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Prevalence of dyslipidemia in children from 2 to 9 years old

Prevalência de dislipidemias em crianças de 2 a 9 anos

Prevalencia de dislipidemias en niños de 2 a 9 años

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ABSTRACT

Objective: Analyze the occurrence of dyslipidaemia and associated factors in children aged 2 to 9 years. **Method:** Cross-sectional study, carried out with 700 children, in a region of Northeast Brazil. For comparison of means, Student's *t* test was used; and, for the comparison of medians, the Mann-Whitney test. **Results:** A prevalence of dyslipidaemia of 68.4% was found. In isolation, the majority had a level of: total desirable cholesterol (386; 55.1%), undesirable lipoprotein cholesterol (376; 53.7%), low density lipoproteins - desirable cholesterol (514; 73.4%) and desirable triglyceride (509; 72.7%). In the final multivariate model, only the variable "preschool age" was significant (prevalence ratio = 1.14), indicating that these children are more likely to have dyslipidaemia than those of school age. **Conclusion:** An association was found between dyslipidaemia and preschool age. The need for programs and strategies to better understand this problem is indicated, in addition to preventing early coronary diseases. **Descriptors:** Dyslipidaemias; Child; Preschool; Risk Factors; Prevalence.

RESUMO

Objetivo: Analisar a ocorrência de dislipidemias e fatores associados em crianças de 2 a 9 anos. Métodos: Estudo transversal, realizado com 700 crianças, em uma região do Nordeste brasileiro. Para comparação de médias, utilizou-se o teste *t* de Student; e, para a comparação de medianas, o teste de Mann-Whitney. **Resultados:** Encontrou-se uma prevalência de dislipidemia de 68,4%. Isoladamente, a maioria apresentou nível de: colesterol total desejável (386; 55,1%), colesterol da lipoproteína não desejável (376; 53,7%), lipoproteínas de baixa densidade – colesterol desejável (514; 73,4%) e triglicerídeo desejável (509; 72,7%). No modelo multivariado final, apenas a variável "idade pré-escolar" foi significante (razão de prevalência = 1,14), indicando que essas crianças têm mais chance de ter dislipidemia do que aquelas na idade escolar. **Conclusão:** Encontrou-se associação entre a dislipidemia e a idade pré-escolar. Indica-se a necessidade de programas e estratégias para melhor conhecimento sobre esse problema, além da prevenção de agravos coronarianos precoces.
Descritores: Dislipidemias; Criança; Pré-Escolar; Fatores de Risco; Prevalência.

RESUMEN

Objetivo: Analizar la ocurrencia de dislipidemias y factores asociados en niños de 2 a 9 años. **Métodos**: Estudio transversal, realizado con 700 niños, en una región del noreste de Brasil. Para comparar medias se utilizó la prueba t de Student; y, para la comparación de medianas, la prueba de Mann-Whitney. **Resultados**: Se encontró una prevalencia de dislipidemia del 68,4%. De forma aislada, la mayoría presentó un nivel de: colesterol deseable total (386; 55,1%), colesterol de lipoproteínas indeseables (376; 53,7%), lipoproteínas de baja densidad - colesterol deseable (514; 73,4%) y triglicéridos deseables (509; 72,7%). En el modelo multivariado final, solo la variable "edad preescolar" fue significativa (razón de prevalencia = 1,14), lo que indica que estos niños tienen más probabilidades de tener dislipidemia que los que están en edad escolar. **Conclusión**: Se encontró asociación entre dislipidemia y edad preescolar. Se indica la necesidad de programas y estrategias para comprender mejor este problema, además de prevenir enfermedades coronarias precoces.
Descriptores: Dislipidemias; Niño; Preescolar; Factores de Riesgo; Predominio.

INTRODUCTION

Dyslipidaemia consists of changes in the lipid profile, expressed by elevated levels of total cholesterol (TC), triglycerides (TG) and low-density lipoprotein (LDL-c) as well as low levels of high density lipoprotein (HDL-c). It may occur either alone or in combinations, or it may be hereditary or acquired[1,2]. Children with dyslipidaemia mostly denote a monogenic or idiopathic manner, associated with risk factors or multifactorial aspects, the monogenic ones being rarer[3]. It is a relevant risk factor for the development of atherosclerosis in children[1]. It is known that, among children with dyslipidaemia, half will become adult dyslipidaemia, a phenomenon known as tracking, that is, high cholesterol levels will persist into adulthood, increasing the risks of coronary diseases[4].

Population Brazilian studies show, according to region and criterion, prevalence of 10% to 23.5% of dyslipidaemia in children and adolescents. This suggests that childhood should be increasingly considered a concern, as it is a strategic phase in the prevention of atherosclerosis at the population level, considering that life habits (important causes of cardiovascular disease risk modulation - CVD) are formed in this phase[5]. In the city of Fortaleza, Ceará, the prevalence of dyslipidaemia in children and adolescents is 66.1% [6]. In Brazil, regional studies point to high prevalence of childhood dyslipidaemia: increased total cholesterol, 86%[7].

CVD is the major cause of morbimortality, both in developed and developing countries, being responsible for 31.8% of the causes of death in adults in Brazil[8]. There are several risk factors associated with the development of cardiovascular diseases, such as smoking, obesity and dyslipidaemia[1]. Specifically, dyslipidaemia is the biggest impact factor in the development of atherosclerotic disease, in particular the presence of increased concentrations of low density lipoprotein (LDL)[1]. Thus, the formation of atherosclerotic plaque, which begins in childhood, progresses in adolescence and adulthood. In view of the involvement of non-modifiable factors (genetics, age and gender) and modifiable factors (lifestyle), research and prevention in early stages of their formation is justified[9].

The epidemiological assessment of the lipid profile is considered relevant as a collective health action for the promotion of public health policies aimed at preventing and reducing cardiovascular risk factors in the population[10]. In addition, in Brazil, population data on changes in plasma lipids are scarce — in general, with series restricted to small samples or very limited geographical areas[11].

OBJECTIVE

Analyze the occurrence of dyslipidaemia and associated factors in children aged 2 to 9 years old in a region of north-eastern Brazil.

METHODS

Ethical aspects

This study was approved by the Ethics Committee of the State University of Ceará (UECE).

Design, study location and period

Cross-sectional study, conducted with children aged 2 to 9 years, 11 months and 29 days, as established in child care services[12], seen at a paediatric outpatient clinic belonging to the 10th Health Region[13] from the state of Ceará, from February to July 2016. This Health Region consists of 11 bordering municipalities, comprising Alto Santo, Erere, Iracema, Jaguaribara, Jaguaribe, Quixeré, Pereiro, Potiretama, Limoeiro do Norte, Tabuleiro do Norte and São João do Jaguaribe, and its creation took place with the purpose of integrating the organization, planning and execution of health actions and services.

Population or sample: inclusion and exclusion criteria

The probabilistic sample was 703 children, calculated based on the prevalence of 66.1%[6], sampling error of 3.5% and significance level of 5%, reducing to 700 children after three losses. The study included children whose parents agreed to participate in the research, after being properly informed. The exclusion criteria considered were: children who had diseases and/or the use of drugs that caused secondary dyslipidaemia and, consequently, interfered in the assessment of the lipid profile. In addition, those who were unable to position themselves for correct weight and/or height verification would be excluded.

Study protocol

For data collection, a semi-structured questionnaire applied by the researcher was used. The outcome was considered as dyslipidaemia in children (yes; no) based on the lipid profile, according to criteria established by the Brazilian Society of Cardiology[5]. The associative variables were sociodemographic, nutritional and protective (breastfeeding and birth weight)[14].

The weighing of the children was carried out on an adult-type mechanical platform scale, from the Welmy brand®, with a graduation of 100 g, previously regulated and given to each new weighing, supported on a flat, smooth surface and away from the wall, with a maximum capacity of 150 kg, divisions of 100 g, with anthropometric ruler in anodized aluminium and divisions of 0.5 cm. The children were positioned in the center of the equipment, with their backs to the scale, barefoot, standing, with their arms extended along their bodies, wearing very light clothes, such as shorts, panties or underpants and being with the guardians[12]. Current body mass in kilograms (kg) and height measured in centimetres (cm) were considered, with the children in the standing posture, Frankfurt position and with the head free of accessories[12].

The Brazilian Society of Paediatrics recommends the assessment of the lipid profile in children aged 2 to 10 years, as a routine for all children who express: positive family history of premature CVD (parents and grandparents) or other CVD risk factors; or who have first-degree relatives with a TC greater than 240 mg/dl and a TG greater than 400 mg/dl, with an unknown family history; or, still, that express diseases or clinical signs indicative of the need for such an evaluation[9,12].

To perform the lipid profile, which includes the dosage of

four parameters - CT, HDL c, LDL-c and TG - 4 ml of blood were collected, with fasting for 12 hours being recommended, except for water and medications. The biochemical dosage of the lipid profile was carried out in a clinical analysis laboratory, Jaguaribano Laboratory of Clinical Analysis, located in the city of Limoeiro do Norte, Ceará.

The material was collected in a vacuum, dried tube and examined in an automatic equipment, Labtest®, Labmaxplenno model. CT and TG were performed using the colorimetric method (enzymatic trinder); and HDL-c, performed using a colorimetric method (accelerator - selective detergent). To obtain safe results, daily quality control was carried out on two levels: normal and altered. Repetition parameters were used for biochemical measurements, with values above the reference. LDL-c was calculated using the Friedwald formula, given by, using fasting TG values. In order to categorize the study participants, inadequacy cut-off points were used, according to the V Brazilian Guideline on Dyslipidaemia[5].

Analysis of results and statistics

The data were stored in the Microsoft Office Excel® program, version 11.0, and processed using the statistical program PASW (Predictive Analytics Software for Windows), version 17.0.

Data analysis was performed in a descriptive manner, using absolute and relative frequencies and measures of median, mean and standard deviation. Inferential analysis involved the association between the outcome represented by dyslipidaemia (yes; no) and the associative variables related to sociodemographic, nutritional and protective factors (breastfeeding and birth weight).

In the unadjusted analysis, the Wald chi-square test was used, with a significance level of 5%. As a criterion for entering the model, variables that registered a descriptive level were selected $p < 0.20$; and, to remain in the adjusted multivariate model, only those with a p-value <0.05. Poisson regression, with robust variance, was used as an estimate by point and by interval of the prevalence ratio (PR)[14]. According to Petersen and Deddens[15], the model converges easily, and adequate PR estimates are obtained in the face of categorical variables. Poisson regression with robust variance produces adequate estimates of the prevalence ratio, in addition to the established confidence intervals regardless of the adopted prevalence[16-17].

The averages of quantitative variables in relation to dyslipidaemia in children were compared, and the medians for qualitative associative variables, using Student's *t* and Mann-Whitney tests, respectively, with a significance level of 5%.

RESULTS

The sample of 700 children stratified in relation to the diagnosis of dyslipidaemia showed: yes (479; 68.4%) and no (221; 31.6%). Most of the children were descendants of farmers (261; 55.6%), with parents' education related to elementary school (247; 56.8%), eutrophic (233; 46.6%), who had mixed or partial breastfeeding (31; 50.8%) and in pre-school age (273; 57.0%). In the unadjusted model (p <0.20), the variables were considered: mother's profession (p = 0.107), parents' education (p = 0.059), children's nutritional diagnosis (p = 0.119), type of breastfeeding (p = 0.052) and children's school age (p = 0.012) (Tables 1 and 2).

In the final model, only the variable "children's age" was significant (p = 0.012), indicating that those in the preschool age profile were 1.14 times more likely to have dyslipidaemia than children in the school age group (Table 3).

Table 1 – Dyslipidaemia and unadjusted prevalence ratio of children (sociodemographic variables), Limoeiro do Norte, Ceará, February to July 2016

Variables	Dyslipidaemia*				PR	CI (95%)			*p* value
	Yes	%	No	%					
Mother's profession									0.107
Others	208	72.0	81	28.0	1.09	0.98	-	1.20	
Agriculture	261	66.2	133	33.8	1				
Father's profession									0.661
Others	226	67.7	108	32.3	0.98	0.88	-	1.08	
Agriculture	223	69.3	99	30.7	1				
Mothers' income									0.583
> 2 ms	19	73.1	7	26.9	1.09	0.85	-	1.38	0.508
1 a 2 ms	150	70.8	62	29.2	1.05	0.94	-	1.17	0.370
< 1 ms	299	67.3	145	32.7	1				
Fathers' income									0.564
> 2 ms	55	69.6	24	30.4	0.97	0.81	-	1.16	0.731
1 a 2 ms	301	67.2	147	32.8	0.93	0.82	-	1.06	0.295
< 1 ms	92	71.9	36	28.1	1				
Parents' education									0.059
Elementary	247	67.3	120	32.7	0.83	0.71	-	0.97	0.021
High School	150	67.6	72	32.4	0.84	0.71	-	0.99	0.034
Higher education	38	80.9	9	19.1	1				
Origin of children									0.879
Urban	190	68.1	89	31.9	0.99	0.89	-	1.10	
Rural	289	68.6	132	31.4	1				

*Note: * The total sample (700) was not expressed in some variables, due to the absent values of dyslipidaemia. MS: minimum salary; PR: prevalence ratio; CI: confidence interval.*

Table 2 – Dyslipidaemia and unadjusted prevalence ratio of children (clinical variables), Limoeiro do Norte, Ceará, February to July 2016

Variables	Dyslipidaemia*				PR	CI (95%)			*p* value
	Yes	%	No	%					
Nutritional diagnosis of children									0.119
Obesity	139	72.4	53	27.6	1.12	0.99	-	1.25	0.064
Overweight	107	71.8	42	28.2	1.11	0.98	-	1.26	0.116
Eutrophic	233	64.9	126	35.1	1				
Presence of breastfeeding									0.394
No	60	72.3	23	27.7	1.06	0.92	-	1.23	
Yes	419	67.9	198	32.1	1				
Breastfeeding time									0.534
< 6 months	202	66.7	101	33.3	0.97	0.87	-	1.08	
≥ 6 months	216	69.0	97	31.0	1				
Type of breastfeeding									0.052
Mixed or partial/Complemented	31	83.8	6	16.2	1.15	1.00	-	1.31	
predominant/Exclusive	30	69.8	13	30.2	1				
Birth weight									0.799
Low weight	26	70.3	11	29.7	1.03	0.83	-	1.28	
Adequate weight	453	68.3	210	31.7	1				
School age child									0.012
Pre-school	273	72.6	103	27.4	1.14	0.79	-	0.97	
School	206	63.6	118	36.4	1				

*Note: *PR: prevalence ratio; CI: confidence interval.*

Table 3 – Adjusted prevalence ratio, in the final model, of dyslipidaemia in children, Limoeiro do Norte, Ceará, February to July 2016

Variables	PR	CI (95%) adjusted		*p* value
Age				0.012
Pre-school	1.14	0.79	0.97	
School	1			

*Note: *PR: prevalence ratio; CI: confidence interval.*

Table 4 – Comparison of means of variables in relation to dyslipidaemia in children, Limoeiro do Norte, Ceará, February to July 2016

	Dyslipidaemia	n	Mean	SD	*p* value*
Abdominal circumference	NO	221	55.07	7.34	0.385
	YES	479	55.62	8.63	
BMI	NO	220	17.470	2.62	0.056
	YES	479	17.906	3.13	

*Note: *Use of Student's t test; SD: standard deviation.*

Table 5 – Comparison of medians of variables in relation to dyslipidaemia in children, Limoeiro do Norte, Ceará, February to July 2016

	Dyslipidaemia	n	Median	SD	*p* value*
Age	NO	221	6.20	2.26	**0.020**
	YES	479	5.40	2.35	
Birth weight	NO	221	22.40	7.88	0.173
	YES	479	21.30	9.31	

*Note: *Use of the Mann-Whitney test; SD: standard deviation.*

The median was used to represent the variables: age, weight, LDL-c and TG (Table 4). For the other variables (height, waist circumference, BMI, CT, HDL-c and birth weight), the arithmetic mean was applied (Table 4).

Regarding the outcome represented by dyslipidaemia, a statistically significant difference was obtained by Student's *t* test, which was not significant (p> 0.05), for the variable "abdominal circumference" (Table 4).

When testing the outcome with the variables "age" and "birth weight", it was found that only "age" showed statistical significance (p <0.05), using the Mann-Whitney test (Table 5).

DISCUSSION

Dyslipidaemia was observed in 68.4% of the studied population. In isolation, the majority had levels of: desirable TC (386: 55.1%), undesirable HDL-c (376: 53.7%), desirable LDL-c (514: 73.4%) and desirable TG (509: 72.7%).

The results of this research showed positive effects in determining the lipid profile, as this is confirmed in other studies according to the age groups: 6 to 9 years (48.1%)[17], 2 to 18 years (16% to 34%)[18], 6 to 17 years old (12.5%)[19]. The following factors are involved in altering the lipid profile: genetics, physical inactivity, atherogenic diet, exposure to tobacco, obesity and dyslipidaemia. Childhood research is needed to prevent complications, morbidities and mortality in adulthood[20].

It is noteworthy that the first 1,000 days of life — from conception to 2 years of age — can be considered the modulating period of growth and anatomical and functional development of the organism[21]. This suggests investment in the formation of good eating habits, aiming at the prevention of chronic non-communicable diseases, which currently affect childhood and will have an impact on adult life[22]. The main objective of universal screening is to identify cases of familial hypercholesterolemia and the use of non-HDL-c in the identification of children with the components of the metabolic syndrome[23].

In this research, according to the findings of dyslipidaemia, it was shown that they may also be affecting mainly children from rural areas, who currently, have the same lifestyle as children in urban areas. This occurs as a result of more sedentary habits, industrialized foods and access to the most diverse forms of electronic entertainment, which make children exercise less, causing a decrease in HDL-c levels. This situation is configured

as a serious collective health problem, which may have future repercussions for the adult life of these children.

It is also worth noting that children with inadequate birth weight expressed dyslipidaemia. Low birth weight has a great influence on infant morbidity and mortality[24], and this clinical condition at birth indicates a possible relationship with the development of obesity, dyslipidaemia, arterial hypertension and type 2 diabetes[25]. Studies show that low birth weight often progresses with increased TG and increased LDL-c[26], being that adults born at term and with low weight gain a higher percentage of fat mass than those born with adequate weight[27]. A study carried out in Argentina with indigenous children showed a high prevalence of dyslipidaemia, but not associated with overweight and obesity, suggesting the existence of genetic factors in this population[28]. This fact shows that, despite being a different population from the one investigated in the present study, there is a high prevalence of dyslipidaemia, suggesting that it is a public health problem in different people/countries. It is also noteworthy that the adequate weight at birth reflects the improvement of public health care policies for pregnant women and their concepts, through the prenatal actions in the Family Health Strategy, contributing to the improvement of healthy birth and rates of adequate Brazilian children.

When relating dyslipidaemia to breastfeeding, there was statistical significance in the borderline; and despite that, it was considered in the model, as mixed or supplemented breastfeeding has a 15% greater chance of developing dyslipidaemia than those who were exclusively breastfed. In this study, however, there was no evidence to link breastfeeding to dyslipidaemia. It is known that the practice of breastfeeding is one of the strategies to reduce neonatal and infant morbimortality. In the present investigation, the majority of children were breastfed.

HDL-c was the fraction of the lipid profile that was altered (53.7%). It is known that HDL-c represents protection against the risk of developing CVD, but previous studies have shown a lower prevalence than that found in this research (35.1%)[7]. Research carried out with 893 children and young adults suggests that TG and HDL-c can be used in the early identification of young people who need a more aggressive intervention to prevent cardiovascular diseases[29]. Cohort study conducted with data from the years 2004 and 2008 in children aged 5 and 9 years showed a prevalence of altered HDL-c in 35.1% and 67.6%, respectively[5].

It is noteworthy that the beginning of physical activity in childhood improves the lipid profile, contributing to the reduction of overweight and obesity and, consequently, being able to collaborate for the continuity of this practice in adulthood.

The study of dyslipidaemia in children from 2 to 9 years old pointed to preschool age[30-32] as the group most likely to develop dyslipidaemia. This indicates that the determination of the lipid profile is valid as a way to prevent early coronary diseases.

Study limitations

This study had limitations related to sample selection, as it is a health region with certain particularities, such as socioeconomic, epidemiological, demographic, cultural, among others. This limitation is very common in studies on dyslipidaemia in children, as it involves the measurement of the lipid profile. Furthermore, it has limitations, as it is a local sample, in a cross-sectional study, highlighting only the cause-effect relationship.

Contribution to the area of nursing, health or public policy

This research was pioneering in this health region when investigating the lipid profile in children from 2 to 9 years old, exclusively, regardless of the overweight factor.

These results are expected to contribute to epidemiological data on dyslipidaemia and associated risk factors for the state of Ceará. Nationally, this study may guide the planning of public maternal and child health actions and policies.

CONCLUSION

Age was a major factor in the association with dyslipidaemia and evidenced the need for health education in the family and school environment, resulting in public health promotion actions and policies.

This research provided epidemiological foundations to highlight the need for actions of food and nutrition education, as well as health promotion programs and policies, aimed at this audience, which include the practice of physical activity, exclusive breastfeeding and complementary feeding healthy, in order to prevent such changes, since they can remain during adolescence and adulthood. Therefore, it is necessary to build scientific knowledge about dyslipidaemia in children, in addition to carrying out additional studies to assess the influx of information obtained.

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