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Correlation Between Prenatal and Postnatal Care of Mothers and Their Child`s Academic Performance

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Abstract

This study examines the relationship between prenatal and postnatal care, maternal socio-demographic factors, and the academic performance of children. The findings suggest that maternal health practices before, during, and after pregnancy significantly influence the cognitive and academic outcomes of their children. Key factors such as the age of conception, maternal educational background, and the intake of essential nutrients like iodine were found to have a significant impact on children's academic performance. Iodine, in particular, was identified as a crucial nutrient for brain development, with a strong correlation to improved academic outcomes. The study highlights the importance of early prenatal care, adequate nutrition, and maternal education in promoting the academic success of children. Recommendations include early consultations for women planning pregnancy and adequate iodine intake during pregnancy to enhance children's cognitive development and school performance.

Keywords: Prenatal and Postnatal Care, Academic Performance, Conception, Iodine, GWA, Supplementary Nutrients

1. Introduction

Mothers' health practices before, during, and after pregnancy significantly influence the future well-being of their children. These practices, driven by the mother's innate desire to ensure the welfare of her child, encompass prenatal and postnatal care, both of which are critical for the health of both mother and child. Prenatal care includes medical check-ups, lifestyle recommendations, and the provision of essential health information, while postnatal care focuses on key interventions such as breastfeeding, immunization, and other health services that enhance the child's health condition. These forms of care contribute to the child's cognitive development, physical growth, and social skills, which, in the later years, can impact academic performance and educational achievement

Academic performance is a common measure of students' success across various subjects. It is influenced by factors such as intellectual ability, personality, behavior, motivation, skills, and interests, which shape the expectations of teachers regarding a child's performance. In this context, prenatal and postnatal care plays a pivotal role in influencing a child's academic outcomesReferences should be cited at the appropriate point in the text using the author's last name and year of publication in parentheses.

Research indicates that the most crucial period for brain and behavioral development occurs in the first 1,000 days of life—the period beginning at conception and ending at the start of the third postnatal year (Beluska-Turkan et al., 2019; Moore et al., 2016). During pregnancy, the concentration of essential nutrients and multivitamins increases to meet the needs of both the fetus and the mother. These nutrients include iodine, docosahexaenoic acid (DHA), selenium, iron, vitamin D, choline, and ferrous sulfate. A deficiency in these nutrients can lead to maternal and neonatal complications. Therefore, the developmental foundation for a child should begin from conception, as proper prenatal and postnatal care—including adequate nutrition, multivitamins, doctor visits, and health-related services—has profound effects on a child's cognitive abilities, academic performance, and socio-economic well-being (Tomalski & Johnson, 2010).

While many studies on prenatal and postnatal care have been conducted in foreign countries, their findings may not fully apply to developing countries like the Philippines. Torche (2018) reported that prenatal exposure to acute environmental stressors does not affect cognitive abilities among children from advantaged families, but it does have a negative impact on children from disadvantaged families. Poor families often have limited access to proper nutrition and prenatal and postnatal care, which exacerbates the challenges faced by expectant mothers, particularly those exposed to environmental and emotional stressors. The timing, dose, and duration of nutrient intake during pregnancy are critical (Cheatham, 2019). Deficiencies in essential nutrients during pregnancy can have irreversible consequences for the child, including weakened

immune responses, reduced antioxidant defenses, and compromised neurodevelopment, particularly in cases of iodine and iron deficiencies (Godswill et al., 2020).

Given these concerns, it is imperative to conduct research examining the impact of prenatal and postnatal care on children's academic performance, particularly in the context of a developing country like the Philippines. This study aims to explore the relationship between the prenatal and postnatal care received by mothers and their children's academic outcomes. Specifically, it seeks to determine whether children whose mothers have received complete prenatal and postnatal care perform differently in academic settings compared to those whose mothers have not received such care.

1.1 The Glimpse of Trimesters of Pregnancy

Pregnancy is divided into three trimesters, each characterized by distinct fetal development stages. According to the University of California, San Francisco (2019), a full-term pregnancy lasts 40 weeks, with babies born before week 37 considered preterm. Premature infants are at a higher risk of growth and developmental challenges, including issues with breathing and digestion. A study by Beatrice et al. (2018) highlighted the alarming lack of knowledge among young pregnant women regarding danger signs during pregnancy, which can jeopardize their pregnancy. In a sample of 384 women, 67 experienced danger signs such as vaginal bleeding, swelling of the fingers, face, and legs, and severe headaches. Among those who recognized these signs, 91% sought medical intervention. This underscores the importance of timely intervention to prevent adverse outcomes.

The first trimester (0-12 weeks) is critical for fetal development, particularly the formation of organs and bodily systems. This stage is highly sensitive to substances like alcohol, drugs, and certain illnesses (Johns Hopkins Medicine, 2019). Pregnant women often experience nausea, vomiting, cravings, and heightened sensory sensitivity (Nguyen et al., 2018). During this time, the fetus is most susceptible to birth abnormalities and miscarriages. Proper nutrition before conception is also crucial; essential nutrients like choline and iodine, found in foods such as eggs, seafood, and leafy greens, play a significant role in brain development and should be consumed starting 28 days before conception (Stanbury, 1994).
The second trimester (13-27 weeks) typically brings relief from the symptoms of the first trimester, and the pregnancy becomes more visibly noticeable. During this period, the fetus continues to grow in size, and vital organs and systems develop. The umbilical cord thickens, providing nourishment to the fetus. Essential nutrients, including iron, protein, calcium, folate, vitamin D, omega-3 fatty acids, and fluids, are crucial during this stage (Schuetze et al., 2018). Avoiding harmful substances like tobacco and alcohol is important for fetal health.

The third trimester (28-40 weeks) is the final stage of pregnancy, during which the fetus's major organs are fully formed. Adequate intake of calcium, vitamin D, and iron is essential to ensure optimal growth and development until birth.

1.2 Importance of Prenatal and Postnatal Care

Prenatal care is defined by the Department of Health and Human Services (DHHS) as the medical treatment that women should receive upon confirming pregnancy. It includes medical check-ups, lifestyle recommendations, and vital health information, such as guidance on nutrition and vitamins, to prevent complications and support the health of both mother and child. Postnatal care, provided after childbirth, focuses on the mother's and newborn's well-being during the first six weeks of life (Wudineh et al., 2018). The World Health Organization (WHO) recommends at least eight prenatal visits, rather than the standard four, to reduce perinatal loss by up to eight per 1,000 births.

Postnatal care is essential during the early hours and days following birth, as these are the most critical for both mother and child. Interventions such as breastfeeding, immunization, and nutrition play a key role in reducing risks and ensuring the infant's survival and development. According to the Healthy Newborn Network, these services can significantly lower the risk of neonatal mortality and morbidity.

Faradita et al. (2022) found that mothers who received prenatal and postnatal care more than eight times during delivery were 3.52 times more likely to ensure that their children received essential vaccinations. Additionally, breastfeeding has been shown to improve maternal sensitivity, foster cognitive performance in children, and promote neurological development (De Weerth et al., 2023; Tumwine et al., 2018). The California Department of Education (2021) emphasizes that the first three years of life are crucial for a child's cognitive development, a sentiment echoed by Cheatham (2019)

1.3 Supplementary Nutrients and their Impact on Brain Development

1.3.1 Iodine

Iodine is vital for fetal growth and development, particularly during pregnancy. Deficiency can lead to developmental delays and conditions such as cretinism (Zhou et al., 2019). Iodine deficiency is also associated with cognitive disorders, including autism and Attention Deficit Hyperactivity Disorder (ADHD) (Tam et al., 2020) Adequate iodine intake is crucial for the continuous development of the brain during infancy, particularly in the thyroid hormones essential for neurogenesis (Hynes et al., 2017)

1.3.2 Selenium

Selenium plays a crucial role during pregnancy, with deficiency linked to complications such as pre-eclampsia, glucose intolerance, and psychomotor delays (Jiang et al., 2019). Selenium-rich foods, like seafood and eggs, help mitigate oxidative stress and promote healthy thyroid function, which is vital for fetal brain development (Ventura et al., 2017)

1.3.3 Iron

Iron is essential for neuronal development, particularly in synaptogenesis and neurotransmitter synthesis (Zhukovskaya et al., 2019). Deficiency during pregnancy can lead to delayed speech, behavioral disorders, and reduced cognitive performance. Iron is also critical for the development of the hippocampus, an area of the brain responsible for memory storage (Georgieff, 2020).

1.3.4 Vitamin D

Vitamin D deficiency during pregnancy has been linked to an increased risk of schizophrenia in offspring. Adequate levels of vitamin D are necessary for fetal brain development, influencing brain size, growth, and cell proliferation (Cheatham, 2019).

1.3.5 Docosahexaenoic Acid (DHA)

DHA is integral for fetal brain development, particularly in the third trimester. Studies suggest that maternal DHA supplementation may have positive effects on infant cognition, although results on overall cognitive function are mixed (Cheatham, 2019). DHA is important for the development of executive functions, such as memory and inhibitory control.

1.3.6 Choline

Choline is crucial for brain development and placental function. Maternal choline intake influences gene expression in the placenta and may mitigate the risk of preeclampsia (Jiang et al., 2019). Choline also supports the development of neurotransmitters essential for cognitive function (Sweiry et al., 1986).

1.4 Importance of Breastfeeding and Immunization

1.4.1 Breastfeeding

Breastfeeding is essential for infant development, providing nutrients that support neurological growth, including vitamin A, B, iodine, selenium, and fatty acids (Innis, 2014). Breast milk contains higher iodine levels postpartum, which are crucial for brain development (Georgieff, 2020). While some studies suggest no significant link between exclusive breastfeeding and academic outcomes, others emphasize the importance of nutrition, home environment, and parental education in improving cognitive abilities (Krol & Grossmann, 2018)

1.4.2 Immunization

Immunization is a cost-effective health intervention that prevents life-threatening diseases, reducing morbidity, disability, and mortality. Vaccination prevents over 20 diseases and saves millions of lives annually (WHO, 2019). Failure to vaccinate can result in long-term physical, social, and cognitive development issues, ultimately reducing the child's potential and future productivity (Ozawa et al., 2017).

1.5 Academic Performance

Studies have shown that prenatal and postnatal care, particularly the intake of specific macronutrients like iodine, iron, and DHA, significantly influences cognitive development and academic performance. Conolly (1979) and Shrestha et al. (1994) demonstrated the cognitive benefits of iodine, improving tasks requiring speed and accuracy. Similarly, vitamin D plays a role in brain activity, particularly in motor functions and emotional behavior (Bivona et al., 2019). Stanbury (1994) found a positive correlation between early macronutrient intake and academic performance, especially in children exposed to adequate nutrition before and after conception.

2. Material and methods

2.1. Research Design

The study employed a correlational design, which is a research method utilized by experts to examine the relationship between two variables. In this case, the variables under investigation are the prenatal and postnatal care provided by mothers and their children's academic performance.

2.2 Research Locale

The research was conducted at Atabay Elementary School, located at Gomez Extension, Atabay, Hilongos, Leyte. This DepEd-managed public school offers both kindergarten and elementary education, with typically three sections per grade level. The researchers selected this location because it provided access to a diverse demographic profile, which was essential for gathering a wide range of data. This diversity allowed for the collection of varied results that contributed to the comprehensiveness and relevance of the study.

2.3 Respondents and Sampling Technique

The respondents of this study were primarily the mothers of Grade 5 students at Atabay Elementary School. The study employed availability sampling, where all available parents of Grade 5 students were selected based on their presence at the school. Following this, the researchers distributed the questionnaire to those who were present, specifically to the mothers of Grade 5 students. The sample size was determined to be 49 out of 81 Grade 5 students, using Slovin's Formula to ensure an appropriate representation.

2.4 Research Instruments

The research instrument used in this study was a structured interview questionnaire. Availability sampling was employed to select respondents who completed a questionnaire centered on the study's subject of interest. The interview schedule, designed for mothers, aimed to gather information on their profiles, including details about their age at conception, dietary habits, nutrient intake during and after pregnancy, infant feeding practices, and the immunizations they received. The school principal, as a secondary respondent, was asked about the students' General Weighted Average (GWA) to assess their academic performance from Grade 1 to Grade 4. The data collected from both primary and secondary respondents served as the basis for evaluating students' academic performance. A pilot test was conducted at Sogod Central School to assess the validity and reliability of the research instruments.

2.5 Data Gathering Procedure

Consent letters were obtained from the mothers of students at Atabay Elementary School, as well as from the school principal, requesting permission to collect data on the students' grades from Grade 1 to Grade 4, ensuring the confidentiality of the data. Additionally, a consent letter was provided to the mothers, seeking their approval for the researchers to conduct interviews regarding their interventions during pregnancy. The interviews were conducted at the mothers' residences during their available time. Data collection primarily involved a survey to gather the list and initial information of the respondents, followed by the interview, during which the prepared questionnaires were utilized. Throughout the survey and interview process, the researchers assured the respondents that their information would be kept confidential and used solely for research purposes, under strict confidentiality measures.

2.6 Statistical Analysis

The study utilized the IBM-SPSS Statistical Data Analysis tool to compare the means of two groups: parents who received complete prenatal and postnatal care, and parents who received incomplete prenatal and postnatal care. This analysis aimed to determine whether there were significant relationships between maternal prenatal and postnatal care and the academic performance of their children, as well as to explore how these variables may correlate with each other.

3. Results and discussion

3.1. Relationship of Supplementary Nutrients to Child`s Academic Performance

The analysis revealed that the supplementary nutrients taken by mothers during pregnancy had varying effects on their children's academic performance. Among the seven supplementary nutrients considered, only iodine was found to have a significant impact. However, this does not imply that the other nutrients are not important; they contribute to the overall health of the child, though not specifically to brain development. The findings indicated that children whose mothers consumed adequate and proper levels of iodine performed better in school. This is consistent with the statement of Zhou et al. (2019), who emphasized that iodine is an essential mineral for growth and development, particularly during the gestational phase. Iodine deficiency, particularly in the early years of a child's life, can cause brain development changes that may result in reduced cognitive function, as noted by Verkaik-Kloosterman et al. (2017).

3.2. Relationship of Mother`s Age of Conception to Child`s Academic Performance

The analysis revealed a significant correlation between the age of conception of the mother and the academic performance of the child. The correlation coefficient matrix, presented in the table below, shows that maternal age at conception has a moderate to strong negative correlation with academic performance across different grade levels: Grade 1 ($r = -0.425$, $p < 0.006$), Grade 2 ($r = -0.398$, $p < 0.010$), Grade 3 ($r = -0.458$, $p < 0.003$), and Grade 4 ($r = -0.542$, $p < 0.0001$). This finding is consistent with the statement of Barclay (2016), who noted that children born to older parents tend to achieve higher levels of education. Fishman, S.H., & Min, S. (2017) further support this, stating that maternal ages between 31 and 40 are associated with the highest levels of offspring educational attainment, suggesting that women who give birth in their 30s may possess more favorable characteristics than younger or older mothers. The data indicates a positive trend in the academic performance of children as their mothers' age at conception increases.

3.3 Relationship of Mother`s Educational Background During Conception to Child`s Academic Performance.

The analysis revealed that the educational background of the mother is positively correlated with the dependent variable, which is the General Weighted Average (GWA) of the students. The correlation coefficients indicate a strong degree of

convergence: Grade 1 ($r = 0.537$, $p < 0.001$), Grade 2 ($r = 0.489$, $p < 0.003$), Grade 3 ($r = 0.529$, $p < 0.002$), and Grade 4 ($r = 0.591$, $p < 0.0001$). These results clearly indicate that the educational background of mothers significantly influences their children's academic performance. As noted, the lower the p-value (alpha), the stronger the relationship between the variables, further reinforcing the importance of maternal education in shaping a child's academic success.

4. Conclusion and Recommendations

Based on the findings, the socio-demographic profile of the mother during her childbearing stage significantly influences the child's academic performance. Specifically, the age of conception has a notable relationship with the child's academic outcomes. Additionally, the educational background of the mother is significantly correlated with the child's academic performance. Among the various supplementary nutrients, only iodine was found to have a significant relationship with the child's academic performance. Furthermore, maternal prenatal care was also shown to have a significant impact on the academic performance of the child. These findings underscore the importance of maternal factors in shaping the academic success of children.

To all women planning to have a child, it is recommended to seek consultations at least one month before conception, as early prenatal care has been shown to positively impact the cognitive and brain development of the child. Pregnant women are also advised to consume an adequate and appropriate amount of iodine to ensure better academic performance for their child, as iodine deficiency has been linked to decreased mental activity and a risk for delayed development.

Compliance with ethical standards

Authors declare that the present research work complies with the institutional and ethical standards. It does not contain any studies performed on animals or human subjects by the author.

Conflict of interest statement

All authors declare no conflict of interest or competing interest related to the publication of this manuscript or any institution or product mention herein.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans' subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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