Introduction. Lead is a toxic metal which, even at low blood levels, can alter normal neurodevelopment in children, so no blood lead level is acceptable. Lead absorption from diet accounts for the highest contribution to blood lead levels in the population who is not exposed to contaminated environments or because of their occupation. The objective of this study was to determine the contribution of diet to lead exposure among children aged 1 to 7 years. The study was conducted between June 2015 and May 2016. A questionnaire on the frequency of food intake was administered to 91 children whose average age ± standard deviation was 3.0 ± 1.7 years, and foods included in the analysis were selected based on this questionnaire. Selected foods were purchased from different regional stores. Composite samples were made up of different food groups. Lead levels corresponding to each food group were determined and, finally, the daily intake of lead was estimated for the studied population.

Results. The daily intake of lead was 138 µg/day. The food groups with the higher intake rates were processed meat products (15.4%), bakery products (14.8%), milk (12.5%), and meat (11.7%).

Conclusions. Children aged 1 to 7 years attending a public hospital in La Plata have a lead burden. Children aged 1 to 7 years attending Hospital de Niños de La Plata for health check-ups who attended Hospital de Niños de La Plata for dietary intake of 138 µg/day.

Key words: lead, child, diet.

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INTRODUCTION

Metals occur naturally in the Earth’s crust and their environmental levels vary among the different regions. Lead enters the environment through natural and anthropogenic sources, such as the Earth’s crust erosion, mining, combustion engine products, industrial effluents, production and final disposal of storage batteries, and some phosphorus fertilizers and pesticides, etc. These sources result in an environmental lead burden that remains on the Earth’s crust, mainly on the water and the ground. Environmental and health conditions during farming, breeding, processing, handling, and storing may affect the contamination of food products with environmental lead.

Some metals are essential for human life because they play a biological role, others, such as lead, have no known biological function but they are known for their harmful effects on health. Over the last years, it has been demonstrated that low lead levels are associated with adverse effects on neuropsychological development in the first years of life that may result in decreased intelligence that may even persist after childhood. Since 2012, the United States Centers for Disease Control and Prevention (CDC) have established the reference blood lead level at 5 µg/dL for children, and 97.5% of children younger than 5 years in the US are under this value. However, the threshold for blood lead levels with no adverse events on neurodevelopment has not been established yet. Children are more vulnerable to lead exposure because they are at a higher risk of ingesting environmental lead due to their hand-to-mouth behavior; also, gastrointestinal absorption of lead is higher among children (25%) than adults (8%) and their developing nervous system makes them more vulnerable to the toxic effects of lead than if they had a mature brain.
Contribution of diet to lead exposure among children aged 1 to 7 years in La Plata, Buenos Aires

Several environmental, socioeconomic, and lifestyle factors may be considered determinants of high blood lead levels.8,9 Particularly for children with low exposure levels (blood lead level of 5-10 µg/dL), it is believed that lead comes from multiple sources.10 Although some individuals are exposed to lead from contaminated environments or their occupation, for most part of the population, the main source of exposure is from diet.11 In addition, mineral nutritional deficiencies, e.g., iron, calcium, and zinc, favor lead absorption, and vitamin deficiency, such as B-group vitamins and ascorbic acid, may exacerbate lead poisoning adverse events.4

The objective of this study was to determine the contribution of diet to lead exposure among children aged 1 to 7 years who attended Hospital de Niños de La Plata for health check-ups.

POPULATION AND METHODS

The study was conducted between June 2015 and May 2016 at the Pediatric Research and Development Institute (Instituto de Desarrollo e Investigaciones Pediátricas, IDIP) “Prof. Dr. Fernando E. Viteri,” Hospital Interzonal de Agudos Especializado en Pediatría (HIAEP) “Sor María Ludovica” - Scientific Research Commission (CIC) of the Province of Buenos Aires.

This was an observational, analytical, cross-sectional study based on the “total diet” or “market basket” methodology.

The studied population’s sociodemographic characteristics are different from those of the general population, e.g., a 36% prevalence of households with unmet basic needs, more than 80% of households with contingent working conditions, and a 10% of mothers who did not complete primary education.12 The sample was selected by convenience, in a non-probabilistic fashion. Participants were children aged 1 to 7 years who attended a visit at the Health Observatory of IDIP. Children who were on a special diet due to a pathophysiological condition or whose parents (or tutor) did not agree to participate in the study were excluded.

The outcome measure “daily food intake” (DI) was defined using the median daily food intake as indicator. Its formula is detailed below.

\[
\text{DI} = \text{I} \times \frac{\text{F}}{30.4} \quad \text{(formula 1)}
\]

Where “I” means the median daily intake of food in g/day and “F” means the frequency of “i” intake, in days over a month. A month was assumed to have 30.4 days (365/12).13

In turn, the outcome measure “food contamination with lead” was defined using the indicator lead level in the composite sample (Cpb) for each food group, expressed in µg of lead/g of food.

Finally, the outcome measure “lead dietary exposure” was defined using the indicator daily lead intake (Ipb), which was estimating using the following formula based on the two indicators mentioned above:

\[
\text{Ipb} = \sum \text{Cpb}_i \times \text{ID}_i \quad \text{(formula 2)}
\]

Stages of the study

Stage 1. Survey on food intake

To determine the DI indicator, a questionnaire on the frequency of food intake (Annex) was administered to the parents or tutors of children, who answered about food intake in the past month. The survey also included questions about the most commonly used brands and where the family acquired fresh and dried products. The survey on food intake was designed based on previous studies conducted at the institution14,15 and administered by professionals with a B.S. in Nutrition.

Stage 2. Analysis of the survey on food intake and selection of foods to be analyzed.

Food groups

Once the survey on food intake was analyzed, we established which products covered 90% of the DI and selected those that would be purchased for lead determination. Based on the analysis of the survey results, foods were categorized into the following groups for analysis, as a composite sample: I. Bakery products, II. Grains, III. Eggs, IV. Oils and fats, V. Fruits, VI. Vegetables, VII. Meat, VIII. Meat products, IX. Milk, X. Dairy products, XI. Beverages, XII. Sweet snacks, XIII. Seasonings, XIV. Water.

Stage 3. Purchase and preparation of selected foods

Selected foods were acquired from different stores according to the answers provided in the survey on food intake as follows: industrially produced foods were purchased from a hypermarket or, if not available there, from a retail store. Fresh products were acquired from four stores: a hypermarket and three different retail stores.
Foods were prepared ordinarily for consumption, separately, and in the most representative manner (raw, washed, peeled or cooked in doubly distilled water using stainless steel utensils); non-edible parts were discarded. Solid foods were homogenized using a stainless steel hand blender. Composite samples were prepared based on the proportion of each food according to the survey answers.

Stage 4. Lead determination

Approximately 0.5 g of each composite sample was weighted and placed into containers that were safe for microwave digestion heating and pressure. Then 8 mL of nitric acid 65% (Merck EMSURE, Darmstadt, Germany) were added by dripping; and then 1 mL of hydrogen peroxide 30% (Merck EMSURE, Darmstadt, Germany) was added. Digestion was done using a CEM MDS-2000 microwave digester (CEM Corporation, Matthews, USA). Finally samples were brought to a 25 mL volume with doubly distilled water and stored at -20 °C in plastic containers until analysis. The Cpb in the digested samples was determined using an Agilent 4100 MP-AES microwave plasma-atomic emission spectrometer (Agilent, Santa Clara, CA, USA), at a 405.781 nm wavelength. Doubly distilled water blanks used to cook foods before and after boiling and reagent blanks were analyzed.

Analysis of results

The SPSS 18 software was used for statistical data analysis. The Ipb was estimated using formulas 1 and 2.

A comparison was done of the Ipb estimated using the provisional tolerable weekly intake (PTWI) of 25 µg/kg of body weight, valid from 1993 to 2010, when new recommendations were issued by the Food and Agriculture Organization (FAO) of the United Nations.16

DISCUSSION

Foods that covered 90% of the DI according to the survey mainly overlap with the foods most frequently referred for children between 6 months old and 5 years old in the 2007 National Survey on Nutrition and Health (Encuesta Nacional de Nutrición y Salud, ENNyS).17 The Ipb estimated in our study is higher than that of most countries (Table 2) included in the comparison, except Chile. Although the Ipb in these studies was assessed for the general population, it has been observed that the estimated lead intake does not vary greatly among the different age groups.18

The lead intake estimation did not include the contribution of water from beverages because it was very difficult to estimate its median daily intake. However, considering daily water consumption requirements, it may have a considerable contribution. For children 1 to 3 years, the daily requirement of water from beverages is 900 mL and for children 3 to 7 years, 1200 mL.19 Assuming that all children in our study met the water intake requirements and subtracting the milliliters corresponding to other beverages (juice, soft drinks, and milk), we established a water intake of 320 mL. Based on this, the lead intake from running water would be approximately 48 µg/day, which would raise the total Ipb to 186.2 µg/day.

The food groups with the highest contribution to lead dietary exposure vary greatly among the different geographic regions. According to the European Food Safety Authority (EFSA), the
food groups that contributed the most to lead exposure in the European population included bread, toasts, soups, vegetables, fruits, water, non-alcoholic beverages, alcoholic beverages, sugar and confectionery. In total diet surveys conducted in the USA between 1991 and 2005, the foods with the highest lead intake included sweet cucumber pickles, milk chocolate candy bars, canned fruit cocktail, chocolate syrup, canned potatoes, canned apricots, and shrimps. In the SCOOP study, conducted in 2004 in 10 European countries, the highest lead levels were found in herbs and spices, followed by game meat, dietetic food, food supplements, and wine. In Chile, the highest lead levels were determined in sugar, fruits, and spices. Other foods that contributed to dietary lead exposure included bread, dairy products, and meat. In Spain, Llobet et al. found that foods that contributed the most to dietary lead exposure among males in all population groups were grains.

| Composite sample                  | Components       | Median DI (g/day) | Cpb µg/g | Ipb µg/day |
|-----------------------------------|------------------|-------------------|----------|------------|
| I. Bakery products               | Bread            | 40                | 0.197    | 20.5       |
|                                  | Salt crackers    | 14                |          |            |
|                                  | Sweet cookies    | 16                |          |            |
|                                  | Filled biscuits  | 21                |          |            |
|                                  | Breadcrumbs      | 13                |          |            |
| II. Grains                       | Noodles          | 28                | 0.070    | 4.4        |
|                                  | Rice             | 27                |          |            |
|                                  | Frosted flakes   | 7                 |          |            |
| III. Eggs                        | Eggs             | 5                 | 0.160    | 0.8        |
| IV. Oils and fats                | Oil              | 25                | 0.412    | 11.9       |
|                                  | Butter           | 4                 |          |            |
| V. Fruits                        | Banana           | 50                | 0.055    | 11.0       |
|                                  | Apple            | 50                |          |            |
|                                  | Tangerine        | 50                |          |            |
|                                  | Orange           | 50                |          |            |
| VI. Vegetables                   | Squash           | 36                | 0.080    | 9.0        |
|                                  | Carrot           | 23                |          |            |
|                                  | Chard            | 9                 |          |            |
|                                  | Potato           | 21                |          |            |
|                                  | Tomato           | 6                 |          |            |
|                                  | Lettuce          | 18                |          |            |
| VII. Meat                        | Fatty beef       | 30                | 0.185    | 16.2       |
|                                  | Semi-fatty beef  | 28                |          |            |
|                                  | Chicken          | 30                |          |            |
| VIII. Processed meat products    | Breaded chicken  | 30                | 0.299    | 21.2       |
|                                  | Chicken nuggets  | 30                |          |            |
|                                  | Vienna sausages  | 11                |          |            |
| IX. Milk                         | Whole milk       | 224               | 0.077    | 17.2       |
| X. Dairy products                | Whole-milk yogurt| 53                | 0.180    | 11.5       |
|                                  | Creamy cheese    | 7                 |          |            |
|                                  | Grated cheese    | 4                 |          |            |
| XI. Beverages                    | Orange juice (powder) | 299 | 0.030 | 10.8 |
|                                  | Soft drink       | 57                |          |            |
| XII. Sweets and sugar            | Sugar            | 10                | 0.118    | 3.1        |
|                                  | Gelatin          | 7                 |          |            |
|                                  | Dulce de leche   | 4                 |          |            |
|                                  | Cookie sandwich  | 5                 |          |            |
| XIII. Seasonings                 | Mayonaise        | 3                  | 0.207    | 0.6        |
| XIV. Running water               |                  |                   |          | 0.151      |
| Total Ipb                        |                  |                   |          | 138.2      |

DI: daily intake. Cpb: lead levels of the composite sample based on wet weight. Ipb: daily intake of lead from the composite sample.
Among females, although grains made a major contribution, fish and shellfish contributed the most to lead intake. Other quantitatively important foods included fruits and vegetables.20

In this study, the food groups that contributed the most to lead intake did not reflect what had been reported by the EFSA, the US or the SCOOP study, but showed certain similarity with the Chilean study by Muñoz et al. and the Spanish study by Llobet et al.

The weekly lead intake, based on our estimation, widely exceeds the PTWI of lead valid up to 2010, which was 25 µg/kg of body weight, considering an extreme case of a 30 kg child (i.e., a 7 year-old child with an adequate weight, up to the 97th percentile).21 The PTWI in that case would be 750 µg of lead per week (30 kg * 25 µg/kg), below the median weekly lead intake established in our study, which was 967.4 µg.

It is worth noting that, in 2010, the Joint FAO/World Health Organization (WHO) Expert Committee on Food Additives and the EFSA Panel on Contaminants in the Food Chain (CONTAM) concluded that the PTWI at 25 µg/kg of body weight was not adequate because there was no evidence of a threshold in relation to critical developmental pathologies in children, including neurotoxicity. Therefore, it was not possible to establish a new PTWI that could be considered “protective” of health.16

Childhood lead exposure in our population was recently estimated at a relatively low median blood lead level of 2.2 µg/dL,12 and no specific sources of exposure were identified, so the dietary contribution to lead burden could be relevant.

The ubiquity of lead in the environment, especially in the water and dust, makes poor sanitation conditions in food production, processing, storing, and presentation for sale become potential explanations for the lead burden observed in foods. Further studies are required to assess this hypothesis. A better control of sanitation conditions in relation to food production and provision activities may reduce their lead burden. In addition, promoting the consumption of foods containing minerals and vitamins that modulate lead effects may mitigate lead exposure and/or any damage caused by this element. For example, a low calcium diet increases lead absorption and toxicity; iron-poor diets, that lead to iron deficiency, may increase lead absorption and retention.7 There is evidence that the presence of zinc in the gastrointestinal tract may reduce lead absorption. In animal studies, it has been demonstrated that selenium may reduce the neurotoxic and nephrotoxic effects of lead; in humans, a negative correlation has been observed between blood lead levels and plasma selenium levels among workers exposed to lead.22 Lead neurotoxicity mechanisms are intricate and include, among other aspects, the oxidative stress generated by free radicals induced by the presence of lead.8 So, the dietary presence of minerals and vitamins with antioxidant properties may reduce lead toxicity caused by this pathway. For example, vitamin C has a well-demonstrated antioxidant property, which is exerted by the inhibition of lipid peroxidation; however, it has also been established that it may have a chelating effect on lead similar to that of ethylenediaminetetraacetic acid (EDTA). In animal studies, it has been observed that vitamin C could have a protective effect against lead-induced hematopoietic toxicity and may also increase lead urinary excretion. Vitamin E-, vitamin B6-, and beta-carotene-rich

| Country               | Estimated DI (µg/day) | Population | Year of publication | Reference         |
|-----------------------|-----------------------|------------|---------------------|-------------------|
| United Kingdom        | 6                     | General    | 2010                | Rose et al.(23)   |
| Korea                 | 9.8                   | General    | 2012                | Koh et al.(24)    |
| Denmark               | 18                    | General    | 2002                | Larsen et al.(25) |
| Germany               | 19                    | General    | 2000                | Seifert et al. (26) |
| Japan                 | 21                    | General    | 2004                | Maitani et al. (27) |
| Canada                | 24                    | General    | 1995                | Dabeka et al. (28) |
| Spain (Basque Country)| 34                    | General    | 1996                | Urieta et al. (29) |
| France                | 52                    | General    | 2000                | Leblanc et al. (30) |
| Spain (Catalonia)     | 59                    | General    | 2008                | Marti Cid et al. (11) |
| China                 | 82                    | General    | 2007                | Zheng et al. (31) |
| Chile                 | 206                   | General    | 2005                | Muñoz et al. (18) |
| La Plata              | 138                   | Children aged 1 to 7 years | 2017 | Martins et al. |

DI: daily intake.
foods may have a protective effect against lipid peroxidation.22

This study is the first approximation to a health field that has not been sufficiently studied in Argentina, with a methodology that may be replicated in other age groups and with exposure to other toxic compounds. Further larger studies with bigger populations are required to determine \( \text{Lp}/ \text{Ch} \) in the pediatric population in a more precise manner.

**CONCLUSION**

The lead burden of children aged 1 to 7 years attending a public hospital in La Plata is 138 \( \mu \text{g/dL} \) day.

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## Questionnaire on the frequency of food intake

| FOOD GROUP                        | CLASS                        | BRAND               | FREQUENCY OF INTAKE |
|-----------------------------------|------------------------------|---------------------|---------------------|
|                                   |                              |                     | NO  | Month | 1-3 | 1  | 2-3 | 4-6 | +6 |
| 1. Grains and grain-based products and dried legumes | Homemade/store-bought gnocchi | Matarazzo, Salteña |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Oralí, Fresh pasta shop |     |       |     |     |     |     |     |
|                                   |                              | Badaloni, Other     |     |       |     |     |     |     |     |
|                                   | Homemade/store-bought ravioli | Matarazzo, Salteña  |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Oralí, Fresh pasta shop |     |       |     |     |     |     |     |
|                                   |                              | Badaloni, Other     |     |       |     |     |     |     |     |
|                                   | Other $                     |                     |     |       |     |     |     |     |     |
|                                   | Homemade/store-bought noodles | Matarazzo, Nutregal |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Favorita, Knorr |     |       |     |     |     |     |     |
|                                   |                              | Marollo, Luchetti, Qué rico, Store brand |     |       |     |     |     |     |     |
|                                   | Other $                     |                     |     |       |     |     |     |     |     |
|                                   | Cappelletti                  | Giacomo, Other      |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Other |     |       |     |     |     |     |     |
|                                   | Polenta                      | Prestopronta, Rivara |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Polenta mágica |     |       |     |     |     |     |     |
|                                   |                              | Other $             |     |       |     |     |     |     |     |
|                                   | Semolina                     | Vitina, Egran       |     |       |     |     |     |     |     |
|                                   | Retail store Supermarket Hypermarket | Other |     |       |     |     |     |     |     |
|                                   | White rice                   | Gallo, Alia         |     |       |     |     |     |     |     |
|                                   |                              | Dos hermanos, Luchetti | |       |     |     |     |     |     |
| FOOD GROUP                        | CLASS                     | BRAND       | FREQUENCY OF INTAKE | NO | Month | 1 | 2-3 | 4-6 | +6 |
|----------------------------------|---------------------------|-------------|---------------------|----|-------|---|-----|-----|----|
| Retail store Supermarket Hypermarket | Bárbara                  | Store brand |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Lentils                          | Egran                     | Marolío     |                     |    |       |   |     |     |    |
|                                  | Mrfood                    | Store brand |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Dried peas                       | Egran                     | Marolío     |                     |    |       |   |     |     |    |
|                                  | Mrfood                    | Store brand |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Beans                            | Egran                     | Marolío     |                     |    |       |   |     |     |    |
|                                  | MrFood                    | Store brand |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Soybeans                         | Egran                     | Marolío     |                     |    |       |   |     |     |    |
|                                  | MrFood                    | Store brand |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Corn flakes                      | Granix                    | Nestlé      |                     |    |       |   |     |     |    |
|                                  | Tres arroyos              | Kellogg’s   |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Frosted flakes                   | Granix                    | Nestlé      |                     |    |       |   |     |     |    |
|                                  | Tres arroyos              | Kellogg’s   |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Chocolate cereals                | Granix                    | Nestlé      |                     |    |       |   |     |     |    |
|                                  | Tres arroyos              | Kellogg’s   |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Honey cereals                    | Granix                    | Nestlé      |                     |    |       |   |     |     |    |
|                                  | Tres arroyos              | Kellogg’s   |                     |    |       |   |     |     |    |
|                                  | Other                     |             |                     | $  | /     |   |     |     |    |
| Puffed corn                      |                           |             |                     |    |       |   |     |     |    |
| Crackers                         | Mediatarde                | Express     |                     |    |       |   |     |     |    |
|                                  | Criollitas                | Mayco       |                     |    |       |   |     |     |    |
| FOOD GROUP | CLASS                          | BRAND          |
|------------|-------------------------------|----------------|
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Sweet cookies                 |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Filled biscuits               |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | French bread                  |                |
|            | Sliced bread                  |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Pastry (simple)               |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Filled pastry                 |                |
|            | Lard-based biscuits           |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Cupcakes/muffins              |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Pudding                       |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Homemade/store-bought yuca    |                |
|            | bread                         |                |
|            | Retail store Supermarket      |                |
|            | Hypermarket                   |                |
|            | Wheat flour                   |                |

|            | FOOD GROUP | CLASS                      | BRAND          |
|------------|------------|----------------------------|
|            |            | Sweet cookies               | Gold Mundo  Bagley |
|            |            | Retail store Supermarket    | Terrabusi Arcor |
|            |            | Hypermarket                 | Tia Maruca Fantocche |
|            |            | Banco                      | Bolsita Store brand |
|            |            | Other $                     | /               |
|            |            | Filled biscuits             | Bagley Lia |
|            |            | Retail store Supermarket    | Coronitas Leiva |
|            |            | Hypermarket                 | Bolsita Store brand |
|            |            | Other $                     | /               |
|            |            | French bread                | Retail store Supermarket Hypermarket |
|            |            | Sliced bread                | Bimbo La Salteña |
|            |            | Retail store Supermarket    | Fargo Lactal |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Pastry (simple)             | Retail store Supermarket Hypermarket |
|            |            | Filled pastry               | Retail store Supermarket Hypermarket |
|            |            | Lard-based biscuits         | Don Satur 9 de oro |
|            |            | Retail store Supermarket    | Maruca Granix |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Cupcakes/muffins            | Valeste Pozo |
|            |            | Retail store Supermarket    | Nevares Bakery |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Pudding                     | Don Satur Nevares |
|            |            | Retail store Supermarket    | Valeste Okebon |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Homemade/store-bought yuca  | Powder Bakery |
|            |            | bread                       | Other $ /       |
|            |            | Retail store Supermarket    | Exquisita Godet |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Homemade/store-bought sponge| Powder Bakery |
|            |            | cake                        | Other $ /       |
|            |            | Retail store Supermarket    | Exquisita Godet |
|            |            | Hypermarket                 | Other $ /       |
|            |            | Wheat flour                 | Favorita Pureza |
| FOOD GROUP                                      | CLASS              | BRAND            | FREQUENCY OF INTAKE |
|-----------------------------------------------|--------------------|------------------|---------------------|
|                                               |                    |                  | NO  | Month | 1-3 | 1  | 2-3 | 4-6 | +6 |
| Retail store Supermarket Hypermarket          | Potato             | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Sweet potato       | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Pumpkin            | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Carrot             | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Bell pepper        | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Onion              | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
|                                               | Fresh tomato       | Retail store     | Supermarket         | Hypermarket         | Street market | Other |
| Tomato puree/canned tomatoes                  | Campagnola         |                  |                    |                    |                |      |
| Retail store Supermarket Hypermarket          | Cica               |                  |                    |                    |                |      |
|                                               | Melto              |                  |                    |                    |                |      |
|                                               | Arcor              |                  |                    |                    |                |      |
|                                               | Canale             |                  |                    |                    | Store brand    |      |
|                                               | Other              |                  |                    |                    |                |      |
| Lettuce                                       | Retail store       | Supermarket      | Hypermarket         | Street market       | Other          |      |
| Spinach/chard                                 | Retail store       | Supermarket      | Hypermarket         | Street market       | Other          |      |
| Globe zucchini                                | Retail store       | Supermarket      | Hypermarket         | Street market       | Other          |      |
| Corn on the cob                               | Retail store       | Supermarket      | Hypermarket         | Street market       | Other          |      |
| FOOD GROUP | CLASS | BRAND          | FREQUENCY OF INTAKE |
|------------|-------|----------------|--------------------|
|            |       |                | NO  | Month | 1 | 2-3 | 4-6 | +6   |
| Corn kernels |       | Marolio, Inca  |     |       |   |     |     |      |
| Retail store Supermarket Hypermarket | Canale | Store brand     |     |       |   |     |     |      |
| Other      | $      | /              |     |       |   |     |     |      |
| Dried peas |       | Marolio, Canale |     |       |   |     |     |      |
| Retail store Supermarket Hypermarket | Arcor | Store brand     |     |       |   |     |     |      |
| Other      | $      | /              |     |       |   |     |     |      |
| Apple      |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Banana     |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Pear       |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Tangerine  |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Orange     |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Strawberry |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Grapes     |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Peach      |       | Retail store, Supermarket, Hypermarket, Street market, Other |
| Peaches in syrup | La colina, BC Canale | Store brand |
| Retail store Supermarket Hypermarket | Other | $ / |
| FOOD GROUP                              | CLASS                       | BRAND            |
|-----------------------------------------|-----------------------------|------------------|
| 3. Milk, yogurt, and cheese             | Whole-cow’s milk: fluid/powder | LS Sancor       |
|                                        | Retail store Supermarket Hypermarket | Iholay Milkaut |
|                                        |                             | Chella Hypermarket |
|                                        | Other                       | $ /              |
|                                        | Reduced-fat cow’s milk: fluid/powder | LS Sancor       |
|                                        | Retail store Supermarket Hypermarket | Iholay Milkaut |
|                                        |                             | Chella Hypermarket |
|                                        | Other                       | $ /              |
|                                        | Milk provided by the mother and child plan |                  |
|                                        | Whole-milk yogurt flavored/fruited/with cereals | Sancor LS       |
|                                        | Retail store Supermarket Hypermarket | Iholay La suipachense |
|                                        | Other                       | $ /              |
|                                        | Low-fat yogurt flavored/fruited/with cereals | Sancor LS       |
|                                        | Retail store Supermarket Hypermarket | Iholay La suipachense |
|                                        | Other                       | $ /              |
|                                        | Liquid yogurt whole-milk/low-fat | Sancor LS       |
|                                        | Retail store Supermarket Hypermarket | Iholay Yatasto  |
|                                        | Other                       | $ /              |
|                                        | Dairy dessert (vanilla-chocolate) | Danonino Sancorito |
|                                        | Retail store Supermarket Hypermarket | Shimmy Danette |
|                                        |                             | Serenito         |
|                                        | Other                       | $ /              |
|                                        | Creamy/full-fat cheese      | La Paulina LS    |
|                                        | Retail store Supermarket Hypermarket | Barraza Sancor  |
|                                        |                             | Riecre Verónica  |
|                                        | Other                       | $ /              |
|                                        | Cream cheese                | Casancrem Mendicrim  |
|                                        | Retail store Supermarket Hypermarket | Adler Iholay    |
|                                        | Other                       | $ /              |
|                                        | Hard (grating) cheese        | Santa Rosa Iholay |
|                                        |                             | LS Tregar        |
## 4. Meat and eggs

| FOOD GROUP | CLASS | BRAND | FREQUENCY OF INTAKE |
|------------|-------|-------|---------------------|
| Retail store Supermarket Hypermarket | Other | $ / |
| Low-fat cheese | Sancor | La Paulina |
| Retail store Supermarket Hypermarket | Ricrem | Verónica |
| Processed cheese | Other | $ / |
| Retail store Supermarket Hypermarket | LS | Sancor |
|  | Other | $ / |
| Retail store | Street market | Other |

### Beef

| Where do you buy it? | Retail store Supermarket Hypermarket | Minced beef | Short Ribs |
|----------------------|--------------------------------------|-------------|------------|
|                       | Beef neckbones | Heel of round | Shoulder |
|                       | Bottom round | Whole knuckle | Outside round |
| Other | $ / |

### Pork

| Where do you buy it? | Retail store Supermarket Hypermarket | Fillet | Sirloin |
|----------------------|--------------------------------------|--------|--------|
| Other | $ / |

### Chicken

| Where do you buy it? | Retail store Supermarket Hypermarket | Wings | Leg quarter |
|----------------------|--------------------------------------|-------|------------|
| Breast | Giblets |
| Other | $ / |

### Fish

| Where do you buy it? | Retail store Supermarket Hypermarket | Hake | |
|----------------------|--------------------------------------|------||
| Other | $ / |

### Canned (tuna, mackerel, horse mackerel)

| Canned (tuna, mackerel, horse mackerel) | Retail store Supermarket Hypermarket | Cumana | Jandala |
|-----------------------------------------|--------------------------------------|--------|--------|
| Robinson Crusoe | Gómez |
| Other | $ / |
| FOOD GROUP                  | CLASS                      | BRAND                        | FREQUENCY OF INTAKE |
|-----------------------------|----------------------------|------------------------------|---------------------|
|                             |                            |                              | NO  | Month | 1-3 | 1 | 2-3 | 4-6 | +6 |
|                             |                            |                              |     |        |     |   |     |     |    |
| Store-bought chicken burger | Poulterer shop             |                              |     |        |     |   |     |     |    |
|                             | Other $                   |                              |     |        |     |   |     |     |    |
| Store-bought burger         | Paty                      | Retail store                 |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Ham                         | La Cabana                 |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Shoulder                    | La Cabana                 |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Salami                      | La Cabana                 |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Mortadella                  | Calchaqui                 |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Pepperoni                   | Calchaqui                 |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Vienna sausages             | Paty                      |                              |     |        |     |   |     |     |    |
| Retail store Supermarket    | Other $                   |                              |     |        |     |   |     |     |    |
| Hypermarket                 |                           |                              |     |        |     |   |     |     |    |
| Spicy sausage               | Retail store Supermarket  | Hypermarket                  |     |        |     |   |     |     |    |
| Blood sausage               | Retail store Supermarket  | Hypermarket                  |     |        |     |   |     |     |    |
| Liver                       | Retail store Supermarket  | Hypermarket                  |     |        |     |   |     |     |    |
| Chicken nuggets             | Granja del sol            | Poulterer shop               |     |        |     |   |     |     |    |
|                             | Other                     |                              |     |        |     |   |     |     |    |
| FOOD GROUP | CLASS | BRAND | FREQUENCY OF INTAKE |
|------------|-------|-------|--------------------|
|            |       |       | NO | Month | 1 | 2-3 | 4-6 | +6 |
| Whole egg  | Retail store | Supermarket | Hypermarket | Egg seller | Other | 1-3 | 1 | 2-3 | 4-6 | +6 |
| Fast food  | McDonald's | Pancho |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Butter     | Sancer | LS |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Illolay | Santa Brígida |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Delicia | Manterina |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Margadan | Dánica |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Margarine  | Natura | Hellmann's |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Fanacca | Store brand |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Mayonnaise | LS | Sancer |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Dairy cream | La suipachense | Illolay |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Oil        | Cada Dia | Cañuelas |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Mazola | Ideal |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Ketchup    | Natura | Hellmann's |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Fanacca | Store brand |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Mustard    | Natura | Fanacca |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Savora | Store brand |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Soup mix   | Knorr | Maggi |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
|            | Other |       |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Broth mix  | Knorr | Maggi |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| Retail store Supermarket Hypermarket | Other | $ / |       |       |       |       | 1 | 2-3 | 4-6 | +6 |
| FOOD GROUP                        | CLASS                                      | BRAND 1         | BRAND 2        | FREQUENCY OF INTAKE |
|-----------------------------------|--------------------------------------------|-----------------|-----------------|---------------------|
|                                   |                                            |                 |                 | NO 1-3              |
|                                   |                                            |                 |                 | MONTH 1             |
|                                   |                                            |                 |                 | No. of times per week 1-3 |
| Bread crumbs                      | Made by a bakery                           | Preferido       | Mamá Cocina     |                     |
| Retail store Supermarket Hypermarket | Other $                                    |                 |                 |                     |
|                                   |                                            |                 |                 |                     |
| 6. Sugar and sweet snacks, confectionery | Sugar                                      | Ledesma         | Chango          |                     |
|                                   |                                            | Santa Celia     | Domino          |                     |
|                                   |                                            | Other $         |                 |                     |
|                                   |                                            |                 |                 |                     |
|                                   | Jam                                        | Arcor           | Dulciora        |                     |
|                                   |                                            | Canale          | La Campagnola   |                     |
|                                   |                                            | Other $         |                 |                     |
|                                   |                                            |                 |                 |                     |
|                                   | Sweet potato/quince paste                  | Esnaola Arcor   |                 |                     |
|                                   |                                            | Other           |                 |                     |
|                                   | Dulce de leche                             | Ilolay          | La Serenisima   |                     |
|                                   |                                            | Sancor          | Milkaut         |                     |
|                                   |                                            | Other $         |                 |                     |
|                                   | Candies                                    |                 |                 |                     |
|                                   | Cookie sandwich filled with dulce de leche/chocolate |                 |                 |                     |
|                                   | Chocolate                                  |                 |                 |                     |
|                                   | Jelly beans                                |                 |                 |                     |
|                                   | Chewing gum                                |                 |                 |                     |
|                                   | Popcorn                                    |                 |                 |                     |
|                                   |                                            |                 |                 |                     |
| FOOD GROUP                          | CLASS                        | BRAND       | FREQUENCY OF INTAKE |
|------------------------------------|------------------------------|-------------|---------------------|
|                                    |                              |             | NO 1-3 1 2-3 4-6 +6 |
| Sunflower seeds                    | Retail store Supermarket Hypermarket | Arcor       |                     |
| Peanut nougat                       | Retail store Supermarket Hypermarket | Nevarés     |                     |
| Gelatin                            | Retail store Supermarket Hypermarket | Godet       | Royal               |
| Potato chips                        | Retail store Supermarket Hypermarket | Exquisita   |                     |
| Puffed cornmeal snacks              | Retail store Supermarket Hypermarket | Pehuamar    | Krachitos           |
| Salted sticks                      | Retail store Supermarket Hypermarket | Krachitos   | Pehuamar            |
| Peanuts or salted/cocktail peanuts | Retail store Supermarket Hypermarket | Pehuamar    | Krachitos           |
| Non-dairy ice cream                |                              | Ice lolly $ |                     |
| Ice cream                           | Ice lolly $                  | Ice-cream shop $ |                     |
| Pizza                              | Dough mix                  | Homemade | Pre-baked pizza crust | Pizza shop Other |
| Turnover dough                      | La Salteña                  | Delicias Doradas |                     |
|                                    | Signo de Oro               | Tapamanía |                     |
|                                    | Dánaica                     | Oralí |                     |
|                                    | Parma          | Store-bought turnovers |     |
| FOOD GROUP   | CLASS          | BRAND                        | FREQUENCY OF INTAKE |
|-------------|----------------|------------------------------|---------------------|
|             |                | Other $ /                    | NO 1-3 1 2-3 4-6 +6 |
|             | Pie dough      | $                            |                     |
|             |                | La Salteña                   | Delicias Doradas    |
|             |                | Signo de Oro                 | Tapamanía           |
|             |                | Danica                       | Oráli               |
|             |                | Parmar                       | Store-bought turnovers |
| Beverages   | Tea            | La Virginia                  | Taragüí             |
|             |                | La Morenita                  | Green Hills         |
|             |                | $                            |                     |
|             | Coffee         | La Virginia                  | Dolca               |
|             |                | Arístán                     | La Morenita         |
|             |                | $                            |                     |
|             | Mate infusion  | Taragüí                      | Tranquera           |
|             |                | Taragüí                      | Marollio            |
|             |                | $                            |                     |
|             | Mate           | Amanda                       | Tranquera           |
|             | Yerba mate brand | Playadito                   | Unión               |
|             |                | Marollio                     | Romance             |
|             |                | $                            |                     |
|             | Cocoa powder   | Nescao                       | Nesquik             |
|             |                | Tody                         | Zucca               |
|             |                | $                            |                     |
|             | Powder juice/juice concentrate | Tang                  | Clight              |
|             |                | Mocoretá                     | Rinde 2             |
|             |                | Verao                        | Caroica             |
|             |                | Baggio                       | Cepita              |
|             |                | $                            |                     |
|             | Chocolate milk | Cindol                       | Ilolay              |
|             |                | Sancor                       |                     |
|             | Soya juice     | Other                        |                     |
1. What kind of water do you drink?........................................................................................................

2. Oil: How many bottles do you buy?.........................How long does it last?......................

How many people share your household?.........

3. What seasonings do you use?

Oregano   Ground chili pepper   Pepper   Thyme   Pizza seasoning

Other.................................................................................................................................

**Retail store:** only retail grocery store, produce shop, bakery or butcher's shop. **Supermarket:** Asian or retail supermarket that comprises meat, fresh produce, dairy, delicatessen, and baked goods aisles. **Hypermarket:** Walmart, Carrefour, Nini.

| Yesterday was... | The type of diet we had yesterday was: |
|------------------|---------------------------------------|
| Monday ☐ Thursday ☐ Sunday ☐ | Like any other day ☐ |
| Tuesday ☐ Friday ☐ | Different than usual because: ☐ |
| Wednesday ☐ Saturday ☐ | Disease ☐ On a diet ☐ Holiday ☐ |

**Detailed menu:**

| Breakfast | Lunch | Tea | Dinner |
|-----------|-------|-----|--------|
| Mid-morning snack | Mid-afternoon snack |       |        |

| Breakfast | Food | Quantity |
|-----------|------|----------|
|           |      |          |
|           |      |          |
|           |      |          |
|           |      |          |

| Lunch | Food | Quantity |
|-------|------|----------|
|       |      |          |
|       |      |          |
|       |      |          |
|       |      |          |
| Tea | Food | Quantity |
|-----|------|----------|
|     |      |          |
|     |      |          |
|     |      |          |

| Dinner | Food | Quantity |
|--------|------|----------|
|        |      |          |
|        |      |          |
|        |      |          |

| Food code | Food name | Net quantity g/cc | Food code | Food name | Net quantity g/cc |
|-----------|-----------|-------------------|-----------|-----------|-------------------|
|           |           |                   |           |           |                   |
|           |           |                   |           |           |                   |
|           |           |                   |           |           |                   |

|           |           |                   |           |           |                   |
|           |           |                   |           |           |                   |
|           |           |                   |           |           |                   |