

Developing Pedagogical Strategies for Prenatal Nutrition as a Preventive Measure Against Down Syndrome

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ABSTRACT

Having a healthy child, both physically and mentally, who grows and develops well is the hope of every parent. However, the birth of children with developmental disabilities, such as Down syndrome, remains a concern that must be addressed, particularly through preventive efforts. Down syndrome is a genetic disorder associated with intellectual disability, often linked to both genetic and environmental factors, including inadequate maternal nutrition during pregnancy. This study aims to develop pedagogical strategies for educating pregnant women on the importance of prenatal nutrition as a preventive measure against Down syndrome. Using a field study method, data were collected through observations and interviews to explore the understanding and practices of maternal nutrition among pregnant women. The findings indicate that adequate nutritional intake during pregnancy contributes significantly to reducing the risk of developmental disorders, including Down syndrome, beyond hereditary factors. The implication of this study highlights the importance of structured and accessible pedagogical interventions to raise awareness and promote responsible nutritional practices during pregnancy. It is hoped that the results can serve as a foundation for future educational programs that empower mothers to make informed decisions for the well-being of their unborn children.

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1. INTRODUCTION

The fulfillment of proper nutrition during pregnancy is a vital aspect that must not be overlooked. During this crucial period, the food consumed by pregnant women does not solely serve to maintain their own health and energy levels but also plays a pivotal role in supporting the health, development, and overall well-being of the fetus. The growth and development of the fetus are heavily influenced by the availability of essential nutrients in adequate quantities. Therefore, it is of utmost importance that pregnant women pay close attention to their dietary patterns and the quality of nutrients they

intake on a daily basis. Several key nutrients are particularly critical during pregnancy, and these must be met consistently to ensure optimal fetal development. These include: a) carbohydrates, proteins, and fats, which are essential as sources of calories and energy, with increasing needs according to the trimester of pregnancy; b) folic acid, found in whole grains, leafy green vegetables, meat, and citrus fruits, which is crucial in preventing neural tube defects; c) calcium, available in milk, cheese, and dark green vegetables, which supports the formation of the fetus's bones and teeth; d) iron, found in chicken, liver, fish, cassava leaves, and legumes, which helps prevent maternal anemia and ensures sufficient oxygen supply to the fetus; e) vitamin D, present in milk, butter, and egg yolks, essential for calcium absorption and bone development; f) iodine, sourced from shrimp, shellfish, fish, and iodized salt, which is important in preventing brain development disorders like cretinism; and lastly, g) zinc, found in seafood and crabs, which plays a role in immune function and cellular growth. Protein, as a building nutrient, should be consumed in higher quantities, especially from animal-based sources such as fish, eggs, meat, and chicken, as they provide more complete amino acids than plant-based sources like tofu, tempeh, and legumes (Husnah, 2017).

Unfortunately, in reality, nutritional fulfillment during pregnancy is often neglected. This negligence is commonly caused by a lack of awareness or understanding regarding maternal nutrition, as well as by socioeconomic limitations. From an interview conducted with a mother of a child diagnosed with Down Syndrome, it was revealed that she had limited knowledge about the types of food and nutrients required during pregnancy. Her lack of understanding was mainly attributed to insufficient access to health education, particularly concerning maternal nutrition. Furthermore, financial constraints served as another major obstacle, as many pregnant women base their dietary choices solely on what they can afford, without considering the nutritional value needed for fetal growth and development. This scenario highlights a significant gap in access to information and health services, which can have serious implications for pregnancy outcomes (Busono, 1989). Children born with developmental barriers or disabilities are often referred to as ABK. According to (Mardi Fitri, 2021) Children with special needs are children who need special treatment because of developmental disorders and disorders experienced by children. Regarding the term disability, children with special needs are children who have limitations in one or several abilities, both physical such as *Down syndrome*. According to (Mayasari, 2019a) *Down syndrome* is included in the disability disorder which is a mental retardation disorder with a below-average IQ. One of the causes of the birth of children with *Down syndrome* is due to a lack of nutritional intake during pregnancy.

This research was conducted to develop a pedagogical strategy aimed at increasing the awareness and understanding of pregnant women about the importance of proper nutrition as a preventive measure against the risk of giving birth to a child with Down Syndrome. The strategy is not limited to the dissemination of nutritional information but also involves participatory and contextual learning methods that align with the needs and conditions of the target community. The primary objective of this study is to offer an educational contribution that can strengthen women's insights—especially future mothers—on the long-term consequences of neglecting health and nutrition during pregnancy. It is hoped that this article will serve as both a reflective piece and an informative resource for the broader public, encouraging greater awareness about fetal well-being from the earliest stages of life. It also aims to underscore the fact that every decision made during pregnancy, including dietary choices, can have lasting impacts on the health and development of the child.

Through this research, a pedagogical strategy was developed that aims to increase the awareness and understanding of pregnant women about the importance of nutrition

during pregnancy as a preventive measure against the risk of birth of a child with Down Syndrome. The main purpose of this study is to provide an educational contribution that can strengthen the insight of women, especially mothers-to-be, regarding the impact of negligence in maintaining health and nutritional intake during pregnancy. It is hoped that this article can be a reflection as well as a source of understanding for the public to be more concerned about the condition of the fetus from the womb and realize that every action, including diet, has long-term consequences for the health of the child to be born.

2. METHOD

This study uses a qualitative approach with a field study method. This method was chosen to gain an in-depth understanding of nutrition fulfillment practices during pregnancy and its impact on the risk of birth of a child with Down Syndrome, especially from a parent's perspective. Field studies were carried out through two main techniques, namely **observation** and **in-depth interviews**.

Observation techniques are used to observe the conditions and habits of research subjects directly in their daily context. According to Sugiyono (2009:64), observation is a person's ability to use observations through the five senses that are carried out systematically to obtain relevant data. In addition, interviews are used as the primary data collection technique. Interviews are conducted in a semi-structured manner to allow for flexible but still directed exploration of information. Referring to Emzir (2010:50), interviews are a process of communication and interaction to explore information through questions and answers between researchers and informants.

This research was carried out in one of the sub-districts in Tasikmalaya by involving two informants, namely parents who have children with Down Syndrome. To maintain the confidentiality of identities, the informants were disguised and given the initials 'MRY' and 'DKL'. The observation and interview process aims to uncover the understanding and practice of nutrition during the pregnancy period undergone by the informant. The data obtained were then analyzed descriptive-qualitatively and strengthened with related literature as the basis for the development of relevant and applicable pedagogical strategies. The results of this study are expected to make an educational contribution to the community, especially in increasing awareness of the importance of nutrition during pregnancy.

3. RESULTS AND DISCUSSION

Based on the results of observations and interviews conducted on two parents who have children with Down Syndrome, it was found that one of the non-genetic factors that contribute to the condition is the lack of fulfillment of nutritional intake during pregnancy.

The first informant, who was initialized as MRY, revealed that during the pregnancy of her third child, she did not pay attention to optimal nutritional intake. One of the most striking things is the absence of milk consumption for pregnant women, which is caused by economic limitations. In fact, pregnancy milk is an important source of nutrients, especially folic acid, which plays a role in supporting metabolic processes and chromosomal formation through epigenetic mechanisms (Hell, 2022–2023). MRY also emphasized that there is no family history of similar developmental disorders, so genetic factors can be ruled out as the main cause.

Meanwhile, the second informant, DKL, stated that during pregnancy she did not carry out routine pregnancy checks and tended to ignore the importance of consuming nutritious foods such as fruits, vegetables, and pregnancy milk. Lack of understanding

and financial limitations are the main causes of these irregular consumption patterns. In addition, DKL also admitted that attention to her child's diet after birth was very minimal, and her child was only diagnosed with Down Syndrome at the age of one. The absence of a similar family history reinforces the suspicion that lack of nutrition during pregnancy played a role in the condition.

Based on the results of the 2 interviews, it is known that the cause of children experiencing *Down syndrome* is due to lack of nutritional intake during pregnancy. Meanwhile, the symptoms of *Down syndrome* according to (Rohmadheny, 2016), One of the causes is the lack of iodine intake when the fetus is in the mother's womb. This is in accordance with the results of research conducted by the health office regarding the iodine content in the water where the child lives is small. This affects the chromosomal arrangement system in the child's body which should be 46 which is paired with each other to 47 because the 21st chromosome becomes 3 chromosomes which greatly affects its metabolism (Mayasari, 2019b). According to (Fiqqi Anggun Lestari, 2015) The definition of Down syndrome is an innate physical damage or defect accompanied by mental retardation. It is characterized by a thick tongue and cracks or splits and a flat face and slanted eyes. Down syndrome is also commonly referred to as mongoloidism because of its distinctive facial characteristics, namely a small skull head, a large tongue protruding out, a small mouth, a wide face, narrow eyes shaped like peanuts with slanted eyebrows, and a slightly flat nose (pesek), and wide fingers (Hoffman & Maynard, 2008; Huang et al., 2021, 2021)

According to (Mayasari, 2019b), The symptoms of *Down syndrome* include the Down syndrome which is a mental retardation disorder with a below-average IQ. According to (Fatimah et al., 2017) In Rachmayana, 2016 stated that disability is a condition characterized by general intelligence that is below average and reduced adaptability that arises before the age of 18. However, even though these disabled children have below-average intelligence, parents can train children to do daily activities on a regular basis.

Then, as explained by the findings of the case above regarding the birth of a child with Down syndrome without genetic factors and a lack of nutritional and nutritional intake during the pregnancy period and a healthy lifestyle, we need to pay attention and make it a reflection, that in the pregnancy process the fulfillment of nutritional and nutritional intake during the pregnancy process must be paid attention to both the pregnancy of the first and third children. Because during the pregnancy period, the food eaten by pregnant women is not only for personal needs and health, but for the health of the fetus (I. G. Pratiwi & Hamidiyanti, 2020). In fulfilling nutritional intake during the pregnancy period, the fulfillment of maternal nutritional needs increases due to an increase in several components of maternal tissue such as fat, blood, and mammary gland reserves, as well as fetal components such as fetus, amniotic and placenta. The increased nutritional needs are used to support the growth and development of the fetus along with changes related to the structure and metabolism that occur in the mother (Hasibuan, 2017).

If the fulfillment of nutritional intake during pregnancy is not met, it will result in malnutrition known as KEK (lack of caloric energy) to the impact of imperfect fetal growth and fetal defects (Hen-herbst et al., 2022). During pregnancy, of the many vitamins and minerals needed, there are some that deserve attention because of their effects, and one of them is Folic Acid (Prasetyo, 2017). Folic acid is one of the vitamins that double the needs of the mother and fetus. In terms of nutritional fulfillment, the education and understanding factors are indicators of problems because of the lack of understanding of very crucial things during the pregnancy period to minimize unwanted things such as defects in the delivery process. In addition, nutritional intake and nutrition during pregnancy need to be checked by pregnancy and pregnancy ultrasound in order to know

the development of the baby while still in the womb. So that if there is a problem, it can be detected as early as possible so that the best solution can be found.

According to (R. D. Pratiwi et al., 2021), During pregnancy, at least pregnant women need a calorie fulfillment of about 400 kcal. The increase in needs is at least 15% of what was consumed before pregnancy or from normal. This need is 40% for the fetus and 60% for the mother. The nutritional intake consumed needs to be considered by pregnant women. The nutritional adequacy figure of pregnant women must be sufficient and balanced. If nutrition during pregnancy is not met, it will cause malnutrition to the worst impact of imperfect fetal growth, low birth weight (BBLR) and fetal defects that cause the child to experience *Down syndrome*.

Nutrition plays a central role in maintaining the health of pregnant women and supporting the development of their unborn children. Adequate nutritional intake during pregnancy contributes significantly to the physical and cognitive formation of the fetus. On the contrary, poor maternal nutritional status has been consistently associated with adverse birth outcomes, including developmental delays and congenital abnormalities. This highlights that the maternal nutritional condition is a critical determinant of fetal health. Among the contributing factors, maternal knowledge about nutrition stands out as a key determinant. When pregnant women lack adequate understanding about what constitutes proper nutrition during pregnancy, the likelihood of poor dietary practices increases. This deficiency in knowledge can lead to suboptimal intake of essential nutrients, which may hinder fetal development. Studies have shown that knowledge positively influences dietary behaviors, encouraging mothers to focus more on the quality of nutrients rather than just the quantity of food consumed (Browne & Jackson, 2013; Hansen, 1999; Huang et al., 2021; Nielsen, 1984; Roothman et al., 2003).

However, the relationship between maternal nutrition and birth outcomes is not always straightforward. It is shaped by a variety of intersecting factors such as biological conditions, socioeconomic status, level of education, and demographic characteristics. These influencing elements vary across different cultural and geographic communities, making the nutrition-birth outcome relationship a complex and multi-layered issue. Mothers with good nutritional knowledge tend to adopt healthier eating habits during pregnancy, such as increasing the intake of fruits, vegetables, folic acid, iron, and calcium. These dietary choices not only support maternal health but also ensure that the fetus receives the necessary building blocks for optimal development. Nutrient-dense foods provide the vitamins and minerals essential for cellular formation, brain development, and overall fetal growth. Consequently, investing in maternal education about nutrition could significantly reduce the risks associated with poor pregnancy outcomes.

The study also indicates that nutrition education must be contextually relevant and culturally sensitive. Educational materials and interventions should consider local dietary practices, belief systems, and available food resources. When mothers receive nutritional information that is practical, affordable, and aligned with their daily lives, they are more likely to implement it. In this way, community-based nutrition education becomes a powerful tool in reducing the risk of developmental disorders, including Down Syndrome.

Down Syndrome is one example of a developmental disorder that may be linked to inadequate nutritional intake during pregnancy, especially deficiencies in folic acid and other essential micronutrients. While not all cases are preventable, improving maternal health and nutrition significantly contributes to lowering the risk. Education about such risks empowers women to take proactive steps to ensure a healthy pregnancy. Thus, promoting maternal nutritional literacy is both a preventive and empowering strategy.

In conclusion, the findings of this study reaffirm the critical importance of adequate nutrition and maternal knowledge during pregnancy. Nutritional intake, when

supported by health literacy and regular medical monitoring, forms a protective foundation for fetal development. A mother's awareness and behavior during pregnancy are pivotal in preventing developmental abnormalities and ensuring the birth of healthy children. Therefore, increasing access to nutritional education and antenatal services should be a public health priority to support better outcomes for both mothers and babies. Furthermore, maternal knowledge goes hand in hand with health-seeking behaviors, such as regular antenatal care visits and early detection of complications. Pregnant women who are informed about the importance of routine medical check-ups are more likely to engage with healthcare services. Through these check-ups, potential risks such as developmental delays, genetic disorders, or physical defects can be detected early. Timely interventions can then be implemented to support the healthy progression of the pregnancy.

Another important finding from the research is the role of socio-economic conditions in shaping dietary choices during pregnancy. Limited economic resources often restrict food choices, leading women to prioritize affordable options over nutritionally rich foods. This condition is compounded when pregnant women are unaware of low-cost yet highly nutritious food sources. Therefore, knowledge alone is not sufficient—accessibility and affordability must also be addressed through integrated health and social policies.

Therefore, a holistic perspective is required when addressing maternal and fetal health challenges. Because if pregnant women have less knowledge, it will have an impact on not maximizing the intake of food and nutrients consumed. With good knowledge, of course, the mother's diet and behavior in consuming food pay more attention to the quality of nutritional content compared to the quantity or quantity of food consumed. By eating foods that contain a lot of nutrients, of course, it can improve the health and growth of mothers and toddlers. Thus knowledge about nutrition for mothers is very important (Mamuroh et al., 2019).

Based on the results and discussions that have been explained above, it can be seen that it is very important to pay attention to nutritional intake and nutrition during pregnancy. Because it greatly affects the development of the fetus in the womb. With good nutritional and nutritional intake, it will minimize the birth of children *with Down syndrome*. There are many types of nutrients consumed, be it fruits, vegetables, folic acid, and others. In addition, routine check-ups with the doctor must also be carried out consistently in order to detect if there are defects or delays in fetal growth. These two things must of course be supported by knowledge and understanding. By having the provision of knowledge, pregnant women will know better and be more careful to minimize abnormal births even for children with abnormalities

4. CONCLUSION

Fulfilling nutritional intake during pregnancy is very important and needs to be considered. Because during the pregnancy period, the food consumed by pregnant women is not only for their own needs and health, but for the health and development of the fetus. If the fulfillment of nutritional intake during pregnancy is not met, it will result in malnutrition known as KEK (lack of caloric energy) which has a bad impact on fetal growth which will result in imperfect growth and fetal disability. By maintaining the fulfillment of balanced nutritional intake during the pregnancy period such as consuming pregnancy milk, protein, juices, fruits and vitamins, it will minimize pregnancy defects such as Down syndrome. Where Down syndrome disease is caused by a lack of iodine intake when the fetus is in the mother's womb. In this context, the insight and understanding of parents, especially the figure of the mother, must have the knowledge to pay more attention to

nutritional intake during pregnancy and be more careful in maintaining pregnancy. This is done with the aim of minimizing abnormal births, even children with abnormalities.

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