presented below dealt with water but not with sanitation. The discussion centered around the identification of the benefits other sectors could derive from improvements in water and sanitation.

Education

* increase school attendance and continuation by girls
* opportunity to train children in "skill for life" (in UNICEF parlance)
* improve school performance (better health, less intestinal worms)

Organization

* a point of entry in communities
* a beginning in local participation and organization
* the first of other subsequent development projects
* water as a source of union between community members, "water source of peace" (UNICEF), water can lessen community conflicts, for example in Santa María de Jesús women fight for water
* higher community status, prestige
* women's groups

Agriculture

* reforestation
* small home and school gardens (water provided by these programs does not allow for intensive "riego"/watering)

Economic

* increase women's economic (income-generating) activities, either new ones or the ones they already carry out, but for more time and better quality (more time for training); involve women in agroindustry
* improvement in quality of housing, more construction work (with water they can build more and better houses)
* increase in tourism and income from tourism

Support to women

* less time
* less effort
* more dignity, sense of control, self-esteem

Quality of life

* better housing
* more comfort

Health

* less gastrointestinal illnesses
* less mortality

* less infections: eyes, skin
* less parasites
* more use of rehydrating solutions (water to prepare liquids and ORS) to prevent dehydration

Nutrition

* better food hygiene
* more breastfeeding (more time)
* more food preparation (more time and more water to prepare)
* better hygiene in infant food preparation
* "water is a nutrient" (idea of one of the nutritionist); drinking more water can be beneficial
* energy expenditure of women is reduced, extra food can be given to children
* increase in children's appetite (children are sick less)
* better nutritional status of mothers and children

Environment (home and community at large)

* reforestation
* less fecal contamination (sanitation)
* happier home environment with ornamental plants

Disadvantages (not benefits) were mentioned regarding the environment:

- no sewage, water used forms puddles around homes
- more "zancudos"/mosquitoes

This analysis led to the main two conclusions:

1. Programs must broaden the focus of their educational component to include notions of other benefits besides better health and reinforce women's ideas of time and effort saved.

2. Programs can start with water supply systems, but need to work with women and other institutions to expand, identify and continue with other activities which may include income generation for women.

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TABLES

TABLE No. 1 CHARACTERISTICS OF STUDIED COMMUNITIES

WITHOUT WATER						
COMMUNITY	MUNICIPIUM	DISTANCE (km)	HOUSE DISTRIBUTION	TOPOGRAPHY	ACCESIBILITY	COMMUNICATION MEDIA
Pamalin	Totonicapán	2	Concentrated	Flat	All times	Radio and TV
Chuijox-Pachoc	Totonicapán	18	Concentrated	Hilly	All times	Radio
Choqui	Sn. Bartolo, aguas calientes	12	Dispersed	Hilly	just by 4 wheel drive car	Radio
Pachichup	Sn. Bartolo, aguas calientes	12	Concentrated	Hilly	All times	Radio
WITH WATER						
Xeatzam	Totonicapán	8	Concentrated	Flat	All times	Radio and TV
Xolbeya	Totonicapán	4	Concentrated	Hilly	All times	Radio and TV
Patulup	Sn. Bartolo, aguas calientes	10	Dispersed	Hilly	just by 4 wheel drive car	Radio

TABLE No. 2 DATA COLLECTION INSTRUMENTS BY OBJECTIVE

	Community participation	User views	Energy expenditure	Time savings	Health and nutrition	Dietary intake
Maternal recall					PA-1	PA-5,6
Anthropometry					PA-1	
Observation				PA-3	PA-2,6,8	
Direct measurements			PA-9		PA-1	PA-6
Interviews		PA-6			PA-6	
Opinions	FOCUS GROUPS		FOCUS GROUPS	FOCUS GROUPS	PA-6	

TABLE No. 3 GENERAL INFORMATION OF THE MOTHERS
TOTAL GROUP N=96

VARIABLES	WET SEASON				DRY SEASON			
	NO WATER		WITH WATER		NO WATER		WITH WATER	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
AGE (years)	28.6	7.1	29.0	7.4	29.0	6.5	29.3	6.8
WEIGHT (kg)	44.4	5.0	47.1	8.0	46.2	6.5	46.6	8.5
HEIGHT (cm)	142.6	4.5	144.8	5.4	144.4	4.5	144.2	5.5

TABLE No. 4 GENERAL CHARACTERISTICS OF THE MOTHERS
STUDY OF ENERGY EXPENDITURE N=24

VARIABLES	WET SEASON				DRY SEASON			
	NO WATER		WITH WATER		NO WATER		WITH WATER	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
AGE (years)	25.4	4.6	31.4	8.2	26.3	3.8	32.7	7.6
WEIGHT (kg)	41.8	5.4	48.2	10.2	43.8	7.9	48.3	11.4
HEIGHT (cm)	141.2	6.0	145.4	5.2	142.4	5.8	145.7	6.1

TABLE No.5 HOUSING CONDITIONS IN STUDY COMMUNITIES

CHARACTERISTIC	1993		1994	
	WPW	NOPW	WPW	NOPW
No. OF ROOMS				
1	18	25	18	33
>1	30	23	30	15
ELECTRICITY				
NO	20	33	20	42
YES	28	15	28	6
FORM OF COOKING				
FLOOR	9	26	9	27
RAISED	30	20	24	20
IMPROVED STOVE	7	2	15	1
FLOOR				
DIRT	35	42	35	46
CEMENT	13	6	13	2
WALL				
BOARD	4	14	2	17
UNCOOKED BRICKS	44	34	45	31
CEMENT BLOCKS			1	

TABLE No. 6 DISTRIBUTION OF THE MAIN SOURCES OF WATER

WET SEASON

WATER SOURCE	WITHOUT WATER		WITH WATER	
	No.	%	No.	%
River	1	2.1	..	..
Community well	1	2.1	..	..
Spring	24	50.0	..	..
Public tap	15	31.2	..	..
In-house tap	3	6.2	48	100.0
Other (rain,well)	4	8.3	..	..
Total	48	100.0	48	100.0

DRY SEASON

WATER SOURCE	WITHOUT WATER		WITH WATER	
	No.	%	No.	%
River	..	..	..	..
Community well	..	..	..	..
Spring	40	83.3	..	..
Public tap	..	..	..	..
In-house tap	5	10.4	45	95.7
Other (rain,well)	3	6.2	2	4.2
Total	48	100.0	47	100.0

TABLE No. 7 ACCESS TO WATER IN STUDY COMMUNITIES

(Based on Reports from Water Committees and Selected Informants)

COMMUNITIES WITH PIPED WATER (WPW)

Community	Distance to water source
Xeatzam	on household premises
Xolbeyá	on household premises
Patulup	on household premises

COMMUNITIES WITH NO PIPED WATER (NoPW)

Community	Distance to water source	Number of trips/day	Time spent/trip	Total time spent
Pamalín*	500 m	No. info.	15 min.	1½ - 4 hr.
Chuijox Pachoc	500 - 1000 m	5 - 6	20 - 40 min.	1½ - 5 hr.
Choquí	1000 - 3000 m	3 - 5	30 - 60 min.	1½ - 5 hr
Pachuchup	1000 - 3000 m	5 - 6	30 - 60 min	1½ - 5 hr

*Pamalín was replaced by Pachuchup for the second data collection round (1994).

TABLE No. 8 CLASSIFICATION OF THE WATER

COMMUNITIES WITH NO-PIPED WATER (NoPW)	COMMUNITIES WITH PIPED WATER (WPW)
* Inside	* Inside
* Outside	* Tap water
	* Cement basin

TABLE No. 9 ACTIVITIES PERFORMED BY WOMEN
(Women's report in group discussions)

ACTIVITY	WITH WATER			WITHOUT WATER		
	Patulup	Xolbeyá	Xeatzam	Pachuchup	Chuijox	Choquí
Start the fire	*	*	*	*	*	*
Prepare food/beverages	*	*	*	*	*	*
Prepare coffee				*		*
Cook nixtamal	*			*		*
Wash nixtamal	*		*	*	*	*
Go to grinding mill	*	*	*	*	*	
Grind corn at home						*
Wrap tamalitos		*	*	*	*	
Prepare/give food to animals	*	*	*	*	*	*
Herding animals					*	
Wash dishes	*	*	*	*	*	*
Wash clothes	*	*	*	*	*	*
Sweep, clean house	*	*	*	*	*	*
Fetch wood	*			*	*	*
Fetch water				*	*	*
Weave	*	*	*	*		
Tend business	*					
Attend meetings, church			*			
Go to market/sell/buy					*	
Other home industries			*			*
Plant corn		*		*	*	
Carry and apply fertilizer	*	*	*	*	*	*
Clean and "calzar" corn	*	*	*			*
Prepare food for agric workers	*					
Harvest		*	*		*	

* = Mentioned in group discussion as a distinct activity.

TABLE No. 10 AMOUNT OF EFFORT MADE IN ACTIVITIES PERFORMED BY WOMEN

(Women's perceptions in group discussions)

ACTIVITY	WITH WATER			WITHOUT WATER		
	Patulup	Xolbeyá	Xeatzam	Pachuchup	Chuijox	Choquí
Start the fire	*	*	*	*	*	*
Prepare food/beverages	*	*	**	*	*	*
Cook nixtamal	*			*		
Wash nixtamal	*		*	*	*	*
Go to grinding mill	*	**	**	*	*	
Grinding at home						**
Wrap tamalitos		*	*	*	*	
Prepare food to animals	**			*	*	*
Herding animals					**	
Wash dishes	*	*	*	*	*	*
Wash clothes	**	**	**	**	**	**
Sweep, clean house	**	*	**	*	**	*
Fetch wood	**			*	**	*
Fetch water				**	**	**
Weaving	*	**	**	*		
Tend business	*					
Plant corn		*		*	*	
Carry and apply fertilizer	**	**	**	*	*	*
Clean and "calzar" corn	**	*	**			**
Prepare food for hired help	**					
Harvest		*	**			

* = less effort
** = more effort

TABLE No. 11 AMOUNT OF WATER REQUIRED FOR ACTIVITIES PERFORMED BY WOMEN

(Women's estimations in group discussions)

ACTIVITY	WITH WATER			WITHOUT WATER		
	Patulup	Xolbeyá	Xeatzam	Pachuchup	Chuijox	Choquí
Prepare food/beverage	*	*	*	**	**	**
Cook nixtamal	**			**		**
Wash nixtamal	**		**	**	***	**
Grinding at home						*
Wrap tamalitos		*	*	*	*	
Prepare food for animals	**			**	it depends	**
Wash dishes	**	**	**	**	*	**
Wash clothes	***	***	***	***	***	***
Sweep, clean house	*	*	*	*	*	*

* = a little
** = regular amount
*** = a lot

TABLE No. 12 TIME SPENT (in minutes) ACCORDING TO DIFFERENT ACTIVITY LEVELS IN GUATEMALAN RURAL WOMEN

WET SEASON-1993

ACTIVITY	WITHOUT WATER (n=11)		WITH WATER (n=12)		DIFFERENCE	p
	Mean	SD	Mean	SD		
BASAL	506.8	61.9	508.7	58.1	1.9	N.S.
SEDENTARY	247.4	192.9	500.3	156.3	252.9	<.05
ACTIVE	589.5	191.3	349.4	153.8	240.1	<.05
MISCELLANEOUS	100.9	34.4	81.5	20.3	19.4	<.05
TOTAL OBSERVED	1384.6	212.6	1358.4	20.3	26.2	N.S.

DRY SEASON-1994

ACTIVITY	WITHOUT WATER (n=11)		WITH WATER (n=11)		DIFFERENCE	p
	Mean	SD	Mean	SD		
BASAL	544.5	61.4	547.3	98.3	2.8	NS
SEDENTARY	176.4	121.6	404.3	195.3	227.9	<.05
ACTIVE	676.0	136.6	466.6	188.4	209.4	<.05
MISCELLANEOUS	42.9	42.8	21.8	35.8	21.1	NS
TOTAL OBSERVED	1397.0	42.8	1418.2	35.8	21.2	NS

TABLE No.13 TOTAL ENERGY EXPENDITURE (kcal/d) BY HEART RATE MONITORING

	Without Water			With Water			Difference	
	Median	Mean	S.E.	Median	Mean	S.E.	Median	Mean
Wet Season 1993	2794	2741	154.1	2158	2224	98.5	636	517
Dry Season 1994	2825	2837	65.8	2341	2480	85.8	484	357
Difference	31	113	..	183	256	..	..	..

TABLE No.14 ENERGY EXPENDED AS MULTIPLES OF BMR BY TYPE OF ACTIVITY AMONG RURAL GUATEMALAN WOMEN WET SEASON-1993

ACTIVITY	WITHOUT WATER		WITH WATER		p
	MEAN	SD	MEAN	SD	
SEDENTARY[1]	1.9	0.35	1.7	0.20	<.05
ACTIVE	4.0	0.74	3.3	0.36	<.05
MISCELLANEOUS	1.8	0.41	1.7	0.20	NS
TOTAL OBSERVED	2.5	0.58	1.8	0.25	<.05
TOTAL/DAY	2.5	0.55	1.8	0.25	<.05

[1] Basal metabolic rate during sleeping time

DRY SEASON-1994

ACTIVITY	WITH WATER		WITHOUT WATER (n=12)		P
	MEAN	SD	MEAN	SD	
SEDENTARY[1]	1.9	0.22	1.7	0.22	<0.05
ACTIVE	4.1	0.48	3.5	0.33	0.05
MISCELLANEOUS	1.3	0.94	1.0	0.88	NS
TOTAL OBSERVED	2.6	0.27	2.0	0.31	<0.05
TOTAL/DAY	2.6	0.27	2.0	0.31	<0.05

[1] Basal metabolic rate during sleeping time

TABLE No. 15 BODY COMPOSITION OF THE MOTHERS

DRY SEASON

VARIABLES	WITHOUT WATER		WITH WATER	
	Mean	S.D.	Mean	S.D.
Total body water (liters)	24.5	3.9	25.2	3.8
Lean body mass (kg)	33.5	5.3	34.5	5.2
Body fat (kg)	10.4	4.7	13.8	7.6
Body fat (% body weight)	23.1	7.6	27.1	9.4
Weight (kg)	43.8	7.9	48.3	11.4
Height (cm)	142.4	5.8	145.7	6.1
Body mass index (kg/m^2)	21.5	2.6	22.7	4.3

* All between groups comparisons are N.S.

TABLE No. 16 NUMBER OF TIMES ACTIVITY WAS OBSERVED BY TYPE OF COMMUNITY AND STUDY PERIOD

WET SEASON

ACTIV. TYPE	MATERNAL ACTIVITIES	WITHOUT WATER (NPW)		WITH WATER (WPW)	
		First visit	Second visit	First visit	Second visit
2	* Eating/drinking	102	97	115	129
3	* Washing dishes	103	97	92	107
4	* Carrying baby	184	174	152	154
4	* Breastfeeding	138	105	102	114
4	* Interacting with child	120	134	104	139
6	* Preparing thread/weaving	45	48	97	87
7	* Going to, being at, coming back from meeting (social, church, health)	135	146	163	185

DRY SEASON

ACTIV. TYPE	MATERNAL ACTIVITIES	WITHOUT WATER (NoPW)		WITH WATER (WPW)	
		First visit	Second visit	First visit	Second visit
2	* Eating/drinking	97	115	101	99
3	* Washing dishes	97	94	97	89
4	* Carrying baby	167	152	106	113
4	* Breastfeeding baby	123	118	105	113
4	* Interacting with child	126	152	130	136
6	* Preparing thread/weaving	0	8	141	131
7	* Going to, being at, coming back from meeting (social, church, health)	148	176	218	207

TABLE No. 17 NUMBER OF TIMES PRODUCTIVE ACTIVITIES WERE OBSERVED

BY TYPE OF COMMUNITY AND STUDY PERIOD

(two observations/subject/period)

ACTIVITY	1993				1994			
	WITH WATER		WITHOUT WATER		WITH WATER		WITHOUT WATER	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Taking care of the shop	6	8	4	2	12	13	3	4
Products for sale	1	0	6	1	0	0	1	0
Preparing thread/weaving for sale	97	87	45	48	141	131	0	8
Animals for sale	30	42	40	46	31	35	45	45
Other activity	11	6	9	23	15	12	21	18
Total	145	143	104	120	199	191	70	75

TABLE No. 18 REPORTED AND OBSERVED DATA ON FREQUENCY AND TIME SPENT CARRYING WATER

DRY SEASON

(values are mean ± S.D.)

WITHOUT WATER COMMUNITIES (NoPW)		FREQUENCY OF WATER COLLECTION (# times/day)		TIME SPENT ON EACH TRIP (minutes)	
		By continuous record (PA3)	Reported by the mother (PA6)	By continuous record (PA3)	Reported by the mother (PA6)
No. 3	PACHOC	3.6 ± 1.7	5.7 ± 1.9	9.1 ± 4.4	12.1 ± 2.7
No. 5	CHOQUI	1.2 ± 0.6	2.3 ± 1.1	34.4 ± 12.5	47.5 ± 29.3
No. 7	PACHICHUP	2.2 ± 0.8	4.3 ± 1.4	13.6 ± 5.1	18.9 ± 8.2
TOTAL		2.1 ± 1.4	3.8 ± 2.0	21.4 ± 14.5	29.5 ± 25.1

TABLE No. 19 MEDIAN AMOUNT OF WATER (liters) USED IN DIFFERENT ACTIVITIES WET SEASON

	COMMUNITIES WITHOUT PIPED WATER	COMMUNITIES WITH PIPED WATER
Wash food	5.70 (2)	3.00 (7)
Wash nixtamal	6.70 (2)	16.80 (7)
Prepare food	1.60 (5)	1.50 (11)
Wash corn husks	1.50 (3)	5.20 (3)
Wash clothes	N/A	137.75 (12)
Wash dishes	4.35 (20)	11.80 (28)
Mop floor	N/O	6.10 (3)
Water floor (sweep)	N/O	6.10 (3)
Water plants	N/O	11.50 (1)
For animals	6.50 (1)	2.40 (1)
Wash hands	0.66 *	0.70 (5)
Wash hair/take bath	N/O	25.20 (1)

NA = Not applicable

NO = Not observed

In parenthesis number of observations.

* Hand washing was not observed. Figures comes from a study conducted in another rural Guatemalan community without piped water and identical hand washing procedure.

TABLE 20 MEAN FREQUENCY OF ACTIVITIES BY LOCATION

LOCATION	WET SEASON		DRY SEASON	
	WPW	NoPW	WPW	NoPW
In house	47.2 (48)	44.6 (48)	45.8 (47)	40.1 (48)
Patio	10.1 (48)	7.0 (46)	9.5 (45)	6.1 (43)
Street	3.6 (11)	4.4 (21)	1.8 (9)	3.4 (8)
Fields	4.5 (39)	5.2 (42)	4.4 (39)	6.2 (45)
Another place	13.5 (25)	19.2 (40)	19.6 (28)	19.6 (39)
Outside community	14.7 (9)	22.2 (5)	10.1 (7)	46.8 (6)

TABLE 21 MEAN FREQUENCY OF ACTIVITIES BY BODY POSITION

BODY POSITION	WET SEASON		DRY SEASON	
	WPW	NoPW	WPW	NoPW
Lying down	4.4 (7)	7.3 (10)	5.9 (9)	2.7 (3)
Sitting, kneeling	32.2 (48)	36.1 (48)	35.8 (47)	33.0 (48)
Standing	29.1 (48)	25.3 (48)	24.3 (47)	24.9 (48)
Walking	5.7 (47)	8.8 (48)	4.0 (46)	11.0 (48)
Walking rapidly	4.0 (1)	7.0 (2)	2.0 (1)	3.5 (2)
Running	1.3 (3)	0	1.0 (1)	1.5 (2)

TABLE No. 22 MORBIDITY FOUND IN CHILDREN BY A 7 DAY RECALL SURVEY

MORBIDITY	WET SEASON				TOTAL		DRY SEASON				TOTAL	
	WITHOUT WATER		WITH WATER				WITHOUT WATER		WITH WATER			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
UPPER RESPIRATORY INFECTIONS (URI)	8	16.7	7	14.6	15	15.6	12	25.0	10	21.2	22	23.1
INTESTINAL (GI) + URI	3	6.2	--	--	3	3.1	2	4.2	4	8.5	6	6.3
DIARRHEA + DISENTERY	3	6.2	6	12.5	9	9.4	3	6.2	4	8.5	7	7.4
GI + FEVER	1	2.1	2	4.2	3	3.1	2	4.2	1	2.1	3	3.1
FEVER	2	4.2	2	4.2	4	4.2	--	--	1	2.1	1	1 0
VOMITING	--	--	1	2.1	1	1.0	--	--	--	--		
OTHERS	--	--	1	2.1	1	1.0	3	6.2	1	2.1	4	4.2
TOTAL ILL	17	35.4	19	39.6	36	37.5	22	45.8	21	44.7	43	45.2
HEALTHY	31	64.6	29	60.4	60	62.5	26	54.2	26	55.3	52	54.7
TOTAL	48	100	48	100		100	48	100	47	100	95	100

TABLE No. 23 CAUSES OF CHILD DIARRHEA

PERCENTAGE OF MOTHERS WHO MENTIONED EACH CAUSE

CAUSE	WET SEASON		DRY SEASON	
	WPW n = 47	NoPW n = 46	WPW n = 47	NoPW n = 48
Mother hands dirty	6.1	17.4	8.5	10.4
Child drinks dirty water	18.4	39.1	29.8	47.9
Child eats dirty food	73.5	69.6	66.0	60.4
Child eats on dirty plates	20.4	13.0	10.6	8.3
Child puts dirty things in mouth	30.6	19.6	51.1	52.1
Child puts dirty hands in mouth	38.8	17.4	40.4	41.7
Lack of hygiene - child	55.1	56.5	38.3	43.8
Lack of hygiene - house	28.6	21.8	19.2	22.9
Other causes (not hygiene related)	46.9	32.6	36.2	27.1

TABLE No. 24

PREVENTIVE MEASURES FOR CHILD DIARRHEA
Percentage of mothers who mentioned each measure

PREVENTIVE MEASURE	1993		1994	
	WPW n = 47	NoPW n = 46	WPW n = 47	NoPW n = 48
Mother's handwashing	26.5	37.0	34.0	27.1
Child's handwashing	81.6	80.4	74.5	72.9
Boil water	20.4	32.6	6.4	27.1
Wash dishes well	28.6	50.0	34.0	56.2
Wash foods well	63.3	50.0	59.6	54.2
Cook foods well	53.1	50.0	48.9	41.7
Cover food	18.4	15.2	21.3	22.9
Cover drinking water	4.1	10.9	0.0	14.6
Do not eat spoiled food	14.3	17.4	21.3	14.6
Keep animals out	8.2	8.7	2.1	0.0
Dispose of garbage	10.2	2.2	8.5	6.2
Other (not hygiene related)	38.8	44.4	27.7	37.5

TABLE NO. 25
USE OF HEALTH RESOURCES
(percentage of mothers who mentioned each resource)

PRESENT CHILD ILLNESS

RESOURCE	1993		1994	
	WPW n = 47	NoPW n = 46	WPW n = 47	NoPW n = 46
None	51.0	30.4	59.6	22.9
Pharmacy	28.6	34.8	17.0	16.7
Health Post	55.1	58.7	34.0	79.2
NGO	0.0	0.0	0.0	0.0
Private physician	14.3	4.4	4.3	2.1
Folk curer	10.2	13.0	6.4	4.2
Midwife	8.2	6.5	2.1	2.1
Hospital				
Other				

LAST CHILD ILLNESS EPISODE

RESOURCE	1993		1994	
	WPW n = 47	NoPW n = 46	WPW n = 47	NoPW n = 46
None	32.6	19.6	55.3	37.5
Pharmacy	22.4	17.4	17.0	10.4
Health Post	34.7	47.8	36.2	56.2
NGO	2.0	0.0	0.0	0.0
Private physician	10.2	10.9	6.4	4.2
Folk curer	7.4	8.4	8.5	2.1
Midwife	6.1	13.0	2.1	0.0
Hospital	2.0	0.0	8.5	2.1
Other	2.0	2.2	2.1	0.0

TABLE No. 26
INSTANCES TO WASH ONE'S HANDS
(percentage of mothers who mentioned each instance)

INSTANCE	1993		1994	
	WPW n = 47	NoPW n = 46	WPW n = 47	NoPW n = 48
Before eating	75.5	71.7	87.2	91.7
Before cooking	89.8	95.6	97.9	93.8
Before breastfeeding	16.3	4.4	4.3	6.2
After defecation	55.1	26.1	66.0	25.0
After diapering child	42.9	19.6	29.8	31.2
Other instance	34.7	65.2	29.8	18.8

TABLE No. 27 NUTRITIONAL STATUS OF THE MOTHERS

BODY MASS INDEX	WET SEASON (n=96)						DRY SEASON (n=95)					
	WITHOUT WATER		WITH WATER		TOTAL		WITHOUT WATER		WITH WATER		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%
Undernourished (<18.5)	1	2.1	4	8.3	5	5.2	2	4.2	2	4.3	4	4.2
Underweight (18.5-19.9)	7	14.6	8	16.7	15	15.6	7	14.6	9	19.1	16	16.8
Normal (20-25)	37	77.1	27	56.3	64	66.7	34	70.8	27	57.4	61	64.2
Excess (>25)	3	6.3	9	18.8	12	12.5	5	10.4	9	19.1	14	14.7

NUTRITIONAL STATUS OF MOTHERS IN THE SUBSAMPLE FOR ENERGY EXPENDITURE

BODY MASS INDEX	WET SEASON (n=23)						DRY SEASON (n=21)					
	WITHOUT WATER		WITH WATER		TOTAL		WITHOUT WATER		WITH WATER		TOTAL	
	No	%	No	%	No	%	No	%	No	%	No	%
Undernourished (<18.5)	1	9.1	1	8.3	2	8.7	1	9.1	1	10.0	2	9.5
Underweight (18.5-19.9)	3	27.3	2	16.7	5	21.7	3	27.3	0	0	3	14.3
Normal (20-25)	7	63.6	6	50.0	13	56.5	5	45.5	7	70.0	12	57.1
Excess (>25)	0	0	3	25.0	3	13.0	2	18.2	2	20.0	4	19.0

TABLE No. 28 NUTRITIONAL STATUS OF THE CHILDREN

WET SEASON

Z-SCORE	WEIGHT/AGE				WEIGHT/HEIGHT				HEIGHT/AGE			
	WITHOUT WATER		WITH WATER		WITHOUT WATER		WITH WATER		WITHOUT WATER		WITH WATER	
	No	%	No	%	No	%	No	%	No	%	No	%
<-2	30	62.5	26	54.2	0	0	3	6.3	43	89.6	39	81.3
-2 to +2	18	37.5	21	43.8	44	91.7	42	87.5	5	10.4	9	18.8
>+2	0	0	1	2.1	4	8.3	3	6.3	0	0	0	0
TOTAL	48	100	48	100	48	100	48	100	48	100	48	100

DRY SEASON

Z-SCORE	WEIGHT/AGE				WEIGHT/HEIGHT				HEIGHT/AGE			
	WITHOUT WATER		WITH WATER		WITHOUT WATER		WITH WATER		WITHOUT WATER		WITH WATER	
	No	%	No	%	No	%	No	%	No	%	No	%
<-2	29	60.4	30	63.8	2	4.2	2	4.3	45	95.7	39	83.0
-2 to +2	18	37.5	17	36.2	43	89.6	45	95.7	2	4.3	8	17.1
>+2	1	2.1	0	0	3	6.3	0	0	0	0	0	0
TOTAL	48	100	47	100	48	100	47	100	47	100	47	100

TABLE No. 29 AMOUNT OF FOOD CONSUMED BY FOOD GROUPS

MOTHERS

FOOD CONSUMED (g)	WITH WATER		WITHOUT WATER		AVERAGE	
	MEAN ± SD		MEAN ± SD		MEAN ± SD	
MAIZE & OTHER DERIV.	776.0	316.5	824.9	377.9	800.7	347.9
SUGARS	67.6	33.9	64.4	35.6	66.0	34.6
OTHER CEREALS	45.4	33.7	45.1	48.6	45.3	41.7
BEANS	29.2	28.5	54.5	35.0	42.0	34.2
VEGETABLES	105.5	92.3	86.4	57.7	95.8	77.0
EGGS	16.5	14.6	12.8	15.8	14.6	15.2
MEATS	27.3	34.1	22.0	29.4	24.6	31.7
TUBERS	19.3	30.8	18.7	37.2	19.0	34.0
CHEESE & DAIRY DERIV.	17.7	53.3	5.3	29.9	11.4	43.3
FAT & OILS	5.8	14.3	2.7	3.0	4.2	10.4
FRUITS	18.9	65.3	11.2	27.5	15.0	50.0

CHILDREN

FOOD CONSUMED (g)	WITH WATER		WITHOUT WATER		AVERAGE	
	MEAN ± SD		MEAN ± SD		MEAN ± SD	
MAIZE & OTHER DERIV.	166.7	122.1	163.5	111.3	165.1	116.2
SUGARS	31.9	21.1	29.0	21.4	30.4	21.2
OTHER CEREALS	27.5	23.9	21.0	18.9	24.2	21.6
BEANS	13.7	16.5	22.6	20.2	18.2	18.9
VEGETABLES	48.8	53.3	35.2	30.0	41.9	43.5
EGGS	11.0	13.1	9.8	13.5	10.4	13.2
MEATS	14.0	20.5	10.4	16.8	12.2	18.7
TUBERS	10.3	17.6	9.1	17.4	9.7	17.4
CHEESE & DAIRY DERIV.	15.0	46.2	4.7	29.5	9.8	38.9
FATS & OILS	2.4	3.8	1.7	2.4	2.0	3.2
FRUITS	12.3	31.4	11.1	28.6	11.7	29.9

TABLE No. 30 NUTRIENTS INTAKE OF CHILDREN

WET SEASON

NUTRIENT	WITH WATER				WITHOUT WATER			
	13-23 mo. (n=15)		> 24 mo. (n=22)		13-23 mo. (n=14)		> 24 mo. (n=25)	
	Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD	
ENERGY (kcal)	660	270	952	360	493	162	923	321
PROTEIN (g)	18.6	10.0	24.9	10.0	12.5	4.1	26.0	10.1
FAT (g)	13.2	8.9	17.4	10.7	8.3	4.8	15.6	7.4
CHO (g)	121.4	48.4	180.0	67.4	95.6	30.5	176.6	65.5
FIBER (g)	2.0	0.9	3.5	1.3	1.9	0.6	4.0	1.9
CALCIUM (mg)	351.7	315.9	299.1	105.0	175.7	60.5	344.9	129.1
PHOSPHORUS (mg)	435.2	290.4	522.3	211.1	270.9	70.7	550.8	198.2
IRON (mg)	6.0	3.8	9.1	3.2	4.7	1.2	9.2	3.2
TIAMIN (mg)	0.6	0.6	0.7	0.3	0.3	0.09	0.7	0.3
RIBOFLAVIN (mg)	0.5	0.5	0.4	0.1	0.2	0.07	0.4	0.2
NIACIN (mg)	3.4	2.1	4.9	2.5	2.3	0.9	4.8	1.9
VITAMIN C (mg)	20.2	14.8	22.6	16.7	13.3	8.3	28.5	28.0
RETINOL (ug)	212.4	313.1	160.7	133.8	71.9	55.6	197.0	274.8

TABLE No. 30 CONTD..

DRY SEASON

NUTRIENT	WITH WATER				WITHOUT WATER			
	13-23 mo. (n=8)		> 24 mo. (n=35)		13-23 mo. (n=10)		> 24 mo. (n=34)	
	Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD	
ENERGY (kcal)	611	290	884	268	725	289.1	837	272
PROTEIN (g)	17.9	7.9	24.2	7.9	20.2	9.9	23.5	7.9
FAT (g)	14.4	11.6	14.3	8.6	13.2	5.6	11.3	6.9
CHO (g)	106.3	45.7	170.4	50.8	136.8	57.2	166.2	51.5
FIBER (g)	2.2	1.3	3.6	1.4	3.5	1.7	3.5	1.3
CALCIUM (mg)	200.8	92.2	323.3	133.2	285.8	140.9	306.5	108.7
PHOSPHORUS (mg)	326.1	132.6	501.9	179.9	444.0	219.1	479.1	148.6
IRON (mg)	5.8	2.9	8.8	3.4	7.6	3.4	8.5	3.0
TIAMIN (mg)	0.4	0.2	0.7	0.3	0.6	0.5	0.6	0.2
RIBOFLAVIN (mg)	0.3	0.1	0.3	0.2	0.3	0.2	0.3	0.1
NIACIN (mg)	3.1	1.7	4.6	1.9	3.8	2.0	4.1	1.4
VITAMIN C (mg)	27.8	32.5	22.3	24.0	17.7	19.9	17.7	18.4
RETINOL (ug)	180.5	135.2	143.5	213.7	124.0	213.6	101.7	118.3

TABLE No. 31 NUTRIENT INTAKE OF THE MOTHERS

WET SEASON

NUTRIENT	WITH WATER		WITHOUT WATER		TOTAL	
	Mean ± SD		Mean ± SD		Mean ± SD	
ENERGY (kcal)	2574	475	2503	548	2538	512
PROTEIN (g)	64.9	14.1	63.9	16.9	64.4	15.5
FAT (g)	37.0	10.5	34.3	10.7	35.6	10.6
CHO (g)	513.6	100.4	503.2	115.7	508.3	107.9
FIBER (g)	9.9	2.4	10.5	3.1	10.2	2.8
CALCIUM (mg)	1060.0	294.9	1035.5	267.0	1047.6	279.9
PHOSPHOROUS (mg)	1455.1	294.8	1450.2	346.0	1452.6	319.9
IRON (mg)	26.1	6.6	25.4	6.8	25.7	6.7
TIAMIN (mg)	1.9	0.4	1.9	0.5	1.9	0.5
RIBOFLAVIN (mg)	0.9	0.2	0.9	0.2	0.9	0.2
NIACIN (mg)	12.5	2.7	11.8	3.1	12.2	2.9
VITAMIN C (mg)	45.0	28.1	52.2	42.9	48.6	36.3
RETINOL (ug)	359.0	253.3	300.7	271.2	329.6	262.7

TABLE No. 31 CONTD..
DRY SEASON

NUTRIENT	WITH WATER		WITHOUT WATER		TOTAL	
	Mean ± SD		Mean ± SD		Mean ± SD	
ENERGY (kcal)	2362	538	2799	591	2583	604
PROTEIN (g)	59.9	13.8	73.1	17.5	66.6	17.1
FAT (g)	34.8	18.7	35.4	12.0	35.1	15.6
CHO (g)	468.9	113.5	566.6	120.1	518.3	126.2
FIBER (g)	9.5	2.5	11.8	2.8	10.7	2.9
CALCIUM (mg)	931.5	239.0	1176.7	289.0	1055.4	291.4
PHOSPHOROUS (mg)	1322.4	319.4	1640.6	369.8	1483.2	379.3
IRON (mg)	23.3	5.7	28.1	7.2	25.7	6.9
TIAMIN (mg)	1.8	0.4	2.1	0.5	1.9	0.5
RIBOFLAVIN (mg)	0.8	0.2	0.9	0.2	0.8	0.2
NIACIN (mg)	11.1	2.7	13.2	3.0	12.1	3.1
VITAMIN C (mg)	43.6	47.4	33.9	30.2	38.7	39.8
RETINOL (ug)	238.6	205.5	184.3	147.2	211.2	179.5

TABLE No. 32 ADEQUACY OF THE CHILDREN INTAKE OF NUTRIENTS

WET SEASON

(% CASES IN EACH CATEGORY)

FOOD GROUP	DEFICIENT < 75%		MARGINAL 75-90%		ADEQUATE >90%	
	13-23 mo.	> 24 mo.	13-23 mo.	> 24 mo.	13-23 mo.	> 24 mo.
WITH WATER						
ENERGY	73.3	63.6	6.7	9.1	20.0	27.3
PROTEIN	46.7	18.2	0.0	4.5	53.3	77.3
CALCIUM	60.0	54.5	0.0	27.3	40.0	18.2
IRON	66.7	13.6	0.0	18.2	33.3	68.1
RETINOL	80.0	86.4	0.0	4.5	20.0	9.1
WITHOUT WATER						
ENERGY	92.9	72.0	7.1	8.0	0.0	20.0
PROTEIN	57.2	16.0	21.4	20.0	21.4	64.0
CALCIUM	92.9	64.0	7.1	12.0	0.0	24.0
IRON	78.6	16.0	21.4	36.0	0.0	48.0
RETINOL	100.0	88.0	0.0	0.0	0.0	12.0

TABLE No. 32 CONTD..
DRY SEASON

(% CASES IN EACH CATEGORY)

FOOD GROUP	DEFICIENT < 75%		MARGINAL 75-90%		ADEQUATE >90%	
	13-23 mo.	> 24 mo.	13-23 mo.	> 24 mo.	13-23 mo.	> 24 mo.
WITH WATER						
ENERGY	75	80.0	25	8.6	0	11.4
PROTEIN	37.5	5.7	0.0	22.9	62.5	71.4
CALCIUM	87.5	62.9	12.5	20.0	0.0	17.1
IRON	75.0	11.4	0.0	37.1	25.0	51.4
RETINOL	75.0	91.4	25.0	0.0	0.0	8.6
WITH WATER						
ENERGY	60	82.3	10.0	14.7	30.0	2.9
PROTEIN	30.0	14.7	0.0	11.8	70.0	73.5
CALCIUM	50.0	61.8	10.0	20.6	40.0	17.6
IRON	40.0	23.5	0.0	11.8	60.0	64.7
RETINOL	90.0	91.2	0.0	2.9	10.0	5.9

TABLE No. 33 ADEQUACY OF THE MOTHER INTAKE OF NUTRIENTS

WET SEASON

(% OF CASES IN EACH CATEGORY)

FOOD GROUPS	DEFICIENT < 75%	MARGINAL 75-90%	ADEQUATE >90%
WITH WATER			
ENERGY	4.2	12.8	83.0
PROTEIN	10.7	21.2	68.1
CALCIUM	14.9	29.8	55.3
IRON	17.0	17.0	66.0
RETINOL	72.4	10.6	17.0
WITHOUT WATER			
ENERGY	12.5	12.5	75.0
PROTEIN	22.9	14.6	62.5
CALCIUM	25.0	25.0	50.0
IRON	20.8	10.4	68.8
RETINOL	79.2	12.5	8.3

TABLE No. 33 CONTD..
DRY SEASON

(% CASES IN EACH CATEGORY)

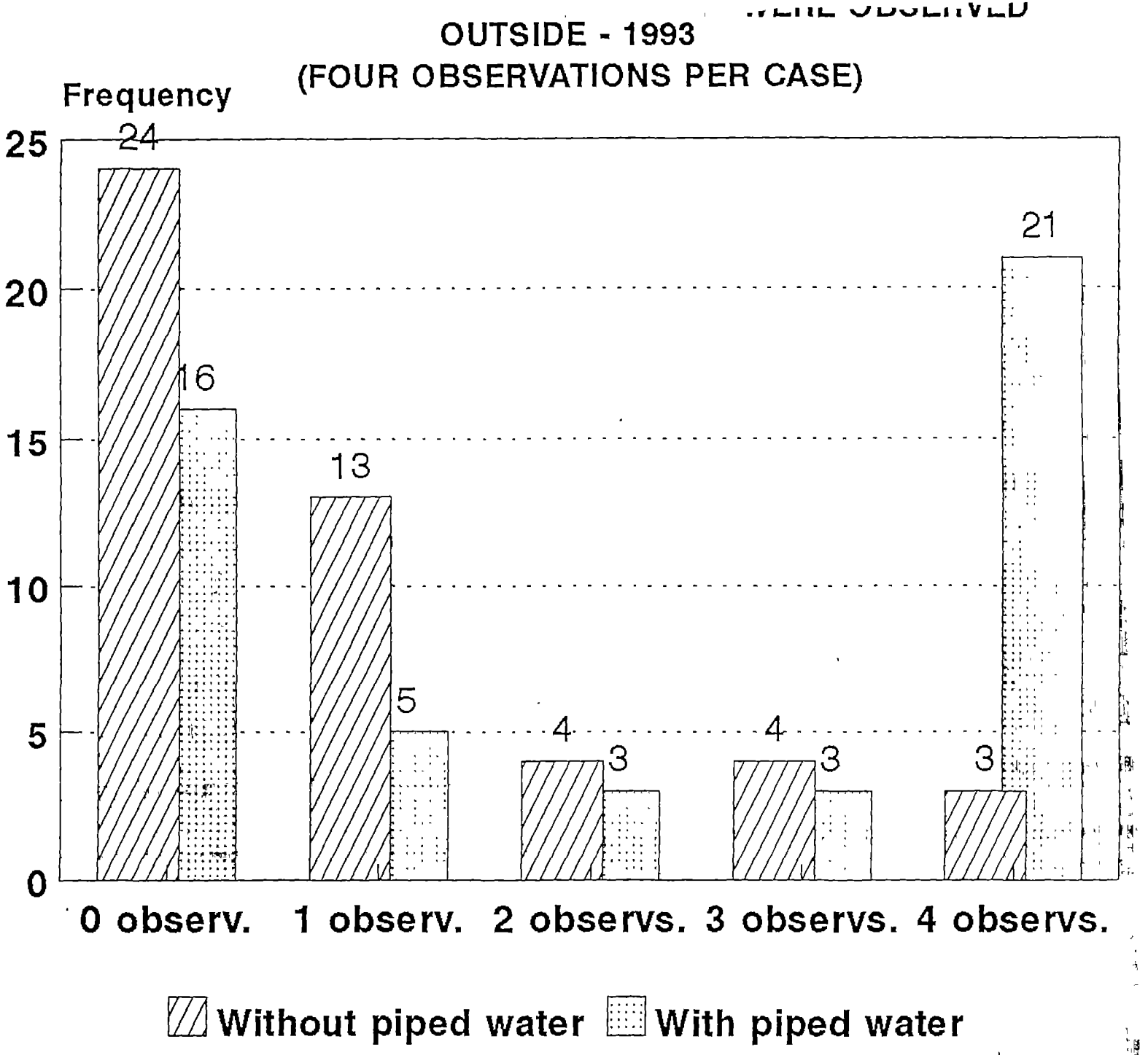
FOOD GROUPS	DEFICIENT < 75%	MARGINAL 75-90%	ADEQUATE >90%
WITH WATER			
ENERGY	10.6	17.0	72.3
PROTEIN	19.1	12.8	68.1
CALCIUM	25.5	29.8	44.7
IRON	19.1	10.6	70.2
RETINOL	83.0	6.4	10.6
WITHOUT WATER			
ENERGY	8.3	4.2	87.5
PROTEIN	10.4	14.6	75.0
CALCIUM	8.3	20.8	70.8
IRON	25.0	2.1	72.9
RETINOL	95.8	4.2	0.0

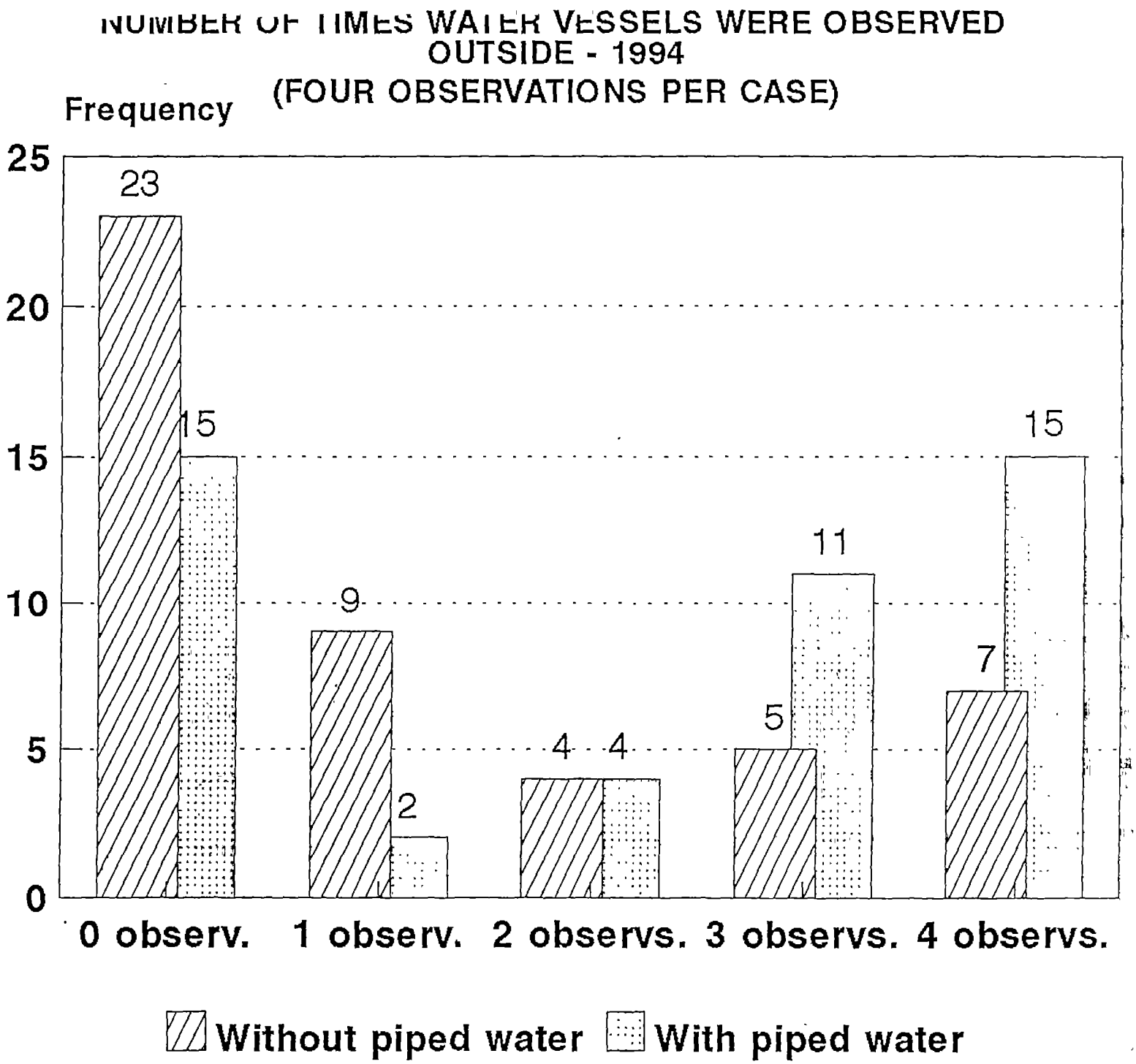
TABLE #34 FREQUENCY OF OCCURRENCE OF SELECTED HIGH EFFORT DEMANDING ACTIVITIES

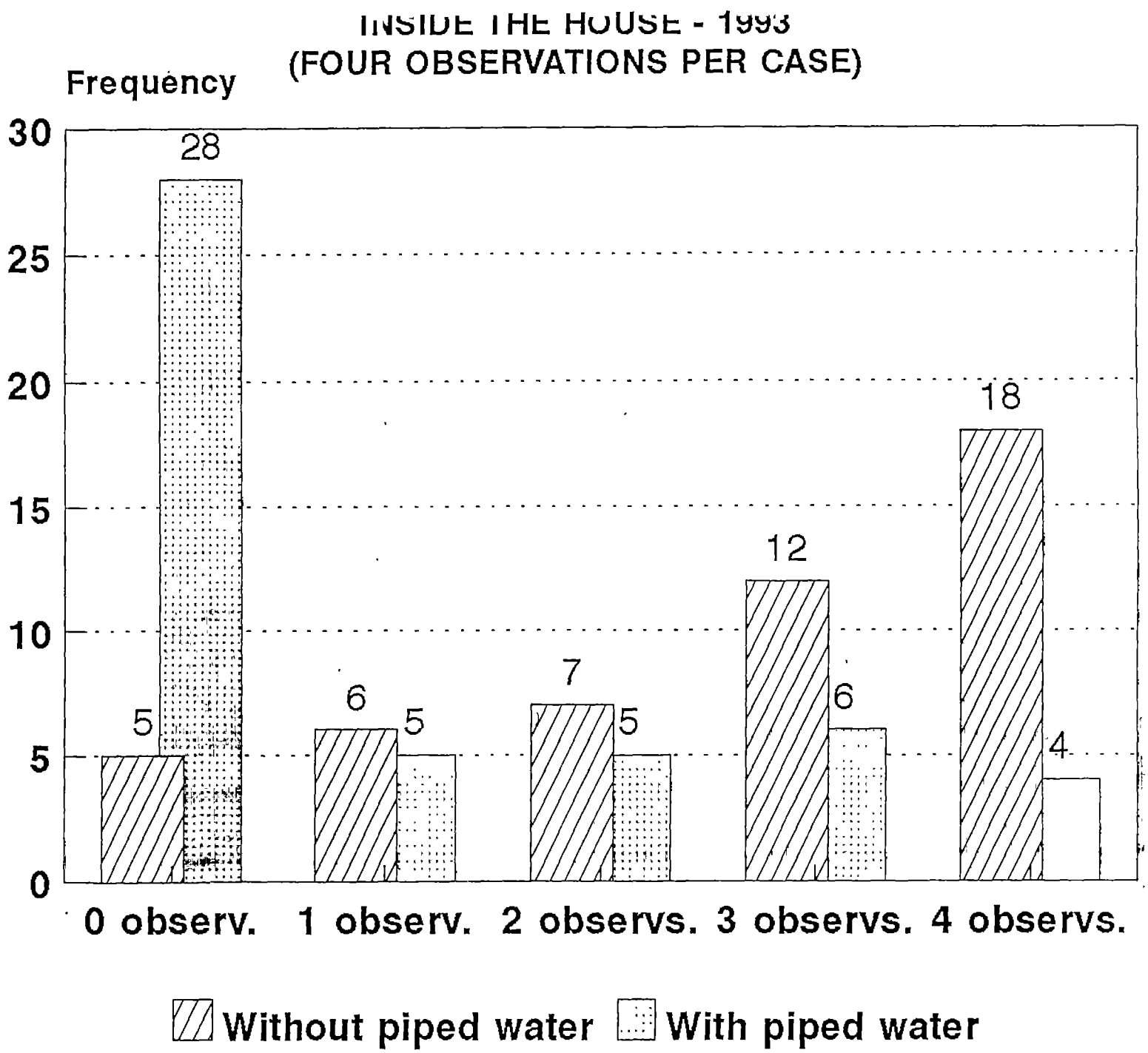
ACTIVITY CODE	WET SEASON			DRY SEASON		
	NoPW	WPW	Ratio NoPW/WPW	NoPW	WPW	Ratio NoPW/WPW
111	216	71	3.0	220	34	6.5
115	25	48	0.5	30	33	0.9
301	11	5	2.2	55	2	27.5
302	248	162	1.5	171	151	1.1
309	114	1	114.0	142	1	142.0
312	53	36	1.5	96	16	6.0
313-4	88	61	1.4	59	18	3.3
316	60	10	6.0	91	13	7.0
602-3	9	1	9.0	3	0	3.0
TOTAL	824	395	2.1	867	268	3.2

ACTIVITY CODES:
111: grinding corn at home
115: walking, being or coming back from the grinding mill
301: walking to or coming back from the field (to bring food or drink)
302: washing clothes
309: carrying water
312: cutting wood
313-314: agricultural activities (not for sale)
316: carrying wood or a heavy object
602-603: agricultural activities (for sale)

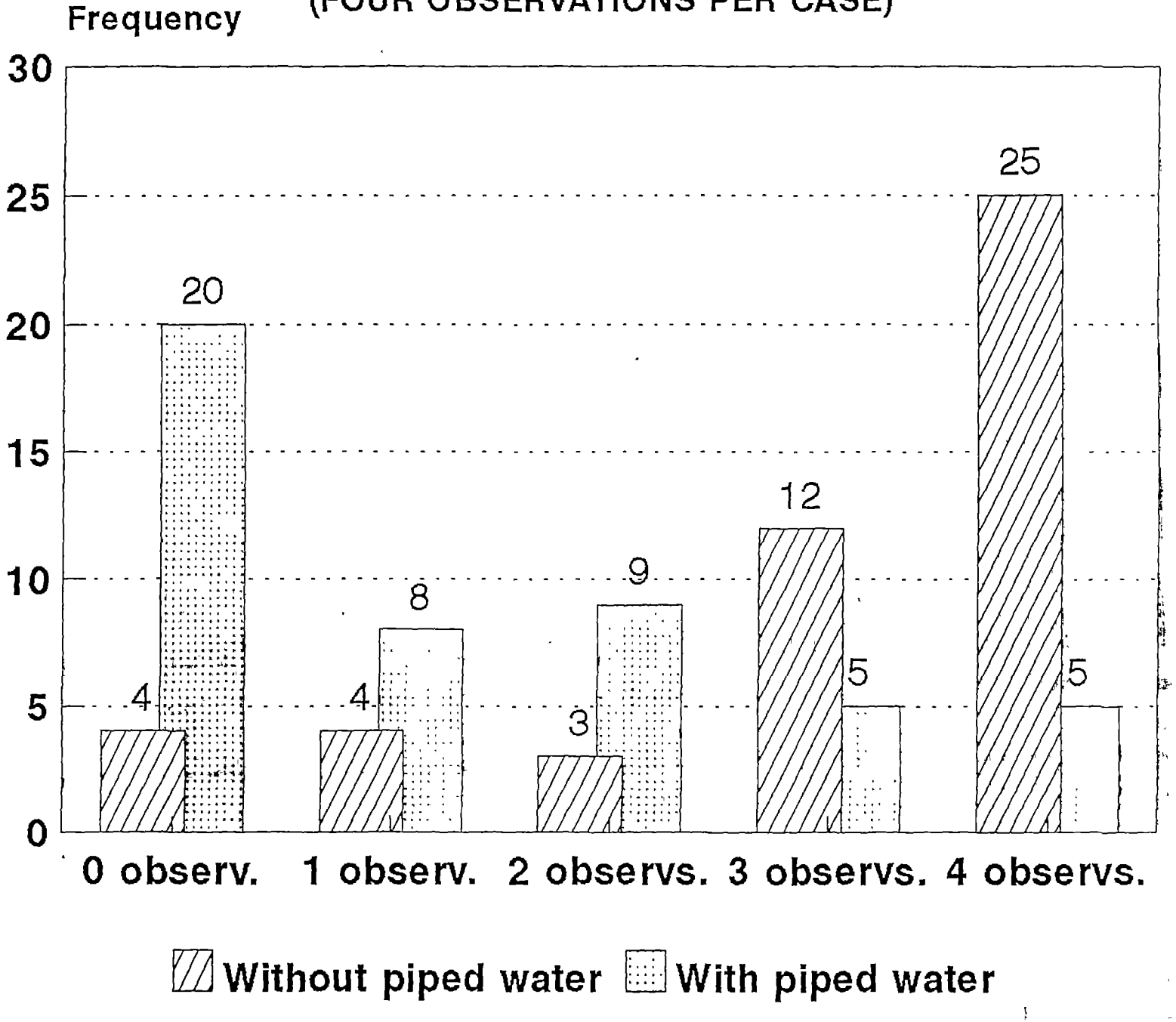
FIGURES

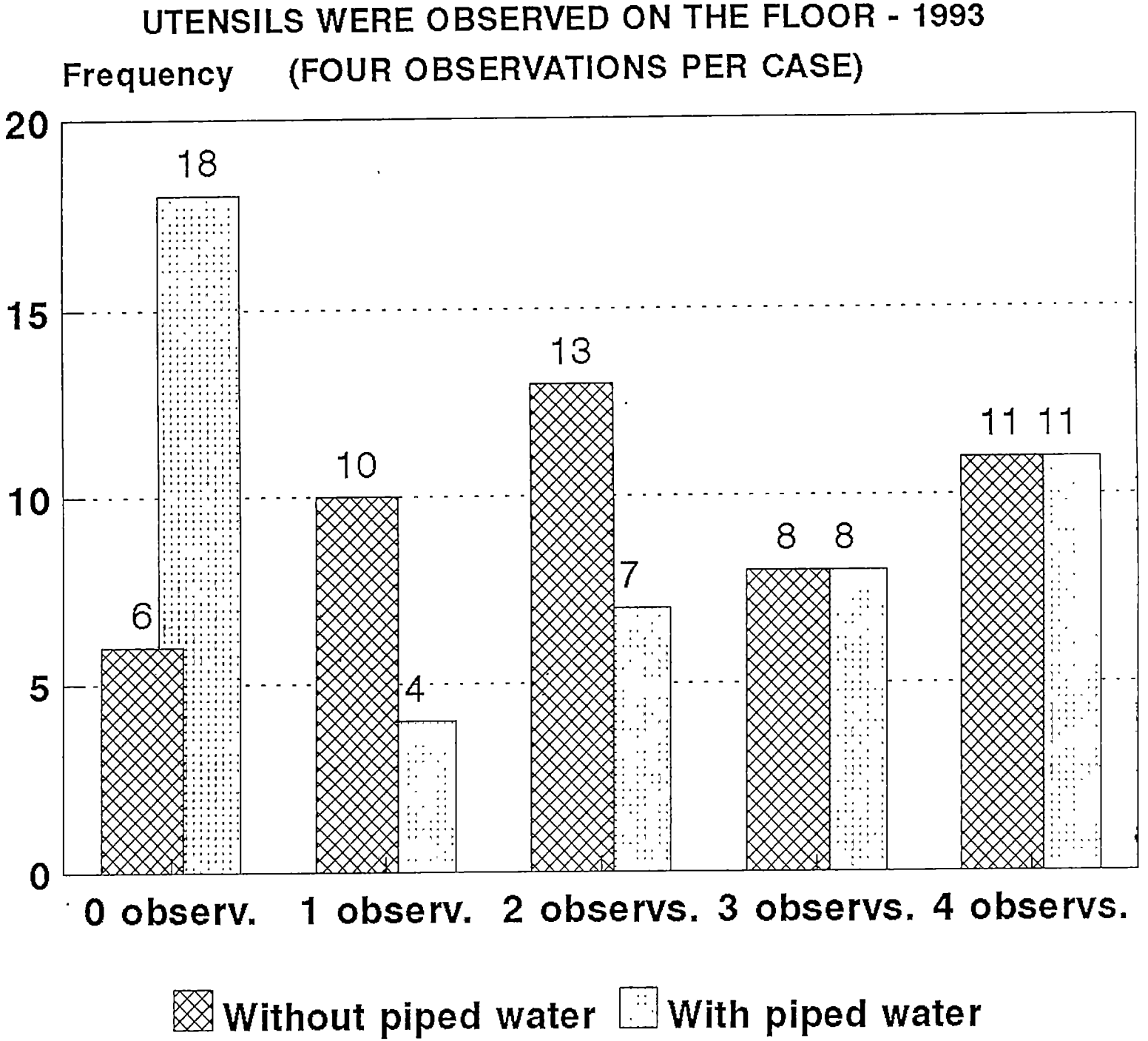

OUTSIDE - 1993
(FOUR OBSERVATIONS PER CASE)
Frequency
25
20
15
10
5
0
24
16
13
5
4
3
4
3
3
21
0 observ.
1 observ.
2 observs.
3 observs.
4 observs.
Without piped water
With piped water

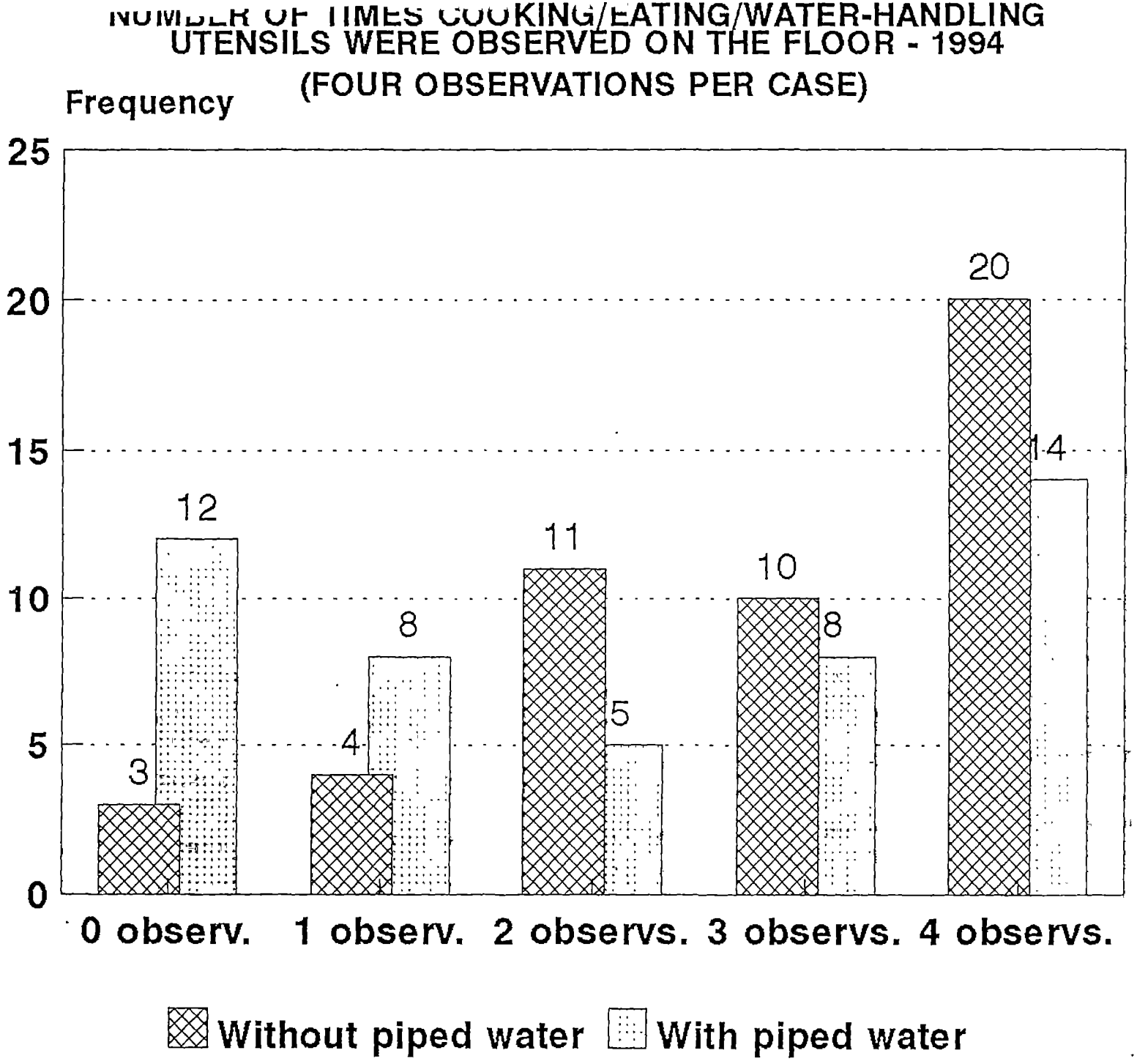

NUMBER OF TIMES WATER VESSELS WERE OBSERVED OUTSIDE - 1994
(FOUR OBSERVATIONS PER CASE)
Frequency
25
20
15
10
5
0
23
15
9
2
4
4
5
11
7
15
0 observ.
1 observ.
2 observs.
3 observs.
4 observs.
Without piped water
With piped water


INSIDE THE HOUSE - 1993
(FOUR OBSERVATIONS PER CASE)
Frequency
30
25
20
15
10
5
0
28
5
6
5
7
5
12
6
18
4
0 observ.
1 observ.
2 observs.
3 observs.
4 observs.
Without piped water
With piped water

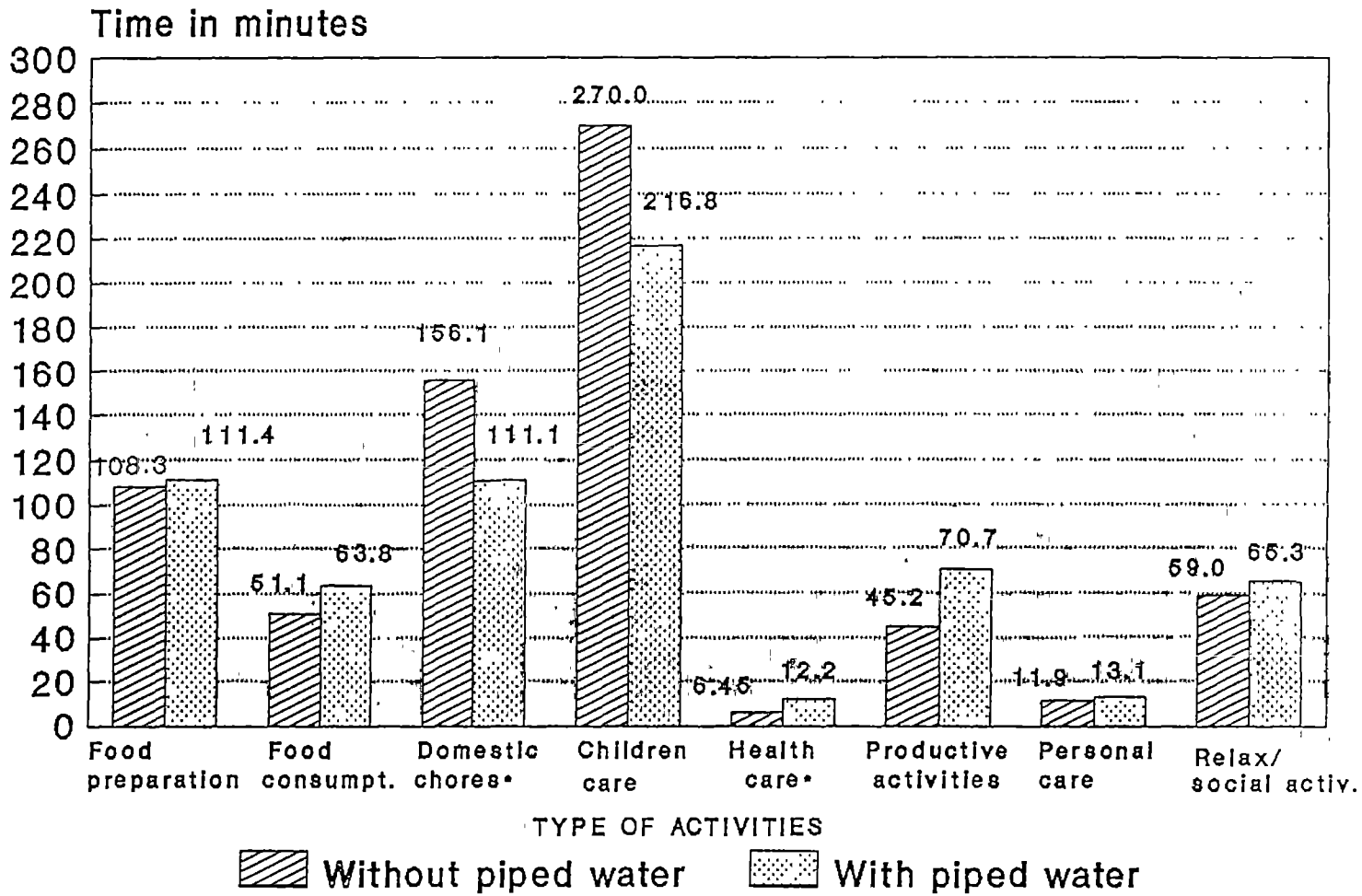
NUMBER OF TIMES WATER VESSELS WERE OBSERVED
INSIDE THE HOUSE - 1994
(FOUR OBSERVATIONS PER CASE)




UTENSILS WERE OBSERVED ON THE FLOOR - 1993
Frequency (FOUR OBSERVATIONS PER CASE)
20
15
10
5
0
18
6
10
4
13
7
8
8
11
11
0 observ.
1 observ.
2 observs.
3 observs.
4 observs.
Without piped water
With piped water

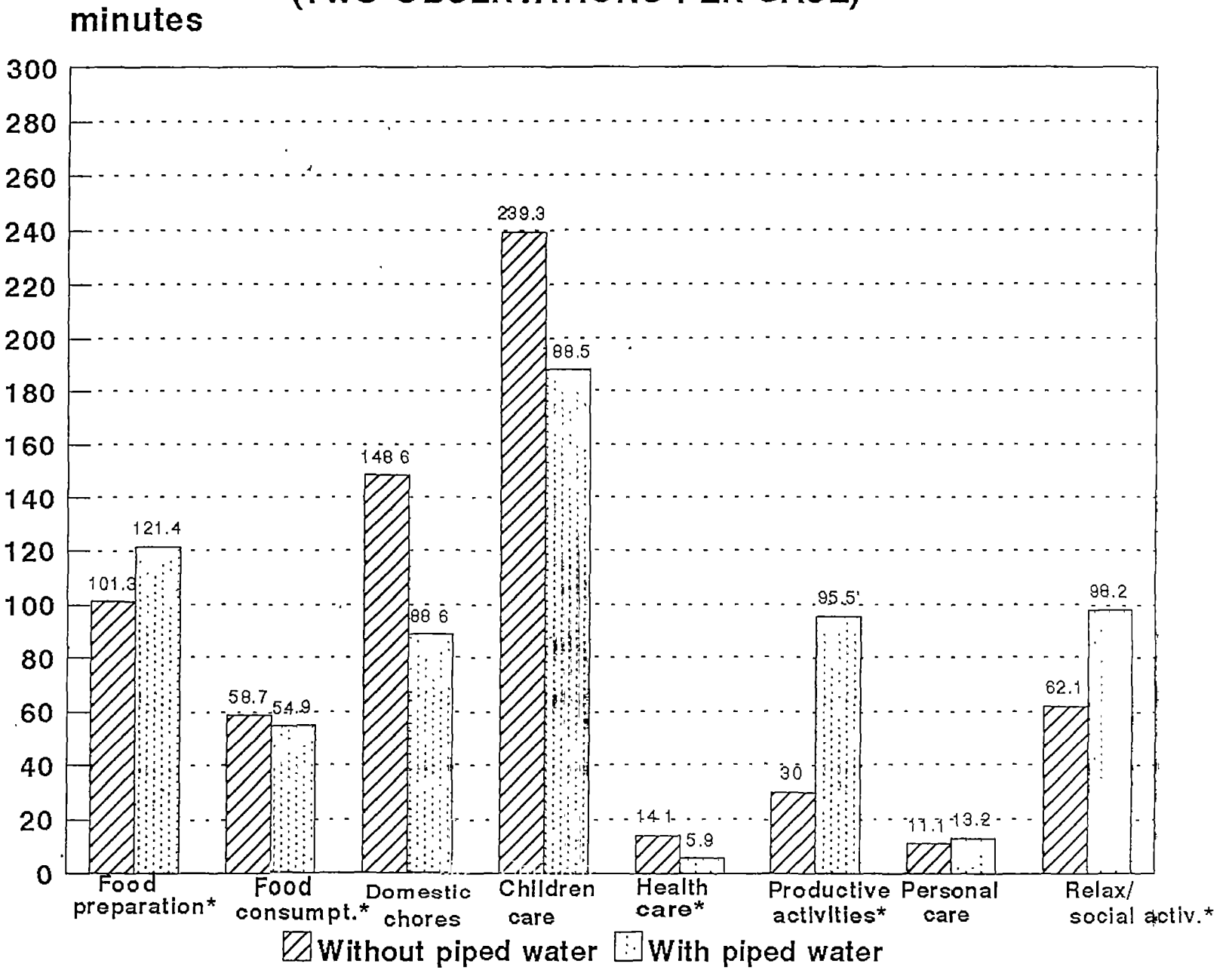

NUMBER OF TIMES COOKING/EATING/WATER-HANDLING UTENSILS WERE OBSERVED ON THE FLOOR - 1994
(FOUR OBSERVATIONS PER CASE)
Frequency
25
20
15
10
5
0
3
12
4
8
11
5
10
8
20
14
0 observ.
1 observ.
2 observs.
3 observs.
4 observs.
Without piped water
With piped water

MEAN TIME DEVOTED TO DIFFERENT ACTIVITIES - 1993 (TWO OBSERVATIONS PER CASE)



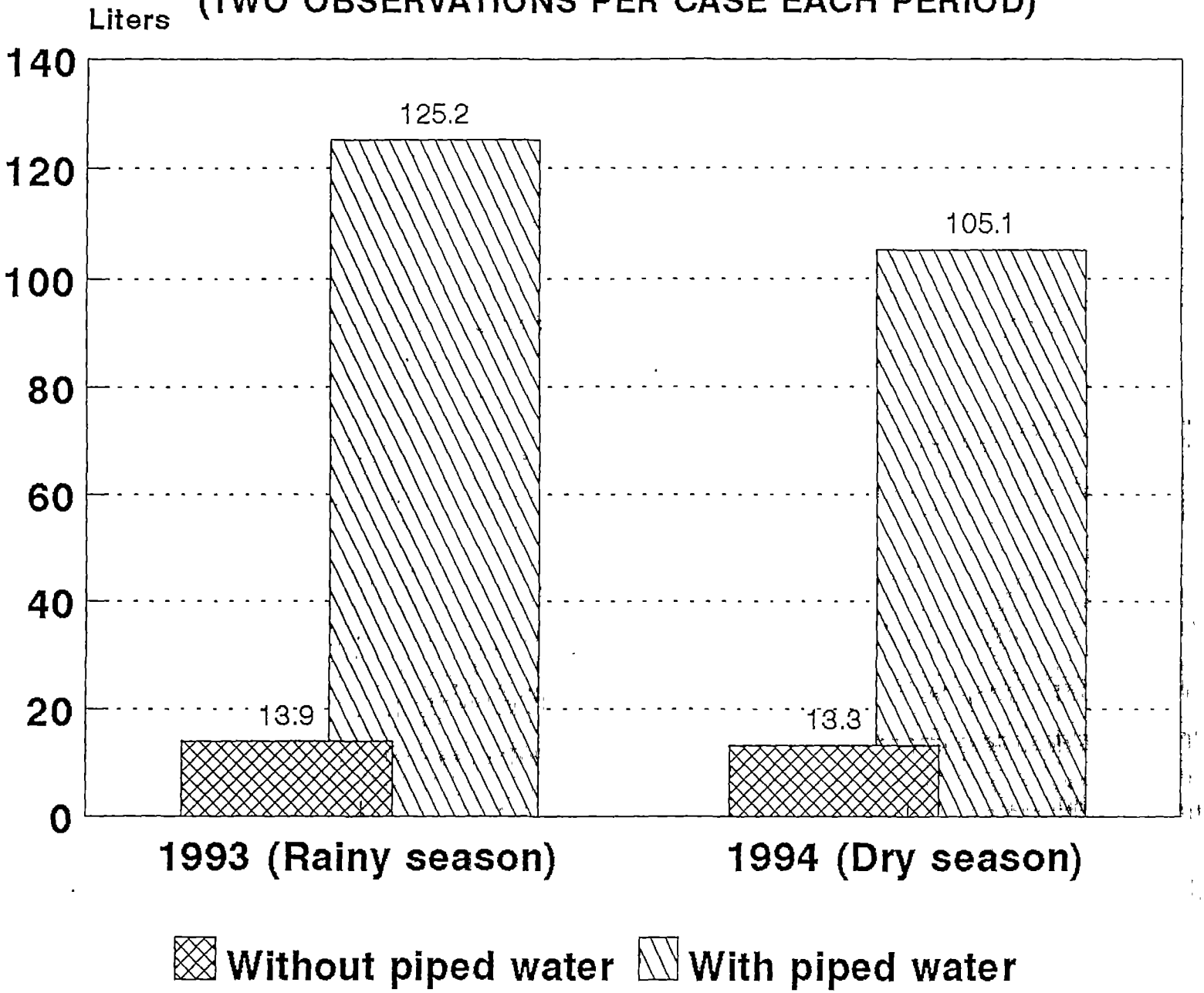
* P<.05

MEAN TIME DEVOTED TO DIFFERENT ACTIVITIES - 1994
(TWO OBSERVATIONS PER CASE)

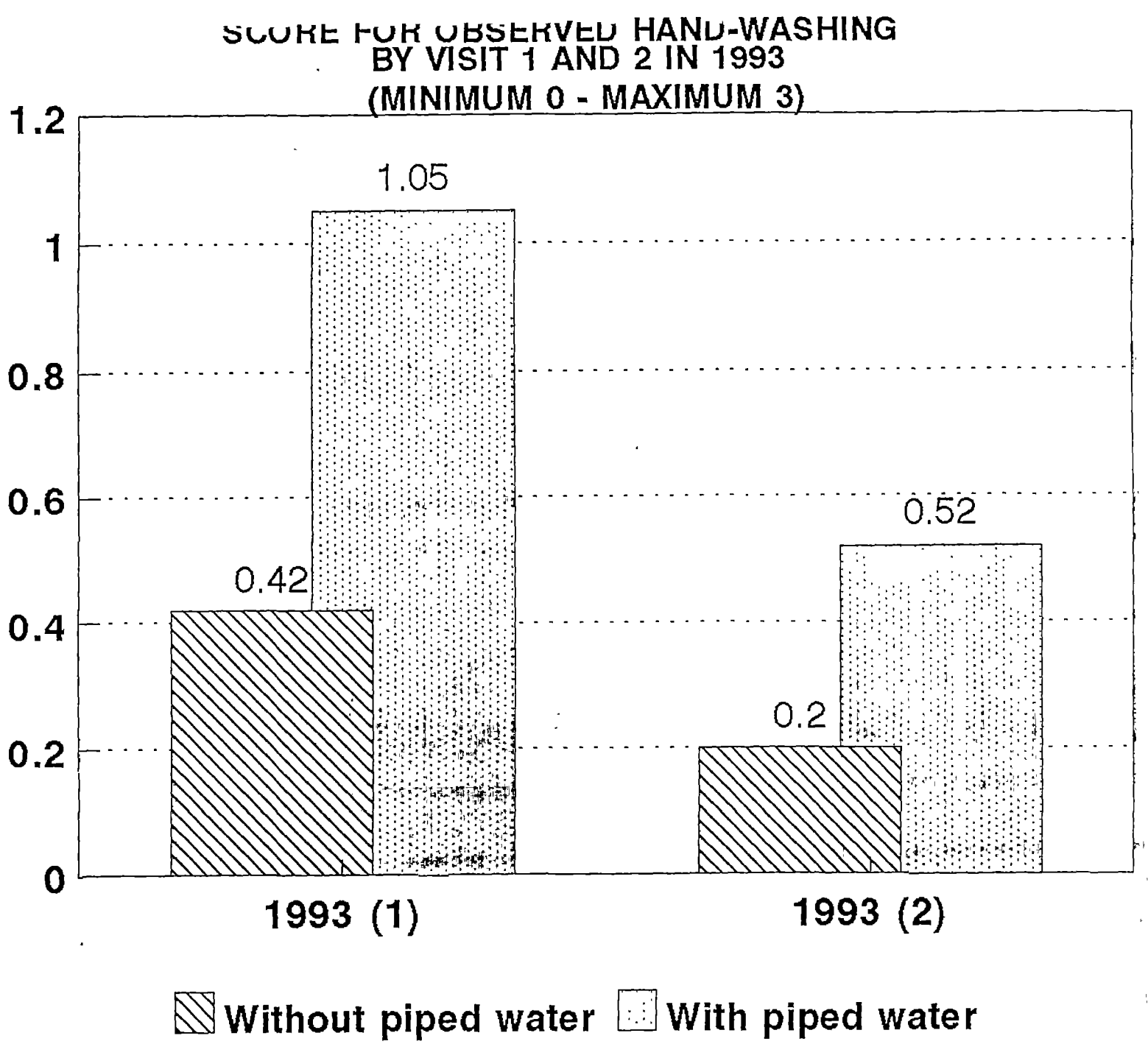


* P<.05

PER TYPE OF COMMUNITY AND STUDY PERIOD
(TWO OBSERVATIONS PER CASE EACH PERIOD)



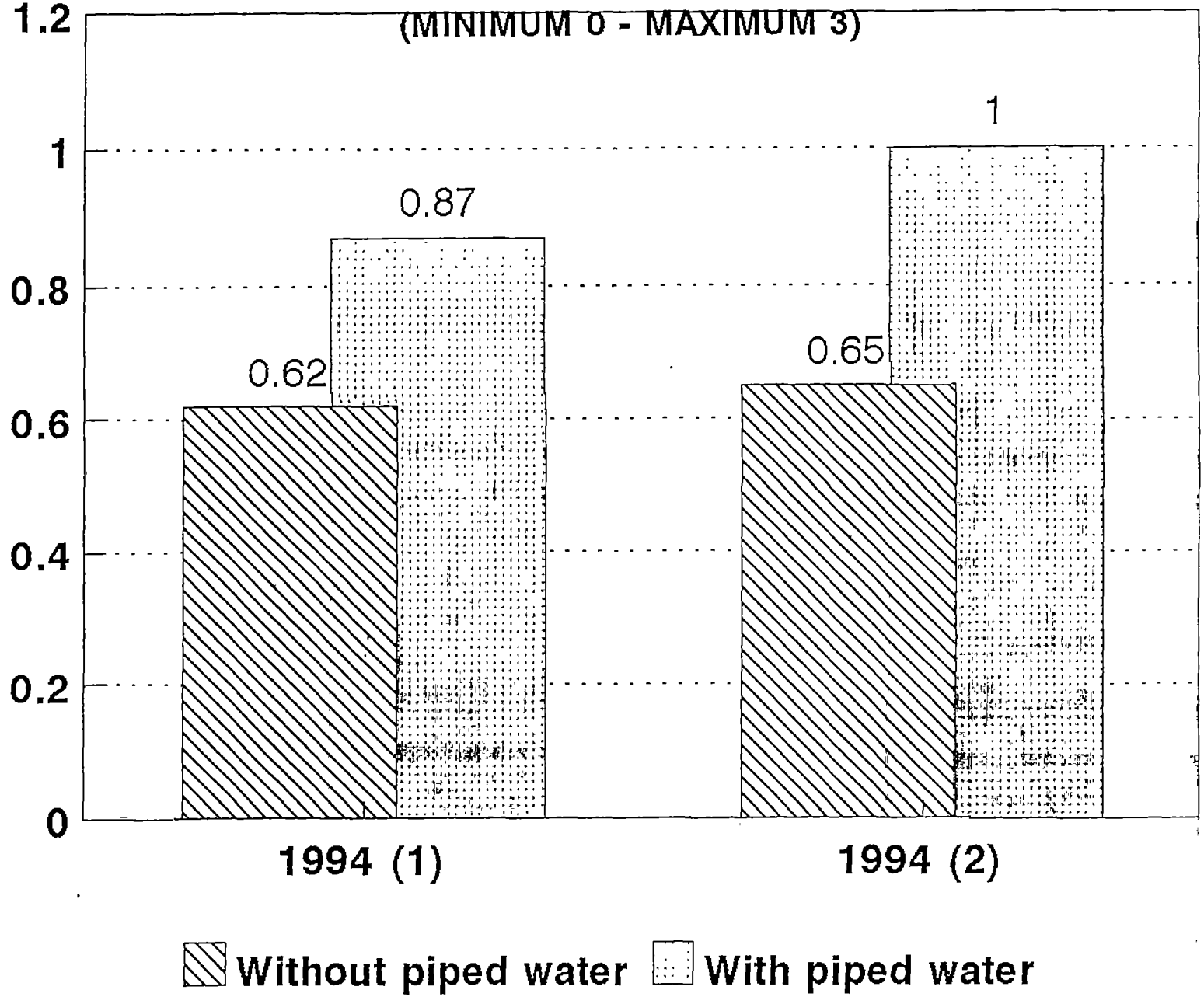
T score significative difference P<.001



Significative difference P<.005, P<.05

BY VISIT 1 AND 2 IN 1994

(MINIMUM 0 - MAXIMUM 3)



Significative difference P<.005, P<.001

PROYECTO DE IMPACTO DE LOS PROYECTOS DE AGUA EN COMUNIDADES RURALES

OBSERVACION DE ACTIVIDADES MATERNAS

Nombre: _____

PA-3 Municipio__, Comunidad__, No. de Familia __ __ No. de Sujeto __ __ No. de Visita __ Fecha __/__/__
1-3 4 5 6 7 8 9 10 11 12 13 14 15 16

Observadora __ Hora inicio __ __:__ __ Hora termino __ __: __ __
17 18 19 20 21 22 23 24 25

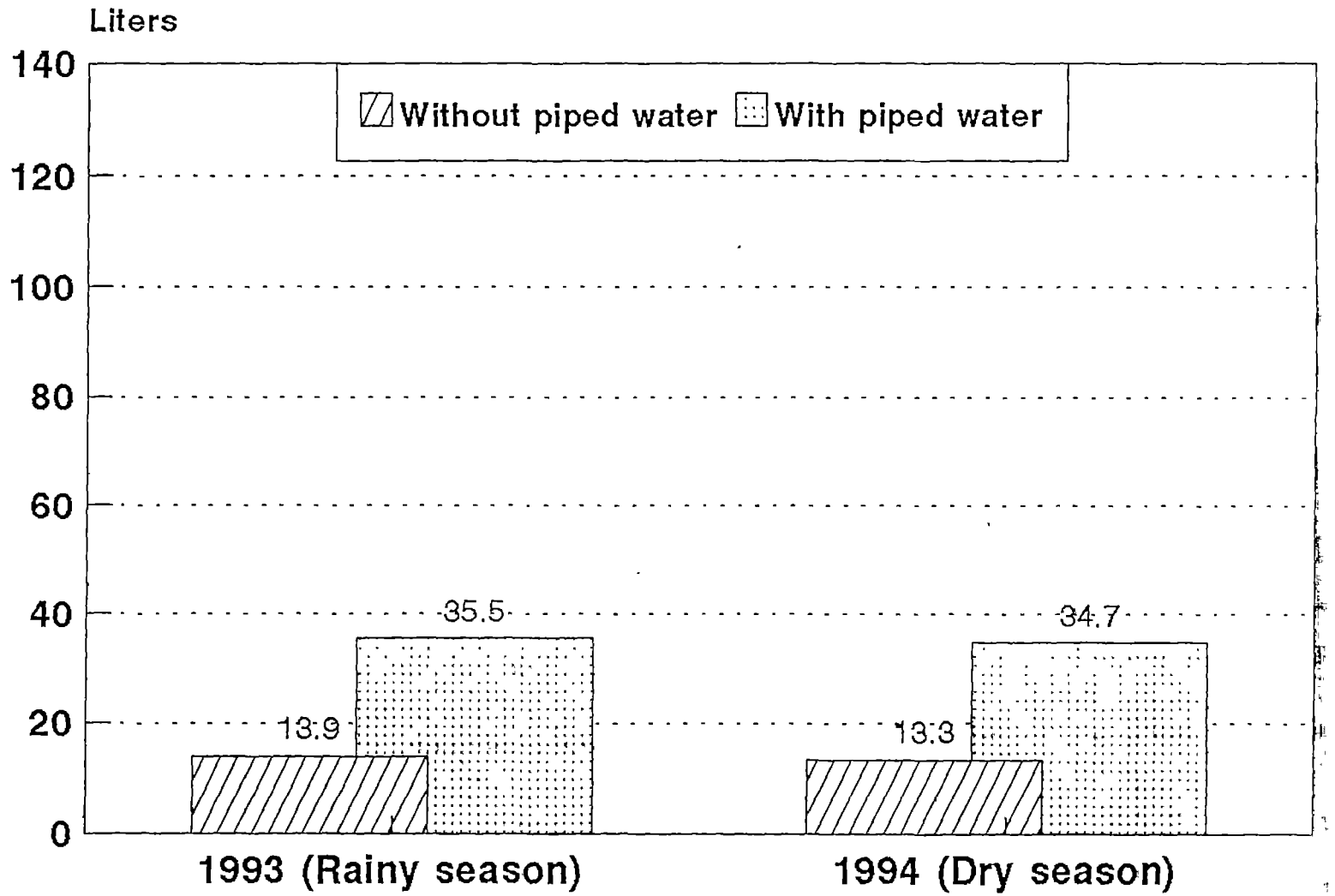
INTER-VALO 26-27	LUGAR 28	POSI-CION 29	ACTIVIDADES DE LA MADRE (Descripción)	CODIGO 30-32	CODIGO 33-35	CODIGO 36-38	Quién cuida al niño 39	Control de acarreo de agua (309)

Códigos:

LUGAR	POSICION DE LA MADRE	CUIDA AL NIÑO
1=Casa 2=patio	1=acostada 2=sentada/hincada/cuclillas	0=nadie 1=madre

MEAN CONSUMPTION OF WATER PER FAMILY EXCLUDING WASHING CLOTHES

(Two observations/case/period)



t-test= p<.001

CALCULATION OF ENERGY EXPENDITURE FROM MINUTE-BY-MINUTE HEART RATE

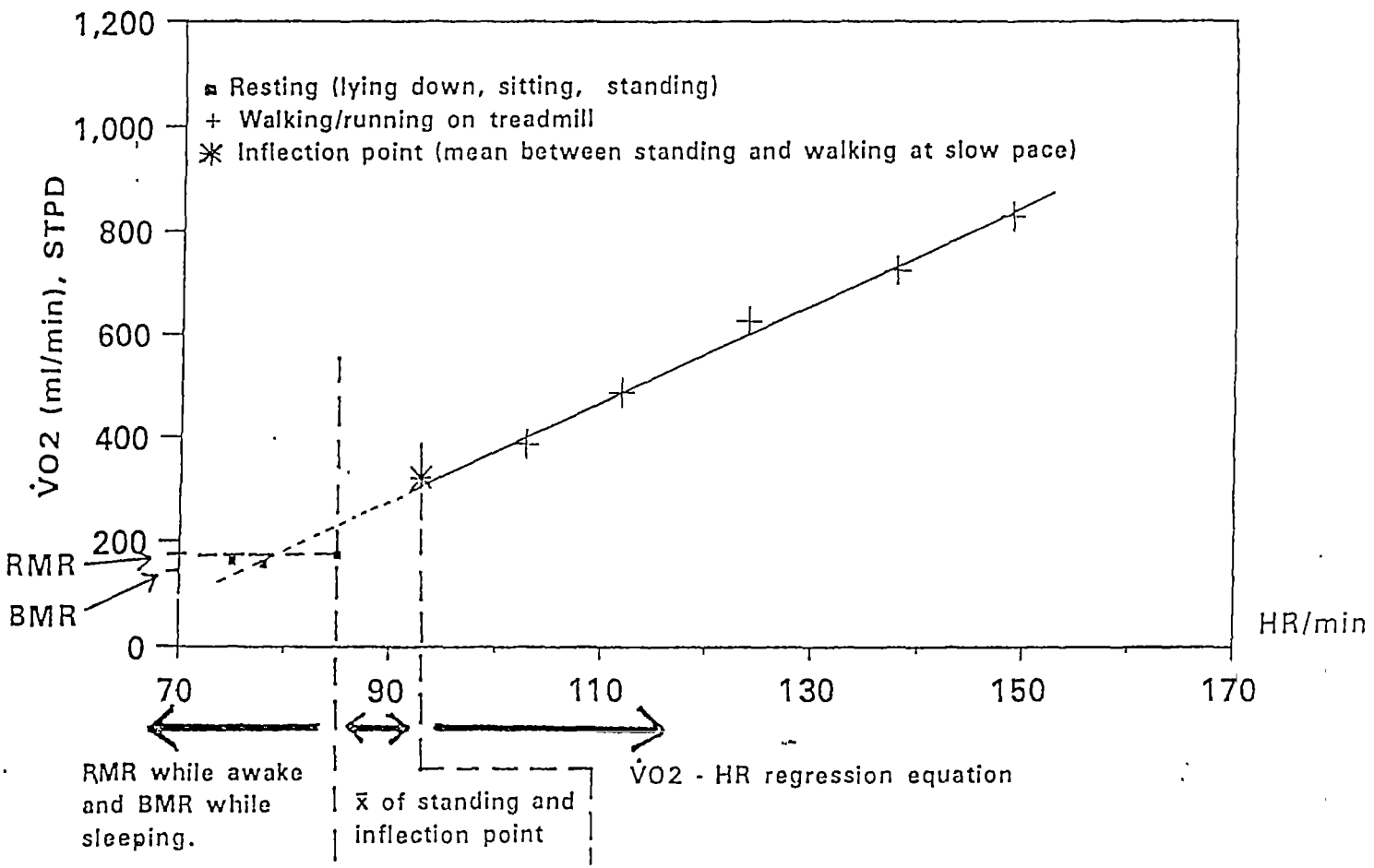


FIGURE 14

Percentage of nutrients supplied by maize and beans

Mothers - Dry Season

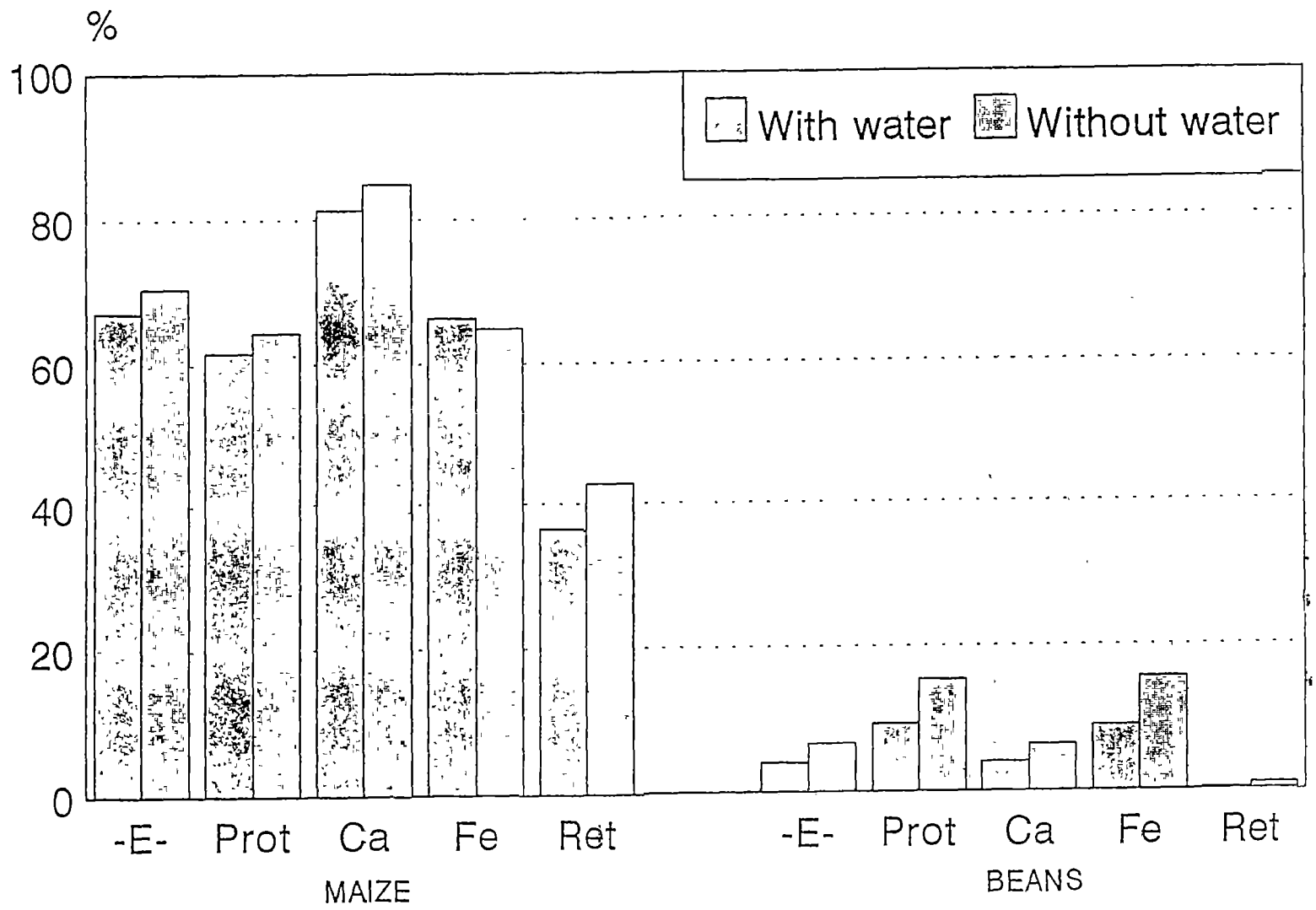


FIGURE 15

Main food sources of ENERGY in the diet of the mothers

Dry Season

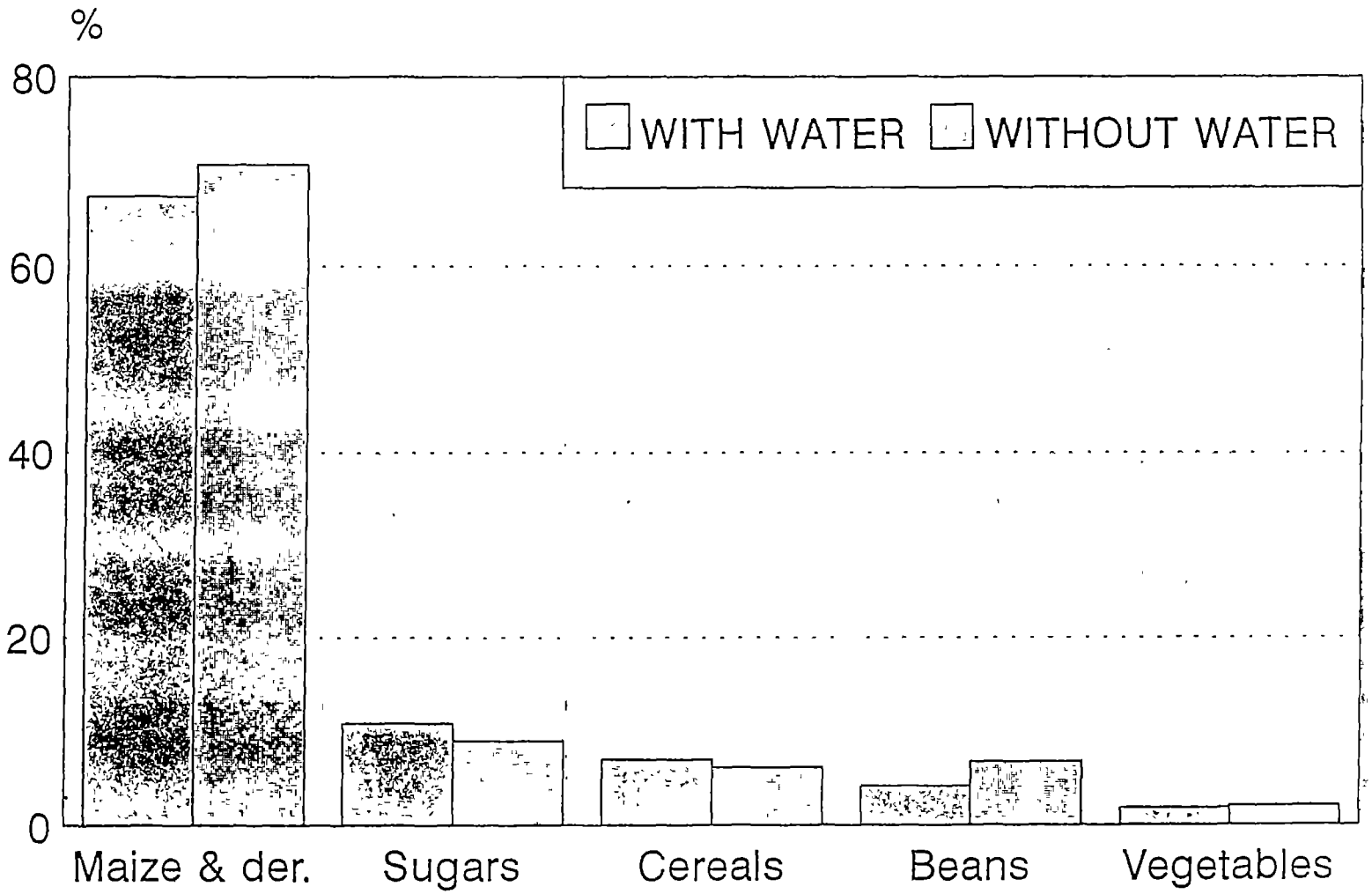


FIGURE 16

Main food sources of PROTEIN in the mothers diet

Dry Season

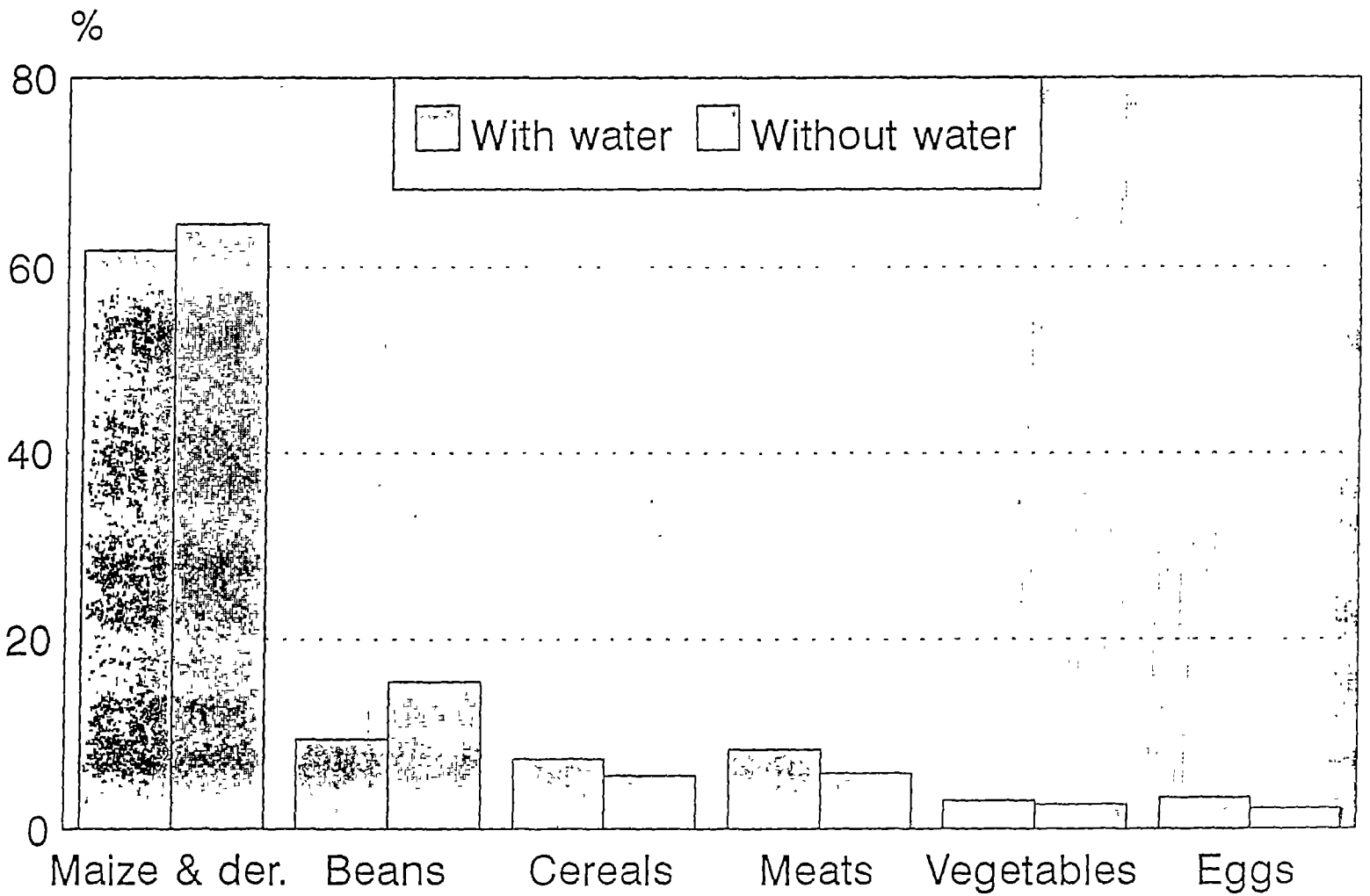
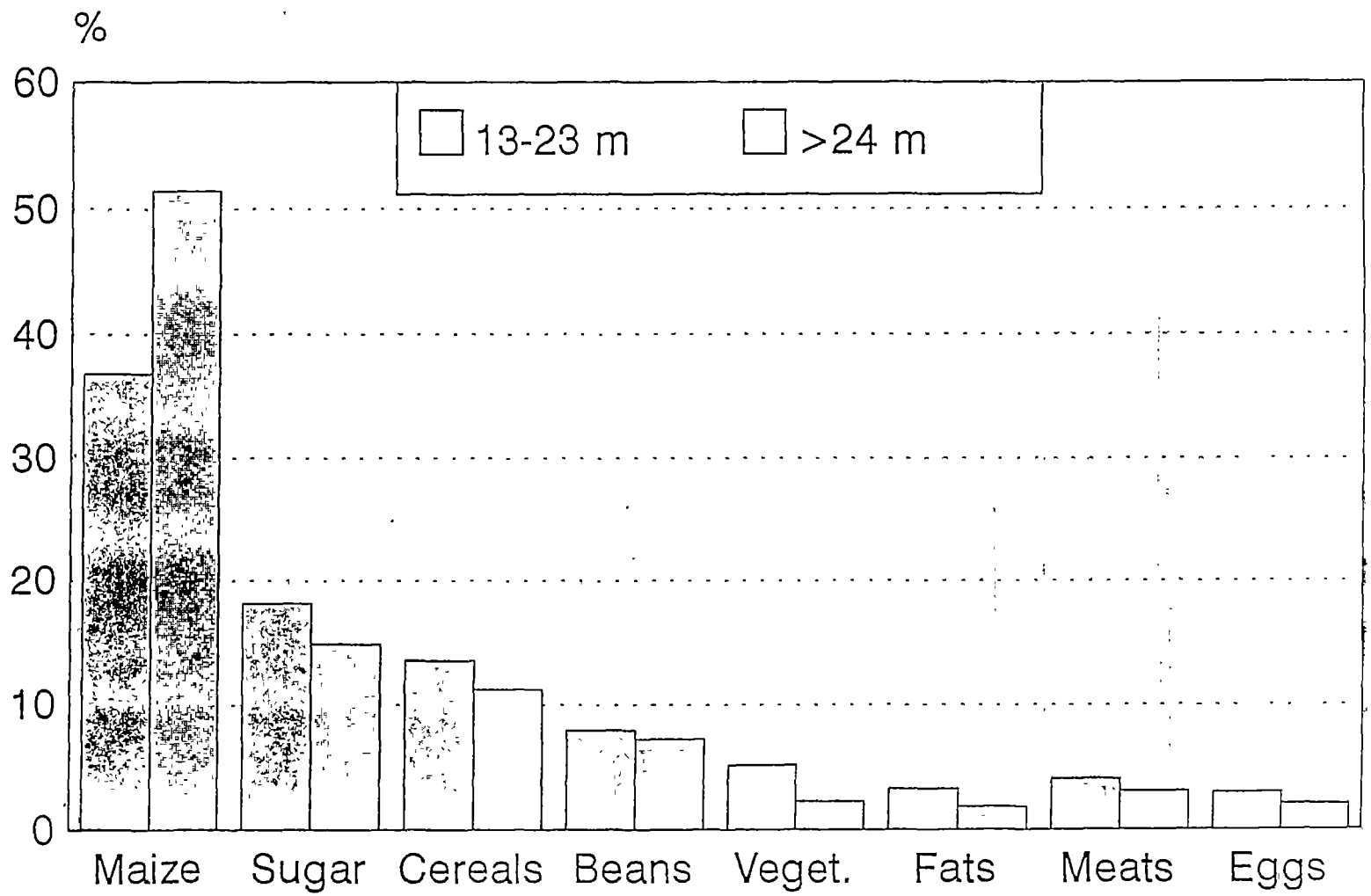


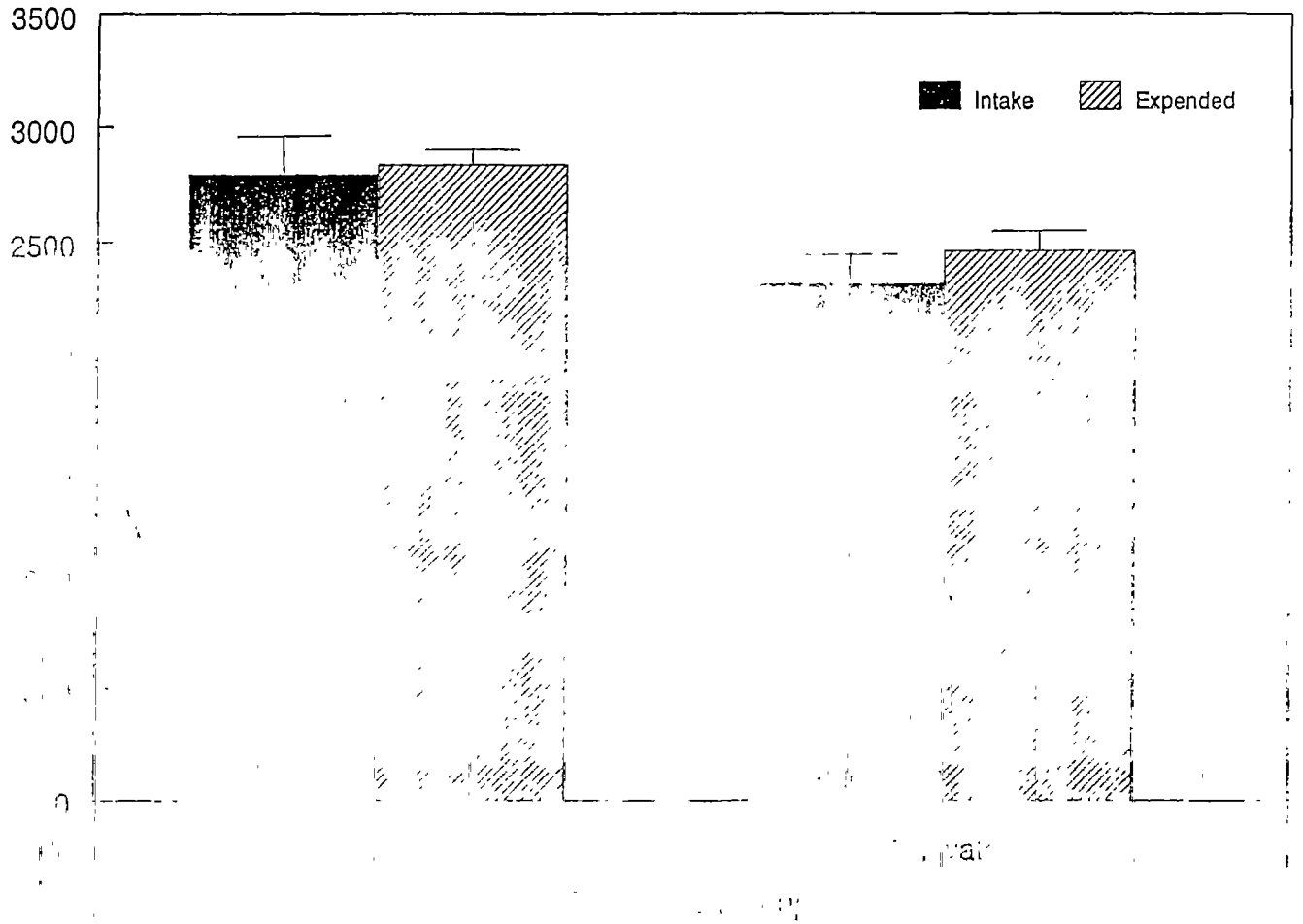
FIGURE 17

Main food sources of ENERGY in the diet of children

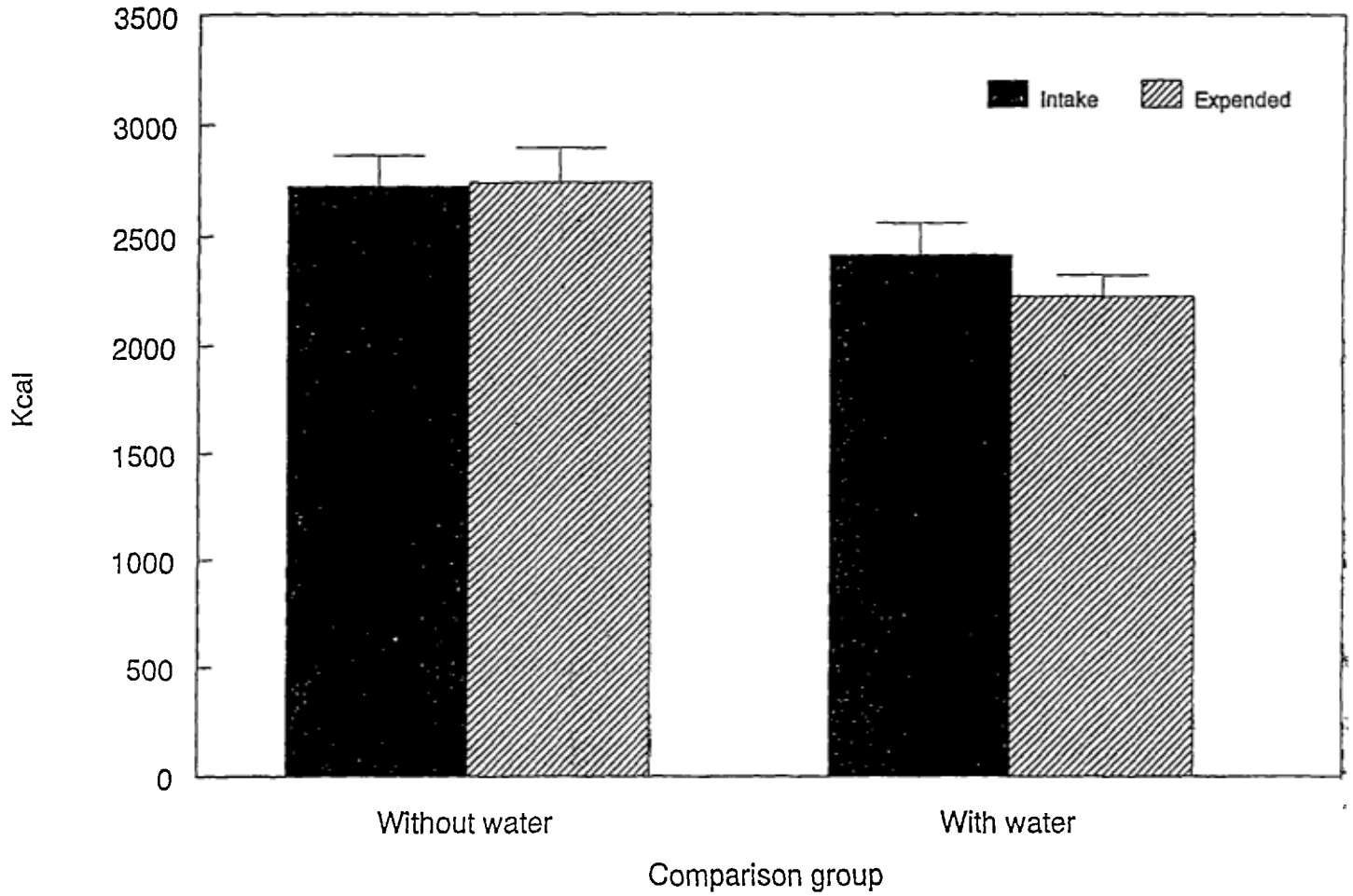
Dry Season



Energy intake and expenditure of rural Guatemalan women with and without an improved water supply, dry season ('94)



Energy intake and expenditure of rural Guatemalan women with and without an improved water supply, wet season ('93)



APPENDICES

Appendix 1. DATA COLLECTION INSTRUMENTS

PA-5
I-3

PROYECTO: Impacto de Proyectos de Agua en Comunidades Rurales   1. CONSUMO DE ALIMENTOS

No. de Municipio: ___ (4)   No. de Comunidad: ___ (5)   Fecha: ___ ___ / ___ ___ / ___ ___ (6 7 / 8 9 / 10 11)   No. de familia: ___ ___ (12 13)   No. de sujeto: ___ ___ (14 15)   No. de visita: ___ (16)

I. Nombre de las preparaciones	2. Alimentos usados				5. Consumo de la familia										10	
	3. Código (oficina)			4. Nombre, tipo color, precio	6. Cantidad: Peso, unidades, volumen, medida, precio			No de raciones	8. Conversión a gramos ~~brutos~~ (oficina)	9. Gramos ~~brutos~~ (oficina)					11. Cantidad: volumen,	
	17	18	19		Preparado	No consumido	Consumido	7.		20	21	22	23	24	Servida	De c so

No. de visita: ______

10. CONSUMO MADRE								14. Consumo del niño							
11. Cantidad: Peso, unidades, volumen, raciones			12 Conversión a gramos brutos (oficina)	13. Gramos brutos (oficina)				15 Cantidad: Peso, unidades, volumen, raciones			16. Conversión a gramos brutos (oficina)	17 Gramos brutos (oficina)			
Servida	Desperdicio o sobras	Consumido		25	26	27	28	Servida	Desperdicio o sobras	Consumido		29	30	31	32

PROYECTO: IMPACTO DE PROYECTOS DE AGUA EN COMUNIDADES RURALES.
CARACTERISTICAS DE LAS PERSONAS QUE VIVEN EN LA CASA Y COMEN JUNTAS.

PA-4
I-3

NO. DE MUNICIPIO ___ (4) NO. DE COMUNIDAD ___ (5) FECHA: ___/___/___ (6 7 8 9 10 11) NO. DE FAMILIA ___ ___ (12 13) NO. DE SUJETO ___ ___ (14 15) NO. DE VISITA: ___ (16)

¿CUANTAS PERSONAS VIVEN EN ESTA CASA Y COMEN DE LA MISMA COMIDA? ___ ___ (17 18)

1. No. orden 19-20	2. Nombre de las personas que viven en la casa	3. Parentesco o relación con el/la Jefe	Código 21-22	4. Edad Años 23-24	Meses 25-26	5. Sexo y estado fisiológico	Cód. 27	6. Escolaridad	Cód. 23	7 Ocupación	Código 29-30	QUIENES CO... 1a. Dieta De.	Al.	Cena	Cód. 31	2... De.	A...

PROYECTO DE IMPACTO SOCIAL DE AGUA
OBSERVACION INSTANTANEA

FORMULARIO PA-2 (1-3) MUNICIPIO ___ (4) COMUNIDAD ___ (5) FECHA __/__/__ (6-11)

FAMILIA ___ (12-13) OBSERVADORA ___ (14) NO. DE OBSERVACIÓN: ___ (15-16)

NOMBRE DE LA MADRE _____

AL NOMAS LLEGAR A/ ANTES DE SALIR DE LA CASA OBSERVE: 0.NO 1.SI 2.NO SE OBSERVO 3.NO HAY

MADRE

Tiene la madre manos sucias (17) _____

NIÑO INDICE

Tiene el niño las manos sucias (18) _____
Tiene el niño pañal sucio con.heces (19) _____

AGUA

Hay en el patio recipientes con agua, destapados (20) _____
Hay adentro de la casa recipientes con agua, destapados (21) _____

TRASTOS

Hay algún trasto en el suelo (22) _____
Hay alguna pacha en el suelo (23) _____
Hay algún juguete en el suelo (24) _____

PAÑALES

Hay algún "pañal" sucio en el suelo (25) _____
Hay algun"pañal" sucio en la pila o lavadero (26) _____

EXCRETAS

Hay heces en el suelo de casa o patio de la casa (27) _____

BASURA

Hay basura en el suelo del patio de la casa (28) _____
Hay basura en el suelo adentro de la casa (29) _____

ANIMALES

Hay animales sueltos en el patio de la casa (30) _____
Hay animales sueltos adentro de la casa (31) _____

LETRINA

La letrina está sin paredes (32) _____
La letrina está sin techo (33) _____
La letrina está sin puerta (34) _____
La puerta de la letrina está abierta (35) _____
La taza de la letrina está destapada (36) _____
La letrina esta sucia (37) _____
La letrina está sin uso (38) _____
La letrina tiene fuerte mal olor (39) _____

CHORRO

El chorro gotea (40) _____
El chorro está sin agua (41) _____
El agua sucia está acumulada (42) _____

2. PESO DE ALIMENTOS
ENCUESTA DIETETICA

Proyecto:
IMPACTO DE PROYECTOS DE AGUA EN COMUNIDADES RURALES

Nombre de la familia:____________________

No. de Familia:____________________

Código — — —	Nombre de Alimento	Unidad de medida	Unidades pesadas (No.)	Peso total (gramos) — — — . —	Peso Promedio (gramos) — — — . —

PROYECTO: IMPACTO DE PROYECTOS DE AGUA EN COMUNIDADES RURALES
OBSERVACION DE LAVADO DE MANOS

PA-8 (1-3) No. de Municipio:___ (4) No. de Comunidad:___ (5), Fecha __ __/__ __/__ __ (6 7 8 9 10 11)
No. de Familia __ __ (12 13) Observadora ___ (14) No de observación : ___ (15)
Nombre de la madre:_____

PARA CADA OBSERVACION DE LAVADO DE MANOS DE LA MADRE, LLENAR LO SIGUIENTE:

	Codigo
LAVADO DE MANOS 1	
EL LAVADO DE MANOS OCURRIO:	_____
1.- Antes de comer	
2.- Antes de cocinar	
3.- Antes de dar de mamar	
4.- Después de usar la letrina	
5.- Después de cambiar pañal	
6.- Después de tocar:_____	
7.- Otra:_____	
PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA	
Usa agua que cae	_____
Usa jabón	_____
Se seca con toalla/ trapo limpio	_____
Se seca al aire	_____
LAVADO DE MANOS 2	
EL LAVADO DE MANOS OCURRIO:	_____
1.- Antes de comer	
2.- Antes de cocinar	
3.- Antes de dar de mamar	
4.- Después de usar la letrina	
5.- Después de cambiar pañal	
6.- Después de tocar:_____	
7.- Otra:_____	
PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA	
Usa agua que cae	_____
Usa jabón	_____
Se seca con toalla/ trapo limpio	_____
Se seca al aire	_____

LAVADO DE MANOS 3

Codigo

EL LAVADO DE MANOS OCURRIO: _____

1.- Antes de comer
2.- Antes de cocinar
3.- Antes de dar de mamar
4.- Después de usar la letrina
5.- Despues de cambiar pañal
6.- Otra:_____

PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA

Usa agua que cae _____
Usa jabón _____
Se seca con toalla/ trapo limpio _____
Se seca al aire _____

LAVADO DE MANOS 4

EL LAVADO DE MANOS OCURRIO: _____

1.- Antes de comer
2.- Antes de cocinar
3.- Antes de dar de mamar
4.- Después de usar la letrina
5.- Después de cambiar pañal
6.- Otra:_____

PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA

Usa agua que cae _____
Usa jabón _____
Se seca con toalla/ trapo limpio _____
Se seca al aire _____

LAVADO DE MANOS 5

EL LAVADO DE MANOS OCURRIO: _____

1.- Antes de comer
2.- Antes de cocinar
3.- Antes de dar de mamar
4.- Después de usar la letrina
5.- Después de cambiar pañal
6.- Otra:_____

PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA

Usa agua que cae _____
Usa jabón _____
Se seca con toalla/ trapo limpio _____
Se seca al aire _____

LAVADO DE MANOS 6	Codigo
EL LAVADO DE MANOS OCURRIO: 1.- Antes de comer 2.- Antes de cocinar 3.- Antes de dar de mamar 4.- Después de usar la letrina 5.- Después de cambiar pañal 6.- Otra:_____	_____
PRACTICA DE LAVADO DE MANOS: 0 = NO 1 = SI 9 = NO APLICA Usa agua que cae Usa jabón Se seca con toalla/ trapo limpio Se seca al aire	_____ _____ _____ _____

No. DE VECES QUE LA MADRE SE MOJA LAS MANOS PARA LAVARSELAS	Codigo
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____
6._____	_____
7._____	_____
8._____	_____
9._____	_____
10._____	_____
Durante la visita hubo agua en el chorro todo el tiempo ? 0 = NO 1 = SI 9 = NO Aplica	_____
(NO) Cuánto tiempo falto agua ? HORAS/ MINUTOS	__/__ __

:OYECTO: IMPACTO DE PROYECTOS DE AGUA EN COMUNIDADES RURALES
:SERVACION DE LAS CONDICIONES DE LA VIVIENDA

~~A-7~~ No. de Municipio:___ No. de Comunidad:___, Fecha __/__/__
-3 4 5 6 7 8 9 10 11

o. de Familia __ __ Observadora ___ No. de observación: ____
12 13 14 15

OBSERVACION DIRECTA		Codigo
1.- Cuantos cuartos hay en la casa ?	16	_____
2.- Tiene luz eléctrica en la casa ? 0 = NO 1 = SI	17	_____
3.- Tienen cocina separada ? 0 = NO 1 = SI	18	_____
4.- Cúal es la forma de cocinar ?	19	_____
1.- En el suelo		
2.- En fogón alto		
3.- En poyo, estufa chefina/lorena		
4.- En Plancha		
5.- En estufa de gas		
6.- Otra:_____		
5.- El techo está hecho de ?	20	_____
1.- Paja o palma		
2.- Teja		
3.- Lamina		
4.- Madera		
5.- Terraza		
6.- Otro:_____		
.- El piso es de?	21	_____
1.- Tierra		
2.- Cemento		
3.- Madera		
4.- Ladrillo/barro		
5.- Mosaico		
6.- Otro:_____		
.- La pared está hecha de?	22	_____
1.- Caña		
2.- Bajareque		
3.- Adobe		
4.- Madera		
5.- Block/ladrillo		
6.- Otro:_____		
- ENSERES: 0 = NO tiene		
1. Bicicleta/ 2. Moto/ 3. Carro/ 4. Dos o más	23	_____
1. Coches/ 2.Mula/ 3.Caballo/4.Toro o vaca/5. Dos o más	24	_____
1. Cabra/ 2. Oveja/ 3. Ambos	25	_____
0 = NO 1 = SI		
Gallinas_____(26) Television_____(27) Radio_____(28)		
Grabadora___(29) Mesa___(30) Cama___(31) Ropero___(32)		

PROYECTO: IMPACTO DE PROYECTOS DE AGUA EN COMUNIDADES RURALES
ENTREVISTAS A MADRES

PA-6 (1-3) No. de Municipio:___ (4) No. de Comunidad:___, (5) Fecha __ __/__ __/__ __ (6 7 8 9 10 11)
No. de Familia __ __ (12 13) Observadora ___ (14) Entrevistada:_____

A. DATOS DE LA FAMILIA (CONTINUACION DEL CENSO)	Codigo
1.- De qué religión es usted ? 0 = Ninguna 1 = Católica 2 = Evangélica 3 = Otra:_____	_____
2.- Qué idioma hablan más en casa ? 1 = Quiché 2 = Español	_____
3.- Qué otro idioma hablan ? 1 = Quiché 2 = Español 3 = Ambos	_____
B.- CONOCIMIENTOS Y PRACTICAS EN SALUD	
1.- Porqué cree usted que le dan asientos a los niños ? 0 = No menciona 1 = Si menciona	
* Madre tiene manos sucias	_____
* Niño toma agua sucia	_____
* Niño come alimentos sucios/pasados/mal cocidos/sin lavar	_____
* Niño come en trastos sucios	_____
* Ninó se mete a la boca cosas sucias	_____
* Niño se mete a la boca las manos sucias	_____
* Falta de higiene/ aseo en el niño	_____
* Falta de higiene/ aseo en el hogar	_____
* Otra:_____	_____
* No sabe	_____
2.- Hay alguna forma para evitar que a sus niños les de asiento muy seguido ? 0 = No 1 = Si	_____

3.-(SI) Cuales ? Qué puede hacer en su casa ?, Si tuviera dinero que podria hacer ?

0 = NO menciona 1 = SI menciona

* Lavarse bien las manos / madre _____
* Lavar las manos del niño _____
* Hervir el agua para tomar _____
* Lavar bien los trastos _____
* Lavar bien los alimentos _____
* Cocer bien los alimentos _____
* Tapar la comida _____
* Tapar el agua para tomar _____
* No comer alimentos descompuestos _____
* Mantener los animales encerrados/afuera _____
* Disponer de la basura adecuadamente _____
* Otra:_____ _____

4.- Cuando tiene una madre que lavarse las manos ?

0 = NO menciona 1 = SI menciona

* Antes de comer _____
* Antes de cocinar _____
* Antes de dar de mamar _____
* Después de usar la letrina _____
* Después de cambiar pañales _____
* Otra:_____ _____
* No sabe _____

5.- Conoce esto (mostrar sobre de rehidratación oral)

0 = NO 1 = SI _____

6.- (SI) para qué sirve:_____

0 = Incorrecta 1 = Parcialmente correcta 2 = correcta _____

7.-Alguna vez los ha usado ?

0 = NO 1 = SI _____

8.-(SI) La última vez que su niño (indice) tuvo diarrea lo usó?

0 = NO 1 = SI _____

9.-Cuando un niño tiene asientos es mejor seguir dandole de mamar o quitarle el pecho ?

0 = Quitarselo 1 = Seguir dando _____

10.-Cuando un niño tiene asientos es mejor seguir dandole de comer o quitarle la comida ?

0 = Quitar 1 = Seguir dando _____

11.- Qué hace con la basura ? 0= NO menciona 1= SI menciona _____

* La tira * La quema * La entierra

12.- Cuando uno de sus niños esta con asientos a donde lo lleva usted ? A donde más ? 0 = NO menciona 1 = SI menciona

* Ninguno/ solo en la casa _____
* Farmacia _____
* Puesto/Centro de Salud _____
* Clinica de ONG _____
* Médico privado _____
* Personas que saben curar/ curandero _____
* Comadrona/promotor _____
* Hospital
* Otro:_____ _____
* No sabe/ no recuerda

13.-La última vez que estuvo un niño suyo enfermo, con quien lo llevo ? Adonde más ? 0 = NO menciona 1 = SI menciona _____

* Ninguno/ solo en la casa _____
* Farmacia _____
* Puesto/Centro de Salud _____
* Clinica de ONG _____
* Médico privado _____
* Personas que saben curar/ curandero _____
* Comadrona/promotor
* Hospital _____
* Otro:_____
* No sabe/ no recuerda

14.- Conoce a algun promotor de salud de la comunidad ? _____
0 = NO 1 = SI _____

15.- (SI) Alguna vez lo ha visitado ? 0 = NO 1 = SI

16.- (SI) En las últimas cuatro semanas (un mes) lo visitó ? _____
0 = NO 1 = SI

C.- CARACTERISTICAS DE AGUA

1.- De dónde obtiene su agua para tomar y cocinar ? _____
(Codificar hasta tres fuentes empezando por la más usada) _____
1.- Rio/lago _____
2.- Pozo comunal
3.- Agua de lluvia
4.- Manantial
5.- Chorro publico o llena cantaros
6.- Pozo de casa
7.- Chorro domiciliar __/__ __

2.- Cuanto tarda (ida y vuelta) para recoger agua cada vez ?
EN HORAS Y MINUTOS 999 = NO acarrea agua

3.- Cuantos viajes hace al dia para recoger agua ? _____
0 = No hace viaje diariamente 9 = NO acarrea agua

Appendix 2. GENERAL DESCRIPTION OF THE POPULATION STUDIED

AGE DISTRIBUTION OF THE POPULATION IN THE FAMILY - WET SEASON 1993

AGE GROUPS (years)	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n	%	n	%
0-5	88	26.1	90	25.4	178	25.8
6-9	63	18.7	66	18.6	129	18.7
10-14	43	12.8	40	11.3	83	12.0
15-19	31	9.2	32	9.0	63	9.1
20-29	43	12.7	53	15.0	96	13.9
30-39	38	11.3	34	9.6	72	10.4
40-49	19	5.6	17	4.8	36	5.2
50-59	5	1.5	9	2.5	14	2.0
>60	7	2.1	13	3.7	20	2.9
TOTAL	337	48.8	354	51.2	691	100.0

NUMBER OF PERSONS PER FAMILY - WET SEASON 1993

NUMBER OF PERSONS	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n	%	n	%
1-5	13	27.8	11	22.9	24	25.3
6-8	19	40.4	20	41.7	39	41.0
>9	15	31.9	17	35.4	32	33.7
TOTAL	47	49.5	48	50.5	95	100.0

GENDER DISTRIBUTION OF THE STUDY POPULATION - WET SEASON 1993

AGE GROUPS	MALE		FEMALE		TOTAL	
	n	%	n	%	n	%
0-5	87	25.6	91	25.9	178	25.8
6-9	64	18.8	65	18.5	129	18.7
10-14	40	11.8	43	12.2	83	12.0
15-19	29	8.5	34	9.7	63	9.1
20-29	47	13.8	49	14.0	96	13.9
30-39	34	10.0	38	10.8	72	10.4
40-49	21	6.2	15	4.3	36	5.2
50-59	7	2.0	7	2.0	14	2.0
>60	11	3.2	9	2.6	20	2.9
TOTAL	340	49.2	351	50.8	691	100.0

SCHOOLING OF THE HEAD OF THE FAMILY - WET SEASON 1993

SCHOOLING	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n	%	n	%
ILLITERATE	5	10.6	15	31.2	20	21.0
1-3 PRIMARY	23	48.9	17	35.4	40	42.1
4-6 PRIMARY	17	36.2	15	31.2	32	33.7
SECONDARY	2	4.3	1	2.1	3	3.2
TOTAL	47	49.5	48	50.5	95	100.0

AGE DISTRIBUTION OF THE HEAD OF THE FAMILY - WET SEASON 1993

AGE (years)	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n	%	n	%
15-24	11	23.4	13	27.1	24	25.3
25-30	9	19.2	11	22.9	20	21.0
31-35	10	21.3	8	16.7	18	18.9
>36	17	36.2	16	33.3	33	34.7
TOTAL	47	49.5	48	50.5	95	100.0

OCCUPATION OF THE HEAD OF THE FAMILY*

OCCUPATION	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n.	%	n	%
HOUSEWIFE	2	4.3	1	2.1	3	3.2
LABORER/FAMILY LAND	3	6.4	7	14.6	10	10.5
AGRICULTURE DAY-LABORER	3	6.4	14	29.2	17	17.9
NON-AGRICULTURE DAY LABORER	0	0.0	1	2.1	1	1.0
ARTISAN	23	48.9	1	2.1	24	25.3
AMBULANT MERCHANT	0	0.0	3	6.2	3	3.2
ESTABLISHED MERCHANT	10	21.3	6	12.5	16	16.8
SPECIALIZED WORKER	5	10.6	15	31.2	20	21.0
EMPLOYEE	1	2.1	0	0.0	1	1.0
TOTAL	47	49.5	48	50.5	95	100.0

Activity generating the highest income or requiring more time.

DISTRIBUTION OF THE FAMILY POPULATION ACCORDING TO SCHOOLING WET SEASON 1993

SCHOOLING	WITH WATER		WITHOUT WATER		TOTAL	
	n	%	n	%	n	%
ILLITERATE	53	25.5	88	38.1	141	32.1
1-3 PRIMARY	84	40.4	95	41.1	179	40.8
4-6 PRIMARY	57	27.4	46	19.9	103	23.5
SECONDARY	14	6.7	2	0.9	16	3.6
TOTAL	208	47.4	231	52.6	439	100.0

Appendix 3: CHANGES OF FAMILIES AND COMMUNITIES

CHANGES IN THE FAMILIES AND COMMUNITIES

COMMUNITY	TYPE	WET SEASON	DRY SEASON
1. Pamalin	NoPW	No changes	Changed by Community No. 7
2. Xeatzam	WPW	Subject #15 Subject #16	Subject #17 Subject #18
3. Chuijox	NoPW	No changes	No changes
4. Xolveya	WPW	Subject #10 Subject #16 Family #4, Child #3	Subject #17 Subject #18 Family #4, child #7 (child #03 died)
5. Choqui	NoPW	Subject #7 Subject #11	Subject #17 Subject #18
6. Patulup	WPW	Subject #13	Did not participate, no replacement
7. Pachichup	NoPW	—	Replacement for the first community

Appendix 4, DIETARY INTAKE RECOMMENDATIONS

DIETARY INTAKE RECOMMENDATIONS FOR CENTRAL AMERICA AND PANAMA.

BOYS AND GIRLS LESS THAN FIVE YEARS OLD

Age (mo)	Energy (kcal)	Prot.	Ca	Fe	B1	B2	Niac.	Vit C	Vit A
1-2 m	550	10.6	500	10	0.2	0.3	3.6	20	350
3-5 m	650	16.9	500	10	0.3	0.4	4.3	20	350
6-8 m	800	18.3	500	10	0.3	0.4	5.3	20	350
9-11 m	950	18.6	500	10	0.4	0.5	6.3	20	350
12-23 m	1100	17.3	400	8	0.4	0.6	7.3	30	400
24-35 m	1300	20.3	400	8	0.5	0.7	8.6	30	400
36-59 m	1500	23.7	600	10	0.6	0.8	9.9	35	400

Contd..

DIETARY INTAKE RECOMMENDATIONS FOR CENTRAL AMERICA AND PANAMA.

SCHOOL AGE AND ADULTS BY SEX

Age (y)	Sex	Energy (kcal)	Prot (g)	Ca (mg)	Fe (mg)	B1 (mg)	B2 (mg)	Niac (mg)	Vit C (mg)	Vit A (mcg)
5-6	Male	1750	26.8	600	10	0.7	1.0	11.6	35	400
	Fem	1600	26.8	600	10	0.6	0.9	10.6	35	400
7-9	Male	2000	35.3	800	12	0.8	1.1	13.2	40	400
	Fem	1700	35.3	800	12	0.7	0.9	11.2	40	400
10-11	Male	2200	45.1	1200	14	0.9	1.2	14.5	45	500
	Fem	1900	45.1	1200	15	0.8	1.0	12.5	45	500
12-13	Male	2350	54.9	1200	18	0.9	1.3	15.5	50	600
	Fem	2000	53.4	1200	20	0.8	1.1	13.2	50	500
14-15	Male	2650	62.1	1200	18	1.1	1.5	17.5	50	600
	Fem	2100	54.1	1200	20	0.8	1.2	13.9	50	500
16-17	Male	3000	70.6	1200	11	1.2	1.7	19.8	60	600
	Fem	2150	52.3	1200	24	0.9	1.2	14.2	60	500
18-25	Male	3100	66.7	1200	11	1.2	1.7	20.5	60	600
	Fem	2100	52.0	1200	24	0.8	1.2	13.9	60	500
26-64	Male	3100	66.7	800	11	1.2	1.7	20.5	60	600
	Fem	2100	52.0	800	24	0.8	1.2	13.9	60	500
+ 64	Male	2200	66.7	800	11	0.9	1.2	14.5	60	600
	Fem (26-49)	1850	52.0	800	9 (24)	0.7	1.0	12.2	60	500
PREGNANCY AND LACTATION NUTRITIONAL ALLOWANCES										
16-17	Pregn.	2435	60.3	1200	60	1.0	1.3	16.1	70	600
	Lact.	2750	75.3	1200	13	1.1	1.5	18.2	85	850
18-49	Pregn.	2385	60.0	1200	60	1.0	1.3	15.7	70	600
	Lact.	2700	75.0	1200	13	1.1	1.5	17.8	85	850

DISTRIBUTION OF THE SOURCES OF ENERGY AND NUTRIENT INTAKE IN CHILDREN

WET SEASON

NUTRIENT	WITH WATER				WITHOUT WATER			
	13-23 mo.		> 24 mo.		13-23 mo.		> 24 mo.	
	Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD	
ANIMAL PROTEIN (g)	6.0	8.1	5.2	4.8	2.2	2.9	5.4	5.6
VEGETAL PROTEIN (g)	12.6	8.2	19.6	7.4	10.3	3.2	20.7	8.6
% ANIMAL PROTEIN	28.0	24.7	18.5	13.2	14.9	17.7	18.5	16.2
% ANIMAL IRON	13.8	11.6	9.9	7.1	8.3	10.8	10.6	11.0
% ANIMAL VIT.A	21.1	24.8	20.1	19.3	19.1	26.5	19.4	19.4
% ENERGY-PROTEIN	10.8	1.9	10.2	1.8	10.2	2.2	11.4	11.4
% ENERGY-CHO	75.4	8.3	77.0	8.4	77.7	6.6	76.6	7.1
% ENERGY-FAT	16.6	6.8	15.5	7.9	14.9	6.7	15.0	5.4

DRY SEASON

NUTRIENT	WITH WATER				WITHOUT WATER			
	13-23 mo.		> 24 mo.		13-23 mo.		> 24 mo.	
	Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD	
ANIMAL PROTEIN (g)	6.8	5.2	4.4	4.4	1.7	1.5	4.4	5.0
VEGETAL PROTEIN (g)	11.1	6.1	19.8	7.8	18.5	9.1	19.0	6.2
% ANIMAL PROTEIN	35.0	18.5	18.5	16.6	8.8	8.6	15.5	13.7
% ANIMAL IRON	20.2	11.6	10.1	9.2	5.6	5.0	9.7	9.2
% ANIMAL VIT.A	24.3	20.4	22.5	20.7	20.9	22.5	14.3	16.2
% ENERGY-PROTEIN	11.9	2.1	11.1	1.9	10.6	2.0	11.2	2.2
% ENERGY-CHO	71.0	7.6	77.2	6.9	74.6	6.4	80.1	4.3
% ENERGY-FAT	19.5	7.3	14.3	5.8	17.8	7.5	11.6	4.1

DISTRIBUTION OF THE SOURCES OF ENERGY AND NUTRIENT INTAKE IN MOTHERS

WET SEASON

NUTRIENT	WITH WATER		WITHOUT WATER		TOTAL	
	Mean ± SD		Mean ± SD		Mean ± SD	
ANIMAL PROTEIN (g)	8.2	7.3	6.3	7.1	7.2	7.3
VEGETABLE PROTEIN (g)	56.7	12.7	57.6	16.8	57.2	14.8
% ANIMAL PROTEIN	12.2	9.8	9.8	11.0	11.0	10.4
% ANIMAL IRON	6.1	5.2	4.8	6.7	5.5	6.0
% ANIMAL VIT.A	11.5	12.5	12.6	14.5	12.0	13.5
% ENERGY-PROTEIN	10.0	1.2	10.2	1.7	10.1	1.5
% ENERGY-CHO	79.8	3.6	80.3	4.1	80.0	3.8
% ENERGY-FAT	13.0	3.4	12.5	3.4	12.7	3.4

DRY SEASON

NUTRIENT	WITH WATER		WITHOUT WATER		TOTAL	
	Mean ± SD		Mean ± SD		Mean ± SD	
ANIMAL PROTEIN (g)	7.5	6.3	6.8	8.2	7.2	7.3
VEGETABLE PROTEIN (g)	52.4	13.8	66.3	14.6	59.4	15.8
% ANIMAL PROTEIN	12.8	11.0	8.1	8.1	10.4	9.8
% ANIMAL IRON	6.0	5.1	4.5	5.0	5.2	5.1
% ANIMAL VIT.A	15.3	14.6	10.6	11.7	12.9	13.3
% ENERGY-PROTEIN	10.2	1.0	10.4	1.2	10.3	1.1
% ENERGY-CHO	79.4	5.2	81.0	3.1	80.2	4.3
% ENERGY-FAT	13.2	5.4	11.4	3.1	12.3	4.5

Appendix 6: LIST OF PARTICIPANTS IN THE WORKSHOP

SEPTEMBER 30, 1994

HOTEL RADISSON VILLA MAGNA, GUATEMALA CITY, GUATEMALA

SPEAKERS:

Dr. Erik Díaz
Lic. Elena Hurtado
Dr. Steven Esrey

NAME	INSTITUTION
1. Mr. Hans Spruijt	Fondo de las Naciones Unidas para la Infancia (UNICEF) 13 calle 8-44 zona 10 Edificio Edyma II nivel Ciudad, Guatemala Tel. 336373, Fax: 336317
2. Ing. Jorán Matías Gil	"
3. Dr. Paul Bloem	"
4. Lic. Nicté de Hernández	"
5. Ing. José Araneda	"
6. Dr. Baudilio Sajché	Departamento de Materno Infantil, División de Atención a las Personas Dirección General de Servicios de Salud 9a. avenida 14-65, zona 1 Ciudad, Guatemala, Tel. 21801
7. Lic. Orlando Marroquín	Proyecto Agua Potable y Saneamiento del Altiplano (PAYSA) Avenida Simeón Cañas 7-33, Zona 2 Ciudad, Guatemala Tel. 512475
8. Ing. Carlos Calderón	USAAID/G-CAP, Oficina de Salud y Educación, Oficina del Proyecto PAYSA 1a. calle 7-66, zona 9 Plaza 1 Ciudad, Guatemala, Tel. 320202
9. Mr. Marco Tulio López	PAYSA, USAID Avenida Simeón Cañas 7-33 Zona 2 Ciudad, Guatemala Tel. 512475, 536049
10. Lic. Inf. Francisco J. Sasvín	"

NAME	INSTITUTION
11. Ing. Julio Guillermo García	División Saneamiento Ambiental 2a. avenida 0-61, zona 10 Ciudad, Guatemala Tel. 321279
12. Lic. Carmen Aída González	PADEL 16 calle 4-53, zona 10 Edificio Marbella 3o. nivel Ciudad, Guatemala, Tel. 373001/3
13. Mrs. Magda de Figueroa	Programa de Seguridad Alimentaria, PROSAQ 10 calle 2-18 zona 5 Santa Cruz del Quiché Tel. y Fax 551-064, Quiché
14. Lic. Dalia de Castañeda	"
15. Mr. Favian Gregorio Alvarez López	"
16. Lic. Clara Aurora García	CARE 15 avenida 3-66, zona 13, Ciudad, Guatemala Tel. 345625/27
17. Dr. Salvador Baldizón	"
18. Ing. Enrique Figueroa	Centro Canadiense de Estudio y Cooperación Internacional (CECI) 13 calle 7-89 zona 10 Ciudad, Guatemala, Tel. 315454
19. Ing. Florence Tartanac	INCAP Calzada Roosevelt, Zona 11 Apartado Postal 1188, Ciudad, Guatemala Tel. 723762 -7 Fax: 736529
20. Dra. Marie Ruel	"
21. Lic. Alma Aída Hernández	Departamento de Nutrición Dirección General de Servicios de Salud 9a. avenida 14-65, zona 1 III nivel Ciudad, Guatemala, Tel. 21801 - 3 Ext. 158
22. Mr. Juan Carlos García	Departamento de Alimentación y Nutrición Escolar 6a. avenida 6a. calle zona 1, Edificio el Sexteo, 5o. nivel, Ciudad, Guatemala Tel. 516454
23. Mr. Jeffry Yeoh	Cuerpo de Paz 8 calle 6-55 zona 9 Ciudad, Guatemala Tel. 348263 -9

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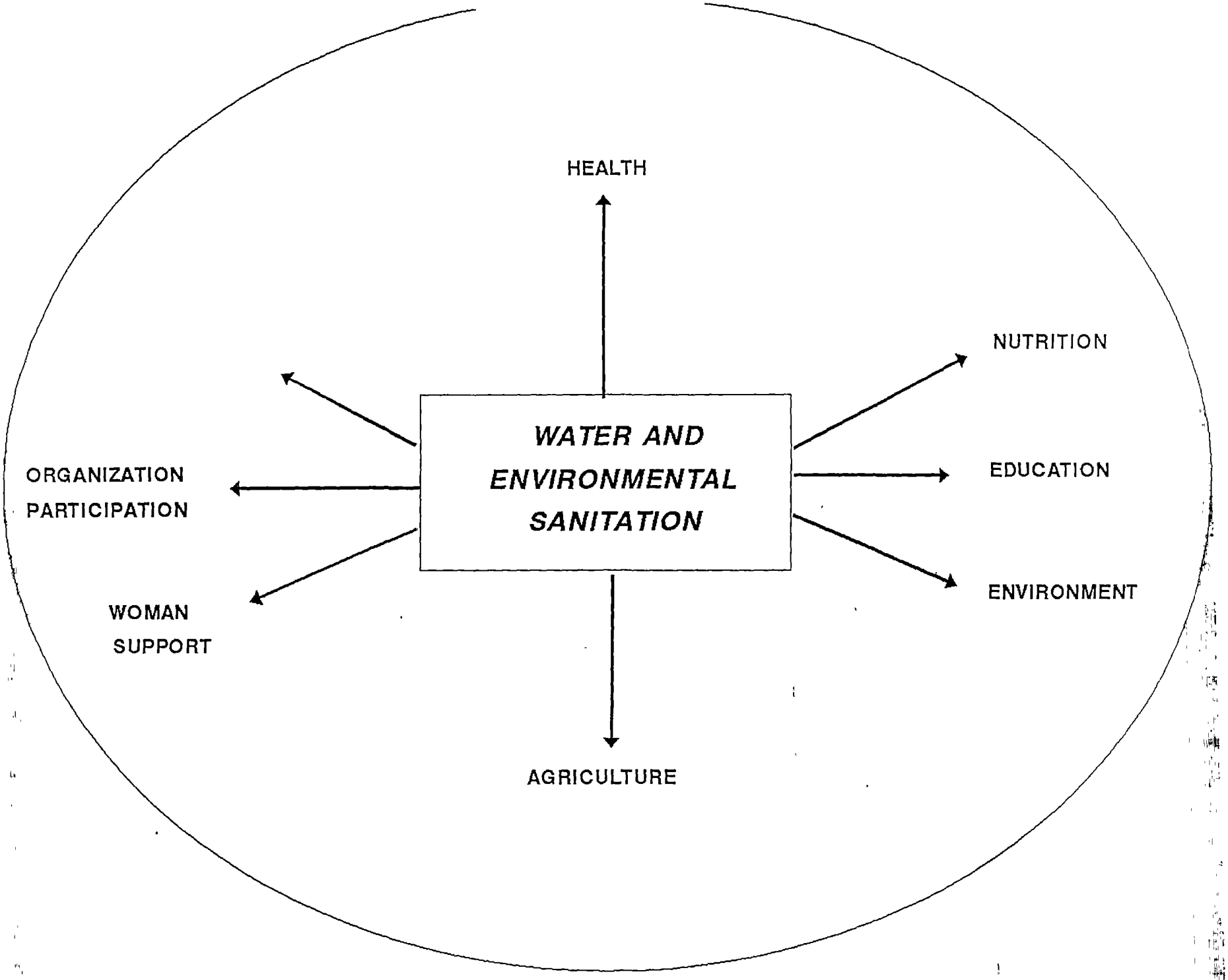
25. Dr. David Salazar	ASINDES y Fundación Behrhorst 4a. avenida A 7-70, zona 10 Ciudad, Guatemala
26. Dr. Rolando Hernández	Proyecto de Salud Materno Infantil, C.E. 20 av. "A" 0-96, Zona 15 Vista Hermosa II, Ciudad, Guatemala Tel. 690494/692443
27. Dra. Ruth Elena de Arango	Comisión Nacional de Promoción de la Lactancia Materna, Secretaría Bienestar Social Presidencia de la República Centro Comercial Zona 4 Torre I Oficina 804, Ciudad, Guatemala Tel. 351633, 351928, 351892

Appendix 7. WATER PARADIGM FIGURE


HEALTH
NUTRITION
ORGANIZATION
PARTICIPATION
WATER AND
ENVIRONMENTAL
SANITATION
EDUCATION
WOMAN
SUPPORT
ENVIRONMENT
AGRICULTURE

Appendix 8. **TOTAL BODY WATER, LEAN BODY MASS AND FAT MASS IN MOTHERS DURING THE DRY SEASON.**

SUBJECT ID	WEIGHT (kg)	TOTAL BODY WATER (l)	LEAN BODY MASS (kg)	FAT MASS (kg)	FAT PROPORTION (%)
202	47.9	28.0	38.4	9.5	19.9
205	42.0	22.7	31.1	10.9	26.0
208	43.4	25.5	35.0	8.4	19.3
211	56.4	24.6	33.7	22.7	40.3
302	44.8	21.3	29.2	15.5	34.7
305	37.9	19.3	26.4	11.5	30.3
308	35.6	21.6	29.5	6.0	16.9
313	32.8	18.3	25.1	7.7	23.4
402	40.6	19.7	27.0	13.6	33.5
403	40.7	24.5	33.6	7.1	17.4
404	50.2	28.3	38.7	11.5	22.8
415	36.5	22.2	30.4	6.1	16.7
502	46.2	29.8	40.8	5.4	11.7
504	37.5	22.6	31.0	6.5	17.3
506	42.2	24,2	33.2	9.0	21.4
515	37.2	29.2	--	--	--
601	58.6	23.3	31.9	26.7	45.5
607	77.3	35.0	47.9	29.4	38.0
608	45.4	26.6	36.4	9.02	19.9
609	40.3	22.0	30.1	10.2	25.3
702	42.7	26.6	36.4	6.2	14.6
704	57.0	28.1	38.4	18.6	32.6
705	49.1	28.7	39.4	9.7	19.8
715	57.1	28.5	39.0	18.1	31.6

* Estimates obtained from oxygen-18, normal body fat ranges 15-30%

Appendix 9

ENERGY EXPENDITURE ESTIMATED FROM HEART RATE MONITORING

HEART RATE MEASUREMENTS RELIABILITY TO ESTIMATE ENERGY EXPENDITURE

TYPE OF COMMUNITY	MEASUREMENT	TOTAL ENERGY-EXPENDITURE (kcal/d)			
		WET SEASON-1993		DRY SEASON 1994	
		MEAN ± SD		MEAN ± SD	
NoPW	1	2734	580.5	2851	241.3
NoPW	2	2748	500.9	2823	403.6
WPW	1	2217	248.9	2317	360.4
WPW	2	2279	466.3	2628	377.2

MEAN ENERGY EXPENDITURE (kcal/day) FOR EACH HEART RATE MONITORING MEASUREMENT PERFORMED AMONG RURAL GUATEMALAN WOMEN

WET SEASON-1993 (n=23)

COMMUNITY	NUMBER OF CASES	FIRST MEASUREMENT		SECOND MEASUREMENT	
		MEAN ± SD		MEAN ± SD	
1 (NoPW)	4	2668	767.0	2701	707.7
2 (WPW)	4	2170	84.4	2155	285.5
3 (NoPW)	3	2987	259.6	3083	435.2
4 (WPW)	4	2091	287.2	2106	352.2
5 (NoPW)	4	2609	632.1	2543	195.5
6 (WPW)	4	2446	245.0	2676	671.9

DRY SEASON-1994 (n=21)

COMMUNITY	NUMBER OF CASES	FIRST MEASUREMENT		SECOND MEASUREMENT	
		MEAN ± SD		MEAN ± SD	
7 (NoPW)	4	2830	245.7	2780	458.4
2 (WPW)	3	2332	336.0	2429	149.2
3 (NoPW)	3	2642	210.8	2999	581.6
4 (WPW)	4	2098	257.0	2563	395.9
5 (NoPW)	4	3028	134.0	2733	250.9
6 (WPW)	3	2593	402.1	2802	520.6

FAO/WHO ESTIMATES OF ENERGY REQUIREMENTS IN RURAL GUATEMALAN WOMEN*

WET SEASON-1993

ACTIVITY	BASAL METABOLISM UNITS (METS)[a]	HOURS		KCAL	
		WITHOUT WATER	WITH WATER	WITHOUT WATER	WITH WATER
IN BED	1.0	8.4	8.5	393.8	434.7
DOMESTIC WORK FIELD WORK & DISCRETIONAL ACTIVITIES	2.7[b]	11.5	7.2	1447.5	996.0
REMAINING TIME	1.4[c]	4.1	8.3	267.5	595.4
TOTAL		24	24	2109	2026.1

DRY SEASON-1994

ACTIVITY	BASAL METABOLISM UNITS (METS)	HOURS		ENERGY (kcal)	
		WITHOUT WATER	WITH WATER	WITHOUT WATER	WITH WATER
IN BED	1.0	9.07	9.1	411.4	467.6
DOMESTIC WORK FIELD WORK & DISCRETIONAL ACTIVITIES	2.7	11.98	8.14	1467.2	1129.4
REMAINING TIME	1.4	2.94	6.74	186.7	484.9
TOTAL	1.9	24	24	2065	2082

a) basal energy expenditure
b) active + miscellaneous time
c) sedentary time