



Child growth: Analysis of schoolchildren regarding teaching methodology and pandemic contexto

Crescimento infantil: Análise de escolares quanto a metodologia de ensino e contexto pandêmico

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ABSTRACT

With the remission of the COVID-19 Pandemic, it is remarkable to observe the changes that the different socioeconomic, family and educational contexts have resulted in child growth in the post-pandemic scenario. In order to contribute to a better understanding of this context and to assist the management of education and health teams with children, the study contemplates a statistical analysis of the BMI of students aged two to ten years old regarding variables of teaching methodologies before and after the pandemic and their relationship with changes in growth. It was described that the type of public education correlates with a greater deviation of the participants from the adequate growth channel, analyzing the influence of the pandemic on the living conditions of the sample in question. In this way, professionals from the health and education teams can direct the necessary changes to promote improvements in the health and quality of life of the population.

Keywords: Growth and development, Child, Education, COVID-19, Pandemics.

1 INTRODUCTION

The full development and growth of children is the result of several aspects and can be influenced by several factors, being biological, social, environmental, psychological and spiritual. Therefore, it is of paramount importance to know and analyze all the factors that act as a risk or



protection to child health (1). It is important to emphasize that the growth of the infant begins to be influenced since its gestation since everything the fetus experiences in the intrauterine environment through maternal experiences will result in repercussions to its constitution throughout life (2).

For example, metabolic disorders present during the gestational period may imply the occurrence of metabolic changes in the conceptus and, consequently, in the child that will develop - children of diabetic mothers are more prone to diabetes and obesity, as well as children of malnourished mothers during pregnancy suffer hormonal and epigenetic changes that comprise a greater chance of overweight in the future. (3).

Thus, the family is the first and most powerful system of child socialization since the interactions established there reflect directly on the child's development. (4). In addition, environmental aspects are also very relevant in child development so that changes that induce a high degree of stress have the ability to interfere with the normal patterns of physiological and emotional responses of individuals, often being associated with various physical and mental disorders. (1).

Thus, it is important to emphasize that food is an essential and decisive factor for the correct growth and development of the child. Based on this assumption, an adequate supply of calories and nutrients becomes essential in childhood since it is a period of numerous changes, biological maturation, new learning and socio-psychomotor development. (5).

In this sense, education is also a factor of high impact with regard to child development, since stimuli are of paramount importance for the correct formation of psychomotor skills. Therefore, different teaching methods can be associated with different forms of child development, with contemporary traditional pedagogy aimed at promoting greater standardization and uniformity of customs and actions, in addition to simultaneous teaching. In parallel to this, active methodologies such as Montessori are based on offering learning that is guided by the freedom to choose their own activities, respect for individuality, thus enabling the student to be the protagonist and acquire greater autonomy. (6).

In the meantime, it is important to emphasize that the understanding of this child development encompasses many details such as the child's dispositional attributes (execution of activities, autonomy, self-esteem, socialization, preferences), family characteristics (responsibilities, affectivity and absence or presence of discord and neglect) and also knowledge about the sources of individual or institutional support available to this child. (1).



In addition to all these aspects mentioned above, in the current situation, the COVID-19 pandemic that began in March 2020 stands out as responsible for many changes in the daily lives of families. With this, it is noted that there have been significant changes in the lives of children such as the closure of daycare centers, schools, leisure and socialization environments, social distancing, increased stress, less access to the health system, reduced physical activities, changes in eating habits, increased unemployment, loss of close people, drastic socioeconomic changes, among other aspects.

Given this scenario, it is evident that there were changes of great potential in all aspects influencing the development and growth of the child already mentioned above. Thus, in order to correctly assess and understand the growth of a child, it is necessary to investigate and know all his previous history and the whole context in which he is inserted seeking to see it from a deep and holistic perspective.

In the complexity of the COVID-19 pandemic scenario, Richard Horton, editor-in-chief of the Lancet journal, considered this disease as a syndemic, not a pandemic and criticizes the narrow approach that is used in the management of COVID-19. The term syndemic implies the presence of a biosocial complex consisting of the understanding or sequence of health conditions associated with social and environmental factors that promote or increase the negative effects of interactions between these conditions. (7).

Accordingly, the discussion of the use of the term syndemic to designate this miscellany of changes that occurred during the coronavirus explosion seeks to encompass the interaction of such problems in different contexts experienced. In the meantime, social and economic disparities and the health problems previously faced associated with such modern changes trigger the need to look at society beyond the scientific character of viral propagation in order to understand and overcome such syndemic effects, especially in children (7).

In view of the above, we sought to analyze the correlation of socioeconomic, educational, family variables, to verify the influence of the COVID-19 Pandemic and to monitor the weights and heights of children during the year 2022 so that it was possible to evaluate the growth of children in order to direct interventions by the health and education teams responsible for promoting health and healthy growth.

2 METHODOLOGY

This is a comparative analytical study that longitudinally followed child growth with 48 children aged between 2 and 10 years as research subjects. Those whose age did not meet the



established range, those who did not attend the interview and/or did not provide reliable data according to the chosen variables were excluded from the study. These quantitative indices were collected at three quarterly intervals between May and December 2022.

Information on variables correlated to growth was also collected through an online form answered by guardians: age, gender, teaching methodology, school cycle, parents' incentive to study during pandemic, weight and height before pandemic, eating habits and sports/leisure practice during pandemic, family composition, level of education and parental workload, parents' marital status, presence of caregiver(s), death of close relative due to COVID-19, loss of source of income due to pandemic, number of family members infected by coronavirus, health condition and degree of medical assistance needed.

The weight and height values were used in the form of the Body Mass Index (BMI), which consists of the formula = $\text{weight}/(\text{height in meters})^2$, applied to the weight-stature curve in Z-score of the World Health Organization (WHO) according to sex and age (9). Then, children up to 5 years of age in the sample were classified into obesity, overweight, risk of overweight, eutrophy, thinness and marked thinness, while those over 5 years of age were divided into severe obesity, obesity, overweight, eutrophy, thinness and marked thinness (16).

To this end, a digital interview form was developed in which the added data were automatically computed in an *Excel* spreadsheet for statistical analysis. After collection, the information was computed under a qualitative analysis based on two analyses.

The first analysis consisted of comparing BMIs in relation to the teaching method, comparing those within the healthy growth channel with those who deviated from the healthy growth channel. Fisher's exact test was used to ascertain the statistical relevance of this data, in order to make comparative-qualitative analyses of two groups in a non-parametric way. If the p-value returned in the test is less than 0.05, it means that the result was statistically significant.

The second analysis was based on the frequencies with which BMIs, according to the classification described, appeared in each measurement, comparing the percentage values of the first collection (considered BMI0, calculated from the weight and height data of children reported before the pandemic, according to the formula already described) with, respectively, the values of the second collection (considered BMI1, calculated from the children's weight and height data in the first post-pandemic collection) and the values of the third collection (considered BMI2) calculated from the children's weight and height data in the last post-pandemic collection.

This analysis was made descriptively from the cumulative percentage data, comparing those who were eutrophic in relation to those who were outside the healthy growth channel at the

mentioned times, seeking to understand how much the pandemic and the post-pandemic context influenced the change in the school BMI profile in a first period and months after the first collection.

A literature review was carried out in the Scielo and Pubmed databases for the bibliographic survey of articles on child growth in order to support the discussion later presented in this study. The authorizations of the participants and their guardians were collected through the Free and Informed Consent Form as well as the approval of the research project by the Ethics Committee.

3 RESULTS

The first anthropometric measurement was carried out with a total number of 54 participants, of which only 48 answered all the criteria required for the calculation of BMI, 23 female and 25 male children. The following general results were obtained:

Table 1 - Distribution of anthropometric data at first measurement.

	n	Frequency relative
Thinness	2	6,66%
Eutrophy	30	62,5%
Risk of overweight	2	6,66%
Overweight	9	30%
Obesity	4	13,3%
Severe obesity	1	3,33%

Of this sample, 35 belonged to private education with Montessori methodology and 13 to the public education network, distributed as follows:

Table 3 - Private (n=35)

	N	Frequency Relative
Thinness	1	2,85%
Eutrophy	25	71,42%
Risk of overweight	1	2,85%
Overweight	5	14,28%
Obesity	3	8,57%
Severe obesity	0	0%

Table 2 - Public (n=13)

	n	Frequency relative
Thinness	1	7,69%
Eutrophy	5	38,46%
Risk of overweight	1	7,69%
Overweight	4	30,76%
Obesity	1	7,69%
Severe obesity	1	7,69%

When analyzing the values grouped according to the type of education in relation to permanence in the healthy growth channel and deviation from the healthy growth channel, it

appears that participants from private education had a greater permanence in adequate growth than those referring to public school.

Table 4 - Results against the growth channel

	Private	Public
Staying in the healthy growth channel	71,42%	38,46%
Deviation from the healthy growth channel	28,58%	61,54%

When analyzing such data statistically with Fisher's Exact test for unpaired samples, a p value of less than 0.05 is obtained, which represents a statistically significant differential value. Thus, there was a significant difference between maintenance of healthy growth channel permanence and consequently its deviation in relation to public and private education.

Table 5 - Results of Fisher's Exact Test

Tabelas de Contingência

Tipo de ensino	Situação no canal de crescimento		Total
	Dentro	Desvio	
Particular	25	10	35
Público	5	8	13
Total	30	18	48

Testes χ^2

	Valor	p
Teste Exato de Fisher		0.049
N	48	

Regarding the analysis of the data answered in the form, of 20 participants only 15 answered satisfactorily to all questions, this group being composed of 5 children from public schools and 10 from private schools.

In a descriptive analysis of the data, 60% of the children were eutrophic in the pre-pandemic period, while 40% had a BMI pattern above the limits established by the World Health Organization (WHO) (9). Comparatively, in the first BMI measurement carried out two years after the beginning of the pandemic, the children had a similar BMI pattern, with 60% of the values being eutrophic and 40% above the WHO limits.

When looking at individual data from the pre-pandemic period (BMI0) relative to the baseline measurement (BMI1), a heterogeneous pattern of growth was observed according to the table:

Table 6 - Comparison BMI0 with BMI1

Pre-pandemic (BMI0)	Post-pandemic (BMI1)	Frequency of occurrence
Eutrophy	Eutrophy	53,3%
Eutrophy	Overweight	6,66%
Overweight	Overweight	6,66%
Overweight	Obesity	6,66%
Obesity	Overweight	20%
Obesity	Eutrophy	6,66%

These data show that 60% of the individuals remained within the same BMI pattern, 13.3% went up a pattern from eutrophy or overweight, and 26.66% showed a decrease in BMI from obesity to values more within the appropriate according to WHO. Therefore, the data, descriptively, are insufficient to establish a causal parameter between the pandemic and changes in BMI pattern in the observed sample.

When comparing the data for the pre-pandemic period with the data collected about 3 years after the beginning of the pandemic in the last assessment carried out (BMI2) we have the following growth pattern:

Table 7 - Comparison BMI0 with BMI2

Pre-pandemic (BMI0)	Post-pandemic (BMI2)	Frequency of occurrence
Eutrophy	Eutrophy	53,3%
Eutrophy	Overweight	6,66%
Overweight	Overweight	6,66%
Overweight	Eutrophy	6,66%
Obesity	Overweight	6,66%
Obesity	Eutrophy	20%

These data show that 60% of the individuals remained within the same BMI standard, 6.66% rose from a standard of eutrophy to a standard above the eutrophy limit defined by WHO, and 33% showed a decrease in BMI from overweight or obesity to values more within the appropriate range.

At the end of the analysis, it was observed that in BMI0 there were 60% of individuals in eutrophy as well as in BMI1, while in BMI2 80% were in eutrophy. Therefore, it is assumed that during the transition period to a post-pandemic context, the conditions that influence the child growth pattern, such as diet, physical activity, screen time and psychosocial factors, improved in order to reflect data more in line with the standard established by WHO.



Moreover, the other parameters analyzed in the form were insufficient and did not present statistical significance so that some causal relationship can be established. Moreover, it is worth remembering that this analysis occurs under a general aspect in order to establish correlations about a population and that the individual assessment of growth is necessary to understand factors inherent to each child.

4 DISCUSSION

As observed in a survey conducted in Florianópolis with children from public and private schools, there was a greater control by the parents of participants from private schools over the consumption of sweets, in addition to a higher frequency of ingestion of these in public school students, which interferes in the decision-making of children and in the formation of a healthy eating behavior, resulting in poor child nutrition and consequently in deviations from the eutrophic growth pattern as observed in the data exposed. (8).

This raises the discussion about the role of parents in the habits acquired by their children, as well as their interference in the growth process of these children and its possible consequences. (9) (3). In this sense, a systematic review carried out on the influence of parents on physical activity and screen time of children (10) suggests that encouraging exercise and reducing exposure to devices by parents results in improving such aspects in the lives of children, habits that also affect energy balance and growth, discouraging an obesogenic environment. Therefore, the importance of addressing the behavior of caregivers in the search for the adequacy of children's lifestyle aiming at health and quality of life is reinforced, as recommended by the Brazilian Society of Pediatrics. (11).

In the meantime, it is seen that the nutritional support offered to parents in the private school with Montessori methodology through a nutritionist who prepares a weekly menu and the restriction of the entry of processed foods in snacks during the school period is in favor of healthy growth and balanced nutrition to these. On the other hand, there is the National School Feeding Program (PNAE) (12) present in all stages of public education in Brazil, which aims to guarantee the right to food for schoolchildren and food education with nutrition professionals responsible for preparing balanced meals and guidelines that transcend the school environment.

Therefore, it is suggested that public policies need to be improved with greater investment, better approach and actions aimed at putting their precepts into practice in order to expand beyond the limits of the school, helping parents to acquire the necessary knowledge to offer adequate nutrition to their children at home, following up on food care. This reinforces the importance of



parental responsibility in maintaining the incentive for healthy practices that are sometimes offered in schools, but discontinued in homes.

In this context, there is also the finding that the proportion of children in eutrophy was higher in the period farthest from the coronavirus pandemic, which corroborates studies in the literature (13) (14) which deal with the negative influence of pandemic factors such as anxiety, sedentary lifestyle and consumption of caloric foods of faster preparation, thus being modifiers of eating behavior and responsible for higher rates of overweight and obesity.

Thus, it can be affirmed that the increase in the proportion of children who approached the adequacy of growth and the reduction in the contingent of participants who raised their standard in the last evaluation is in line with the improvement in life habits and return to normality in the post-pandemic period, moving away from the obesogenic context. Therefore, it is inferred that the measures adopted during the pandemic were insufficient to guarantee healthy habits in the midst of the isolation scenario, requiring actions aimed at recovering the pandemic effect on child health. (15).

In contrast, similar work (16) which comparatively evaluated children from public and private schools found higher BMI among children from private schools, assuming that greater access to food would be related to the accumulation of fatty tissue. Thus, two possible scenarios are proposed:

One in which children in public education have lower purchasing power and have a more restricted diet, therefore less growth compared to those in private education who have access to balanced meals. Another in which children in private education, because they have better monetary conditions, enjoy more caloric foods and in greater quantity, causing higher body mass indexes. Thus, it is seen that both situations are possible and that it is necessary to analyze more variables related to the populations studied to obtain more detailed conclusions.

In this sense, according to a literature review (17) it is worth mentioning that the use of BMI in weight assessment is questioned since it does not differentiate muscle, bone and fat mass, being, however, of great value for obesity diagnosis and epidemiological analyzes, associated with growth curves, in order to contribute to the correct assessment of children according to age group. In addition, as the curves are based on data from several countries, the idea arises that it would be necessary to construct a curve with the national growth pattern adapted to the reality of the local population for better analysis of child growth data.



Thus, systematized data collection and rigorous analysis can contribute emphatically to the understanding of biosocial factors, which is the understanding or sequence of health conditions associated with social and environmental factors that influence the health and integrity of children.

5 CONCLUSION

It can be concluded that it is of paramount importance to know all the aspects that can interfere in the development of a child, since the infant is the result of everything he has experienced from the intrauterine period to the present moment. In addition, it was remarkable the differences that an environment, families and different context directly influence the infant.

It is inferred that the fact that the children of the public network evaluated in the sample present a higher percentage of deviations from the growth pattern, this being the predominant condition in the group is due to the socioeconomic conditions having the family, also fundamental role for the maintenance of adequate weight-stature gain. Therefore, aspects such as control of caloric food intake, physical activity, exposure to screens, psychological aspects and family income are listed as possible influencers of inadequate growth.

It is concluded that it is necessary to move integrated efforts between the areas of health and education to promote a balanced diet and healthy lifestyle habits in order to combat overweight and obesity and ensure adequate growth. Finally, the complexity of child growth and the multiple factors that interfere with it is noted, resuming the narrative that a global assessment in childhood is necessary in order to promote integrality in child health care.

In this context, it is clear that from now on, associated with an understanding of the factors already known in the literature that influence the growth and development of children, it is essential to investigate all the syndemic influences that the COVID-19 pandemic may have left on patients, even if indirectly.

However, it is directed on what actions the health and education teams need to take to change the panorama of possible deficits in the scenario of their performance in the post-pandemic context and improve the quality of life of these infants. Thus, an integrated approach is needed encompassing the scenarios of education, employment, housing, food and environment.



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