

**GROWTH AND DEVELOPMENT OF CHILDREN BORN DURING COVID PANDEMIC:
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ABSTRACT

Background: Covid pandemic had distorted routines of human life in all dimensions. Many children are born at home with no professional health services available to them for days together. Parents could not take the newborn out of the house. Untoward life events in terms of loss of either or both the parents jeopardized initial basic care to the newborns. This paper studies the impact of COVID pandemic on growth and developmental at 2 years of age.

Objectives: a) To assess growth and development of 2 years old children born during COVID pandemic. b) To estimate deviation from normal growth and development of 2 years old children born during COVID pandemic.

Study Design: a cross sectional study, **Population:** Children of 2 years age born during the COVID pandemic in containment zones, **Sample Size:** 256, **Study Setting:** Home setting of the children, **Material:** Investigator developed Developmental Milestones inventory ($r=0.78$). **Results:** The mean height of 2 years old boys was 82.41 ± 3.03 cm, and the mean weight was 10.54 ± 1.99 kg. The mean height for girls was 78.33 ± 2.11 and mean weight was 8.79 ± 1.85 which is less than normal as per country standard. Developmental scores in social emotional domain was 44%, Language and communication was 37.62%, Cognitive was 37.64% and Motor/Physical development was 36.03%. **Conclusion:** Growth parameters and development scores of 2 years children born during the COVID pandemic fall short of required standards. Special attention is required for enhancing growth and development of these children to have a healthy nation in future. (249 words)

KEYWORDS: Growth, development, 2 years old children, COVID pandemic.

INTRODUCTION

The first few years of a child's life are a critical period for development. During this time, children undergo rapid growth and development in various domains, including physical, cognitive, social, and emotional. The age of 2 years is a particularly significant milestone in a child's life, as it marks the transition from infancy to early childhood.

At the age of 2, children exhibit considerable growth in terms of height and weight. According to the World Health Organization (WHO), the average height for a 2-year-old boy falls around 32.5 inches (82.7 cm), and for a girl, it's about 31.8 inches (80.8 cm). The average weight for a 2-year-old boy is approximately 28.4 pounds (12.9 kg), and for a girl, it's around 27.6 pounds (12.5 kg) (WHO, 2007).^[1] The Ministry of Health and Family Welfare, India states height of 90.6 cms and weight 12.7 kgs for boys and height of 86 cms and weight of 12.1 kgs as standard for the children of 2

years.^[2]

Brain development is a critical aspect of physical growth during this period. The brain of a 2-year-old is about 80% the size of an adult brain and is highly plastic, allowing for rapid cognitive development (Giedd, 2004). This period is marked by increased myelination and synapse formation, which enhances cognitive abilities.^[3]

Language development is a prominent cognitive milestone at age 2. By this age, most children can use simple sentences and understand a wide range of words. They engage in conversations, express their needs, and begin to grasp grammatical rules. Their vocabulary typically ranges from 200 to 1,000 words (Fenson et al., 1994).^[4]

The 2-year-olds exhibit problem-solving skills, albeit at a basic level. They can solve simple puzzles, find objects that are hidden from view, and engage in pretend play,

which demonstrates their cognitive growth (Piaget, 1963).^[5]

At the age of 2, children start to develop social skills. They become more aware of others and begin to engage in parallel play, where they play alongside their peers without direct interaction. They also display preferences for certain playmates and may exhibit early signs of empathy (Howes, 1988).^[6]

Emotional regulation is a significant aspect of development. Two-year-olds are known for their emotional outbursts, but they also start to show some ability to regulate their emotions. They may use language to express feelings, and they seek comfort and security from their caregivers (Kopp, 1989).^[7]

Proper nutrition plays a pivotal role in the growth and development of 2-year-old children. It is essential to provide a balanced diet that includes adequate nutrients like protein, carbohydrates, healthy fats, vitamins, and minerals. Meeting nutritional needs is crucial for healthy growth and brain development (Hesketh et al., 2017).^[7] Regular health check-ups and vaccinations are also essential to ensure that the child is developing according to standard parameters and is protected against common childhood illnesses.

The children who were born during COVID pandemic did not get adequate health care services as most of the health care services including maternal and newborn care health services were focusing on treating people with infection. Further, the newborn also faced loss of a parent or very near primary caretaker immediately after birth resulting into basic care being at stake as the substituted care takers were mourning the sad demise of primary caretaker.

Objectives of the Study

1. To assess the growth and development of 2 years old children born during COVID pandemic.
2. To estimate the deviation from normal growth and development of 2 years old children born during COVID pandemic.
3. To find out the association of demographic characteristics with the growth parameters and development scores of 2 years old children born during COVID pandemic.

MATERIALS AND METHODS

Study Design: a cross sectional study,

Population: Children of 2 years age born during the COVID pandemic in containment zones,

Sample Size: 256, Study

Setting: Home setting of the children who resided in the containment zones at the time of their birth. Fourteen areas of Nagpur city which were declared containment zones during the CORONA pandemic were selected purposively. The children who were born during COVID pandemic from these areas were included in the study.

The initial information of the birth was taken from local hospitals' birth register. The period of birth was May 2019 to August 2020. The period of data collection was June 2021 to September 2022.

Sampling Technique: Purposive sampling.

Material: Investigator developed Developmental Milestones inventory ($r=0.78$). The data collection tool consists of three parts. Part-I has items collecting information regarding demographic information of the study participants and the Part – II consists of Chart of growth parameters such as height and weight of the children aged 2 years born during COVID pandemic. Part – III consists of items on a rating scale with subscales of Cognitive domain, language and communication domain, physical motor development and social emotional development domain of the 2 years old children. The rating is based on performance of the child in front of the investigator. If the child did not perform the skill, then '0' marks, performs the skill '1' mark, Performs the skill and parents are aware of it then the child gets '2' marks and if the child performs the skill for the first time in front of the investigator then the child gets '1' mark. There are five items in the social emotional domain, 7 items in the language and communications skills domain, 8 items in cognitive domain and 7 items in the Motor skill development domain. The maximum score for social emotional domain is 10 and minimum score is 0. For Cognitive domain the maximum score is 18 and the minimum score is 0. For the Language and communication domain as well as the motor physical development domain the maximum score was 14 and the minimum score is 0. For over all development the maximum score was 54 and the minimum score was 0. The interrater reliability was established for the tool. It was found $r=0.78$. The national standards for growth parameters of height and weight of 2 year old children of Bharat were taken as normal.

Method of Data Collection

The parents of the children were explained about the study and their doubts were cleared during the first interaction. Permission from the local administrative authorities to visit the families in their locality was taken orally.

The children were visited home to home. Written informed consent was taken from their parents. The children who were non-cooperative during data collection were excluded from the study. The children were asked to perform the tasks as per the developmental milestone inventory.

Height and weight were recorded for each child with regular inch tape and the digital weighing scale. It took on an average 30 minutes for each child to complete the tasks.

Plan for data Analysis

The data collected was processed and analyzed with descriptive statistics and inferential statistics. The study participants were described with frequency and its percent. Inferential statistics of Pearson's correlation coefficient was used to find out relationship between growth and development parameters. One way ANOVA is used to establish the association between demographic characteristics and growth and development scores of children aged 2 years born during COVID pandemic.

RESULTS

The demographic distributions of study participants showed that 48% were males and females were 52%. Around 54% (138) percent of the children in the study were born in maternity hospitals and 40%(102) were born in the Primary Health Centres and 6%(16) were born at home. Majority (49.67%) of the parents of the participants were educated up to secondary school level and 29.67% were graduates. The main occupation of the study participants' parents was private job (31%), labourer (22%), followed by (20.67%) businessmen, 8.67% having professional practice and 17.33% having government job. Only one parent was jobless. Most of the families had (55.67%) 2 children and 40.33% had one child. Maximum number of families (78.33%) had 3-5 family members. Majority of the participants (37%) belonged to Hindu religion. Majority (54.33%) lived in urban area and 45.67% lived in urban slums. 66% of the children in the study were enrolled in balwadi/play group at the time of data collection. There was family history of COVID infection among 62.67% study participants. 8.59% had lost their one parent and 3.9% had lost their both parents in pandemic. Mother of the child was primary care take for 91% (233) participants, father for 2.34% (6) participants and for 6.6% (17) the primary caretaker was grandmother.

The mean height of 2 years old boys was 82.41 ± 3.03 cm, and the mean weight was 10.54 ± 1.99 kg. The mean height for girls was 78.33 ± 2.11 and mean weight was 8.79 ± 1.85 . [Table 1] The pandemic seems to influence maximum on the first two years of life. This is more serious as these are the crucial years of brain and other body.

The score on developmental parameters reveals that at the age of 2 years the social and emotional development was 43.98%, the language and communication skills development was 37.61%, the Cognitive developments was 37.62% and the physical development was 36.64%. The children are falling short with inability to achieve even the 50% of the development in most of the domains of development. The pandemic seems to influence the most on cognitive development domain. The height weight differences are re-stated by impact on the movements and physical development of 2-year-old children. [Table 2]

At the age of 2 years, the relationship between height and development has non-significant and strong positive relationship with development ($r=0.339$; $p>0.05$). The relationship between development and height is weak positive and non-significant because the height and development are both influenced by the pandemic. The average height for all children at 2 yrs is less than their standard criteria height. Similarly, the development for 2 years old children in four domains is less than 50%.

At the age of 2 years, weight and development has non-significant and weak positive relationship with development ($r=0.105$; $p>0.05$). The average weight for all children at 2 years is less than their standard criteria weight. Similarly, the development for 2 years old children in four domains is less than 50%.

Pearson's correlation coefficient estimated for 2 years old children's height and weight is 0.420 which shows moderate statistically significant positive relationship at 5% level of significance. The relationship between height and weight is strong positive and significant because the weight and height are both influenced by the pandemic. The children of age 2 years fall short of their weight and height standards for the country. The more the difference between the height of the preschool children and its standard height, the more is the difference between the weight of the child and its standard weight.

The height of 2 years old children was found to be statistically significantly negatively associated with gender 'F' = -0.303 and 'p' = 0.022. A statistically positive association was found between number of children in the family and family history of Covid with 'p' = 0.014 and 0.003 respectively. Continuous attentions of at home and having a sibling facilitated the growth (height) of 2 years old preschool children.

The gender and lockdown related no schooling either in the form of balwadi, play group, etc. are influenced by covid pandemic. The children could not attain their normal weight. However, having a sibling facilitated the growth and development of 2 years old preschool children.

The development of 2 years old preschool children is influenced negatively by education and occupation of the parent, religion, residence and history of covid in the family. It is positively influenced by gender, number of children in the family and number of family members.

This indicates that the even if there is no statistically significant association with any of the demographic characteristics the growth and development of the 2 years old is influenced negatively by the Covid pandemic. The children could not attain their normal development.

Table 1: Growth parameters of 2 years old children born during COVID pandemic.

| Gender | Std. Ht. in cms for Indian Population | Height Mean | Height SD | Std. Wt. in kgs. for Indian Population | Weight Mean | Weight SD |
|---------|---------------------------------------|-------------|-----------|--|-------------|-----------|
| Males | 90.6 | 82.41 | 3.03 | 12.7 | 10.54 | 1.99 |
| Females | 86 | 78.33 | 2.11 | 12.1 | 8.79 | 1.85 |

Table 2: Developmental Milestones of the study population.

| Sr. No. | Domain of Development | Freq. | Max. Total Score | Total Score Obtd. | % of Score |
|---------|---|-------|------------------|-------------------|------------|
| 1 | Social And Emotional | 256 | 2560 | 1126 | 43.98 |
| 2 | Language/Communication | | 3584 | 1348 | 37.61 |
| 3 | Cognitive (Learning, Thinking, Problem-Solving) | | 4096 | 1541 | 37.62 |
| 4 | Movement/Physical Development | | 3584 | 1313 | 36.64 |

DISCUSSION

The present study aimed at estimating the deviation in the growth and development parameters of children born during COVID pandemic. The investigator could not retrieve any article that had studies this aspect. However, following studies prompted the similar findings.

A rapid survey conducted by UNICEF and the World Health Organization (WHO) in collaboration with other organizations examined the impact of the COVID-19 pandemic on households, including children's nutrition and growth. The study, conducted in multiple countries, found disruptions in nutrition services, increased food insecurity, and decreased access to healthcare services, which could potentially contribute to stunting and malnutrition among young children (UNICEF and WHO, 2020).^[8]

A study published in the Indian Journal of Pediatrics in 2020 highlighted the potential impact of the COVID-19 pandemic on child nutrition and growth in India. The study suggested that disruptions in food supply chains and access to healthcare services might lead to adverse nutritional outcomes among children, including stunting (Sinha et al., 2020).^[9]

A study published in The Lancet in 2020 discussed the potential global impact of the COVID-19 pandemic on child nutrition and stunting. The study emphasized that disruptions in food systems, loss of livelihoods, and reduced access to healthcare could have severe consequences on child nutrition and growth, particularly in low- and middle-income countries (Headey et al., 2020).^[10]

The psychosocial impact of the pandemic on parents and caregivers can indirectly affect child growth. Stress and mental health issues in parents can impact caregiving practices, nutrition, and overall child well-being. These factors were explored in various studies during the pandemic (Prime et al., 2020; Spinelli et al., 2021).^[11,12]

A study by Gerald F Giesbrecht, Catherine Lebel, Cindy-Lee Dennis, et. al. conducted a study to estimate the risk for developmental delay among the children born during COVID pandemic. The authors

reported that in covariate-adjusted analyses, pandemic-born infants had lower mean scores and higher odds of screening positive for delay on the Communication, Gross Motor, and Personal-Social domains of the ASQ-3 compared with prepandemic infants.

A study was conducted in China to investigate the association between the experience of the coronavirus disease 2019 (COVID-19) pandemic and neurodevelopment of 6-month-old and 1-year-old children and explore the differences in the association by birth order. The findings showed that the experience of the pandemic in 2020 was associated with a higher risk of delay in the fine motor (adjusted OR: 2.50, 95% CI: 1.25, 4.99; estimated by logistic regression) and communication (adjusted RR [aRR]: 1.13, 95% CI: 1.02, 1.25; estimated by log-binomial regression) domains at age 1 year. The association between the experience of the pandemic and communication delay at age 1 year only existed in first-born children (aRR: 1.15, 95% CI: 1.03, 1.30) but not in later-born children (aRR: 1.02, 95% CI: 0.84, 1.25). No associations were observed in any domain among 6-month-olds.

CONCLUSION

The growth and development parameters of 2-year-old children are characterized by significant changes in height, weight, brain development, language skills, and social interactions. The growth and development of children born during COVID pandemic is jeopardized for variety of reasons. The growth parameters and development of children 2 years old born during COVID pandemic show remarkable decline from their normal standards for the age. Long-term follow-up studies are necessary to understand the lasting impact on children born during this period. Such studies are ongoing and may provide more comprehensive insights into growth parameters and other developmental outcomes.

CONTRIBUTIONS

Dr. Vaishali Tendolkar conceived the study and developed tools for data collection. Contributions by Mr. Nandkishor Bankar are as validator of data collection tool and his valuable inputs as data processor. The contribution of Dr. Ujwala Gawande is acknowledged for interpretation of the findings and manuscript writing.

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Data Availability Statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author/s.

Ethics Statement

The studies involving human participants were reviewed and approved by The Institutional Ethics Committee of APN Institutional Ethics Committee, Nagpur, Maharashtra, India. Written informed consent to participate in this study was provided by the participants i.e. parents/guardians of the children.

Author Contributions

VT conceptualized and designed the study, supervised its implementation, and reviewed and revised the manuscript. NB and UG carried out data analysis, drafted the initial manuscript, and reviewed and revised the manuscript. VT was involved in data collection, tool development, data collection and management. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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