Nutrition and health implications of preterm children born to adolescent mothers

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ABSTRACT

Preterm birth is one of the most important determinants of adverse infant outcomes, in terms of survival and quality of life. Adolescent pregnant is among the factors that are associated with an increased risk of preterm birth. However, despite its significant contribution, this age group has not received sufficient attention in efforts to prevent and reduce the burden of preterm births. The current efforts are generalized to all age groups and do not consider that adolescents have special age requirements even before becoming pregnant. This literature review summarizes some of the key nutrition and health challenges in pregnant adolescent that are linked to preterm birth as well as possible acute and chronic nutritional and health challenges to their preterm children. Electronic databases such as PubMed, Google Scholar, and MEDLINE were searched using keywords such as "adolescent", "health," "preterm", "Teen mothers", "nutrition" "preterm birth" and pertinent articles (N = 74) were retrieved and reviewed. Due to maternal young age, preterm children of adolescent mothers also have high risk of suffering from short and long adverse health and nutritional problems. Female adolescents should not only be viewed from one angle of growing girls but also as part of women of the reproductive age group. They should not receive any less of the benefits of this age group that include adequate education about reproductive health, pregnancy nutrition and use and choice of contraceptives.

Key Words: *Adolescent Health; Nutrition; Preterm birth; Teen mothers*

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Introduction

According to the World Health Organization (WHO) a preterm is defined as a baby born alive before 37 weeks of pregnancy are completed. Preterm babies are classified as extreme preterm (≤ 28 weeks), very preterm (28-31 weeks), moderate preterm (32-34 weeks) and late preterm (34-36 weeks). Every year 15 million babies are born preterm globally with over more than half of the births occurring in Africa and Asia (1). Preterm birth is among the most important determinant of adverse infant outcomes, in terms of survival and quality of life. Complications associated with preterm birth also, have been reported as the leading cause of mortalities among babies (2).The rate of mortalities associated with preterm birth is considerably higher in low and middle income countries compared to high income countries (1).

Preterm birth is a complex subject with multiple risk factors of which maternal age is among the high-risk one. Young maternal age of <19 years which covers adolescent group increases the risk of preterm birth. Studies report that pregnant adolescents are 3 times more likely to give birth to preterm babies compared to older women and have more incidents of extreme and very preterm births (3–6). Gynecological immaturity (short cervix [≤ 25 mm] and small uterine volume), malnutrition and susceptibility to subclinical infections are some of the reasons that put adolescent mothers at higher risk of preterm birth(7). Increased fertility and adolescent's pregnancies accelerate rise in the number and rate of preterm births(8).

One of the key measures to combat the problem of preterm birth is identification and prevention of its risk factors. This and other measures are normally directed towards one major group namely, women of reproductive age that fall between 15-49 years old. This is to say, women between 15-49 years old have the same need and contribution with respect to reproductive health. However, in the human development perspective this age group includes adults and adolescents. Pregnant women of different ages have shown to contribute differently to the burden of preterm birth and its subsequent complications. Greater burden and more and severe complications are evident in adolescents(5,9–11). Moreover, it should be noted that adolescents have special growth and nutritional needs of their own that by becoming pregnant may become interrupted and impact both maternal and child nutrition and health. This review highlights common nutritional challenges in pregnant adolescents that may lead to preterm birth. The burden of detrimental nutrition and health outcomes in preterm children of adolescent mothers is also discussed.

Discussion

Adolescents' contribution to new births

By 2010 adolescents made up to 18% of total global population. Female adolescents represent nearly a half of the total adolescent population and a quarter of all female individuals. Over 70% of the adolescents live in middle and low income countries (12). In addition, adolescents represent one fifth of women giving birth to their first live babies with the highest proportion residing in sub-Saharan Africa where the use of contraceptives is the lowest(12). Approximately 23 million and 18.5 million girls aged ≤19 years become pregnant and give birth respectively, in developing countries every year(13,14). The World Bank reported that, adolescent birth rate has declined from 66 births per 1000 girls in 1990 to 41 births per 1000 girls in 2020 globally (15). However, the population of adolescents continues to grow and it is predicted that the number of adolescent pregnancies will rise up especially in Africa (12). Adolescent pregnancies occur mostly in marginalized communities and are commonly driven by poverty, lack of reproductive health education, child marriage and lack of access to modern contraception (13,16). Other drivers include lack of parental adolescent communication and monitoring, being in a sexual relationship, alcohol use, peer pressure and involuntary and forced first sexual debut (17,18).

A link between adolescence, nutrition and pregnancy

Adolescence is the period of rapid growth and development that transitions a person from childhood to adulthood. The period of adolescence ranges between 10-19 years of age and is accompanied by biological, physical, neuro-developmental, psychological and social changes (19). To accommodate the changes and maintain a healthy body, nutritional needs increases. Pregnancy in a similar way is another case that brings in increased nutritional needs necessary for growth of a fetus. Therefore, being both an adolescent and pregnant makes the growing mother and the growing fetus compete for nutrients (20). However, adolescents are normally challenged by poor eating habits which may get worse if they become pregnant. Such habits in a way threaten the possibility of a pregnant adolescent to meet the mother and fetal nutritional requirements particularly vitamins and minerals that are vital for fetal growth and development. On the other hand, maternal nutritional

deficiencies during pregnancy have been reported to increase risk of preterm birth(21).

Adolescent nutritional problems associated with preterm delivery

Adolescence is the second window of opportunity for growth after the first 1000 days of life (22). It is a period of maturity in terms of physical, emotional, social and psychological aspects. Due to rapid growth during this period, there is an increased need of nutrients to compliment with the growth (23); (24). Also, starting menstruation for girls and attaining maximum bone growth increases the need for iron and calcium minerals respectively. Common nutritional problems found in this group are anemia, underweight and poor growth. Because of these nutritional compromises, giving birth during adolescence increases the risk of adverse pregnancy outcomes and has a negative impact on the future well-being of a mother and an infant (23). This section discusses some of the common and significant nutritional problems among pregnant adolescents that are associated with an increased risk of preterm birth.

Anemia

Anemia during pregnancy is a leading nutritional disorder with serious short and long-term consequences for both the mother and the fetus, preterm birth included (25,26). About 75% of pregnant adolescents have been reported to get anemia during their first pregnancy (27). Iron deficiency anemia which is the type of anemia caused by lack of iron to support normal red blood cell production is the most common type of anemia in pregnant women (28). Normally, as a pregnancy progresses to the second and third trimester exhaustion of iron stores occurs in most pregnant women and leads to more iron demand(28,29). On the other hand, elevated iron demand to accommodate the needed production of myoglobin in muscles and hemoglobin in blood during adolescence put adolescents at a high risk of becoming anemic(5,21,22). Apart from increased iron demand during adolescence and pregnancy, pregnancy anemia can be caused by low consumption of iron rich foods, poor up taking of iron and folate supplements and parasitic diseases such as malaria and hookworms (22,30). Adolescents rarely take iron supplements unless medically indicated due to health reasons (31). Therefore, being an adolescent and pregnant predisposes a girl to even higher risk of anemia which in turn increases the risk of preterm birth if pregnant.

Poor growth

In human life there are two stages of rapid growth i.e. from the time of pregnancy to infancy and teenage stage. These stages are accompanied with high nutritional demands to cater growth processes (22). Becoming pregnant may impair a female adolescent of adequate and proper nutrition she needs. This is because nutrients sufficient for the growth of an adolescent will be used to sustain growth of two beings and possibly become inadequate for both (32). On the other hand, the pregnancy itself can have effects on nutritional outcomes of the mother. Maternal failure to get adequate nutrition may affect an unborn baby in two ways. Firstly, the mother will not be able to supply through placenta enough nutrients to the baby for growth and development. Secondly, if a mother is malnourished she will not properly grow and acquire the physiological maturity and physical strength that a pregnant woman requires. Both insufficient supply of nutrients through placenta and immaturity of an adolescent mothers may cause inadequate weight gain during pregnancy, anemia and intrauterine growth retardation that may lead to preterm delivery (29)(5). Therefore, maximum growth is crucial for proper supply of nutrients to the fetus so as to improve birth outcome and lower the risk of preterm delivery.

Under nutrition

Under nutrition occurs when the body receives inadequate nutrients to support its normal functioning. Thinness (wasting) and underweight are among the signs of under nutrition affecting adolescent girls (5);(31). The two also increase the chance of preterm births among pregnant women (5). Under nutrition among adolescents is linked to poor eating habits and lifestyle factors such as cigarette smoking and alcohol consumption which impair adequate nutrients uptake and subsequent low weight gain. According to TDHS 2015/16 adolescents aged between 15-19 years are more likely to be thin than older women and the effect is higher in rural than urban areas. Preterm birth, both spontaneous and clinically indicated, have been associated to maternal under nutrition among other factors (33).

Health and nutritional care

Family support during pregnancy is needed to ensure both health and nutritional recommendations are well supported. Pregnant adolescents are more likely to not be married or living with a partners (34), hence might miss spouse support to care for the pregnancy (35). Moreover, most adolescents do not even plan to conceive and are still in lower levels of

education. Such shortcomings may affect their up taking and understanding of key health and nutrition information provided at prenatal clinics(5). It has been reported that pregnant adolescents go for prenatal care less often than older women (21). Fewer prenatal care visits prevent a pregnant woman from obtaining health and nutrition counseling according to pregnant stage thus increases the chance of having negative pregnancy outcomes that may include preterm birth.

Common nutrition problems of preterm children of adolescent mothers

Being born preterm is considered a nutrition emergence that requires proper nutritional care intervention to support the child's growth(36). The best and recommended source of nutrients for all newborns including preterm babies is breast milk (37). However, preterm babies are likely to have immature guts or other health complications that may delay initiation of breastfeeding as well as impair their ability to feed properly(38). For instance, in most clinical settings preterm babies are normally provided with intravenous dextrose for 2-3 days while receiving other necessary medical care (38). Dextrose contains only carbohydrates and lacks other important nutrients necessary for every newborn's growth. Micronutrients deficiency, low birth weight, severe acute malnutrition, stunting and poor growth are among the common nutrition problems in preterm babies. In this section, these problems are discussed in the light of preterm babies of adolescent mothers.

Low birth weight

Low birth weight (LBW, birth weight < 2,500 g) is among the common negative nutrition outcomes of preterm birth. Extreme LBW and extreme preterm birth are basically linked and the risk of occurrence is relatively high among pregnant adolescents. A retrospective study at Muhimbili National Hospital in Tanzania reported that adolescent mothers were more likely to deliver LBW babies compared to older mothers(39). LBW is also associated with increased mortality and morbidity in children (40). Since the incidence of LBW is more than twice as much among adolescent mothers when compared to adult mothers, babies born to adolescent mothers are in a higher risk of morbidities and mortalities during the first year of life (40). LBW babies among adolescent mothers may be as a result of biological immaturity of a mother, feto–maternal competition for nutrients and lack of adequate antenatal care(41).In a study that was conducted to evaluate whether adolescence pregnancy is a risk factor for LBW, it was found that about 1.5% of pregnant women do not receive antenatal care at all; and among them the proportion of pregnant adolescents was twice as much that of older women (40).

Micronutrients deficiency

Micronutrients are nutrients such as vitamins and minerals that are required by the body in trace amount. Despite their minimal requirement micronutrients are very important for child growth and development. Preterm babies have higher demand for micronutrients than term babies as they are born with low micronutrient stores. In a uterus a fetus receives nutrients from a mother through a placenta. This process occurs mostly in the third trimester. Extreme preterm babies, for instance, which are common among pregnant adolescents, have the highest risk of having micronutrient deficiencies and low nutrient stores as they are born within few weeks of the third trimester (36). Low micronutrient stores at the time of birth increases the risk of metabolic bone diseases(42).Moreover, babies born to adolescent mothers are even more prone to micronutrient deficiencies than those born to older mothers because adolescents are more likely to be undernourished compared to their older counterparts(14).

Poor growth and development

Malnutrition is often the main cause of poor growth among preterm babies. Reduced nutrient stores, insufficient nutrient absorption and immature organs are among the factors that make preterm babies susceptible to malnutrition. Growth assessment at birth provides an important benchmark for evaluating subsequent changes in nutritional status in preterm babies and determining goals for their discharge. Despite receiving adequate nutrition care, during hospital discharge most of these babies are still classified as postnatal or severe growth restricted (43,44).. It is also difficult to monitor growth pattern of preterm babies including how they reach to full term babies. Generally, preterm babies experience poor growth patterns that involve delays in achieving developmental milestones such as cognitive behaviors, movement, language and social aspects. Compared to adult mothers, adolescent mothers are less knowledgeable, less responsive, less skilled and more controlled in infant feeding, which interferes with infants' healthy growth (20). Infant feeding knowledge and child development skills among adolescent mothers are highly recommended to ensure proper growth of their children especially those born preterm.

Stunting

Stunting

Stunting or low height for age is the type of malnutrition caused by long-term insufficient nutrient intake and frequent infections. It occurs generally during the first 1000 days of the life of the baby starting from pregnancy period to two years of age. Past two years the effects of stunting are irreversible. Childhood stunting also has long-term effects that predisposes stunted children at risk of lower academic achievements. In retrospective study on the factors affecting stunting it was observed that, the risk of stunting at infancy stage was 3.7 times higher among preterm infants than the term infants (45). There are several causes of stunting ranging from poor maternal nutrition, poor breastfeeding and complementary feeding practices, lack of psychosocial stimulation as well as poor water and sanitation hygiene (WASH) practices that may cause frequent infections (45). These factors are common in children born to adolescent mothers as they are less likely to receive proper nutrition, health care, and cognitive and psychosocial stimulation. Studies conducted in urban Nigeria and South Africa reported higher prevalence of stunting in under-five children born by adolescent mothers when compared to older mothers (46,47). Higher rate of stunting children among adolescent mother can be explained by nutrients competition between the mother and the fetus and lack of prenatal and postal care visits among adolescent mothers.

Severe acute malnutrition

Severe acute malnutrition (SAM) is defined by a very low weight for height which can be seen as visible severe wasting or by the presence of nutritional edema. Low weight for height is a strong predictor of mortality among under-five children. It is usually the result of acute significant food shortage and/or diseases. It has been observed that preterm infants are at an increased risk for SAM, which is a very common case among hospitalized preterm babies(48). Nutrient deprivation predisposes preterm babies to significant metabolic maladaptation, growth failure, and long-term neurological injury that bring about SAM. A study conducted to adolescent mothers revealed that there is an increased risk of wasting that is associated with exclusive breastfeeding duration of less than 6 months (47). Children born to adolescent mothers experience poor nutrition status as the mothers are not yet well prepared to take the responsibility of childcare that includes feeding a child (47). Hence it is important to invest nutrition education and practices for school age children so as to reduce the chance of SAM to children born to adolescent mothers.

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Health implications associated with preterm children of adolescent mothers

Preterm babies are at a greater risk of health complications that not only compromise their health as infants and lead to high mortality rate but also predispose them to life-long disabilities. While some of complications are a direct effect of just being preterm and are more common and severe in extreme preterm infants, other complications are a result of the medical interventions they go through in order to save their lives. Generally, pregnant adolescents are more likely to give birth to preterm and low birth weight babies that will require harsher and prolonged clinical interventions that may sometimes come with costly health outcomes (49). Moreover, adolescent mothers are more likely not to receive proper pre and post-delivery care and education therefore, are less informed about what can be done to rescue the health of their children. Some immediate and lifelong complications associated with preterm children of adolescent mothers are discussed in this section.

High mortality rate

Prematurity is the leading and the second leading cause of death in neonates and children under five years of age respectively (2,50). Moreover, preterm babies born to adolescent mothers have minimal chances of surviving compared to babies of older women. High mortality rate may be explained by high prevalence of extreme and very preterm births among pregnant adolescents (51). The earlier the baby is born the lower the chance of survival particularly beyond the first month of life (neonatal period). In low income countries for instance, mortality rate in extreme preterm babies is as high as 90% (52). Babies with high degree of prematurity require specialized and intensive health care which is challenging in low income countries where most adolescent pregnancies occur. Pregnant adolescents are also at an increased risk of delivering LBW and small for gestational age babies. These conditions when are accompanied with prematurity elevates the risk of mortality even past the neonatal period(53,54).

Increased risk of mother to child HIV transmission

Adolescent mothers are at an increased risk of mother-to-child-transmission (MTCT) of Human Immunodeficiency Virus (HIV) and they contribute to more than 50% of all vertical transmissions of HIV infection (55). High rate of transmission is presumably due to inadequate use of prevention-of-mother-to-child-transmission (PMCTC) service.

HIV suppression and prevention of transmission can be achieved through the use and adherence to antiretroviral therapy (ART) (56). However, the proportion of HIV positive adolescents using and adhering to ART is hardly half the proportion of adults (Martelli et al., 2019). In a study conducted by Nachega et al., (2009) only 20.7% and 6.6% of HIV positive adolescents achieved 100% adherence to ART treatment within the first 6 and 24 months respectively, following initiation.

Additionally, PMCTC services that include HIV testing and initiation of ART for HIV positive pregnant women among many other services should be started as early as when a woman is planning to conceive to throughout pregnancy, labor and breastfeeding. Nevertheless, for most adolescent's pregnancy is an unplanned event and they have little tendency of testing for HIV. Majority of HIV positive pregnant adolescents become aware of their HIV status when they firstly book for antenatal care (ANC) (55). Unfortunately, pregnant adolescents book for ANC and initiate PMCTC services late during pregnancy particularly within the second trimester (Mustapha et al., 2018). It has been observed that, for HIV positive pregnant adolescents every single week delay in ANC booking increases the risk of MTCT by 10% (60). Time of initiation of ANC and number of ANC visits on the other hand influence pregnancy outcomes (61). Therefore, children born to HIV positive adolescents are at an increased risk of both being born preterm and infected with HIV through vertical transmission.

Mental health disorders

Studies conducted on mental health of preterm children points out to increased risk of mental health problems that are mainly evidenced by attention deficit/hyperactivity disorder (ADHD), emotional disorders and autism spectrum disorders (ASD) than in term children(62–64). The first two disorders are mainly characterized by inattention and anxiety disorders respectively. The risks increases with increasing level of prematurity at birth and is still significant even after active prenatal care for the children compared to the general population(65,66).Furthermore, ADHD and ASD have been linked to neuro-developmental disabilities that are mainly caused by brain injury and small brain volume (10,67). Brain injuries are among the common detrimental heath complications in preterm babies. Intraventricular hemorrhage (IVH) and white matter injury comprise the most common brain injuries in preterm babies (9,68,69). Small brain volume is also among the common outcome in preterm babies and has been shown to be influenced by both brain injury and gestational age independently of brain injury (9,67,68). Both brain injury and abnormal brain volume affect normal development of the brain and lead to developmental and cognitive disabilities that are characteristic in children with ASD.

On the other hand, emotional disorders are associated with social and medical factors (70). Maternal age at the time of birth, education, socioeconomic status and stress significantly impact child behavior and emotions (71). Medical practices for management of preterm babies such as long stay in the neonatal intensive care unit, artificial ventilation and postnatal corticosteroid exposure also may lead to similar effects (71,72). Studies show that young maternal age (>20 years) especially when associated with other socioeconomic and life style factors can have serious negative mental health implication to a child (11,73).

Non-communicable diseases

Early life events can seriously impact what happens later in life. Onset of non-communicable diseases such as cardiovascular diseases and type 2 diabetes is not only attributed to lifestyle behaviors in the mid adult age but also during fetal development, early infancy and childhood (74). Consumption of enhanced nutrition to prevent postnatal growth faltering (35–37) and conditions affecting intrauterine growth and development (69–75)(74)(73)(73)predisposes preterm babies to adult-hood chronic diseases(36,75). Also, preterm babies who experience accelerated growth early in life may have increased fat deposits and be at higher risk of metabolic and cardiovascular problems later in life (43). Therefore, when the babies reach term-corrected age they remain underweight but with proportionally more fat than fat-free mass compared with term babies (76). Having more fat than fat-free mass is linked to an increased risk of chronic diseases (77). The risk can be presented in later stages of life especially at the age of 30 to 40 years. In addition, unhealthy infant feeding practices among adolescent mothers such as a combination of formula feeding and early introduction of complimentary foods increases the chance of rapid or excessive weight gain in early infancy (20). This indicates that, preterm babies of adolescent mothers are at higher risk of overweight and non-communicable diseases than those born by older mothers. It should be noted that, proper nutrition education among adolescent mothers will increase knowledge and skills on infant feeding and consequently reduce the risk of overweight and non-communicable diseases.

Conclusion

Young maternal age contributes substantially to the burden of preterm birth and serious nutrition and health complications to both mother and child. Female adolescents should not only be viewed from one angle of growing girls but also as part of women of the reproductive age group. They should not receive any less of the benefits of this age group that include adequate education about reproductive health, pregnancy nutrition and use and choice of contraceptives. Countries should make policies that allow adolescents to have access to contraceptives and ensure the policies are well known by the adolescents as well as all key practitioners. Adequate and user-friendly antenatal, childbirth and postnatal cares to adolescent mothers are also essential in promoting good pregnancy outcomes and lower the risk of preterm births. Additionally, the WHO recommendations on antenatal care pointing to prevention of preterm births have to be followed. Some of the key recommendations include counseling on healthy eating and nutrient supplementation, HIV testing and a minimum of 8 antenatal care contacts throughout pregnancy to monitor pregnancy health and identify and manage indicators of negative pregnancy outcomes (78). Lastly, strategies for preventing preterm birth should not be generalized but rather varied depending on main issues across the reproductive life span to ensure positive pregnancy outcome for every woman.

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