Contribution of diet to lead exposure among children aged 1 to 7 years in La Plata, Buenos Aires

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ABSTRACT

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 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. 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 from 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.[1] 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.[1,2] Environmental and health conditions during farming, breeding, processing, handling, and storing may affect the contamination of food products with environmental lead.[3]

Some metals are essential for human life because they play a biological role;[4] 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.[5] 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.[6] However, the threshold for blood lead levels with no adverse events on neurodevelopment has not been established yet.[7] 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%)[1] and their developing nervous system makes them more vulnerable to the toxic effects of lead than if they had a mature brain.[5]

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.

DI= I x F /30.4 (formula 1), where "I" means the median daily intake of food in g/day and "F_i" 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:

$$Ipb = \sum_{i=1}^{n} Cpb_i \times ID_i \text{ (formula 2)}$$

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 institution[14,15] 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]

Ethical aspects

The study protocol was approved by the Institutional Research Protocol Review Committee (Comité Institucional de Revisión de Protocolos de Investigación, CIRPI) of Hospital de Niños "Sor María Ludovica." Personal data were collected according to article 3 of National Law No. 25326 for Personal Data Protection. In all cases, a written authorization in the form of a free, informed, and express consent was obtained from parents or tutors following a detailed explanation of the study's procedures and objectives.

RESULTS

Surveys on food intake were administered to the parents or tutors of 91 children whose average age ± standard deviation (SD) was 3.0 ± 1.7 years. Sixty-six percent were males. Most survey respondents (59%) came from the south west area of La Plata, made up of the following neighborhoods: Los Hornos, Altos de San Lorenzo, Olmos, and Villa Elvira. The west area was the second most represented area (41%), made up of the San Carlos, Melchor Romero, Abasto, and Gorina neighborhoods.

Table 1 lists the food products that covered 90% of the daily intake altogether, grouped into composite samples. The total Ipb was 138.2 µg/day. The food groups with the higher intake were processed meat products (15.4%), followed by bakery products (14.8%), milk (12.5%), and meat (11.7%). These food groups altogether accounted for more than 50% of lead intake.

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.[16] 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.[16] 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.[13] 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.[18] In Spain, Llobet et al. found that foods that contributed the most to dietary lead exposure among males in all population groups were grains.

TABLE 1. *Components of each composite sample and their median daily intake. Lead levels of the composite sample based on wet weight and daily intake of lead*

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	Mayonnaise	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

TABLE 2. *Comparison of daily intake of lead from diet in different countries*

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 Ipb 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 μg/day. ■

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ANNEX
Questionnaire on the frequency of food intake

First and last names:..
Age:....................
Address:..
FREQUENCY OF FOOD INTAKE

FOOD GROUP	CLASS	BRAND		FREQUENCY OF INTAKE					
				NO	Month	No. of times per week			
					1-3	1	2-3	4-6	+6
1. Grains and grain-based products and dried legumes	Homemade/store-bought gnocchi	Matarazzo	Salteña						
		Oralí	Fresh pasta shop						
	Retail store Supermarket Hypermarket	Badaloni							
		Other							
	Homemade/store-bought ravioli	Matarazzo	Salteña						
		Oralí	Fresh pasta shop						
	Retail store Supermarket Hypermarket	Badaloni							
		Other $	/						
	Homemade/store-bought noodles	Matarazzo	Nutregal						
		Favorita	Knorr						
	Retail store Supermarket Hypermarket	Marolio	Luchetti						
		Qué rico	Store brand						
		Other $	/						
	Cappelletti	Giacomo							
	Retail store Supermarket Hypermarket	Other							
	Polenta	Prestopronta	Rivara						
		Polenta mágica							
	Retail store Supermarket Hypermarket	Other $	/						
	Semolina	Vitina	Egran						
	Retail store Supermarket Hypermarket	Other							
	White rice	Gallo	Ala						
		Dos hermanos	Luchetti						

FOOD GROUP	CLASS	BRAND		NO	FREQUENCY OF INTAKE				
					Month	No. of times per week			
					1-3	1	2-3	4-6	+6
	Retail store Supermarket Hypermarket	Bárbara	Store brand						
		Other $ /							
	Lentils	Egran	Marolio						
		Mrfood	Store brand						
	Retail store Supermarket Hypermarket	Other $ /							
	Dried peas	Egran	Marolio						
		Mrfood	Store brand						
	Retail store Supermarket Hypermarket	Other $ /							
	Beans	Egran	Marolio						
		MrFood	Store brand						
	Retail store Supermarket Hypermarket	Other $ /							
	Soybeans	Egran	Marolio						
		MrFood	Store brand						
	Retail store Supermarket Hypermarket	Other $ /							
	Corn flakes	Granix	Nestlé						
		Tres arroyos	Kellogg's						
	Retail store Supermarket Hypermarket	Other $ /							
	Frosted flakes	Granix	Nestlé						
		Tres arroyos	Kellogg's						
	Retail store Supermarket Hypermarket	Other $ /							
	Chocolate cereals	Granix	Nestlé						
		Tres arroyos	Kellogg's						
	Retail store Supermarket Hypermarket	Other $ /							
	Honey cereals	Granix	Nestlé						
		Tres arroyos	Kellogg's						
	Retail store Supermarket Hypermarket	Other $ /							
	Puffed corn								
	Retail store Supermarket Hypermarket								
	Crackers	Mediatarde	Express						
		Criollitas	Mayco						

FOOD GROUP	CLASS	BRAND			FREQUENCY OF INTAKE					
					NO	Month	No. of times per week			
						1-3	1	2-3	4-6	+6
	Retail store Supermarket Hypermarket	Neosol	Traviata							
		Tía Maruca	Store brand							
		Other $ /								
	Sweet cookies	Gold Mundo	Bagley							
		Terrabusi	Arcor							
	Retail store Supermarket Hypermarket	Tía Maruca	Fantoche							
		Bolsita	Store brand							
		Other $ /								
	Filled biscuits	Bagley	Lia							
		Coronitas	Leiva							
	Retail store Supermarket Hypermarket	Bolsita	Store brand							
		Other $ /								
	French bread	Retail store	Supermarket	Hypermarket						
	Sliced bread	Bimbo	La Salteña							
		Fargo	Lactal							
	Retail store Supermarket Hypermarket	Other $ /								
	Pastry (simple)	Retail store	Supermarket	Hypermarket						
	Filled pastry	Retail store	Supermarket	Hypermarket						
	Lard-based biscuits	Don Satur	9 de oro							
		Maruca	Granix							
	Retail store Supermarket Hypermarket	Other $ /								
	Cupcakes/muffins	Valente	Pozo							
		Nevares	Bakery							
	Retail store Supermarket Hypermarket	Other $ /								
	Pudding	Don Satur	Nevares							
		Valente	Okebon							
	Retail store Supermarket Hypermarket	Other $ /								
	Homemade/store-bought yuca bread	Powder								
		Bakery								
		Other $ /								
	Homemade/store-bought sponge cake	Exquisita	Godet							
	Retail store Supermarket Hypermarket	Other $ /								
	Wheat flour	Favorita	Pureza							

FOOD GROUP	CLASS	BRAND					NO	FREQUENCY OF INTAKE				
								Month	No. of times per week			
								1-3	1	2-3	4-6	+6
	Retail store Supermarket Hypermarket	Cañuelas		Caserita								
		Other	$	/								
2. Vegetables and fruits (fresh, dried)	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 Retail store Supermarket Hypermarket	Campagnola		Aleo								
		Cica		Marolio								
		Molto		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					NO	FREQUENCY OF INTAKE				
								Month	No. of times per week			
								1-3	1	2-3	4-6	+6
	Corn kernels	Marolio	Inca									
		Canale	Store brand									
	Retail store Supermarket Hypermarket	Other	$	/								
	Dried peas	Marolio	Canale									
		Arcor	Store brand									
	Retail store Supermarket Hypermarket	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		NO	FREQUENCY OF INTAKE				
					Month	No. of times per week			
					1-3	1	2-3	4-6	+6
3. Milk, yogurt, and cheese	Whole-cow's milk: fluid/powder	LS	Sancor						
		Ilolay	Milkaut						
	Retail store Supermarket Hypermarket	Chelita	Hypermarket						
		Other $ /							
	Reduced-fat cow's milk: fluid/powder	LS	Sancor						
		Ilolay	Milkaut						
	Retail store Supermarket Hypermarket	Chelita	Hypermarket						
		Other $ /							
	Milk provided by the mother and child plan								
	Whole-milk yogurt flavored/fruited/with cereals	Sancor	LS						
		Ilolay	La suipachense						
	Retail store Supermarket Hypermarket	Other $ /							
	Low-fat yogurt flavored/fruited/with cereals	Sancor	LS						
		Ilolay	La suipachense						
	Retail store Supermarket Hypermarket	Other $ /							
	Liquid yogurt whole-milk/low-fat	Sancor	LS						
		Ilolay	Yatasto						
	Retail store Supermarket Hypermarket	Other $ /							
	Dairy dessert (vanilla-chocolate)	Danonino	Sancorito						
		Shimmy	Danette						
	Retail store Supermarket Hypermarket	Serenito							
		Other $ /							
	Creamy/full-fat cheese	La Paulina	LS						
		Barraza	Sancor						
	Retail store Supermarket Hypermarket	Ricrem	Verónica						
		Other $ /							
	Cream cheese	Casancrem	Mendicrim						
		Adler	Ilolay						
	Retail store Supermarket Hypermarket	Other $ /							
	Hard (grating) cheese	Santa Rosa	Ilolay						
		LS	Tregar						

FOOD GROUP	CLASS	BRAND					FREQUENCY OF INTAKE					
							NO	Month	No. of times per week			
								1-3	1	2-3	4-6	+6
	Retail store Supermarket Hypermarket	Other $ /										
	Low-fat cheese	Sancor	La Paulina									
		Ricrem	Verónica									
	Retail store Supermarket Hypermarket	Other $ /										
	Processed cheese	LS	Sancor									
	Retail store Supermarket Hypermarket	Other $ /										
4. Meat and eggs	Store-bought breaded chicken	Retail store	Supermarket	Hypermarket	Street market	Other						
	Store-bought breaded beef	Retail store	Supermarket	Hypermarket	Street market	Other						
	Beef	Minced beef	Short Ribs									
	Where do you buy it?	Heel of round	Shoulder									
		Beef neckbones	Whole knuckle									
	Retail store Supermarket Hypermarket	Bottom round	Outside round									
		Other $ /										
	Pork Where do you buy it?	Fillet	Sirloin									
	Retail store Supermarket Hypermarket	Other $ /										
	Chicken Where do you buy it?	Wings	Leg quarter									
	Retail store Supermarket Hypermarket	Breast	Giblets									
		Other $ /										
	Fish Where do you buy it?	Hake										
	Retail store Supermarket Hypermarket	Other $ /										
	Canned (tuna, mackerel, horse mackerel)	Cumana	Jandaia									
		Robinson Crusoe	Gómez									
	Retail store Supermarket Hypermarket	Other $ /										

FOOD GROUP	CLASS	BRAND				NO	FREQUENCY OF INTAKE				
							Month	No. of times per week			
							1-3	1	2-3	4-6	+6
	Store-bought chicken burger	Poulterer shop									
		Other	$	/							
	Store-bought burger	Paty		Retail store							
	Retail store Supermarket Hypermarket	Other	$	/							
	Ham	Laural		La Cabana							
		La rio		Paladini							
	Retail store Supermarket Hypermarket	Other	$	/							
	Shoulder	Laural		La Cabana							
		La rio									
	Retail store Supermarket Hypermarket	Other	$	/							
	Salami	La rio		Paladini							
		Cagnoli									
	Retail store Supermarket Hypermarket	Other	$	/							
	Mortadella	Paladini		Calchaquí							
		Lario									
	Retail store Supermarket Hypermarket	Other	$	/							
	Pepperoni	Paladini		Calchaquí							
		Lario									
	Retail store Supermarket Hypermarket	Other	$	/							
	Vienna sausages	Granja Iris		Paty							
		Vienísima		Swift							
	Retail store Supermarket Hypermarket	Other	$	/							
	Spicy sausage	Retail store	Supermarket	Hypermarket	Other						
	Blood sausage	Retail store	Supermarket	Hypermarket	Other						
	Liver	Retail store	Supermarket	Hypermarket	Other						
	Chicken nuggets	Granja del sol		Poulterer shop							
		Other									

FOOD GROUP	CLASS	BRAND					NO	FREQUENCY OF INTAKE				
								Month	No. of times per week			
								1-3	1	2-3	4-6	+6
	Whole egg	Retail store	Supermarket	Hypermarket	Egg seller	Other						
	Fast food	McDonald's										
		Pancho										
5. Oils, fat, and broth	Butter	Sancor	LS									
	Retail store Supermarket Hypermarket	Ilolay	Santa Brígida									
		Other $ /										
	Margarine	Delicia	Manterina									
	Retail store Supermarket Hypermarket	Margadan	Dánica									
		Other $ /										
	Mayonnaise	Natura	Hellmann's									
	Retail store Supermarket Hypermarket	Fanacoa	Store brand									
		Other $ /										
	Dairy cream	LS	Sancor									
	Retail store Supermarket Hypermarket	La suipachense	Ilolay									
		Other										
	Oil	Natura	Cada Día									
	Retail store Supermarket Hypermarket	Cocinero	Cañuelas									
		Mazola Other	Ideal									
	Ketchup	Natura	Hellmann's									
	Retail store Supermarket Hypermarket	Fanacoa	Store brand									
		Other $ /										
	Mustard	Natura	Fanacoa									
	Retail store Supermarket Hypermarket	Savora	Store brand									
		Other $ /										
	Soup mix	Knorr	Maggi									
	Retail store Supermarket Hypermarket	Other										
	Broth mix	Knorr	Maggi									
	Retail store Supermarket Hypermarket	Other $ /										

FOOD GROUP	CLASS	BRAND		NO	FREQUENCY OF INTAKE Month	No. of times per week			
					1-3	1	2-3	4-6	+6
	Breadcrumbs Retail store Supermarket Hypermarket	Preferido	Mamá Cocina						
		Made by a bakery							
		Other $ /							
6. Sugar and sweet snacks, confectionery	Sugar Retail store Supermarket Hypermarket	Ledesma	Chango						
		Santa Celia	Domino						
		Other $ /							
	Jam Retail store Supermarket Hypermarket	Arcor	Dulciora						
		Canale	La Campagnola						
		Other $ /							
	Sweet potato/quince paste Retail store Supermarket Hypermarket	Esnaola Arcor							
		Other							
	Dulce de leche Retail store Supermarket Hypermarket	Ilolay	La Serenísima						
		Sancor	Milkaut						
		Other $ /							
	Candies Retail store Supermarket Hypermarket								
	Cookie sandwich filled with *dulce de leche*/chocolate Retail store Supermarket Hypermarket								
	Chocolate Retail store Supermarket Hypermarket								
	Jelly beans Retail store Supermarket Hypermarket								
	Chewing gum Retail store Supermarket Hypermarket								
	Popcorn Retail store Supermarket Hypermarket								

FOOD GROUP	CLASS	BRAND		NO	FREQUENCY OF INTAKE Month	No. of times per week			
					1-3	1	2-3	4-6	+6
	Sunflower seeds Retail store Supermarket Hypermarket								
	Peanut nougat	Arcor							
		Nevares							
	Retail store Supermarket Hypermarket	Other							
	Gelatin	Godet	Royal						
		Exquisita							
	Retail store Supermarket Hypermarket	Other $ /							
	Potato chips	Pehuamar	Krachitos						
		Bum	Lay's						
	Retail store Supermarket Hypermarket	Other $ /							
	Puffed cornmeal snacks	Cheetos Krachitos	Pehuamar						
	Retail store Supermarket Hypermarket	Other $ /							
	Salted sticks	Krachitos	Pehuamar						
		Pep							
	Retail store Supermarket Hypermarket	Other $ /							
	Peanuts or salted/cocktail peanuts	Pehuamar	Krachitos						
		Croppers							
		Other $ /							
	Non-dairy ice cream	Ice lolly $							
		Ice-cream shop $							
		Other							
	Ice cream	Ice lolly $							
		Ice-cream shop $							
		Other							
	Pizza	Dough mix | Homemade | Pre-baked pizza crust	Pizza shop | Other						
	Turnover dough	La Salteña	Delicias Doradas						
		Signo de Oro	Tapamanía						
		Dánica	Oralí						
		Parma	Store-bought turnovers						

FOOD GROUP	CLASS	BRAND		NO	FREQUENCY OF INTAKE				
					Month	No. of times per week			
					1-3	1	2-3	4-6	+6
		Other $ /							
	Pie dough	La Salteña	Delicias Doradas						
		Signo de Oro	Tapamanía						
		Dánica	Oralí						
		Parma	Store-bought turnovers						
		Other $ /							
Beverages	Tea	La Virginia	Taragüí						
		La Morenita	Green Hills						
		Other $ /							
	Coffee	La Virginia	Dolca						
		Arlistán	La Morenita						
		Other $ /							
	Mate infusion	Taragüí	Tranquera						
		Taragüí	Marolio						
		Other $ /							
	Mate Yerba mate brand	Amanda	Tranquera						
		Playadito	Unión						
		Marolio	Romance						
		Other $ /							
	Cocoa powder	Nescao	Nesquik						
		Tody	Zucoa						
		Other $ /							
	Powder juice/juice concentrate	Tang	Clight						
		Mocoretá	Rinde **2**						
		Verao	Carioca						
		Baggio	Cepita						
		Other $ /							
	Chocolate milk	Cindor	Ilolay						
		Sancor							
		Other							
	Soft drink								
	Soya juice								

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...		
Monday ☐	Thursday ☐	Sunday ☐
Tuesday ☐	Friday ☐	
Wednesday ☐	Saturday ☐	

The type of diet we had yesterday was:
Like any other day ☐
Different than usual because: ☐
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