Outcomes that explain excess of body fat mass in preschoolers: a cross-sectional exploratory study

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Research Article

Keywords: Childhood obesity, Environmental factors, Preschoolers

Posted Date: March 15th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-289547/v1

Abstract

Background: Childhood obesity requires approaches that combine personal interventions with social and environmental changes. The preschool period is crucial in the context of the expansion of adipose tissue since it covers the adiposity rebound. Although emerging studies verifying a range of possible social, environmental, and personal explanatory variables for childhood obesity, the assessment of body fat mass using a gold standard instrument, is still a gap especially during the preschool period. The aim of this study was to determine social, environmental, and personal factors associated to the excess of body fat mass in preschool period.

Methods: Quantitative, exploratory, cross-sectional study developed in public schools.

Results: Analyzes using univariate and multivariate models demonstrated that parental obesity, highest quality of environmental stimulation and screen time explained almost 50% the excess of body fat mass in preschoolers.

Conclusion: The presence of obesity in one parent, a home environment with high stimulation, and permanence for a long period on-screen are outcomes strongly associated with the presence of an excess of body fat mass in the preschool period. These findings may assist the development of public guidelines focusing on child health to outline effective strategies that contribute to the quality of life and treatment of preschoolers with excess body fat mass.

Background

Childhood obesity is a public health problem, in which it requires approaches that combine individual interventions with social and environmental changes. Obesity is defined as an excess of body fat mass (FM)[1], recognized for impacts related to physical fitness and health, signs of cardiovascular disease in childhood and adolescence[2]. It substantially increases the risk of diseases such as type 2 diabetes mellitus, fatty liver disease, hypertension, myocardial infarction, stroke, dementia, osteoarthritis, contributing to a decline in quality and life expectancy[3]. Early detection has been encouraged by the World Health Organization (WHO), in order to enable the development of coping public policy strategies that include healthy habits of life in early stages, including childhood [4].

The preschool period covers the “adiposity rebound”, a phase of early childhood in which the amount of FM a minimum physiological value is reduced to later start to increase again[5]. Epidemiological studies have shown that the risk of childhood obesity is higher among preschoolers with early or pronounced adiposity rebound[6,7]. Thus, considering that the preschool phase is a critical period for prevention[7] and acquiring healthy lifestyle habits[8], it is crucial to identify explanatory factors that favor the increase in the amount of FM in childhood, especially in the preschool phase.

The body mass index (BMI) and the FM are important determinants of metabolic health at the population level[9]. Despite the recognized use of BMI for associations with health outcomes[10], the greatest accumulation of FM in early childhood has been associated with increased body weight, increased waist-hip circumference[11] contributing to the later risk of cardiometabolic disease[12]. Studies investigating obesity in children used different methods to assess the amount of body fat mass, such as BMI [13], waist-hip circumference[14], FM measured by bioelectrical impedance[15] or Dual Energy X-ray Absorptiometry – DEXA[16]. The measurement of FM using the gold standard method, e.g. DEXA, is considered a reference[12, 9], since evidence indicates that FM gain in early childhood predicts increased levels of blood biomarkers related to cholesterol metabolism[11].

Research seeks to understand outcomes that interfere in the gain of FM[1] in the preschool phase[17]. The reasons for having excess of FM in childhood are diverse[20]. There is an extensive literature on the relationship between obesity and eating habits[19,20]. The nutritional quality of the foods consumed and the eating behaviors are linked since diets rich in animal products, proteins, high fat, sugar and salt were associated with excess of FM[7].

Added to changes in the global food system with increased caloric intake[19] the increase in sedentary behavior emerges[21] understood as periods of low physical activity (PA), high sedentary activity and screen time, identified as the main drivers of the obesity pandemic[7]. Other factors such as maternal and paternal overweight[22] may reflect on genetic interaction, lifestyle and environmental risk factors shared within families, exposing greater susceptibility to excess of FM throughout life[23, 24].

The complexity of the social, environmental and personal factors and their relationships for the development of obesity have been reported in the literature[25]. Thus, factors such as social environment, life situations, demographics, economic status, social structures in general and educational aspects could have a potential role in defining the risk of overweight/obesity[20,26,27] .

Obesity is not caused by personal choice or by society, but by the relationship between an individual and his environment. Therefore, emerge studies that associate the social environment with excess weight[28]. Vrijhed and colleagues[18] evidenced that the characteristics of the built environment, such as locomotion capacity and spaces, play a potential role in children's PA habits and other health behaviors and, consequently, in the development of childhood obesity.

Documenting what children experience in their environments is of great value as research shows continuous interaction of environmental resources and human functioning at the genetic, neural and behavioral levels[29]. Family aspects, such as parental involvement in caring, having many siblings, physical factors of the home can influence the risk of childhood obesity, reinforcing the importance of identifying the child's home and the family factors associated with gaining to understand the origins of development obesity[30]. Evidence points out that significant parental involvement can be a key factor for the effectiveness of interventions for children of preschool age[31].

As for the school environment, studies show that the inclusion of PA added to school curriculum has a positive impact on health and on educational results in preschoolers[32]. Although there are prevalence studies that evaluated the daycare environment[33], as far as is known no study investigated the impact of the daycare environment on the amount of FM.

Studies that associated home environments with excess body fat mass have not used validated instruments for the home context[22], demonstrating the need to identify whether the home environment is indeed an associated factor with excess of FM especially in preschoolers. Besides, the identification of behavioral components to be included in multi-component programs is necessary to achieve the recommended lifestyle changes and subsequently reduced FM [34].

A growing body of evidence suggests that obesity is a disorder of the energy homeostasis system, rather than simply due to the passive accumulation of excess of FM[1]. In this sense, to reduce the burden of obesity requires approaches that combine personal interventions with social environmental changes. Therefore, a better understanding of the outcomes that predict excess of FM in preschoolers[28] would help to identify the social causes of obesity and provide guidance on which are the most promising intervention strategies, especially in the preschool phase[3]. Given the above, the aim of this study is to determine possible factors associated to excess of FM mass in preschoolers. For this, ranges of socio-environmental and personal factors were evaluated as independent variables. i.e., birth weight[35], marital status, number of children [20,26, 27], economic status, maternal education[33,36], screen time[37], PA level[9,15], presence of maternal or paternal obesity[22], food caloric intake, quality of the home and school environment[18,28].

Materials And Methods

Study design and sample

This is a quantitative, exploratory, cross-sectional study approved by the Research Ethics Committee of Universidade Federal dos Vales do Jequitinhonha e Mucuri-UFVJM (Protocol: 2.773.418), with written informed head parent consent and participant assent and all protocols are carried out in accordance with relevant guidelines and regulations. Data collection took place from July to December 2019. Pre-school children, that is, children from 3 to 5 years old, from public schools in a Brazilian municipality, were eligible. The sample size was calculated using the GPOWER 3.1 statistical program. For this, we used linear multiple regression considering a partial determination coefficient of 0.50 for body fat mass as outcome. Thus, alpha error of 0.01, statistical power of 99%, considering 20% of possible sample losses, the sample size was estimated in 51 preschoolers.

Exclusion criteria were preterm and low birth weight infants; infants with pregnancy and delivery complications; infants with signs of malnutrition or illness that interfere with growth and development.

Instruments and procedures

Body fat mass was quantified using Dual Energy Radiological Absortometry (DEXA) (Paediatric medium scan mode software, Lunar Radiation Corporation, Madison, Wisconsin, USA, modelo DPX), known as a reliable quantification tool[1].

The children were invited to the DEXA evaluation and, to encourage adherence, a video of another child performing the scan was made available before the measurement. The instrument was properly calibrated and the scans were analyzed by a trained technician. The body composition variable chosen for this study included a measure of total adiposity, that is, FM. To measure the weight, an analog scale (0.1 kg precision) was used. To measure the height, a portable, folding infant stadiometer was used. The children were instructed to remove their shoes and these measurements were performed by a properly trained examiner.

The sample was characterized according to BMI, as well as the z score, using WHO Anthro software version 3.2.2 (Geneva, Switzerland), developed by WHO[38]. Thus children with z-scores between -1 and +1 were classified as normal weight, > +1 as overweight; > +2 as obese There was a high correlation between BMI and FM (Spearman's correlation, $r = 0.898$, $p < 0.001$).

As possible independent outcomes, birth weight, presence of obese parents, birth order, sex, age, marital status, economic status, maternal education[39], quality of the home and school environment[36], PA[15], caloric intake [19] were considered.

The biological and sociodemographic factors were collected using an specific questionnaire, containing information about the history of pregnancy, data on the vaccination card, such as weight and height at birth, presence or absence of siblings, self-report of maternal and / or paternal obesity. In addition, information about environmental opportunities for active and sedentary behavior, such as the time the child is exposed to screens, the presence of internal and external physical space in the house, the presence of a playground at school, and other outcomes were collected. The outcome ‘time of exposure to screens’ was collected considering the parents' report of the time in minutes that the child is exposed to the screens (television and cell phone).

Sociodemographic variables were collected using a specific questionnaire. To verify the economic level of families, the Brazil economic classification criterion, from the Brazilian Association of Research Companies was used. This is a questionnaire that stratifies the general economic classification resulting from this criterion from A1 (high economic class) to E (very low economic class)[40], considering the assets owned by the family, the boss's education and housing conditions, such as running water and street paving.

The quality of the environment in which the child lives was assessed using the Early Childhood Home Observation for Measurement of the Environment (EC_HOME) [41]. The EC_HOME is applied through observation and semi-structured interviews during home visits, standardized for children aged 3 to 5 years. The instrument contains 55 items divided into 8 scales: I-Learning materials, II-Language stimulation, III-Physical environment, IV-Responsiveness, V-Academic stimulation, VI-Modeling, VII-Variety, and VII-Acceptance For analysis, the sum of the raw scores of the subscales was used, after the environment is classified as High stimulation, Medium stimulation and risk environment.

The quality of the school environment was assessed using the Early Childhood Environment Rating Scales (ECERS) [42], which contain inclusive and culturally sensitive indicators for many items. The scale consists of 43 items organized into 7 subscales (1-Space and Furnishings, 2-Personal Care Routines, 3-Language and Literacy, 4-Learning activities, 5-Interactions, 6-Program Structure, 7- Parents and staff). Each quality indicator was marked, considering its presence or absence in each collective environment (classroom), with the items scored from 1 to 7. The final score of the scale is given by the mean of the seven subscales. It is an ordinal, increasing scale, from 1 to 7, the interpretation of quality being 1: inadequate; 3: minimal (basic); 5: good; 7: excellent.

The PA level was measured using an accelerometer (Actigraph®- Model GT9X); for a period of 3 days, without including the weekend[43], for a minimum of 570 minutes a day[15], which is considered suitable for preschoolers[43]. Accelerometers were initialized and analyzed using 5-second epochs. In all analyses, consecutive periods of ≥ 20 minutes of zero counts were defined as non-wear time[44], with a sampling rate of 60 Hz. The acceleration units were expressed in triaxial vector magnitude (VM). The accelerometer was positioned on the right side of the hip to capture accelerations and decelerations of the body and determine objective measurements of gross acceleration, intensity of physical activity, heart rate intervals and total time of suspension of use[44]. Pediatric cutoff points validated for preschool children, with score values, classify as sedentary (0 to 819 counts / m), mild (820 to 3907), moderate (3908 to 6111) and vigorous (above 6612)[45]. For this study, the child's mean time at these intensities was used. The classification adopted for “active” or “insufficiently active” was established according to the WHO, which considers an active child to be one who has a PA of at least 180 minutes/day, with a minimum of 60 minutes/day in moderate to vigorous PA[46].

For the assessment of food intake, the food diary was used to collect information about an individual's current intake. In this method, the responsible person writes down, in a specific form, all the food and drinks consumed over one or more days, and must also note the food consumed outside the home[47]. For helping the portion size the best estimates, of the portion size, we used counted on the help of traditionally used homemade measures, containing portion sizes and three-dimensional models of food[48]. The Average daily total energy values (Kcal) were calculated using the DietPro 5i software (A.S. Sistemas, Viçosa, Minas Gerais, Brazil). The first stage was carried out at the child's home with the completion of the survey questionnaires to assess socioeconomic data [40], quality of the home environment (EC-HOME)[41], data on opportunities environmental aspects of active and sedentary behavior, clinical history of pregnancy, childbirth, child and parents, anthropometric assessment, in addition to guidance on the instrument (accelerometer) that the child used to measure the level of physical activity. The second stage was carried out in the school environment, where the daycare environment assessment (ECERS)[42] was applied. In the third stage, the parents and the child were referred to the Exercise Physiology Laboratory (LAFIEX), on Campus 2 (UFVJM) for DEXA. All children were evaluated in the same places.

The researchers first went through training to apply the tests and measures to carry out the measures of weight, height, application of tests to assess body mass, as well as to apply the questionnaires. To ensure greater reliability, only 1 examiner per test and step was used, ensuring internal control for the measurements of the outcomes in a sequential study.

Data analysis

Statistical analysis was performed using SPSS 24.0. First, a descriptive analysis of the outcomes was performed to determine the data distribution. The Shapiro-Wilk test was used to determine the normality of the data. Afterwards, Spearman's or chi-square correlation was used. Simple linear regression analyzes were performed to determine the strength of the associations between the variables (child's age, sex, maternal age and education, marital status, weight acquired during pregnancy, birth weight, economic status, presence of siblings , father practices PA, son practices PA, presence of siblings, breastfeeding time, obese father or mother, ECERS score, EC_HOME classification, screen time for the week and weekend, sedentary PA, mild to vigorous PA, Classification PA in active or little active, measured calories) and the outcome (FM). All possible explanatory outcomes were inserted into the multiple linear regression model. The stepwise method was used to determine which variables remained associated with FM, with only explanatory variables with a p-value <0.05 remaining in the final model after adjustments. Given that outcomes that had no significance in simple linear regression can become significant in multiple linear regression when associating with other outcomes, as they can be considered confounding outcomes, multiple linear regression was performed including all the outcomes analyzed in simple regression.

Results

The group consisted of fifty-one preschoolers, of whom about half are boys, most of whom attend the partial school shift (33 children, 65%) and belong to the lower middle class of the economic classification (Extract C, 33 children, ± 1). Of the participants, most mothers have more than 12 years of time / attendance at school (± 0.72) and most families have more than one child. Just over half of preschoolers are considered physically active despite the fact that a large part of the group does not do systematic physical activity. Most children live in a house with no yard, and with some internal space in the home's environment (Table 1). For overweight children, the median FM was 10.75 kg of FM, while for eutrophic children, the FM median was 3.63 kg.

Table 1
Characterization of the sample.

Outcomes	%	X^2 or r	p value
Gender		0.024[a]	0.877
Male	28(54.9)		
Female	23(45.1)		
Child age (in years)	5 (3–5)	0.222[c]	0.117
Maternal age	32(20–45)	0.142[c]	0.321
Breastfeeding time (months)	14(1–48)	0.155[c]	0.292
Economic Classification Class B Class C Class D	14(26.9) 33(63.4) 5(9.6)	4.573[b]	0.338
Maternal Education		6.812[b]	0.056
Elementary School	9(13.5)		
High school	31(59.5)		
University education	12(23.1)		
House has backyard		0.015[a]	0.903
Yes	22(43.1)		
No	29(56.9)		
House has 30m² per inhabitant		0.494[a]	0.482
Yes	26(51)		
No	25(49)		
Son Does Physical Activity		0.397[b]	0.610
Yes	3(4.9)		

Note: [&] statistical test considering the fat mass, [a] square chi, [b] Fisher's exact test, [c] Values corresponding to Spearman's correlation. * $p \leq 0.05$ AF: Physical Activity; [d] Guideline classification 180 min with 60 min of moderate to vigorous physical activity[46]. ERCS = Environment rating scales in early childhood education. EC_HOME = Early Childhood Home Observation for Measurement of the Environment.

Outcomes	%	X^2 or r	p value
No	48(94.1)		
Presence of brothers		0.158[a]	0.691
Yes	36(70.6)		
No	15(29.4)		
Parents do AF		0.980[b]	0.772
Yes	4(7.8)		
No	41(80.4)		
Obese parent (s)?		11.366[a]	0.001*
Yes	9(17.6)		
No	42(82.4)		
Quality of the school environment (ERCS)	2.71(1.90–2.92)	0.065[c]	0.648
EC_HOME Classification		8.993[b]	0.007*
Medium Stimulation	42(78.8)		
High Stimulation	10(19.2)		
Active or inactive child[d]		0.000 [a]	1.000
Active	28(56)		
Little Active	22(44)		
Sedentary time ST (min)	393.99(± 45.79)	0.108[c]	0.455
Sum Light, moderate and vigorous time (min)	249.70(± 44.98)	0.004[c]	0.978
Calories ingested / day	1509.36 (837.57-2266.76)	0.272[c]	0.062
BMI		0.898[c]	0.000
Eutrophic	26(50.90)		
Overweight	25(49.01)		

Note: [&] statistical test considering the fat mass, [a] square chi, [b] Fisher's exact test, [c] Values corresponding to Spearman's correlation. * $p \leq 0.05$ AF: Physical Activity; [d] Guideline classification 180 min with 60 min of moderate to vigorous physical activity[46]. ERCS = Environment rating scales in early childhood education. EC_HOME = Early Childhood Home Observation for Measurement of the Environment.

Table 2
Simple linear regression with body fat mass (dependent outcome).

Independent outcomes	R^2	B	Standard Error	β	95% CI (Lower)	(Upper)	p value
Child's age (years)	0.071	1.802	0.933	0.266	-0.073	3.676	0.059
Sex	0.008	0.714	1.156	0.088	-1.609	3.037	0.540
Maternal age (years)	0.049	0.152	0.096	0.221	-0.041	0.344	0.120
Maternal schooling (in years)	0.026	0.893	0.784	0.161	-0.682	2.467	0.260
Marital status	0.011	0.683	1.156	0.106	-1.459	3.185	0.459
Weight acquired during pregnancy (kg)	0.002	-0.009	0.027	-0.045	-0.063	0.046	0.753
Birth weight (kg)	0.034	1.738	1.333	0.183	-0.940	4.416	0.198
Economic status	0.039	-0.741	0.523	-0.198	-1.792	0.310	0.163
Presence of brothers	0.000	-0.133	1.267	-0.015	-2.679	2.414	0.917
Father does physical activity	0.001	0.005	0.018	0.035	-0.033	0.042	0.246
Son does physical activity	0.007	1.438	2.445	0.084	-3.476	6.352	0.559
Breast feeding time (months)	0.011	0.072	0.058	0.179	-0.045	0.188	0.222
Obese father or mother	0.240	5.191	1.321	0.490	2.537	7.845	0.000*
Quality of the school environment ECERS	0.007	1.140	1.967	0.083	-2.812	5.093	0.565
EC_HOME classification	0.114	3.184	1.265	0.338	0.642	5.725	0.015*
Screen time (minutes / day of the week)	0.040	0.019	0.008	0.323	0.003	0.035	0.021*
Screen time (min / day weekend)	0.105	0.009	0.006	0.199	-0.004	0.021	0.161
Sedentary time ST (min)	0.038	0.017	0.013	0.194	-0.008	0.042	0.176
PA Light, moderate and vigorous (min)	0.006	-0.007	0.013	-0.077	-0.033	0.019	0.595
Active and Inactive Classification (60 MVPA)	0.000	0.064	1.179	0.008	-2.307	2.434	0.957

Note: R^2 = R Adjusted square. B = Non-standardized coefficient. β = Standardized coefficient. PA = Physical activity MVPA = Moderate to Vigorous Kcal = kilocalories. ERCS = Environment rating scales in early childhood education. EC_HOME = Early Childhood Home Observation for Measurement of the Environment.

Independent outcomes	R^2	B	Standard Error	β	95% CI (Lower)	(Upper)	p value
Measured Calories / day (Kcal)	0.063	0.003	0.002	0.251	-0.000	0.007	0.085
Note: R^2 = R Adjusted square. B = Non-standardized coefficient. β = Standardized coefficient. PA = Physical activity MVPA = Moderate to Vigorous Kcal = kilocalories. ERCS = Environment rating scales in early childhood education. EC_HOME = Early Childhood Home Observation for Measurement of the Environment.							

The independent outcomes that showed significance in the simple regression were, respectively, obese father or mother, classification of Home, Screen time (minutes / days of the week) (Table 2).

Table 3
Multiple linear regression between independent outcomes and body fat mass (dependent outcome).

Dependent outcome	Independent outcomes	B	SE	β	95% CI (Lower)	(Upper)	T	p value
Body fat mass (kg)	Obese father or mother	5.293	1.345	0.464	2.577	8.010	3.936	0.000*
	EC_HOME classification	4.491	1.129	0.451	2.210	6.771	3.977	0.000*
	Screen time (minutes / day)	0.020	0.007	0.329	0.034	2.864	2.864	0.007
B = Non-standard beta. SE = Standard Error. β = Standardized Beta. *p < 0.001. EC_HOME = Early Childhood Home Observation for Measurement of the Environment.								

The outcomes that remained in the model and that explained the excess of body fat mass were obese father or mother, home classification and screen time, respectively (Table 3). Therefore, being the child of parents with excess body weight, living in an environment of high stimulation and having high exposure to screens predicts excess of FM in preschoolers. The value of the adjusted determination coefficient was 0.46. That is, these outcomes together explained 46% of the model. The post-hoc analysis revealed a large effect size (Effect size = 0.85).

Discussion

This study was constructed to investigate possible social, environmental and personal factors that explain the excess of FM specifically in preschoolers, which is a stage of child development characterized as a rebound of adiposity [5,6]. The strength of our study was based on the outcome directly related to obesity, e.g., FM. In addition, FM was measured using a gold standard instrument. Besides, we encompassed as possible explanatory outcomes, e.g., social, environmental, and personal aspects, such as birth weight, marital status, number of children[20,26,27], economic status, maternal education[33], screen time[37], PA level[15], presence of maternal obesity or pate

rnal[22], food intake, quality of the home and school environment[18,28]. Thus, parental obesity, higher quality of environmental stimulation and screen time explained preschool obesity in the regression models. Together they explained almost 50% of the excess of FM of preschoolers.

Paternal or maternal obesity was positively associated with FM. Thus, having an obese father or mother represents an increase of around 0.464 Kg in the child's FM in the preschool phase. According to data from Yi and colleagues[49] in the clinical practice guidelines for the treatment of pediatric obesity in Korea, which states that children of obese parents are more likely to have excess fat. Although genetic factors that act in isolation do not explain the rapid increase in the prevalence of obesity[1], it is quite possible that certain genetic factors increase the risk of obesity caused by environmental influences in favor of the positive energy balance (higher calorie intake, less physical activity, or both) [22] and, consequently, excess of FM. Superimposed on potentially relevant environmental influences such as changes in the composition of the diet and lifestyle, and many others are also the potential roles played by parents' obesity[1].

These findings are in line with studies that associate overweight of parents with overweight of children and explain this relationship with repercussions on family behaviors[22], since parents' lifestyle habits induce childhood obesity[50]. Yi and colleagues[49], in a clinical practice guideline for the diagnosis and treatment of pediatric obesity, presents recommendations for a comprehensive family model and a multidisciplinary team approach to successful interventions, considering that the interactions between parents and children and parents' lifestyles strongly affect children's unhealthy lifestyles.

The high stimulation environment in the present study was also positively associated with excess of FM. Thus, the greater stimulation of the environment was associated to an increase of 0.451 Kg in the body fat mass in the preschool phase. Highly stimulated environments provide more continuous interaction of environmental resources and human functioning at the genetic, neural and behavioral levels[41]. Although an environment of low stimulation is associated with malnutrition[29], we evidenced that an environment of high stimulation seems to be associated with excess of FM in preschoolers. This result differ with a longitudinal study carried out in Chile[30], that investigated the association of family environment and overweight in young Chileans using the same instrument to assess the home environment and found an inverse relationship. We elaborated the hypothesis that this factor is explained due to the controversies found in different countries about the relationship between financial conditions, maternal education, possession of household goods and excess child fat[3,33], since these factors are added to the environment of high stimulation[29]. A review study indicates that increased levels of obesity favor the improvement of the economy and wealth[51]. In this sense, the prevalence of childhood obesity in developing countries appears to be higher in people with higher socioeconomic status who reside in urban areas, shifting to lower socioeconomic status groups in rural areas[3,31,52].

With regard to screen time, the greater exposure time to screens is associated with excess of FM in preschoolers. Thus, the 1 minute / day increase in screen time was associated to an increase of 0.329 Kg in the FM in the preschool phase. Our findings are in accordance with the study by Gonçalves and colleagues [53]. In addition, Lee and colleagues[54] studying the role of parental and environmental characteristics in the screen time of young children, found that parents and their interactions with the home environment can play an important role in the screen time of children. Thus, the knowledge of these reciprocal relationships about the time of the home screen is important and shows how much the parents' habits (including screen habits) can influence the children's life habits. Although the screen time of the parents was not investigated in the present study, we believe that the environment of high stimulation was composed of parents with higher education who have access to multiple screens (cell phone, notebook, Ipeds, in addition to the TV). Therefore, this fact could be a catalyst for the high screen time found in the investigated group, given evidence of a positive correlation between maternal education and screen time[37].

Finally, the explanatory factors seem highly interconnected in the present study, since the paternal and maternal lifestyle habits such as hours of computer use, television, and parents' eating habits can affect children's weight through an effect on children's habits and lives[25, 51]. The degree of obesity between parents and children tends to be similar because parents and children share not only genes, but also the same family environment.

Considering that the preference of preschoolers for sedentary or active activities seems to be linked to the habits of parents[25], the family environment plays an important role in shaping the lifestyle of children, and can provide obesogenic environments [49]. Thus, guidelines for the control of childhood obesity must have family-centered approaches, including limiting screen time, especially in highly stimulating home environments[37].

This study has limitations and strengths. The study has a cross-sectional format, which does not allow inferring a cause and consequence relationship, requiring more longitudinal studies to examine. However, as far as we know, this is the first well-controlled study focusing in excess of FM exclusively with preschoolers. Moreover, we considered a range of possible independent factors including the quality of the home environment[41] and the school[42]. In addition, our study presents as strengths a restricted interval of collection of all data, maximum of 3 weeks between the collection stages, the use of measuring the amount of FM using the gold standard method for the measurement [1,55] and direct measurement of the PA level[15]. We also considered relevant factors for the theme such as the presence of obese parents[22], lifestyle habits such as screen time[37], socioeconomic level and maternal education[36].

Conclusion

Our results suggest that the presence of obesity in one parent, a home environment with high stimulation and permanence for a long period on screen are outcomes strongly associated with the presence of obesity in the preschool phase. These findings can assist in the development of public guidelines aimed at child health, in order to outline effective strategies that contribute to the quality of life and treatment of preschoolers with excess body fat mass.

List Of Abbreviations

WHO: World Health Organization; FM: Body fat mass; BMI: body mass index; PA: physical activity; ECERS: Early Childhood Environment Rating Scales; EC-HOME: Early Childhood Home Observation for Measurement of the Environment; DEXA: Dual Energy Radiological Absortometry; MVPA: Moderate to Vigorous; UFVJM: Universidade Federal dos Vales do Jequitinhonha e Mucuri.

Declarations

Acknowledgements: We thank the Universidade Federal dos Vales do Jequitinhonha e Mucuri for institutional support. The CNPq, FAPEMIG, and CAPES. The authors are grateful to municipal education secretary and directors of public schools of Diamantina (MG).

Funding: The FAPEMIG and CAPES- Finance Code 001 for financial support and scholarships

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate: All protocols was carried out in accordance with relevant guidelines and regulations. This study was approved by the Research Ethics Committee of the Universidade Federal dos Vales do Jequitinhonha e Mucuri (Protocol: 2.773.418), authorized by the Municipal Education Secretariat of Diamantina (MG), Brazil.

Consent to participate: We declare that all parents of the children or legal guardians signed the informed consent form in writing, authorizing participation in the study.

Consent for publication: Not applicable.

Competing interests: We declare no competing interests.

Authors' contributions: JNPN: Conceptualization , Formal analysis, Data Curation, Methodology; RLSM: Writing Review & Editing – Original Draft; MLRJ: Formal analysis, Review; : ACF: Conceptualization, Formal analysis, Data Curation; AAV: Methodology, Writing; PHSF: Review & Editing; HSC: Review & Editing; EAE: Review & Editing, FASJ: Review & Editing, ACRC: Review & Editing; VAM: Review & Editing; ACRL: Conceptualization, Data Curation, Writing, Review & Editing – Original Draft. All authors have read and approved the manuscript.

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