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ORIGINAL ARTICLE

Feeding behavior, dietary sufficiency and nutritional status in children between 6 and 18 months

Comportamiento alimentario, suficiencia dietaria y estado nutricional en niños entre 6 a 18 meses

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What do we know about the subject matter of this study?

Few studies address this issue in children aged 6 to 18 months. The literature focuses on breastfeeding (BF), and not especially on the initiation and continuation of complementary feeding (CF).

What does this study contribute to what is already known?

It provides additional information on both BF and CF to identify aspects of feeding behavior and dietary adequacy in this group of children. It also provides updated information on the nutritional status of children with different socioeconomic statuses (SES).

Abstract

Infant feeding has specific qualitative and quantitative characteristics. The influence of parents on food intake is crucial in the development of habits and an adequate nutritional state. **Objective:** To evaluate eating behavior, dietary characteristics, and nutritional status of children between 6 to 18 months. **Subjects and Method:** Cross-sectional descriptive study in 199 children. Using convenience sampling, demographic and anthropometric data were recorded for nutritional status, and dietary history, through a 24-hour reminder for dietary behavior and food sufficiency. The Student's t-test and one-way ANOVA were applied for continuous variables and the chi-square test for the categorical ones. **Results:** 54.8% were women. Regarding nutritional status, 21.1% were overweight and 7.6% obese. 56.8% of the children had meal numbers according to their age. The average energy intake was 652.9 ± 224.2 calories per day. The intake of energy and macronutrients was significantly higher in children not consuming breast milk and aged 12 to 18 months. The energy, lipids, and carbohydrates adequacy in girls was significantly higher than in boys. 83.1% of food consumption was habitual for this age group. **Conclusion:** In eating behavior, we observed that 4 out of 10 children have meal numbers higher than suggested for their ages. Regarding dietary sufficiency, there is a higher intake in children with normal nutritional status, without breastfeeding, and between 12 and 18 months. Despite the high prevalence of obesity, it was lower than that observed at the national level.

Keywords:
Nutritional Status;
Foods;
Nutrients;
Energy;
Feeding Behavior;
Children

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Introduction

Eating habits, dietary intake, and nutritional status of infants and children during the first 2 years of life are of great relevance. During this stage, breastfeeding and the initiation and strengthening of complementary feeding are intended to cover the high nutritional requirements for the maintenance of an adequate nutritional and health status. In addition, both types of feeding are essential in the dietary education given by parents, as well as in the development of eating habits and preferences, which will be largely repeated and maintained throughout childhood and beyond[1,2].

In infants, inadequate complementary feeding, maternal malnutrition, and the absence or partial breastfeeding can have direct or indirect negative repercussions on the child's health, her/his physical growth, the risk of acute and infectious pathologies, obesity, or malnutrition, and autoimmune and atopic diseases[3].

In 2003, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) published a document where they emphasized that inadequate feeding practices are a major risk factor for morbidity and mortality in early childhood[4]. The Chilean Ministry of Health (MINSAL)[5] published in 2015 the Feeding Guide for Children under 2 years of age which highlighted the relevance of feeding in the first 1000 days of life[6], affective bonds, and the child's attachment to the mother, as well as recommendations on normal feeding, habits, and eating behavior for healthy children[2]. In 2017, the document on complementary feeding by the European Society for Pediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) emphasized the cultural differences in feeding practices between countries, encouraging breastfeeding, promoting the safe, gradual, and nutritional quality inclusion of various foods in complementary feeding (including potentially allergenic foods), and encouraging parents to react to hunger and satiety signals, without overfeeding or giving food as a prize or reward[7].

Regarding the nutritional status of Chilean children, in 2016, MINSAL reported that in children aged between 7-11 months and 12-17 months, the prevalence of obesity and overweight ranged from 10.1% to 10.2% and from 24.8% to 25.6%, respectively. These are alarming figures, placing Chile as one of the countries with the highest prevalence of overweight and obesity worldwide[8].

However, there are very few international studies that provide evidence on feeding behavior in infants or that determine the detailed nutrient intake during this period. The studies that have been found show a poorly varied diet, high in dairy and meat, but low in legumes, fish, and foods rich in essential fatty acids[9]. Among the most relevant studies are the Norwegian Mother and Child Cohort Study (MoBa)[10], the Dortmund Nutritional and Anthropometric Longitudinally Design (DONALD)[11], the Avon Longitudinal Study of Parents and Children (ALSPAC)[12], and the Public Health Impact of Long-term, Low-Level Mixed Element Exposure (PHIME)[13] in susceptible population strata. It is important to note that no studies have been found at the national level that investigate dietary behavior and intake in this age group.

The objective of the study is to evaluate feeding behavior, dietary characteristics, habits, and nutritional status in children aged 6 to 18 months in Santiago, Chile.

Subjects And Method

A descriptive cross-sectional study was conducted from June to August 2017, in children aged 6 to 18 months in Santiago, Chile. The sample was selected by convenience and the following were considered as inclusion criteria: term newborn, with adequate weight for gestational age, and with regular initiation of complementary feeding at the sixth month of life. In addition, we stratified the socioeconomic status (SES) of the family based on the occupational status and educational level according to the ESOMAR classification[14]. These categories were regrouped into three groups: high SES: ABC1; medium SES: C2 and C3; and low SES: D[15].

The public research agency Gfk Adimark contacted the mothers and/or caregivers of 256 children by telephone and then were visited at home by a team of specialized nutritionists in anthropometry and dietary records. In the first visit, all subjects were informed of the study protocol and asked to accept and sign the informed consent, resulting in a total sample of 199 children. In the second visit, the nutritionists recorded the sociodemographic data and evaluated the children anthropometrically, measuring body weight in kilograms and grams with a SECA model 354 digital scale (Hamburg, Germany), with 10 grams of graduation and 20 kilograms of maximum capacity, and length with a SECA model 417 mobile measuring board (Hamburg, Germany), with 1 millimeter of graduation and measuring range of 10 - 100 centimeters.

In addition, mothers were trained to complete the online self-recording 24-hour diet recall (24HR) survey from four to seven days, including at least one weekend day, recording time, type, and amount of food consumed by the child and its equivalence in grams or milliliters. The telephone contact information of the nutritionists was also given to the mothers in case of questions about the application of the 24HR.

The data extracted from the 24HR survey were

analyzed with the Food Processor II Software version 11.3, using those foods that are identical or have greater similarity in their nutritional characteristics to Chilean foods. This software has been previously validated and used by our group[16]. In the case of breast milk, its intake was only recorded qualitatively because it was impossible to quantify it.

Data coding and management were carried out by specialized nutritionists in Food Processor II Software and the following were considered for nutritional analysis: energy (Kcal), total protein (g), lipids (g), omega 3 (g), omega 6 (g), carbohydrates (g), vitamin A as retinol equivalent (µg), vitamin D (µg), vitamin E as α-tocopherol equivalent (mg), vitamin K (µg), vitamin C (mg), thiamin (mg), riboflavin (mg), niacin (mg), pyridoxine (mg), folate (µg), vitamin B12 (µg), pantothenic acid (mg), biotin (µg), calcium (mg), phosphorus (mg), copper (µg), fluoride (mg), iodine (µg), iron (mg), zinc (mg), potassium (g), and sodium (g).

The anthropometric history was analyzed according to the standards of the WHO 2006[17,18]. Undernutrition (UN) was defined as zW/A score ≤ -1 in children younger than 12 months and zW/L ≤ -1 for children older than 12 months (at risk of undernutrition: zW/A or zW/L -1 to -1.99; malnutrition: zW/A or zW/L ≤ -2, depending on the age respectively). Overnutrition (ON) was defined as zW/L score ≥ + 1 (overweight: zW/L + 1 to + 1.99; obesity zW/L ≥ + 2). In addition, we used the Feeding Guide for Children under 2 years of age, published by the MINSAL in 2015[5] as a reference for healthy eating habits and behaviors, and finally, we considered the intake of processed and ultra-processed foods, defined as those formulations mainly from industrial sources and dietary foods plus additives that require a series of processes[19], which are usually high in total fat, saturated fat, added sugar and salt, along with a lower density of fiber and vitamins[20].

Ethical Considerations

This study followed the World Medical Association Declaration of Helsinki on ethics in medical research on human beings and the regulations currently in force in our country and was approved by the Bioethics Committee of the *Universidad Finis Terrae*. Informed consent was requested from the parents or legal caregivers of the children included in our study.

Statistical Analysis

The normality of the variables was verified with the Shapiro Wilk test. Numerical variables were described as mean and standard deviation. For each child, average daily energy, macronutrient, and micronutrient intakes were calculated based on the 24HR of 4 to 7 days, excluding the use of supplements. Energy intake was compared with the estimated energy requirements according to the Principles and application of the new energy requirements according to the FAO/WHO Expert Committee 2004[21], and protein and micronutrient intake was compared with the Dietary Reference Intakes 2006[22]. Normal adequacy of the actual dietary intake concerning the nutritional requirements of each child was considered when energy and macronutrients were between 90-110% and vitamins and minerals between 70-130%[22].

Those variables with two categories were compared using the Student's t-test and variables with three or more levels were compared with the one-way ANOVA and the Bonferroni's multiple comparison test. Categorical variables were described according to frequencies. A $p < 0.05$ was considered significant and the statistical software SAS 9.4 and SPSS 17 were used.

Results

199 children participated in the study (age 12.2 ± 3.9 months), 54.8% were female, 51.7% were of medium socioeconomic level, 28.7% presented ON (overweight + obesity), 53.8% consumed breast milk, and 43.2% consumed more meals per day than recommended (Table 1).

Table 2 shows the energy, macronutrient, and critical micronutrient intakes of all children according to breast milk consumption and age range. There were significant differences between the highest intake of energy, macronutrients, minerals, and vitamins A, D, E, and C, except for vitamin K, in children aged 12-18 months and those who did not consume breast milk in their daily diet. The energy intake of the total sample was 652.9 ± 224.2 calories. There were no significant differences in energy intake according to sex, age, and nutritional status. In the analysis of macronutrients and critical micronutrients (vitamins A, E, D, K, C; minerals calcium, iron, and zinc), there were no significant differences in intake by sex and nutritional status.

When evaluating the percentage of adequacy according to SES (ABC1 vs. D) in energy (86.0 ± 28.0 vs. 92.4 ± 33.7) and protein (178.5 ± 71.3 vs. 198.1 ± 94.7), we found normal adequacy for energy and high adequacy for protein. Regarding the percentage of lipid, carbohydrate, and critical micronutrients adequacy, there were no significant differences according to SES.

Table 3 shows the percentages of adequacy of the complete and compared sample according to sex. It should be noted that although the mean adequacy for energy of the entire sample was within the normal range, the adequacy of lipids, omega 3 and 6, vitamins A, D, E, niacin, biotin, and minerals such as copper, fluoride, iodine, potassium, and sodium were below the expected. Proteins, carbohydrates, vitamins K, C,

and B12 had a mean above the adequate range. When comparing by sex, it was observed that for energy, lipids, and carbohydrates, girls had significantly higher adequacy compared with boys.

Table 4 shows the comparison of adequacy percentages according to nutritional status. It was observed that children with UN and normal nutritional status had mean energy adequacy within the normal range, but in those with ON, it was slightly below. In addition, we found that the mean adequacy for lipids, omega 3 and 6, vitamins A, D, E, niacin, biotin, and minerals such as fluoride, iodine, and sodium were below the expected in the three groups of nutritional status. It is important to note that sodium in the UN group had significantly higher adequacy compared with the ON group, however, both groups were below normal adequacy. In the case of potassium, it was observed that it was only adequate in the UN group and was significantly higher when compared with the normal and ON groups. On the other hand, the mean adequacy for protein, carbohydrates, vitamins K, C, and B12 was above the adequate in the three groups, and when comparing specifically carbohydrates, it was observed that children with UN had significantly higher adequacy than children with ON, however, in the three nutritional groups, it was elevated.

All foods consumed were grouped into 13 categories which were evaluated according to sex, age range, and nutritional status (Table 5). It was observed that 83.1% of the foods consumed were the usual foods for the age group, especially breast milk, grains, fruits, vegetables, milk, meats/legumes, and raw oils, 12.9% consumed processed foods (e.g., strained baby food), and 3.9% consumed ultra-processed foods such as sausages, sugars, and salty snacks. This was observed for sex, age range, and nutritional status. The addition of artificial sweeteners was observed in girls with normal nutritional status and in both age groups.

Discussion

In this study, regarding feeding behavior, it was observed that 43.2% of the total sample (16.1% children aged 6-11 months and 67% children aged 12-18 months), had a higher number of meals per day than suggested by the Feeding Guide for Children under 2 years of age 2015 published by the MINSAL[5], which recommends 5 to 6 mealtimes for children aged 6 to 11 months and 4 to 5 meals per day for children aged 12-18 months.

In children, it has been described that the increase in the number of meals, including more snacks or "snacking", regardless of the daily energy and macronutrient intake, could be a risk factor for developing obesity[23], as well as the alteration of hunger and satiety signals in children that are acquiring eating habits[24]. This habit of snacking between meals affects 47% of Chilean parents of children aged 0-12 years[25], and the influence of parental eating habits on children is well known.

It was also observed that 83.1% of the foods consumed were among the usual food categories that are incorporated at this age, and that 12.9% of the intake was of strained or chopped processed foods, highly commercially available. This shows compliance with Chilean recommendations that encourage the start of complementary feeding from the sixth month of life, which should be gradual and involves diversifying food intake, usually including from this period onwards dairy products (breast milk or infant formula), meat, fish, legumes, eggs, grains, potatoes, rice, pasta, other grains, fruits, vegetables, and raw oils[5]. This shows that the recommendations are highly followed by parents and caregivers in feeding the children.

We also found a worrying consumption of sausages, sugars, and salty snacks in both sexes, age ranges, and nutritional status, as well as the consumption of added artificial sweeteners in women of both age ranges and with normal nutritional status. Although these are not high percentages, they are not part of any dietary recommendation for children of this age, sex, or nutritional status[5], but are highly purchased and consumed by the Chilean population[27,28]. It should be noted that the consumption of artificial sweeteners could be higher since only the voluntary addition of artificial sweeteners was considered in the records and no foods with added sweeteners in their ingredients. The consumption of these foods has increased in Chile after the implementation of the Food Law 20.606 "On Nutritional Composition of Food and its Advertising"[29], as the industry seeks to reduce the number of high-calorie and high-sugar labels on food packaging, but it is not known whether their regular and high intake can have adverse effects, especially in children[30].

Regarding dietary adequacy, we did not find significant differences in energy intake, macronutrients, and critical micronutrients according to sex and nutritional status, however, the average energy intake in children with UN and normal children was higher than in children with ON, and the same was observed in their energy adequacy. This is consistent with the findings of other studies where higher intakes were observed in children with normal nutritional status[31-33]. It is important to note the differences with these studies, which, despite being studies in the pediatric population, were conducted in older children and with different sample sizes. In addition, the under or overestimation of intake in children with obesity or undernutrition, respectively, by parents or caregivers is well known.

Table 1. General characteristics of de sample

Characteristics	n	%
Sex		
Male	90	45.2
Female	109	54.8
Age range		
6-11 month	93	46.7
12-18 month	106	53.3
Socioeconomic status (SES)		
ABC1	33	16.6
C2	54	27.1
C3	49	24.6
D	63	31.7
Nutritional status		
Malnutrition	1	0.5
Risk of undernutrition	17	8.5
Normal	124	62.3
Overweight	42	21.1
Obesity	15	7.6
Stature		
Short	8	4.0
Normal	178	89.5
High	13	6.5
Intake breast milk	107	53.8
6-11 month	66	70.9
12-18 month	41	38.7
Number of meals per day to recommendation (total)	113	56.8
6-11 month (5 to 6 daily meals)	78	83.9
12-18 month (4 to 5 daily meals)	35	33.0
Age in months (mean and SD)	12.2	3.9

Table 2. Intake of energy, macronutrients y critical micronutrients according to the consumption of breastfeeding (BF) and age range

Nutrients	All children	With BF (n = 107)	Without BF (n = 92)	p	6 to 11 months (n = 93)	12 to 18 months (n = 106)	p
	Mean ± SD	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Energy (Kcal)	652.9 ± 224.2	522.9 ± 199.2	803.3 ± 147.7	0.00	546.9 ± 228.2	746.6 ± 176.9	0.00
Proteins (g)	23.2 ± 10.1	18.7 ± 9.8	28.6 ± 7.5	0.00	17.9 ± 8.3	28.0 ± 9.2	0.00
Lipids (g)	21.9 ± 9.0	16.2 ± 6.9	28.6 ± 6.1	0.00	18.1 ± 8.8	25.3 ± 7.7	0.00
Carbohydrates (g)	128.8 ± 53.6	112.4 ± 53.5	148.1 ± 47.0	0.00	118.3 ± 60.0	138.2 ± 129.4	0.00
Vit. A, RE (µg)	227.5 ± 161.0	157.6 ± 120.6	309.6 ± 164.2	0.00	180.7 ± 152.6	269.7 ± 157.3	0.00
Vit. D (µg)	1.6 ± 1.5	0.9 ± 1.2	2.5 ± 1.4	0.00	1.3 ± 1.8	1.9 ± 1.2	0.01
Vit. E, α-TE (mg)	2.5 ± 2.0	1.8 ± 1.4	3.2 ± 2.3	0.00	1.7 ± 1.5	3.1 ± 2.1	0.00
Vit. K (µg)	27.2 ± 31.9	27.7 ± 31.1	26.6 ± 32.9	0.81	25.8 ± 34.0	28.4 ± 30.0	0.56
Vit. C (mg)	39.8 ± 31.1	28.1 ± 21.9	53.5 ± 34.6	0.00	29.0 ± 26.0	49.5 ± 32.2	0.00
Calcium (mg)	442.5 ± 289.9	275.6 ± 209.7	638.6 ± 245.2	0.00	325.2 ± 276.5	548.5 ± 260.3	0.00
Iron (mg)	9.4 ± 3.9	7.1 ± 3.1	12.0 ± 3.1	0.00	8.2 ± 4.2	10.4 ± 3.4	0.00
Zinc (mg)	3.2 ± 1.9	2.1 ± 1.3	4.5 ± 1.6	0.00	2.4 ± 1.7	4.0 ± 1.7	0.00

RE: retinol equivalents; α-TE: α-tocopherol equivalents. T-test $p < 0.05$.

Table 3. Percentage of adequacy of dietary intake by sex

Nutrients	All children Mean ± SD	Girls Mean ± SD	Boys Mean ± SD	p
Energy	89.7 ± 30.8	94.8 ± 29.2	83.5 ± 31.7	0.01
Proteins	189.9 ± 90.3	197.5 ± 82.8	180.6 ± 10.3	0.19
Lipids	64.2 ± 26.5	67.6 ± 25.3	60.2 ± 27.4	0.04
Omega 3	3.4 ± 8.1	2.3 ± 2.9	4.6 ± 11.5	0.07
Omega 6	47.9 ± 40.7	47.0 ± 37.8	48.9 ± 43.9	0.75
Carbohydrates	141.5 ± 62.7	150.0 ± 60.1	131.2 ± 64.7	0.03
Vit. A, RE	66.7 ± 51.1	69.4 ± 55.9	63.5 ± 44.8	0.41
Vit. D	13.0 ± 12.4	13.4 ± 11.9	12.5 ± 13.1	0.61
Vit. E, α-TE	46.4 ± 35.4	45.3 ± 30.9	47.7 ± 40.2	0.64
Vit. K	707.4 ± 1383.9	685.8 ± 1167.6	732.9 ± 1608.8	0.81
Vit. C	196.4 ± 201.1	216.9 ± 219.0	172.0 ± 175.7	0.11
Thiamine	74.4 ± 50.0	77.1 ± 49.4	71.1 ± 50.8	0.39
Riboflavin	115.9 ± 83.5	124.2 ± 78.6	106.0 ± 88.4	0.13
Niacin	39.9 ± 32.3	39.6 ± 31.8	40.2 ± 33.0	0.90
Pyridoxine	97.1 ± 54.7	97.4 ± 48.8	96.6 ± 61.3	0.92
Folate	80.9 ± 59.3	81.6 ± 55.2	80.2 ± 64.1	0.86
Vit. B12	166.6 ± 170.4	182.7 ± 168.3	147.4 ± 171.7	0.14
Pantothenic acid	73.2 ± 48.5	76.6 ± 47.6	69.1 ± 49.6	0.28
Biotin	64.4 ± 55.8	61.5 ± 51.4	67.8 ± 60.6	0.43
Calcium	103.9 ± 85.4	110.2 ± 76.8	96.5 ± 94.7	0.27
Phosphorus	100.2 ± 69.1	107.5 ± 62.4	91.3 ± 75.9	0.10
Copper	65.2 ± 35.5	64.9 ± 90.9	65.6 ± 40.4	0.89
Fluoride	2.1 ± 5.4	1.8 ± 1.5	2.4 ± 7.7	0.47
Iodine	19.2 ± 21.0	18.4 ± 19.8	20.2 ± 22.4	0.56
Iron	113.1 ± 56.5	118.3 ± 58.1	106.7 ± 54.2	0.14
Zinc	106.9 ± 62.3	112.1 ± 60.1	100.7 ± 64.8	0.20
Potassium	62.0 ± 47.3	64.7 ± 48.6	58.6 ± 45.3	0.36
Sodium	47.7 ± 31.3	49.9 ± 20.0	45.1 ± 33.8	0.29

RE: retinol equivalents; α-TE: α-tocopherol equivalents. T-test $p < 0.05$.

As for dietary intake, it was significantly higher in children that did not include BF in their diet and were between 12 and 18 months old. This is consistent with the type of survey used, since we did not quantify BF intake in our children, and we only used this variable qualitatively, showing a lower proportion of children with BF in those between 12 and 18 months of age than in the group aged 6 to 11 months (38.7% vs. 71%, respectively). The dietary contributions of children who consumed BF are similar to those observed in another study, which found that the daily energy gap that should be covered by complementary feeding in children aged 6 to 8 months was 200 calories, 300 calories in children aged 9 to 11 months, and 500 calories in children aged 12 to 23 months, based on an approximate energy requirement of 600, 700, and 900 calories, respectively[34].

When comparing the intake versus the requirements of the sample, we observed that the percentage of energy adequacy was normal according to sex, normal nutritional status, and the presence of UN. However, the estimation of energy requirements calculated by theoretical equations may tend to overestimate, which would explain why the energy adequacy in this study is not associated with nutritional status[21].

In addition, we observed that most of the ma-

Table 4. Comparison of percentage of adequacy of dietary intake versus nutritional requirements. by nutritional status.

Nutrients	Undernutrition Mean ± SD	Normal Mean ± SD	Overnutrition Mean ± SD	p
Energy	97.5 ± 31.9	90.4 ± 30.6	85.5 ± 30.9	0.32
Proteins	215.3 ± 132.8	191.5 ± 84.2	178.3 ± 86.8	0.30
Lipids	68.0 ± 25.5	64.4 ± 25.9	62.7 ± 28.4	0.75
Omega 3	1.9 ± 1.6	3.8 ± 9.6	3.0 ± 5.5	0.59
Omega 6	45.3 ± 31.6	46.7 ± 43.1	51.2 ± 38.3	0.76
Carbohydrates	174.5 ± 59.2[a]	141.2 ± 66.4	131.6 ± 52.3[a]	0.04
Vit. A. RE	59.7 ± 37.1	66.8 ± 55.7	68.8 ± 44.3	0.80
Vit. D	13.4 ± 12.1	13.7 ± 13.0	11.4 ± 11.2	0.53
Vit. E. α-TE	48.0 ± 34.0	46.1 ± 36.8	46.6 ± 33.3	0.97
Vit. K	1.217.6 ± 1627.8	612.5 ± 1.383.6	746.7 ± 1.285.8	0.21
Vit. C	140.9 ± 153.9	209.0 ± 217.6	186.5 ± 174.2	0.37
Thiamine	72.1 ± 44.5	74.2 ± 52.7	75.5 ± 46.4	0.96
Riboflavin	111.6 ± 82.3	118.6 ± 78.7	111.4 ± 94.7	0.84
Niacin	43.7 ± 31.4	39.8 ± 33.6	39.0 ± 30.2	0.86
Pyridoxine	101.8 ± 58.2	98.6 ± 58.8	92.1 ± 43.6	0.71
Folate	95.0 ± 68.7	78.7 ± 55.6	81.5 ± 64.5	0.54
Vit. B12	171.9 ± 158.5	177.1 ± 165.4	141.8 ± 184.6	0.43
Pantothenic acid	66.9 ± 44.7	77.6 ± 51.0	65.5 ± 43.6	0.25
Biotin	61.5 ± 29.5	67.8 ± 65.1	57.8 ± 36.7	0.53
Calcium	136.8 ± 95.3	102.4 ± 74.7	97.0 ± 102.0	0.21
Phosphorus	111.3 ± 70.1	103.0 ± 63.6	90.7 ± 79.8	0.42
Copper	77.4 ± 34.2	62.2 ± 36.8	67.8 ± 32.4	0.19
Floride	2.2 ± 1.7	2.4 ± 6.8	1.5 ± 1.2	0.59
Iodine	14.7 ± 16.7	21.4 ± 22.9	16.0 ± 17.2	0.19
Iron	112.4 ± 43.9	111.1 ± 55.6	117.5 ± 62.6	0.77
Zinc	112.0 ± 62.5	106.8 ± 61.4	105.5 ± 65.4	0.92
Potassium	91.0 ± 54.9[a.b]	60.6 ± 49.4[b]	55.8 ± 36.5[a]	0.01
Sodium	65.0 ± 36.8[a]	46.9 ± 29.9	44.1 ± 31.4[a]	0.04

RE: retinol equivalents; α-TE: α-tocopherol equivalents. One-way ANOVA test and Bonferroni multiple comparison test. [a.b]$p < 0.05$.

cronutrients and micronutrients were not within the expected ranges. It is worth noting that proteins and carbohydrates were above the expected range and that proteins were similar to those observed in an Italian study in children aged 6, 9, and 12 months[35]. Several studies associate excess intake of these macronutrients with childhood obesity.

This relationship has been observed in children that consume infant formulas (IF) with a high protein concentration[36,37] along with their complementary feeding[38,39], where an increase in body weight and body fat has been observed. The results are consistent with a national study that showed the difficulty in diluting the IF, especially in the low SES, where about 40% of parents use more than the recommended amount in children between 6 and 11 months of age[40].

Regarding the nutrients that were below the expected, lipids could be underreported, which could be attributed to the lack of quantitative recording of BF, which provides on average 44% of its calories as lipids[41]. As for omega 3, its deficit is due to the lack of consumption of seafood in the Chilean population[28] and finally, vitamin D, which, although it is highly bioavailable in breast milk and sun exposure[42], is not a nutrient highly present in foods commonly consumed by young children, and therefore should be added

Table 5. Frequency of consumption of different food group by sex, age and nutritional status (%)

Food group	Sex		Age range		Nutritional status		
	Girls	Boys	6 to 11 months	12 to 18 months	Undernutrition	Normal	Overnutrition
Breastmilk	9,2	10,0	16,4	4,9	8,6	9,8	9,4
Cereals*	18,0	15,9	17,5	16,8	20,1	17,9	14,1
Fruits	11,9	12,6	11,3	12,8	10,4	11,9	13,6
Vegetables	12,9	11,5	9,8	13,9	12,4	11,5	13,9
Meats#	2,4	2,3	0,8	3,4	1,3	2,3	2,9
Legumes	1,9	1,8	1,2	2,3	2,0	1,7	2,1
Milks&	21,9	22,8	20,7	23,4	22,0	22,2	22,5
Strained baby foods	11,8	14,0	16,3	10,4	13,6	12,8	12,5
Oils	5,8	5,4	3,7	7,0	5,7	5,4	6,2
Sausages	0,2	0,3	0,1	0,3	0,6	0,2	0,2
Sugar∞	3,7	3,2	2,1	4,4	3,1	4,0	2,4
Salty snack$	0,1	0,2	0,1	0,2	0,2	0,1	0,2
Artificial sweeteners	0,2	0,0	0,0	0,2	0	0,2	0
Total	100%	100%	100%	100%	100%	100%	100%

*Cereals: infant cereals, potato, rice, noodles, and other cereals. #Meats: meats, chicken, fish, and egg. &Milks: infant milk, artificial milk formulas and other milks. ∞Sugar: added sugar and high sugar snack. $Salty Snack: salty snacks and foods high in sodium and fat.

as a fortification in foods or supplemented in case of deficiency[42]. Also, a significant decrease in potassium intake can be observed in children with ON compared with children of normal nutritional status, and studies show that a diet rich in potassium lowers blood pressure values; therefore, the consumption of fruits and vegetables should be encouraged from the beginning of complementary feeding[43].

It should be noted that the adequacy of calcium, iron, and zinc in the general sample, according to sex and nutritional status, were within expected ranges, which are essential micronutrients at this stage of growth and development. This may be related to the regular inclusion in the diet of these children of dairy products, eggs, legumes, animal proteins, and fortified grains, as described in other studies where a positive relationship was found in the intake of these micronutrients, where the consumption of IF, dairy products, and fortified grains predominated. In addition, the diversity of foods predicts an adequate intake of these essential micronutrients[44,45].

The results of this research regarding the classification of nutritional status show that the prevalence of ON was lower, while the UN was higher than that reported by the MINSAL[8]. Even so, there is a high percentage in this sample of children with ON, reaching 28.7% in the age group between 6 and 18 months. These differences, especially in overweight and obesity, may be related to the type of sampling, which included 16.6% of children of SES ABC1, who have the lowest prevalence of ON compared with those of lower SES[23,46].

Among the weaknesses observed, we highlight that there was no sample size calculation, which could affect the results of nutritional status, so it is not possible to extrapolate the results to the entire Chilean population. In addition, the digital self-recording by caregivers of the 24HR should be considered, which may be influenced by the lack of knowledge of weights or portions despite the training provided, as well as by the perception of intake according to the nutritional status of the child, which may lead to over- or underestimation of intake; also, the absence of quantification of breast milk; and finally the time of application of the study, which cannot consider long-term intake.

On the other hand, we believe that evaluating the nutritional status and mainly the intake and feeding behavior of children between 6 to 18 months is one of the greatest strengths of this study since it allows us to take an initial look at the nutritional behaviors of this population, in order to intervene opportunely in the dietary behaviors and their impact on nutritional problems in childhood and later ages. Also, among the strengths is the detailed 24HR that was from 4 to 7 days and the type of software used, which allowed the collection and analysis of a large amount of data for

the evaluation of dietary intake and behavior during childhood.

Conclusions

This descriptive study provides specific information on energy intake and adequacy, macronutrients, and micronutrients, as well as the eating habits and nutritional status of the sample evaluated. Food education in the early stages of life is crucial in the development of feeding behavior, as well as in the maintenance of an adequate nutritional status. For this reason, the real characterization of the dietary intake of our children can contribute efficiently to solve very prevalent health problems in the current population, such as micronutrient deficiency and childhood obesity, and its role as a relevant factor in the presence or triggering of chronic non-communicable diseases in adulthood.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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