

# Evaluation of food consumption at public day care centers in São Paulo, Brazil

*Avaliação do consumo alimentar em creches públicas em São Paulo, Brasil*

*Evaluación del consumo alimentar en guarderías públicas en São Paulo, Brasil*

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## ABSTRACT

**Objective:** To evaluate the energy intake and dietary adequacy of children attending nurseries of public and not-for-profit daycare centers in the city of São Paulo, Brazil.

**Methods:** Cross-sectional study conducted at 16 nurseries, attended by 236 children between the ages of 12 and 29 months. Data collection was carried out by the direct weighing method over three nonconsecutive days. The DietWin<sup>®</sup> 2.0 Professional software was used for nutritional calculations. The adequacy of energy, protein, iron, vitamin A and vitamin C intake was calculated, also with the aforementioned software, using 2002 National Research Council Estimated Average Requirements as a reference. Adequate Intake (1999) was used as the reference for calcium intake, and Estimated Energy Requirements (2002), for evaluation of energy intake. Data were analyzed using the Epi-Info 3.4.3 software.

**Results:** We identified deficiencies in energy, iron, and calcium intake (mean deficits of 49.78%, 81.67%, and 57.44% respectively), as well as excessive intake of protein (183.27%) and vitamins A and C (126.86% and 57.44% respectively). Regarding macronutrients, fat intake was also found to be inadequate.

**Conclusions:** Although the meals served at public daycare centers in Brazil are planned by dietitians, the findings of this study reveal potential flaws in the way food is prepared, portioned, and offered to children. These results demonstrate the need for further recycling and ongoing su-

pervision to ensure the provision of adequate levels of food consumption to this population.

**Key-words:** dietary consumption; daycare; nursery; institutional catering; dietary recall; food.

## RESUMO

**Objetivo:** Avaliar o consumo energético e a adequação da dieta de crianças frequentadoras de berçários de creches públicas e filantrópicas no município de São Paulo.

**Métodos:** Estudo transversal em 16 berçários, frequentados por 236 crianças com idades entre 12 e 29 meses. A coleta dos dados foi realizada pelo método de pesagem direta durante três dias não consecutivos. Para o cálculo nutricional, foi utilizado o *software DietWin Profissional 2.0<sup>®</sup>*, sendo posteriormente calculada a adequação do consumo de energia, proteína, ferro, vitamina A e vitamina C. Para o cálculo de proteína, ferro, vitamina A e C, foi utilizada como referência a necessidade média estimada (*Estimated Average Requirement*) do *National Research Council* (2002). O cálcio foi avaliado pela ingestão adequada (*Adequate Intake*, 1999). A avaliação da ingestão de energia foi realizada com base na necessidade energética estimada (*Estimated Energy Requirement*, 2002). Os dados foram analisados no programa Epi-Info 2000, versão 3.4.3.

**Resultados:** Foram identificados déficits médios para energia (49,78%), ferro (81,67%), cálcio (57,44%), exces-

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sos de proteína (183,27%) e vitaminas A (126,86%) e C (57,44%). A distribuição dos percentuais de adequação dos macronutrientes mostrou-se inadequada para lipídeos.

**Conclusões:** Embora os cardápios servidos em creches sejam planejados por nutricionistas, os resultados apontam possíveis falhas no processo da alimentação infantil relacionadas à preparação, porcionamento e/ou práticas de oferta dos alimentos. Tais achados reforçam a necessidade de ações de educação e supervisão em saúde para garantir o fornecimento de alimentação adequada a este grupo populacional.

**Palavras-chave:** consumo de alimentos; creches; berçários; alimentação institucional; inquéritos sobre dietas; alimentos.

## RESUMEN

**Objetivo:** Evaluar el consumo energético y la adecuación de la dieta de niños frequentadores de guarderías públicas y filantrópicas en el municipio de São Paulo.

**Métodos:** Estudio transversal en 16 nidos, frecuentados por 236 niños con edades entre 12 y 29 meses. La recolección de los datos se realizó por el método de pesaje directo durante tres días no consecutivos. Para el cálculo nutricional, se utilizó el *software DietWin Professional 2.0*<sup>®</sup>, siendo posteriormente calculada la adecuación del consumo de energía, proteína, hierro, vitamina A y vitamina C. Para el cálculo de proteína, hierro, vitaminas A y C, se utilizó como referencia la necesidad mediana estimada (*Estimated Average Requirement*) del *National Research Council* (2002). El calcio se evaluó por la ingestión adecuada (*Adequate Intake*, 1999). La evaluación de la ingestión de energía se realizó con base en la necesidad energética estimada (*Estimated Energy Requirement*, 2002). Los datos fueron analizados en el programa Epi-Info 2000, versión 3.4.3.

**Resultados:** Se identificaron déficits medianos para energía (49,78%), hierro (81,67%), calcio (57,44%), excesos de proteína (183,27%) y vitaminas A (126,86%) y C (57,44%). La distribución de los porcentuales de adecuación de los macronutrientes se mostró inadecuada para lípidos.

**Conclusiones:** Aunque los menús servidos en guarderías sean planeados por nutricionistas, los resultados apuntan a posibles fallas en el proceso de la alimentación infantil relacionadas a la preparación, proporcionamiento y/o prácticas de oferta de los alimentos. Tales hallazgos refuerzan la necesidad de acciones de educación y supervisión en salud para garantizar el suministro de alimentación adecuada a este grupo poblacional.

**Palabras clave:** consumo de alimentos; guarderías; nidos; alimentación institucional; averiguaciones sobre dietas; alimentos.

## Introduction

Widespread industrialization and urbanization, coupled with the increasingly active role of women in the workplace, has led to an expansion of free daycare services in the large and medium-sized cities of Brazil. This is currently the fastest-growing educational sector in the country, with 1461 facilities in the municipality of São Paulo alone, providing daycare coverage for 1.2 million preschoolers<sup>(1)</sup>. At these facilities, also known as Infant Education Centers (*Centros de Educação Infantil*, CEIs), children between the ages of 0 and 36 months spend up to 12 hours of every business day, taking five meals a day<sup>(2)</sup>.

Within this context, assessment of the dietary patterns of preschoolers and of whether the dietary needs of this population are being adequately met is of critical importance, in view of the relevance of childhood diet to the maintenance of proper nutritional status<sup>(3)</sup>. Nutritional deficiencies, such as iron deficiency anemia, vitamin A deficiency, and malnutrition, are epidemiologically associated with age range<sup>(4)</sup>.

On the other hand, misguided dietary habits contribute to increasing overweight and obesity rates. In addition to potentially jeopardizing growth and development during childhood, inadequate dietary consumption may lead to early onset of adult diseases, such as hypertension and type 2 diabetes, and may even increase risk of heart disease, osteoporosis, and cancer in adulthood<sup>(5)</sup>.

Although the meals served at daycares are meant to follow regulation-defined menus and ensure qualitative and quantitative nutritional adequacy, dietary recommendations are not always followed successfully. Several studies designed to assess the adequacy of dietary intake among children have found that daycare centers often fail to provide adequate and sufficient food<sup>(6-8)</sup>.

Bearing in mind that estimation of energy and nutrient intake has proved useful as a means of identifying public health issues (particularly nutritional disorders) and providing input for the planning of interventions designed to improve nutritional conditions, the aim of the present study was to assess the energy intake and dietary adequacy of children attending the nurseries of public and nonprofit daycare centers in the city of São Paulo, Brazil.

## Method

The present study is a subproject of *Projeto CrecheFiciente – Impacto do treinamento de educadores de creches públicas/filantrópicas nas práticas higiênico-dietéticas e na saúde/nutrição dos lactentes* (Impact of public and nonprofit daycare staff training on hygiene and dietary practices and on infant health and nutrition)<sup>(4,9,10)</sup>, a large project designed to serve as a training, improvement, and refresher course on child health and nutrition care for daycare teachers and evaluate the acquisition of knowledge about the activities carried out by teachers.

The study sample was drawn from 36 daycare centers registered with the local board of education (*Coordenadoria de Educação*) of the district of Santo Amaro, São Paulo: 16 public (run by the municipal government, staffed by municipal employees, and operating from municipal facilities) and 20 nonprofit (staff provided by nonprofit organization, operating from municipal facilities). Of these, eight public and 10 nonprofit centers were visited, depending on ease of transportation and access. After visits and phone contact for further information, four public and four nonprofit daycares were selected for fieldwork, according to the methodological criteria proposed by Beghin<sup>(11)</sup>. The following criteria were prioritized, in descending order of importance: greater number of infants (children between the ages of 0 and 24 months), greater number of staffers, absence of prior health education interventions, research safety, and rules for attendance that ensure that only children from low-income families (those with a monthly per capita income of two minimum wages or less) are accepted.

This cross-sectional study was conducted at the nurseries of the eight selected daycare centers, for a total of 16 nurseries. Data were collected from August through September 2007 by four trained dietitians.

All daycares included in this study had two nurseries (I and II), which operated full-time, Monday through Friday, and provided five meals a day. Food distribution followed the traditional method for daycare centers, that is, meals were served by daycare staff (predominantly by teachers).

At 7 a.m., children were served breakfast, which consisted of cakes, bread or crackers with margarine or jam, or cereal, plus white coffee or cocoa as beverages. At 9 a.m., children were given what centers refer to as “hydration” – all-natural fruit juice.

Lunch was served starting 10:30 a.m. and consisted of rice and beans, a choice of meat (usually beef, alternating with chicken, fish, eggs, or sausage), salad, a side dish, and dessert (fruit or sweets).

Around 2 p.m., children were served an afternoon snack, which was similar in composition to breakfast. The last meal of the day was served starting 3:30 p.m., and usually consisted of soup or rice, beans, meat, and a side dish, followed by dessert.

Dietary intake was assessed by direct weighing of foods served over three nonconsecutive days, as suggested in the literature for increased precision<sup>(6)</sup>. Each team of two dietitians collected data at four daycares. The investigators remained at the facilities throughout their operating hours, over three days of the week. Therefore, the data collection period extended over four weeks at each facility.

Solid foods were weighed on a portable digital scale (Plenna<sup>®</sup>) with a capacity of 5kg. Fluids were measured using a plastic measuring cup with a capacity of 1000mL and 50mL resolution.

Foods were portioned as usually consumed by children. Three servings were weighed for calculation of the mean quantity served. Three samples were collected randomly as food was being served to the children. In case of repeat servings, the type and quantity of repeated food(s) were recorded in a standardized form and later added to the previously weighed amounts.

Unconsumed food was collected in plastic bags, divided by meal and nursery. All foods or fluids left on the child's plate or in the child's cup at the end of the meal were considered leftovers and were weighed or measured using the aforementioned scale and measuring cup.

The mean amount of food and beverages served was multiplied by the number of children in each group. Repeat helpings were added to the total for a final mean quantity of food and beverages served.

The percentage of leftovers was calculated as follows:

$$\% \text{ Leftover} = \frac{\text{Leftover} \times 100\%}{\text{Mean} + \text{repeated helpings}}$$

The percentage of leftovers was subtracted proportionally from each served food. The nutritional value of each meal was calculated with the *DietWin Professional 2.0<sup>®</sup>* software package<sup>(12)</sup>.

Percentage adequacy of intake was calculated using the dietary recommendations in force at the time of the study (2007), which mandated the provision of 100% of the nutritional requirements of children who stay at daycare centers full-time<sup>(13)</sup>.

Thus, the adequacy of total energy, protein, iron, calcium, and vitamin C and A content was calculated. Protein, iron, and vitamin A and C content was defined according to 2002

**Table 1** - Mean ( $\pm$ Standard Error), minimum, maximum, and adequacy of energy and nutrient intake of children attending daycare centers, São Paulo, 2007

Nutrients	Recommended daily intake	8 daycares (16 nurseries)				
		Mean	Adeq (%)	SE	Minimum	Maximum
Energy (Kcal)	1051.0*	523.19	49.78	41.90	357.72	848.80
Protein (g)	11.0**	20.16	183.27	2.47	10.78	38.70
Vitamin C (mg)	13.0**	72.04	554.15	9.51	35.16	133.91
Calcium (mg)	500.0***	287.21	57.44	51.46	118.91	732.91
Vitamin A (mcg)	210.0**	266.40	126.86	45.90	138.72	574.80
Iron (mg)	3.0**	2.45	81.67	0.22	1.56	3.58

Adeq %: adequacy of energy and nutrient intake; SE: standard error; \*Estimated Energy Requirement<sup>(14)</sup>; \*\*Estimated Adequate Requirement<sup>(14)</sup>; \*\*\*Adequate Intake<sup>(15)</sup>

**Table 2** - Mean ( $\pm$ standard deviation) distribution of macronutrients as percentage of total energy intake of children attending daycare centers, São Paulo, 2007

Nutrient	Recommended intake* (%)	8 daycares (16 nurseries)	
		Mean (%)	SD
Protein	5–20	15.36	$\pm$ 2.33
Carbohydrate	45–65	59.56	$\pm$ 6.89
Fat	30–40	24.98	$\pm$ 5.04

SD: standard deviation; \*Dietary Reference Intake, 2002<sup>(14)</sup>

National Research Council Estimated Average Requirements (EARs). Calcium was assessed as a percentage of Adequate Intake (AI) (1999). Energy adequacy was assessed on the basis of Estimated Energy Requirements (EERs) (2002)<sup>(14,15)</sup>.

The percent contribution of each macronutrient (fat, carbohydrate, and protein) toward energy intake was calculated on the basis of the energy provided by each of these macronutrients.

Due to the absence of standardized soup recipes, the study investigators monitored preparation, recording the raw weight of all ingredients before preparation and the final yield of preparation in a standardized form. Nutritional information for each soup was calculated using the *DietWin Professional 2.0*<sup>®</sup> software package<sup>(12)</sup> and then added to the software food list as a new product. The preparation and dilution of milk beverages was also supervised, and all ingredients were once again weighed prior to preparation.

Statistical analyses were made using the means of all 16 nurseries included in the sample. Public and nonprofit daycares and their respective nurseries I and II were pooled for analysis because all daycares used the same dietary recommendations and cared for children in similar age ranges.

Children are enrolled in nurseries I or II according to birth year; therefore, at the time of the study, age ranges were homogeneous in both nurseries (12–29 months). Furthermore, the recommended menu is the same for children aged 12 to 36 months.

The double data entry method was used for compilation of data. All data were validated and analyzed using the Epi-Info 2000 3.4.3 software package<sup>(16)</sup>.

The present project was approved by the Federal University of São Paulo Research Ethics Committee with judgment no. 0272/08.

## Results

Children were aged 12 to 29 months. The mean number of children was 30 per daycare center and 15 per nursery.

Percent adequacy, mean, minimum, maximum values and standard errors for dietary intake of each macro- and micronutrient of interest are shown in Table 1. The results of all 48 direct weightings carried out at the 16 nurseries show uniformity in the provision of meals across all eight daycare centers, as shown by the minimum and maximum values and standard errors of energy distribution and of each of the nutrients measured.

By current recommendations, the meals served at all nurseries provided insufficient energy, calcium, and iron. Conversely, vitamin A and C and protein levels were, on average, two to five times above recommended daily intakes.

If, on the one hand, there was significant failure to comply with nearly all nutritional recommendations, whether due to excess or to insufficiency, the provision of macronutrients was proportionally insufficient only with respect to the fat content of served meals (Table 2).

## Discussion

Although the direct weighing method is considered the gold standard for evaluation of dietary intake in institutional settings, it does have certain limitations. The fact that the mean of three servings was considered rather than what was truly eaten by children may lead to approximations that skew far from actual individual food intake, even after correcting for mean group intake.

The accuracy of data collection was insured by investigator training, collection on nonconsecutive days, review of collection forms, proper calibration of measuring equipment, and double data entry and analysis.

The data presented herein reflect the reality of public and nonprofit daycares in the city of São Paulo. Although we did not employ a probability sampling strategy, we sought to include daycares that reflected the universe of these institutions. A longitudinal design, however desirable, would entail an expense of time and resources not available to our team.

Our findings show that the adequacy of mean energy intake was in the region of 50%, far below the planned target of providing 100% of the daily energy needs of children<sup>(13)</sup>.

Similar results were reported by Spinelli *et al*<sup>(7)</sup> and Menezes *et al*<sup>(8)</sup>, who found adequacy rates of energy intake of 57 and 41.4% respectively. This agreement suggests that achieving the target of meeting 100% of the daily energy needs of children within the daycare environment is quite unfeasible. Therefore, eating meals at home, at night and in the morning (breakfast), is absolutely essential to ensuring dietary needs are met. These meals should be guided by dietitians so as to harmonize the actions of educators at the daycare center and parents at home.

Bernardi *et al*<sup>(17)</sup>, in an assessment of dietary intake at daycare centers and at home, note that acceptance of meals served in daycare may be influenced by the energy density of foods eaten at home before and after the school period. Children would thus compensate by eating less of the high-nutritional density foods provided at the daycare center. This observation corroborates the hypothesis of other authors who justify this habit by noting that children prefer foods with high energy density, as they satisfy basic physiological needs with greater speed and less effort.

On the other hand, protein consumption was in excess of recommended daily intake. Most studies that assessed protein intake in the diet of children have reported similar findings, corroborating the fact that nutritional deficiencies

are usually due to insufficient energy and micronutrient intake, with dietary protein deficiency not occurring in children<sup>(18,19)</sup>.

Our finding of iron intake below recommendations was also consistent with prior studies of children fed at daycare centers<sup>(7,18)</sup>. This scenario contributes to the high rate of iron deficiency anemia often detected in surveys of children in this age range. Although the National Child and Female Demographics and Health Survey (PNDS-2006)<sup>(20)</sup> found the prevalence of iron deficiency anemia to be 20.9% in children between the ages of 6 and 59 months, recent studies have reported rates in excess of 50% in under-fives, with the intensity of anemia being inversely proportional to age<sup>(4,21,22)</sup>.

This inadequate iron intake may be explained by infrequent and insufficient per capita meat consumption. Meat is considered the finest source of iron, but is not provided daily in daycare centers; it is often replaced by eggs or sausage products, which are usually cheaper but poorer in iron content from both a quantitative and a qualitative standpoint<sup>(23)</sup>.

When associated with elevated protein consumption, low calcium intake is even more concerning; excess protein intake leads to a hypercalciuretic effect, thus potentially jeopardizing dietary calcium absorption<sup>(8)</sup>, which stresses the importance of providing calcium and protein in balanced quantities so as to ensure unaffected physical growth and prevent osteoporosis.

There is no contraindication to the excess consumption of vitamin C detected in this study-five times above the recommended daily intake; though excessive, these levels pose no risk of toxicity. In fact, sufficient vitamin C intake facilitates absorption of nonheme dietary iron and adequate immune system function. Furthermore, vitamin C is the most unstable nutrient in the presence of light, heat, pH, and oxygen, and its content thus varies depending on preparation<sup>(18)</sup>.

The adequacy of vitamin A intake (126.86%) was consistent with values reported in previous studies conducted at daycare centers, which justify excess intake of this nutrient due to the frequent offer of source foods in daily meals<sup>(3,23,24)</sup>.

The mean distribution of fat intake as a percentage of total energy intake was consistently below recommendations, which may partly account for the low overall energy intake in our sample, as fat is the macronutrient that most contributes to energy intake. Although recommended



menus provide for a balanced diet (that is, one including adequate lipid intake), in practice, meals did not provide sufficient fat. Therefore, one technically adequate dietary means of improving the energy density of meals served at the study daycares would be to increase the proportion of fat in these meals<sup>(25)</sup>.

All daycare centers provided adequate carbohydrate and protein levels according to recommended Dietary Reference Intakes (DRIs)<sup>(14)</sup>.

The issues detected in our assessment of dietary consumption in this sample of daycare centers—particularly deficiencies in energy intake—may be related to operational factors throughout the food service process, from preparation to serving.

The operational standards used at daycare kitchens are the same that regulate the structure and operation of industrial kitchens. In practice, however, daycare kitchens are much closer in structure to household kitchens, which makes implementation of official standards difficult. Attempts at adapting standards for greater feasibility in a daycare setting have been proposed<sup>(26)</sup>. However, in Brazil, there are no specific operational standards for daycare kitchens, nor for the kitchens of any type of educational institution.

Furthermore, and despite a variety of policies and incentives meant to encourage adoption of healthy dietary habits in the daycare setting, the training of educators (who are predominantly responsible for feeding) is insufficient, as current teacher training curricula have no specific subject on child nutrition<sup>(27)</sup>. According to the literature, the knowledge of educators is associated with their own concepts and is based on customs, habits, and beliefs rooted in past experience. This may jeopardize childcare as far as feeding is concerned<sup>(10)</sup>.

We conclude that the dynamics of providing meals may reflect both employee motivation to improve acceptance of meals by children and a difficulty in feeding very young children in the time made available by the facility, in light of the high leftover rate (27%).

In light of the complexity of providing meals in a daycare setting, failure to ensure adequate dietary intake does not occur in Brazil alone. Similar issues have been identified in a variety of overseas studies as well<sup>(28,29)</sup>. A study of the food served in 24 kindergartens in Korea, using a sample of 30 children per institution, found that servings (with teachers in charge of portioning) did not reach the size recommended by the local meal plan<sup>(28)</sup>.

Furthermore, Benjamin Neelon *et al*<sup>(30)</sup> note there is little concern with the practical application of rules and standardized menus: in a study of 84 daycares in the U.S. state of North Carolina, only 52% of meals served were in accordance with the defined menu; 110 food and beverage items were served despite not being provided for in the official menu, which may contribute to poor control over the nutritional value of served meals.

Another study, conducted at four daycare centers run by the Chilean *Junta Nacional de Jardines Infantiles* (JUNJI) in East Santiago (Chile), assessed the nutritional adequacy of meals provided in daycare and at home during the week and during weekends, and found that, if recommended daily intakes are to be met, complementary feeding at home is required, and should correspond to approximately 50% of total daily intake<sup>(29)</sup>.

It should be stressed that satisfactory energy intake is influenced not only by serving size, but also by the number of daily meals and by the variety and energy density of served foods. Therefore, the set schedule of meals currently used at daycares may lead to poor acceptance by children due to insufficient spacing between meals<sup>(31)</sup>.

Given the complexity of fully meeting dietary needs in a daycare center environment, since 2009, the National Fund for Educational Development (*Fundo Nacional de Desenvolvimento da Educação*, FNDE) has recommended that 70% of the nutritional needs of children attending full-term daycare be met within the facility. This recommendation also seeks to improve family relations, as the child is able to have at least one daily meal with his or her family<sup>(32,33)</sup>.

Within this context and in light of the results obtained, we stress that children should take at least one meal outside daycare. From this standpoint, the most concerning factor is the quantitative and qualitative aspect of the child's home meal, as variations may either contribute to adequate nutritional and energy intake or lead to dietary excess, consequently increasing the risk of overweight and obesity.

Although the menus served at public daycares in Brazil are planned by trained dietitians and published with a view to standardization, the feeding of children who attend these centers may still be inadequate due to potential flaws in the way food is prepared, portioned, and offered. The findings of this study suggest that proper standardization does not suffice; health education and supervision actions are essential to ensure that children who attend public and nonprofit daycares have adequate nutrient intake.

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