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Iron Deficiency Anemia In Pregnancy: The Fate Of The Mother And The Unborn Child In The Gambia

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Abstract: ***Studies have indicated that iron deficiency anaemia in pregnancy is a risk factor for preterm delivery, low birth weight and poor neonatal health. Women of reproductive age with severe anaemia are eight times more likely to die than those with higher haemoglobin levels. Therefore, the purpose of this article is to examine the effects of iron deficiency anaemia on pregnancy and its birth outcome based on a review of the literature, and share The Gambian experience. In The Gambia, the effect of Iron Deficiency Anaemia (IDA) in pregnancy and its outcome is not well documented. Despite the fact that all pregnant women upon registration at all health facilities are given iron/folate tablets until 6 weeks postpartum and anti- malaria prophylaxis, IDA in pregnancy is one of the most prevalent micronutrient malnutrition of public health importance in this country. About 68% of pregnant women are found to be anaemic which is more prevalent in the rural than in the urban areas and 19.9% of babies weight at birth had low birth weight (<2.5kg). The maternal mortality ratio of The Gambia though declining albeit slowly, is unacceptability high. Hemorrhage which is one of the five leading causes of maternal death accounting for 25% of all cases in this country which may be exacerbated by pre-existing maternal anemia. However, the high prevalence of anaemia among reproductive age women in The Gambia, has been associated with under-nutrition due to poverty, food deficit, poor dietary habits and low status of women. Therefore, addressing maternal nutrition is key to improving birth outcomes and reducing maternal deaths associated with anaemia. Studies targeting the effect of IDA on pregnancy and birth outcome is highly needed in the Gambia.***

Keywords: ***Iron Deficiency Anemia, Pregnancy, Maternal Health, Neonatal Health, The Gambia***

I. INTRODUCTION

Iron Deficiency Anemia (IDA) in pregnancy has continued to be a global problem associated with increased maternal morbidity and mortality particularly in developing countries. IDA in pregnancy is defined as hemoglobin value less than 110g/L (McLean, Cogswell, Egli, Wojdyla, & De Benoist, 2009) in any trimester during pregnancy and when serum ferritin levels was less than 20µg/L (American College of Obstetricians and Gynecologists [ACOG], 2008). A high proportion of women in both industrialized and developing countries become anaemic during pregnancy. Estimates from the World Health Organization ([WHO], 2008) report that from 35% to 75% (56% on average) of pregnant women in developing countries, and 18% of women from industrialized countries are anaemic. In 2011, the global prevalence of anemia for pregnant women was 38.2% and for all women of reproductive age was 29.4%. These prevalence translate to 32.4 million pregnant women out of which 0.8 million pregnant women had severe anemia. The African Regions had the lowest mean blood haemoglobin concentrations and the highest prevalence of anemia across population groups. Severe anemia accounted for about 38.9% to 48.7% for pregnant women in these regions. The prevalence rate in some of the countries ranged from 50.2% in Togo, 66.7% in Nigeria, 68.3% in Burkina Faso, 72.7% in Benin and 75.1% in The

Gambia (De Benoist, McLean, Egli, & Cogswell, 2008). Similarly, studies of anaemia prevalence during pregnancy have recorded the following prevalences; 87% (India), 77% (Bangladesh), 59% (Bhutar), 65% (Nepal), 60% (Sri Lanka) and 87.6% (India) (Seshadri, 1997).

Bora, Sable, Wolfson, Boro, and Rao (2014) found that lower gestational age, low birth weight and increased risk of small-for-gestation were associated with maternal anaemia, especially when maternal hemoglobin (Hb) was <80 g/L. According to Huang, Purvarshi, Wang, Zhong and Tang, (2015) anemia in late trimester was associated with incidence of low birth weight and preterm birth ($p < 0.05$) and a positive correlation between Hb level and birth weight was seen in late trimester amongst anaemic patients ($p < 0.05$).

In the Gambia, IDA is one of the most prevalent micronutrient malnutrition of public health importance. According to The Gambia Demographic Health Survey ([GDHS], 2013) 68% of pregnant women were found to be anaemic which is more prevalent in the rural than in the urban areas. The Multiple Indicator Cluster Survey (2010) revealed that 19.9% of babies weight at birth had low birth weight (<2.5kg). However, it is not known whether the low birth weight amongst new born babies are as a results of IDA in pregnancy. Limited data exist on the effect of IDA in pregnancy and its outcome in the Gambia. Moreover, understanding the effect of IDA on maternal health and birth outcomes may provide a basis for developing nutritional interventions that will improve birth outcomes and reduce mortality and morbidity associated with IDA especially in the Gambia. Therefore, the purpose of this article is to highlight the gap and examine the effects of iron deficiency anemia on pregnancy and its birth outcome based on a review of the literature, and share the Gambian experience.

II. IRON DEFICIENCY ANEMIA AND MATERNAL HEALTH

During pregnancy, growth of the fetus, the placenta and the larger amount of circulating blood in the expectant mother, lead to an increase in the demand for nutrients especially iron and folic acid. The majority of women in the developing countries start pregnancy with depleted body stores of these nutrients and this means that their extra requirement is even higher than usual (Okeke, 2011). It is a well-established fact that there is a physiological drop in haemoglobin (Hb) in the mid trimester. This physiological drop is attributed to increase in plasma volume and hence decrease in blood viscosity (Ahmad, Kalsoom, Sughra, Hadi, & Imran, 2011). While plasma volume and red blood cell mass both known to expand during pregnancy, plasma volume grows to a greater extend, therefore diluting the maternal haemoglobin concentration (Nestle, 2002). Research has found that Hb and Hct concentrations typically decrease during the first trimester, reach the lowest levels at the end of second trimester and increase again during the third trimester of pregnancy (Morrison, & Parrish, 2011). Iron deficiency during pregnancy is thought to be caused by combination of factors such as previously decreased iron supply, the iron requirements of growing foetus and expansion of maternal plasma volume (Morrison, & Parrish, 2011).

Moreover, IDA is aggravated by worm infections, malaria and other infectious diseases such as HIV and tuberculosis (WHO, 2016; Christian, 2002; Schantz-Dunn, & Nour, 2009) and also some adverse cultural practices such as food taboos. According to Tiwari, Kotwal, Kotwal, Mishra, Dutta, and Chopra (2013) showed that IDA is prevalent due to inappropriate eating habits in India. Low socioeconomic conditions also contribute to anaemia in pregnancy (Anorlu, Oluwole, & Abudu, 2006).

In addition, severe anaemia is associated with grave consequences for mother and fetus, studies suggest an increased risk of maternal deaths (Hoque 2006). Anaemic mothers donot tolerate blood loss to the same degree as healthy women. During childbirth, a healthy mother may tolerate a blood loss of up to 1L. However, in an anaemic mother, the story is different, a loss of as little as 150ml can be fatal. Anaemic mothers have poor anaesthetic and operative risks because anaemic lowers resistance to infection and wounds may fail to heal promptly after surgery or may break down altogether **(**Okeke, 2011). It has been estimated that even when food intake is adequate, it may take 2 years to replenish body iron stores after a pregnancy. In developing countries, every second pregnant woman is estimated to be anemic. Women of reproductive age with severe anaemia are eight times more likely to die than those with higher haemoglobin levels in Kenya (Ronsmans, Collins & Filippi, 2008) and anemia contributes to 20% of all maternal deaths (WHO, 2006).

III. MATERNAL IRON DEFICIENCY ANEMIA ON BIRTHWEIGHT AND INFANT HEALTH

Preterm birth, which is defined as a gestational age less than 37 completed weeks, contributes substantially to the incidence of low birth weight and is the leading underlying cause of infant mortality among infants with nonlethal congenital anomalies (Scholl & Johnson, 2005). Low birth weight is defined as a birth weight less than 2,500g; it can result from premature delivery, intrauterine growth failure or disruption, or a combination of the two (Goldenberg, & Culhane, 2007). Low birth weight is an important secondary factor in 40%–80% of neonatal deaths, 98% of which occur in developing countries (Bhutta, Darmstadt, & Hasan, 2005). In both developed and developing countries, low birth weight is strongly associated with perinatal morbidity and increased risk of long-term disability (Goldenberg, & Culhane, 2007).

Furthermore, low birth weight and subsequent premature delivery, low Apgar score and risk of birth asphyxia, intrauterine fetal death (Lee & Kim, 2006; Kousar, Memon, Sheikh, Memon, & Seht, 2010) and possibility of anaemia in infants are some of the attendant problems documented to be associated with maternal anaemia in pregnancy (Koura, Oue´draogo, Cottrell, Le Port, Massougbodji, & Garcia 2012). Furthermore, Marahatta (2007) reported the prevalence of anaemia of 42.6% in pregnant women of Kathmandu Nepal and the birthweight, Apgar score at the time of birth, occurrence of preterm delivery and intra uterine fetal death

were more common in anaemic group than in the non-anaemic group. Maternal anaemia in pregnancy continued to be considered a risk factor for poor pregnancy outcome and can result in complications that threaten the life of both mother and fetus. According to United Nation International Children Emergency Fund (2009) states that 20% of infants are born with a low birth weight. These babies in turn may never recoup from their early disadvantage and may be susceptible to infectious disease and death, and as adults they may face a higher risk of chronic illness such as heart disease and diabetes.

IDA in pregnancy has been regarded as detrimental to the fetal growth and pregnancy outcomes. Infants born to anemic mothers have low iron stores and are more likely to develop anemia. A meta-analysis showed that anaemia during early pregnancy is associated with slightly increased risk of preterm delivery and low birth weight (Bondevik, Lie, Ulstein, & Kvale, 2001). Similarly, Iron deficiency during the first trimester, has a more negative impact on fetal growth than anemia developing later in pregnancy (Gautam, Saha Sekhri & Saha, 2008).

Prenatal IDA in the third trimester is associated with mental development of the child and maternal micronutrient supplementation with sufficient iron protects child mental development even when the woman's iron deficiency anemia is not properly corrected during pregnancy (Chang, Zeng, Brouwer, Kok, & Yan, 2013). Brain iron deficiency (ID) in the fetus or neonate could be more detrimental than postnatal ID because of the rapidity of brain growth during pregnancy (De Deungria, Rao, Wobken, Luciana, Nelson, & Georgieff, 2000). Iron is essential for neurotransmission, energy metabolism, and myelination in the developing brain (Lozoff, Beard, Connor, Barbara, Georgieff, & Schallert, 2006). In humans, the brain growth spurt begins in the last trimester of pregnancy and extends through the first 2 years of life (McCann, & Ames, 2007). Numerous studies showed lower cognitive and motor test scores in infants with iron deficiency anemia (IDA) that persist even though they received iron treatment as infants (Lozoff, Beard, Connor, Barbara, Georgieff, & Schallert, 2006). Similarly, there is direct evidence of biochemical abnormalities in brains of iron-deficient infants, which demonstrated a slowed nerve conduction velocity in iron deficient infants at 6 months of age (Roncagliolo, Garrido, Walter, Peirano, & Lozoff, 1998).

IV. SITUATION IN THE GAMBIA

IDA in pregnancy is more common in sub-Saharan Africa due to poor nutrition resulting from poverty and illiteracy and the Gambia is not an exception. The Gambia is amongst the Least Developed Countries (LDCs) with Gross Domestic Product (GDP) per capita of US$ 560 (International Monetary Fund, 2011). The Gambia is ranked 172 out of 187 countries in the UN Human Development Index (United Nation Development Program, 2014) and about 55% of the population lives below the poverty line. According to the Gambia Bureau of Statistics (2013) women constitute 51% of the total population and the fertility rate is 5.4 children per woman.

In The Gambia, under-nutrition continues to be a major public health problem exacerbated by poverty, food deficit, rural-urban migration, environmental degradation, poor dietary habits (foods rich in these micronutrients), low literacy level, poor sanitation, infections, and a high population growth rate. The seasonal agricultural pattern also contributes to acute food shortages in the rainy season often referred to as the "hungry season" (July to September), as households exhaust their food supply before the harvest period. The low purchasing power of poor urban and rural households also has serious nutrition and health implications (Gambia National Nutrition Policy, 2010-2020). Among the factors determining its high prevalence, cultural norms play a crucial role such as food taboos, for instance it is common for women to share the best part of the dish to their husbands or their male partners thus depriving themselves the amount, frequency, and quality of nutrients that pregnant women and children consume. Similarly, pregnant women do not eat eggs fearing that the child will be mute or stuttering. Women of 'Fulla' ethnicity are usually forbidden from eating several types of food rich in carbohydrate, animal proteins, and micronutrients during pregnancy. Interestingly, eggs, fish, and bananas are also considered food taboos during pregnancy in other ethnic groups in Papua New Guinea and in Nigeria (Meyer-Rochow, 2009).

There is evidence that the majority of Gambian women who live in rural areas are in a constant energy - deficient state caused by poor dietary intake, heavy workload and a high infection rate. IDA is one of the most prevalent micronutrient malnutrition of public health importance. This is reflected in the high prevalence of low birth weight babies especially in the rainy season. Birth weight is a good indicator of a mother's health and nutritional status and a predictor of the newborn's chances of survival, growth, long-term health and psycho-social development. According to the Multiple Indicator Cluster Survey (2010) revealed that 19.9% of babies weight at birth had low birth weight (<2.5kg).

The Gambia is committed to resolutions of the World Summit for Children (September, 1990), the Dakar Consensus Conference (October, 2004) and numerous other resolutions to reduce, prevent or eliminate micronutrient deficiency disorders. In 2005, the National Nutrition Agency (NaNA) located under the Office of the Vice President was mandated and charged with the responsibility of coordinating all nutrition and nutrition related activities in the country. Furthermore, there is a national nutrition policy for the period 2010-2020 and various interventions to combat IDA are being implemented by the agency. Under the Reproductive and Child Health (RCH) Program, all pregnant women upon registration at all health facilities are given iron/folate tablets and folic acid supplementation until 6 weeks postpartum to reduce the prevalence of IDA in pregnancy.

Late antenatal booking is a common phenomenon in the country. It is during this period that at risk mothers are identified and the appropriate action taken to minimize mortality and morbidity. Limited data exist on the prevalence of IDA on booking in the Gambia. Previous international studies have shown that the late antenatal booking is associated with poor obstetrics such as anemia, hypertension, diabetes and intrauterine fetal death (Amna, 2015). Similarly,

the prevalence of anaemia at antenatal booking was 69.6%, most of whom had moderate anaemia and anaemia was significantly prevalent in the 10–19 year age group, and in women with secondary education, and in their 2nd trimester, in Port Harcourt, Niger Delta Region of Nigeria (Okoh, Iyalla, Omunakwe, Iwo-Amah, & Nwabuko, 2016).

De Benoist, McLean, Egli, and Cogswell, (2008) found the prevalence of anemia in pregnancy was 75.1% in Gambia. According to the GDHS (2013) 68% of pregnant women were found to be anaemic which is more prevalent in the rural than in the urban areas. A survey conducted by NaNA in 2001 showed that 73% and 56% of pregnant women and lactating mothers respectively were anaemic (Bah, Semega-Janneh, Prentice, & Bates, 2001). In 2006, NaNA conducted a baseline study on integrated community based anaemia control in one of the rural communities (Upper River Region) and the results showed anaemia to be high among the 259 pregnant women that participated in the study (73.1% moderate levels; 4.4% severe levels), 1,170 lactating mothers (63.9% moderate levels; 1.3% severe levels), and their children (75.4% moderate levels; 12.6% severe levels). The study further revealed that many of the respondents were willing to take iron/folate tablets to prevent anaemia, although only a small proportion took the tablets for the duration of the whole pregnancy. The unavailability of the tablets and late booking/registration at the clinic on becoming pregnant were some of the reasons mentioned by many respondents for not taking the tablets. The consumption of iron-rich food was found to be low among pregnant women, lactating mothers and children. However, the above studies did not indicate the trimester of these pregnancies.

Anaemic mothers donot tolerate blood loss to the same degree as healthy women. Blood loss is associated with delivery and this puts women at greater risk of postpartum haemorrhage (Kavle, Stoltzfus & Witter, 2008). Hemorrhage is the leading cause of maternal mortality in the Gambia accounting for 25% cases (WHO, 2013) which may be exacerbated by pre-existing maternal anemia. The maternal mortality rate was 430 per 100,000 live births in 2012 (GBoS, 2013) due declining albeit slowly, it is still unacceptability high. A survey conducted by NaNA in 2001 showed anaemia, due to iron deficiency, is also very common among women, especially during pregnancy, and is a major contributory factor to the high maternal morbidity and mortality rates. With the magnitude of evidence on IDA in pregnancy shown in The Gambia, it is therefore not surprising to have such a high maternal mortality. This shows that anemia, hemorrhage and maternal mortality are closely intertwined. Therefore, interventions targeting maternal nutrition is key to improving birth outcomes and reducing maternal deaths associated with anaemia in the Gambia.

Moreover, parasitic infestation such as malaria is endemic in the country and could be one of the causes of IDA in pregnancy and preterm delivery. Subsequently, the most widely used interventions to prevent malaria in pregnancy are the Insecticide Treated Bed Nets (ITN) that are distributed free of charge at least once during antenatal visits, and the intermittent prophylactic treatment (IPT) (Fansidar) is given to pregnant women to serve as prophylaxis to the endemic malaria disease during pregnancy at least twice or more. According to the Gambia Malaria Control Strategic Plan 2008 – 2015, the goal is to reduce the incidence of malaria in pregnancy from 8% to 5%, increase ITN usage from 65% to 90% and increase IPT 2 uptake from 33% to 80% by 2015.

Furthermore, there is ongoing and intensive information education and communication for the consumption of iron-rich foods with communities encouraged and assisted (where possible) to have communal/individual gardens (The Gambia National Nutrition Policy 2010-2020). Despite these interventions, the prevention and management of micronutrient malnutrition is still a priority.

V. SUMMARY AND CONCLUSION

In The Gambia, IDA is high amongst pregnant women which is more prevalent in the rural than in the urban areas, despite the fact that all pregnant women upon registration at all health facilities are given iron/folate tablets until 6 weeks postpartum and anti- malaria prophylaxis. Despite these interventions IDA in pregnancy continue to pose a public health challenge in the country. However, the effect of IDA on pregnancy and birth outcome is not known in the country. In conclusion, addressing the poor maternal nutrition to improve birth outcomes and reduce maternal deaths associated with anaemia is urgently needed in the Gambia.

VI. RECOMMENDATIONS

In order to reduce the impact of anemia on pregnancy outcome and improve both neonatal and maternal survivals in the Gambia, the following recommendations should be put into consideration:

- ✓ Comparative studies targeting the impact of IDA in pregnancy and birth outcome in the Gambia is warranted
- ✓ Strengthening health education programs on the benefits of early antenatal booking and the consumable of locally iron rich food eg leafy vegetables, beans
- ✓ To conduct empirical studies on sociocultural factors determining IDA in pregnancy in the Gambia.

REFERENCES

[1] ACOG Practice Bulletin No. 95: (2008). Anemia in pregnancy. *Obstet Gynecol. 112*(1): 201-7.
[2] Ahmad, M. O., Kalsoom, U., Sughra, U., Hadi, U., & Imran, M. (2011). Effect of maternal anaemia on birth weight. J *Ayub Med Coll Abbottabad*; *23*(1):77-79.
[3] Amna, A. (2015). Late Antenatal Booking, Its Barrier and Maternal Complications. *ISRAMedical Journal*, *Volume* 7 - Issue 1
[4] Anorlu, R.I., Oluwole, A.A., &Abudu, O.O. (2006). Socio-demographic factors in anaemia in pregnancy at booking in Lagos, Nigeria. *Journal of Obstetrics and Gynaecology 26*:773–776.
[5] Bah, A., Semega-Janneh, I., Prentice, A., & Bates, C. (2001). Nationwide survey on the prevalence of vitamin

A and iron deficiency in women and children in the Gambia.
[6] National Nutrition Agency, Banjul, Gambia.
[7] Bhutta, Z.A., Darmstadt, G.L., & Hasan, B.S., (2005). Community based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. Pediatrics.115(2 suppl):519–617.
[8] Bondevik, G.T, Lie, R.T, Ulstein, M, & Kvale, G. (2001). Maternal haematological status and risk of low birth weight and preterm delivery in Nepal. *Acta Obstat Gynecol Scand*; 80(5):402-208
[9] Bora, R., Sable, C., Wolfson, J., Boro, K., & Rao, R. (2014). Prevalence of anemia in pregnant women and its effect on neonatal outcomes in Northeast India. *The Journal of Maternal-Fetal & Neonatal Medicine* Volume 27, Issue 9
[10] Chang, S., Zeng, L., Brouwer, I.D., Kok, F.J., &Yan, H. (2013). Effect of iron deficiency anemia in pregnancy on child mental development in rural China. *Pediatrics,131 (3)*755-63.
[11] Christian, P. (2002). Maternal nutrition, health, and survival. *Nutr Rev. 60*(5):S59–S63.
[12] De Benoist, D., McLean, E., Egli, I., & Cogswell, M. (2008).“Worldwide prevalence of anaemia 1993–2005,” De Deungria, M., Rao, R., Wobken, J.D., Luciana, M., Nelson, C.A., & Georgieff, M.K. (2000).
[13] Perinatal iron deficiency decreases cytochrome c oxidase (CytOx) activity in selected regions of neonatal rat brain. Pediatr Res.;48(2): 169–176
[14] Gautam, C.S., Saha, L., Sekhri, K., & Saha, P.K. (2008). Iron deficiency in pregnancy and the rationality of iron supplements prescribed during pregnancy. *Medscape J Med; 10*:283
[15] Gambia Bureau of Statistics (2013) The Gambia population and household census preliminary results http://catalog.ihsn.org/index.php/catalog/6065/download/74258Accessed 12th June, 2016
[16] Gambia Demographic Health Survey (2013).
[17] Goldenberg, R.L., & Culhane, J.F. (2007). Low birth weight in the United States. *Am J Clin Nutr.; 85*(2):584S–590S.
[18] Hoque M. (2006). Prevalence of anaemia in pregnancy at Greytown, South Africa. Tropical *Journal of Obstetrics and Gynaecology 23*:3–7.
[19] Huang, L., Purvarshi,G., Wang, S., Zhong, L., & Tang, H. (2015). The Influence of Iron-deficiency Anemia during the Pregnancy on Preterm Birth and Birth Weight in South China. *Journal of Food and Nutrition Research, Vol. 3, No. 9, 570-574*
[20] Kavle, J.A., Stoltzfus, R.J. & Witter, F. (2008). Association between Anemia during Pregnancy and Blood Loss at and after Delivery among Women with Vaginal Births in Pemba Island, Zanzibar, Tanzania. *J Health Popul. Nutr*. 26(2), 232–240.
[21] Kousar, T., Memon, Y., Sheikh, S., Memon, S., & Seht, R. (2010). Risk factors and causes of death in Neonates. *Rawal Medical Journal 35*:205–208.
[22] Koura, K.G., Oue´draogo, S., Cottrell, G., Le Port, A., Massougbodji, A., & Garcia, A. (2012).
[23] Maternal anaemia at delivery and haemoglobin evolution in children during their first 18 months of life using latent class analysis. PLoS One 7:e50136. doi:10.1371 /journal.pone. 0050136
[24] Lee, H.S., Kim, M.S., Kim, M.H., Kim, Y.J., & Kim, W.Y. (2006). Iron status and its association with pregnancy outcome in Korean pregnant women. European Journal of Clinical Nutrition 60:1130–1135.
[25] Lozoff, B., Beard, J., Connor, J., Barbara, F., Georgieff, M., & Schallert, T. (2006). Long-lasting neural and behavioral effects of iron deficiency in infancy. *Nutr Rev; 64* (5 Pt 2):S34–S43
[26] Marahatta, R. (2007). Study of anemia in pregnancy and its outcome in Nepal medical college teaching hospital, Kathmandu, Nepal. *Nepal Med. Coll. Journal, 9*: 270-274
[27] McLean E, Cogswell M, Egli I, Wojdyla D, & de Benoist B. (2009). Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. *Public Health Nutr. 12*(4): 444-54.
[28] McCann, J.C., & Ames, B.N. (2007). An overview of evidence for a causal relation between iron deficiency during development and deficits in cognitive or behavioral function. *Am J Clin Nutr.85*(4): 931–945
[29] Meyer-Rochow, V. B. (2009). “Food taboos: their origins and purposes,” *Journal of Ethnobiology and Ethnomedicine*, vol. 5, p. 18
[30] Morrison, J, & Parrish, M. (2011). *Anaemia in Pregnancy. Glob. libr. women's med.*, DOI 10.3843/GLOWM.1016
[31] National Nutrion Agency (2006). Baseline Study Report of the Integrated Community Based Anaemia Control Pilot Project. Accessed 12th June 2016
[32] Nestle, P. (2002). Adjusting Haemoglobin Values in Program Surveys.”International Nutritional Anaemia Consultative Group.
[33] Okeke, P. U. (2011). Anaemia in Pregnancy-is it a Persisting Public Health Problem in Porto Novo-Cape Verde? *Research Journal of Medical Sciences, 5* Issue: 4, Page No. 193-199
[34] Okoh, D. A., Iyalla, C., Omunakwe, H., Iwo-Amah , R. S., & Nwabuko, C. (2016): A retrospective study of the prevalence of anaemia in pregnancy at booking in Niger Delta, *Nigeria, Journal of Obstetrics and Gynaecology*
[35] Roncagliolo, M., Garrido, M., Walter, T., Peirano, P., & Lozoff, B. (1998). Evidence of altered central nervous system development in infants with iron deficiency anemia at 6 mo:delayed maturation of auditory brainstem responses. *Am J Clin Nutr.68* (3):683–690
[36] Schantz-Dunn, J., &Nour, N.M. (2009). Malaria and pregnancy: A global health perspective. *Rev Obstet Gynecol, 2*(3):186–192
[37] Scholl, T.O., & Johnson, W.G. (2005). Folic acid: influence on the outcome of pregnancy. *Am J Clin Nutr.71*(5 suppl):1295S–1303S.
[38] Seshadri, S. (1997). Nutritional anaemia in South Asia. In Malnutrition in South Asia-A regional Profile, 75-124.
[39] Suying, Chang, Lingxia, Zeng, Inge, D., Brouwer, J., &Yan, H. (2013). Effect of Iron Deficiency Anemia in Pregnancy on Child Mental Development in Rural China. *Pediatrics, 131* (3).

ISSN: 2394-4404

[40] The Gambia Malaria Control Strategic Plan 2008 – 2015
[41] The Gambia National Nutrition Policy 2010-2020. Accessed 28th May 2016
[42] Tiwari, M., Kotwal, J., Kotwal, A., Mishra, P., Dutta, V., & Chopra, S. (2013) Correlation of haemoglobin and red cell indices with serum ferritin in Indian women in second and third trimester of pregnancy. *Med J Armed Forces India. 69*(1): 31-6.
[43] UNDP (2014). http://www.undp.org/content/undp/en/home/presscenter/events/2014/july/HDR2014.html Access 21st September, 2016
[44] UNICEF (2009). Tracking Progress on Child and Maternal Nutrition.
[45] http://www.unicef.org/publications/files/Tracking_Progress_on_Child_and_Maternal_Nutrition_EN_110309.pdf Access 21st September, 2016
[46] World Health Organization. (2016). Nutrition. http://www.who.int/nutrition/topics/ida/en/Accessed 24th May 2016.
[47] World Health Organization (2015). The Global Prevalence of Anaemia in 2011.
[48] http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf accessed 28th May 2016.
[49] World Health Organization. (2008). Worldwide Prevalence of Anemia 1993–2005: WHO Global Database on Anemia
[50] Zimmermann, M. B & Hurrell, R. F. (2007). "Nutritional iron deficiency," *Lancet, vol. 370,* no. 9586, pp. 511–520