

CHILD CARE AND PARASITIC INFECTIONS

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ABSTRACT

Parasitic diseases are a public health problem in Brazil, especially in environments intended for childcare. This study aimed to assess the prevalence of parasitic diseases in daycare centers in Aracaju (SE) and related risk factors. Coproparasitological tests and clinical and anthropometric evaluations were performed on 276 children. Risk factors were identified using questionnaires and visual assessment. Data were analyzed using Pearson's chi-squared test and Fisher's exact test ($p < 0.05$). Prevalences of 44.5% and 31.2% were found for intestinal parasites (21.7% ascariasis) and for ectoparasites (18.2% pediculosis), respectively. There was a significant correlation between intestinal parasitic infections and low weight, age group (3-4 years), unpaved streets and family income and between ectoparasitic diseases and low weight. The socioeconomic profile revealed 51.6% owner-occupied, brick (88.6%) houses with drinking water (97.5%) and a family income of 1-2 minimum wages (42%). The level of parental education may be responsible for the lack of knowledge regarding the prevention of parasitic diseases (73.8%). Structural and behavioral characteristics were relevant for the presence of parasitic diseases, including the collective use of soap, improper storage of toys and toothbrushes and deficient toilet facilities. These data underscore the need for new studies on child hygiene and health education.

Keywords: Childcare. Parasites. Daycare Centers.

INTRODUCTION

Currently, more than 1/3 of the world's population (2.5 billion) harbors some species of intestinal parasite, and infectious and parasitic diseases account for 2-3 million deaths per year. Among other causes, this scenario results from the population explosion in urban centers where a portion of the population aggregates on the outskirts of cities in unstable locations with geographical slopes, which usually lack health infrastructure, leading to contamination and the spread of parasitic infections⁽¹⁻²⁾.

The segment of the population most susceptible to parasitic diseases is children, given the non-compliance and lack of basic hygiene because they are passing through the oral stage, in which all objects are placed in the mouth, thereby providing greater contact with infectious stage parasites and the potential for

infection⁽²⁾. Parasitic infections in children require special attention due to the complications that they can cause, including malnutrition (*Ascaris lumbricoides* and *Trichuris trichiura*), anemia and hypoferrremia (*Ancylostoma duodenale* and *Necator americanus*) and diarrhea and malabsorption (*Entamoeba histolytica* and *Giardia lamblia*), which may cause delays in child development among other sequelae^(1, 3-4).

Symptoms of parasitic diseases in children are subdivided into mild and nonspecific symptoms, including sleep disturbances, occasional vomiting, difficulty concentrating and irritability, and serious symptoms directly related to malnutrition, chronic diarrhea and depression of the immune system, which result in the child's poor quality of life⁽¹⁾.

In modern society, the growing participation of women in the labor market has consequently generated an increase in childcare centers,

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which, combined with deficient hygiene among caregivers, results in a large number of increasingly younger children living together for several hours per day in non-home environments^(2, 4, 5), increasing their risk of exposure to parasites. This study aimed to evaluate parasitic diseases in municipal daycare centers in Aracaju/SE and to correlate the levels of parasitic infection with socioeconomic and environmental risk factors because daycare centers are the first non-home environments attended by children.

MATERIALS AND METHODS

The study design was cross-sectional, descriptive and exploratory, with a quantitative approach.

The study area, the municipality of Aracaju/SE, encompassed 18 municipal daycare centers involved in full-time childcare for children aged 1-4 years. In 2008, 972 children were enrolled, from which the sample size was determined ($n=276$)⁽⁶⁾. To select participants for the research study, enrollment files were randomly selected with a sampling interval of four numbers from daycare centers located in the four health districts of Aracaju.

Data were collected during the period from January to December 2008. Two interviewers previously trained during the pre-test administered a questionnaire intended for the children's parents and/or guardians that aimed to assess the family's socioeconomic and environmental profile, education level and knowledge of parasites.

Sterile universal collectors were delivered to the children's parents/guardians after administering the questionnaire. The delivery and receipt of fecal material was scheduled daily at daycare centers within 15 days. Fecal samples from 276 children were analyzed using the Hoffmann-Pons-Janer, centrifugal-flotation, Rugai and spontaneous flotation methods⁽⁷⁾. Fecal material was collected at the children's residence for greater preservation. Those responsible were advised they could take a fecal sample from diapers or underpants immediately following defecation using a trowel and packing the sample in a universal collector if a child had an uncontrolled sphincter.

Children were weighed and clinically evaluated during their morning baths to reduce embarrassment and preserve their privacy. Each child's weight was assessed using a portable scale and recorded on each child's card from the Department of Health, and children were classified as underweight (between percentile 10 and 0.3 or <0.3), normal weight (percentile 10 to 97) or overweight (above percentile 97) according to the National Center for Health Statistics. The children's clinical evaluations mainly focused on pediculosis and scabies and were performed using a detailed physical examination of all body areas. In case of a positive diagnosis of ectoparasitic disease, the affected body areas were recorded.

An observation guide to record facts and relevant data on physical condition, routines and daily behaviors related to hygiene at daycare centers and guidelines on health provided to children and relatives was used to record and evaluate the structural and behavioral characteristics of the daycare centers.

Statistical analysis was performed using Pearson's chi-squared test and Fisher's exact test, with a confidence level of 5% ($p \leq 0.05$) using the Statistical Package for the Social Sciences (SPSS) version 16.0. Socioeconomic and environmental variables were correlated to the presence of ectoparasites and intestinal parasites.

This study was approved by the Research Ethics Committee of Tiradentes University (Universidade Tiradentes), located in Aracaju/SE (Process No. 250907).

RESULTS AND DISCUSSION

The study population was represented by a sample of 276 children (28.4%) distributed across 18 public daycare centers in the four health districts of Aracaju/SE, including 51.4% boys and 48.6% girls. The age distribution was concentrated between the ages of 2 and 3 years.

Among the parasitic infections observed in this group, the prevalence of intestinal parasitic disease was 44.50% and 31.20% for ectoparasitic disease, specifically pediculosis and scabies. There was a higher prevalence of monoparasitism (29.3%) than concomitant infections (12.7% biparasitism and 2.5%

polyparasitism). *A. lumbricoides* was the most common helminth among the intestinal parasites diagnosed, and *G. lamblia* was the most common protozoan (Table 1). The most prevalent parasites included *A. lumbricoides*, with greater incidence at 3 years of age, and *T. trichiura* and *G. lamblia* occurred more frequently at 2 years of age.

Parasitic infections have been reported among children attending daycare centers throughout Brazil. A previous study⁽⁸⁾ conducted with preschool children from Aracaju/SE reported a similar prevalence as this

study among preschool children aged 5-6 years. A 56% prevalence of monoparasitized children was found in daycare centers in the State of Minas Gerais⁽⁹⁾. The prevalence of monoparasitism with enteroparasites was 41.7% in the Amazon⁽⁴⁾. The most prevalent endoparasite species in children from the municipality of Aracaju, *A. lumbricoides*, *T. trichiura* and *G. lamblia* (Table 1), are similar to those found by other researchers to be the most common in early childhood, all of which are transmitted orally^(2, 5, 8).

Table 1. Distribution of helminths and protozoa observed in fecal samples from children aged 1-4 years enrolled in municipal daycare centers in Aracaju/SE, 2008.

| Helminths and protozoa | Simple frequency | Relative frequency (%) | 95% CI |
|----------------------------------|------------------|------------------------|---------------------|
| <i>Ascaris lumbricoides</i> | 60 | 21.7 | 17.0 to 27.1 |
| <i>Giardia lamblia</i> | 46 | 16.7 | 12.5 to 21.6 |
| <i>Trichuris trichiura</i> | 27 | 9.8 | 6.5 to 13.9 |
| <i>Entamoeba coli</i> | 13 | 4.7 | 2.5 to 7.9 |
| <i>Endolimax nana</i> | 12 | 4.3 | 2.3 to 7.5 |
| <i>Entamoeba histolytica</i> | 6 | 2.2 | 0.8 to 4.7 |
| <i>Strongyloides stercoralis</i> | 3 | 1.1 | — |
| Ancilostomidae- | 2 | 0.7 | — |
| <i>Enterobius vermicularis</i> | 2 | 0.7 | — |
| <i>Hymenolepis nana</i> | 1 | 0.4 | — |
| Total | 123 | 44.6 | 38.6 to 50.6 |

Obs: Frequencies calculated based on the total (276 children). CI: Confidence Interval.

No statistically significant differences in the prevalence of parasitic diseases ($p=0.30$) were found between boys (41.5%) and girls (52.0%) when correlating the children's gender and positivity in coproparasitological tests. The prevalence of ectoparasites and age group were significant correlated ($p=0.006$). Children aged 2, 3 and 4 years had a higher prevalence of parasitic diseases than 1-year-olds (Table 2) most likely because the risk of exposure to ectoparasites increases with age given the increase in interpersonal contact (child-child and child-worker) among older children, who already move around with greater autonomy⁽⁵⁾.

The age profile of children in the municipal daycare centers of Aracaju (Table 2) corresponds to the early childhood stage in which children begin the process of autonomy from parents because mothers return to the labor market following maternity leave⁽¹⁾.

In early childhood, gender apparently has no significant effect on parasitic infections in daycare centers in Aracaju/SE ($p=0.30$), although the prevalence was slightly higher among girls. This observation may be related to the involvement of girls in recreational and domestic activities, including cooking, sweeping and playing with dolls, exposing girls to direct contact between objects and the oral cavity, which may be an additional route of infection^(3, 10). These children contact sand and domestic animals in recreation areas and toys scattered across the floor (Figure 1B), which are conducive to the development of perception, curiosity and exploration of the surrounding environment but also increase the risk of acquiring parasitic infections orally or by contact⁽³⁾.

Table 2. Unadjusted logistic regression of the outcome variable risk of being parasitized with respect to the factors age, weight and income among children aged 1-4 years enrolled in daycare centers in Aracaju/SE, 2008.

| Variable | n | % | Parasitized (%) | Gross OR | OR 95% CI | p |
|----------------------|-----|-------|-----------------|----------|-------------|-------|
| | 276 | 100.0 | 44.6 | | | |
| Age | | | | | | |
| 1 year | 58 | 21.0 | 25.9 | 1 | | |
| 2 years | 95 | 34.4 | 44.2 | 2.3 | 1.1 to 4.6 | 0.02 |
| 3 years | 75 | 27.2 | 54.7 | 3.5 | 1.6 to 7.3 | 0.001 |
| 4 years | 48 | 17.3 | 52.1 | 3.1 | 1.4 to 7.0 | 0.006 |
| Underweight | | | | | | |
| Yes | 47 | 17.0 | 59.6 | 2.1 | 1.18 to 3.9 | 0.02 |
| No | 229 | 83.0 | 41.5 | 1 | | |
| Family income | | | | | | |
| Less than 1 MW | 110 | 40.3 | 50.0 | 2.3 | 1.1 to 4.7 | 0.03 |
| Between 1 and 2 MW | 117 | 42.9 | 44.4 | 1.8 | 0.9 to 3.8 | 0.10 |
| More than 2 MW | 46 | 16.8 | 30.4 | 1 | | |

OR= Odds Ratio. MW = Minimum wage. CI = Confidence Interval

Growth and development were assessed using data from each child's card, standardized by the Department of Health ⁽¹¹⁾, which determines the optimal percentile for each age group (weight/age). Underweight (17%) and overweight (11.3%) children were found despite the higher frequency of normal weight children in the municipality of Aracaju (71.7%). There was a significant correlation between underweight and positive coproparasitological tests ($p=0.02$; Table 2) when assessing the underweight children's risk of being parasitized. After weighing, triage was performed to address the problems of parasitic diseases in children because nutritional deficiency, particularly vitamin A and zinc, is related to decreased levels of immunoglobulins in the intestinal mucosa and immune system function, respectively, resulting in an impaired immune response ⁽¹²⁾ and greater susceptibility to pathogens.

The assessment of weight/age does not determine the level of malnutrition, although it may be used as a marker of factors that affect healthy growth ⁽¹³⁾. The underweight children's parents/guardians were advised to visit the Basic Healthcare Unit (BHU) for assessment of their child's growth and development, which could not be performed given the lack of interinstitutional integration between the BHU

and the daycare center. A dietitian is responsible for managing the supply of quantitatively and qualitatively adequate meals and preparing nutritional recovery programs for children at daycare centers ⁽¹⁴⁾. The presence or assistance of a dietitian in the daycare centers in this study would help to implement a monitoring program of the children's development, thereby minimizing that deficiency in the integration between institutions.

The health problems most prevalent in childhood, including anemia, diarrhea and parasitic diseases, may cause organic changes in children and imbalances in their health, including delays in weight gain ^(2, 8). This observation may reflect the strong association between the risk of being parasitized and low weight-for-age and a family income below one minimum wage among children from the municipality of Aracaju (Table 3).

Regarding the economic conditions of the studied children's families, the father/mother had informal work arrangements in 47% of the households, the family income ranged from less than one minimum wage to one to two wages (Table 2), and the level of education was elementary education for 31.9%, incomplete secondary education for 30.4% and higher education for 0.7% of participants. When posed

the question “*what are parasites?*”, 73.8% failed to provide the correct answer. The economic profile of these families had no effect on the prevalence of intestinal parasitic infections. However, there was a significant effect ($p=0.02$) of low family income as a risk factor for parasitic infection in children (Table 2) when families with less than one minimum wage were compared with those with more than two minimum wages.

Previous studies ^(1-2, 8-9) have emphasized the need for improvements in socioeconomic and education levels for the establishment and maintenance of child health. The economic profile of the study families, with 46.7% of women engaged in informal work, underscores the inclusion of maternal caregivers in the labor market and their direct participation in the household income, which is a factor relevant for the presence of children in daycare centers as identified in other studies ^(2, 3, 5). Conversely, informal work (unregistered work) favors the breakdown of family stability because a variable monthly income exposes family members,

especially children, to a situation of unmet basic needs, including food, health and hygiene. The level of education among parents in Sergipe is consistent with this context of informal work and the lack of knowledge of parasitic diseases and related prophylactic measures.

As shown using univariate analysis to assess the risk of being parasitized, age was another significant component of the prevalence of intestinal parasitic diseases, which was higher at ages 2, 3 and 4 years, especially among underweight children and those from families with incomes of less than one minimum wage (Table 2). However, the adjusted regression analysis revealed that 3-year-olds are at greater risk of being infected by parasites than are 1-year-old children as highlighted in the correlation between the prevalence of infection and age group. Underweight children in turn had a two-fold higher risk of being parasitized (Table 3). A previous study found that the rate of parasitic infection tends to increase with age ^(2, 15), most likely resulting from immunity acquired and conferred during breastfeeding.

Table 3. Logistic regression of the outcome variable risk of being parasitized adjusted for the factors age, underweight and low income in children with ages ranging from 1 to 4 years enrolled in daycare centers in Aracaju/SE, 2008.

| Variable | Gross OR | OR 95% CI | Adjusted OR | OR 95% CI | P |
|--------------------|----------|------------|-------------|------------|-------|
| Age group | | | | | |
| 1 year | 1 | - | - | - | - |
| 2 years | 2.3 | 1.1 to 4.6 | 2.3 | 1.1 to 4.7 | 0.02 |
| 3 years | 3.5 | 1.6 to 7.3 | 3.5 | 1.6 to 7.3 | 0.001 |
| 4 years | 3.1 | 1.4 to 7.0 | 2.9 | 1.3 to 6.7 | 0.01 |
| Underweight | | | | | |
| Yes | 2.1 | 1.1 to 3.9 | 2.0 | 1.1 to 3.9 | 0.03 |
| No | 1 | | 1 | | |

OR= Odds ratio; CI= confidence interval

Regarding the socio-environmental risk factors for parasitic infection, most family environments were noticeably brick-type constructions (88.6%), with two to four rooms (63.4%), 97.5% had indoor plumbing, 78.5% had flush toilets, and 58.9% had access to the public sewage system. Regarding the pavement of residential streets, 41.1% of families lived on paved streets and 14.4% on gravel roads. Most

families stored trash in external areas (74.6%) and had access to the public collection service (91.6%). It should be emphasized that only the gravel-type roads presented a significant risk for enteroparasitic infection ($p=0.04$).

Improvement in the overall quality of the dwelling produces an improvement in the quality of life, significantly reducing the scope of childhood diseases, including parasitic infections

acquired in the family environment ⁽¹⁶⁾. Conversely, in the Brazilian Northeast, gravel-type public roads retain rainwater, which favor the acquisition of various diseases because they represent potential sources of contamination with waterborne parasites ⁽⁵⁾. The lack of pavement is considered an aggravating factor for parasitic diseases, especially when associated with deficient public collection and sewage systems ⁽¹⁵⁾ as found in this study ($p=0.04$).

In the present study, the adequate disposal of residential trash from the home environment coupled with good basic sanitation may be a key factor for reducing mechanical vectors of parasites, including cockroaches (*Periplaneta americana*) and flies (*Musca domestica*) ⁽⁸⁾. The high frequency of household waste collection illustrates an improvement in the environmental hygiene habits of the community in the present study and an upward trend in the health infrastructure to which these children have

access. However, some children's guardians reported that household waste is stored within the kitchen or in the hallways of the house, given the small physical area of the residence, and this should be considered a target population group for health education initiatives.

The key structural and behavioral risk factors for parasitic infection in the public daycare centers of Aracaju include the following (Figure 1A-C): deficient physical structures and water networks; deficient cleaning of dining areas; lack of waterproof liners on mattresses and improper storage of toys in the nap room; lack of use of protective equipment by food handlers; and collective use and storage of child hygiene implements. No food preparer was found with protective equipment for food handling, including aprons, gloves, protective masks and caps (100%; Figure 1E) during the assessment of 18 municipal daycare centers in Aracaju.

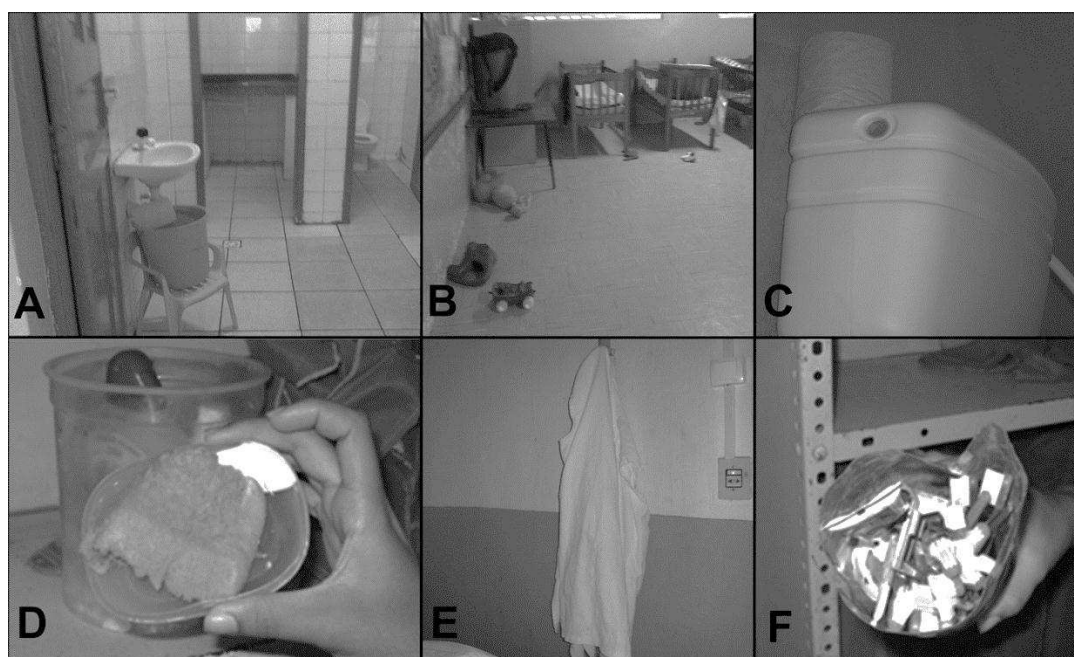


Figure 1: Structural and behavioral issues observed in the public daycare centers in Aracaju /SE in 2008. A - Sinks too high for children aged 1-4 years; B - Lack of waterproof liners on mattresses and toys scattered on the floor of the nap room; C - Inadequate storage of bathroom tissue; D - Collective sponges and soaps; E - Cooks' aprons exposed in areas of the daycare center; F - Collective storage of toothbrushes.

Hygiene in daycare centers should follow specific standards, which should be passed on to children through habits, including washing hands, brushing teeth and bathing ⁽¹⁷⁾. However, most of the daycare centers evaluated in Aracaju

featured structural and behavioral issues that complicate the learning and incorporation of hygiene habits and self-care, including sinks for hand washing that are too high for children (Figure 1A) and the storage of bathroom tissue

in inaccessible locations. This scenario may be related to the presence of the various enteroparasitic diseases observed in this childcare area (Table 1).

The sharing of children's individual hygiene products, including soap, bath sponges and toothbrushes, and their collective storage (Figure 1E, F) is a scenario consistent with the presence of scabies (11.2%) and pediculosis (18.2%). This observation is presumably related to complaints about the lack of public resources for maintaining these institutions because the instability and constant replacement of caregivers at daycare centers resulting from the termination of public contracts cause distancing and loss of the bond between the children and their caregivers. Therefore, a new perspective on labor relations with the professional caregiver could culminate in greater commitment and involvement in the rational use of existing resources and the correct use of alternative solutions to build a healthier environment for children⁽¹⁸⁾.

The caregivers' daily behavior in the daycare centers studied, including the failure to use protective equipment for handling food, including aprons, gloves, protective masks and caps (Figure 1D), and the use of jewelry and trinkets may increase the foodborne parasitic load. The children studied received three daily meals during their stay at the daycare centers. Therefore, periodic training of professional caregivers and the establishment of partnerships between childcare centers and BHU, with the integration of educational and healthcare initiatives, are key factors for improving this area of care. The education of teachers, caregivers and guardians is an essential ingredient in the promotion of child health because the daycare center or home itself becomes a medium for exposure when these initiatives are fragmented or nonexistent^(8, 15).

Furthermore, the children's clinical evaluation revealed infection rates of 18.2% for pediculosis, 11.2% for scabies and 1.8% for

concomitant ectoparasitic infections. The body areas affected by injuries and/or scabs included the head, chest and upper and lower limbs, whereas lice (*Pediculus humanus*) were only observed on the children's heads. Underweight condition was significantly associated with pediculosis ($p=0.02$) and scabies ($p=0.0007$). The aggregation of individuals in collective environments with poor hygiene is crucial for infection with pediculosis⁽¹⁹⁾ and scabies, especially among children, given that transmission occurs by direct contact. Moreover, underweight and malnutrition make children more susceptible to these infections due to immune suppression⁽²⁰⁾. Failure to clean and store cloth and plush toys (Figure 1D) and the failure to use waterproof liners in the nap room (Figure 1D) also favor ectoparasitic and respiratory infections via the accumulation of dust⁽²⁾.

CONCLUSIONS

This study showed that the rates of parasitic infection in public daycare centers in Aracaju/SE are approximately 30% for ectoparasitic diseases and 45% for enteroparasitic diseases. In this setting, children 2 and 3 years old are the most susceptible, especially those that are underweight.

Family and professional caregivers are responsible for increasing the risk of parasitic infection in children, especially with respect to income and level of knowledge of parasitic diseases among parents and the failure to use protective equipment and deficiencies in education and reinforcement of hygiene habits in children on the part of the daycare center staff.

Considering the above, parasitic infections are a relevant social problem, and new strategies for health initiatives in daycare centers that favor the interaction between the family care environment, the school environment and BHU must be designed.

CUIDADO INFANTIL E INFECÇÕES PARASITÁRIAS

RESUMO

As parasitoses constituem um problema de saúde pública no Brasil, principalmente nos ambientes destinados ao cuidado infantil. Este estudo objetivou determinar a prevalência de parasitoses em creches de Aracaju, Estado de Sergipe, bem como os fatores de risco relacionados. Realizaram-se exames coproparasitológicos e avaliação clínica/antropométrica em 276 crianças. Os fatores de risco foram identificados por meio de questionários e

avaliação iconográfica. Os dados foram avaliados pelo teste de Qui-quadrado e o teste exato de Fisher ($p \leq 0,05$). Observou-se prevalência de 44,5% para enteroparasitos (ascaridíase/21,7%) e 31,2% para ectoparasitos (pediculose/18,2%). Verificou-se correlação significativa entre enteroparasitoses e baixo peso, faixa etária de 3 a 4 anos, ruas não pavimentadas e renda familiar, como também entre ectoparasitoses e baixo peso. O perfil socioeconômico revelou que 51,6% das residências eram próprias, de alvenaria (88,6%), com água potável (97,5%) e renda de um a dois salários mínimos (42%). O grau de escolaridade dos pais (ensino médio incompleto) pode ter influenciado no desconhecimento sobre profilaxia de parasitoses (73,8%). Aspectos estruturais/comportamentais mostraram-se relevantes na ocorrência de parasitoses: uso coletivo de sabonete, acondicionamento inadequado de brinquedos e escovas dentárias e instalações sanitárias deficientes. Estes dados mostram a necessidade de novas reflexões sobre a higiene infantil e educação em saúde.

Palavras-chave: Cuidado da Criança. Parasitos. Creches.

CUIDADO INFANTIL E INFECCIONES PARASITARIAS

RESUMEN

Las parasitosis constituyen un problema de salud pública en Brasil, principalmente en los ambientes destinados al cuidado infantil. Este estudio tuvo el objetivo de determinar la prevalencia de parasitosis en guarderías de Aracaju, Estado de Sergipe, así como los factores de riesgo relacionados. Fueron realizados exámenes coproparasitológicos y evaluación clínica/antropométrica en 276 niños. Los factores de riesgo fueron identificados a través de cuestionarios y evaluación iconográfica. Los datos fueron evaluados por la prueba ji-cuadrado y la prueba exacta de Fisher ($p \leq 0,05$). Se observó prevalencia de un 44,5% para enteroparásitos (ascaridiasis/21,7%) y un 31,2% para ectoparásitos (pediculosis/18,2%). Se verificó correlación significativa entre enteroparasitosis y bajo peso, franja de edad de 3 a 4 años, calles no pavimentadas y renta familiar, así como entre ectoparasitosis y bajo peso. El perfil socioeconómico reveló que 51,6% de las residencias eran propias, de albañilería (88,6%), con agua potable (97,5%) y renta de uno a dos salarios mínimos (42%). El grado de escolaridad de los padres (enseñanza media incompleta) puede haber influido en el desconocimiento sobre profilaxis de parasitosis (73,8%). Aspectos estructurales/comportamentales se mostraron relevantes en la ocurrencia de parasitosis: uso colectivo de jabón, acondicionamiento inadecuado de juguetes y cepillos dentarios e instalaciones sanitarias deficientes. Estos datos muestran la necesidad de nuevas reflexiones sobre la higiene infantil y educación en salud.

Palabras clave: Cuidado del Niño. Parásitos. Guarderías.

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